November 2024

Organisation of
Eastern Caribbean States

OHPC Grade 6 Mathematics Curriculum

OVERVIEW OF THE GRADE SIX OECS HARMONISED PRIMARY CURRICULUM

The Grade 6 mathematics curriculum is designed to solidify learners' fundamental mathematical understanding, skills, and values, building upon their prior knowledge. This curriculum introduces more complex mathematical concepts, encouraging learners to apply logical reasoning and critical thinking to a variety of mathematical problems. Learners will delve into topics such as number operations, fractions, ratios, algebra, geometry, and data analysis, all of which are crucial for future mathematical studies. Through interactive activities, real-world problem-solving, and collaborative learning, the curriculum aims to foster learners' interest and confidence in mathematics, equipping them with essential skills for success.

This Grade 6 curriculum provides school leaders, teachers, and parents with a clear overview of the learning experiences planned for learners at this grade level. The curriculum emphasizes six core content areas: **Number Sense, Operations, Patterns and Relationships, Geometric Thinking, Measurement, and Data Handling and Probability**. It also focuses on developing critical mathematical skills, such as problem-solving, reasoning, communication, making connections, and representation. These skills enable learners to engage deeply with mathematical concepts, justify their thinking, express their ideas, and link mathematical ideas across various contexts.

Instructional time in Grade 6 is focused on five key areas: applying multiplication and division to solve ratio and rate problems, developing a comprehensive understanding of fraction division and introducing rational numbers, including negative numbers, creating and interpreting expressions and equations, enhancing knowledge of area, surface area, and volume, and building an understanding of probability and statistical reasoning. While this overview may not include every specific standard, all topics will be addressed during instruction.

In Grade 6 mathematics, learners will delve into various mathematical concepts such as:

- **Ratios and Proportions**: Solve real-world problems using multiplication and division with ratios and rates and connect ratios to fractions.
- **Number System**: Develop a deeper understanding of fractions, rational numbers (including negatives), and their placement on the coordinate plane.
- **Expressions, Equations, and Inequalities**: Write and evaluate expressions, recognize equivalencies, and solve basic equations using equality principles.
- **Geometry**: Calculate areas of shapes and surface areas of prisms and explore volume with fractional dimensions.
- **Data handling and Probability**: Analyse data sets for trends and patterns and create simple probability models to understand chance events.

Number Sense

Introduction to the Strand:

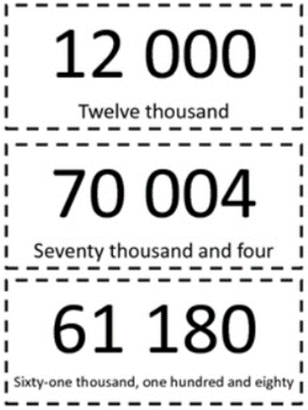
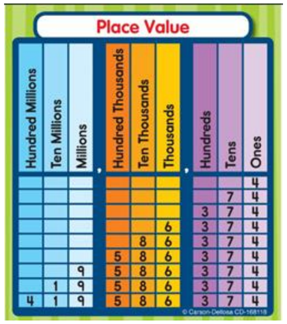
Number sense provides an understanding of numbers, their relationships and properties. It helps learners acquire a foundation in numerical concepts, enhance computation fluency and develop critical thinking skills. Through engaging activities and making reference to real world situations the learner will explore whole numbers, prime numbers, composite numbers, and square numbers.

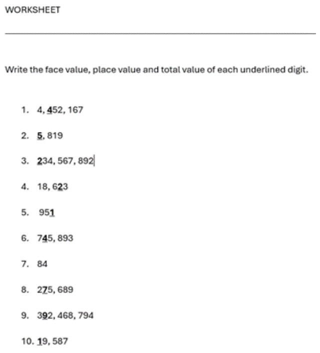
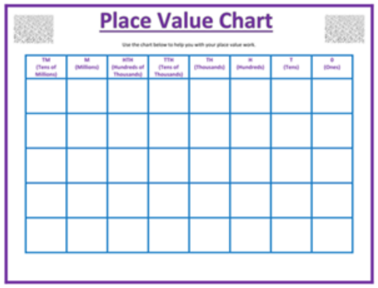
At the end of the unit learner will gain mastery in essential number skills and the foundational skills necessary to develop competence in mathematics.

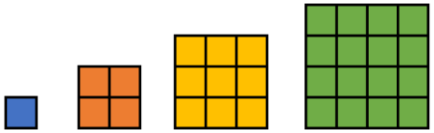
Essential Learning Outcome: N1.1. Whole Number – Saying Number Sequence, Meaningful Counting and Skip Counting

Grade Level Expectations and/or Focus Questions:

- Demonstrate an understanding of the meaning of all whole numbers to seven digits model; identify and describe special sets of numbers (E.g., square, prime and composite) sequence the number names and numerals up to 999 999 999
- State the place value of each digit in a numeral up to 999 999 999
- Round numbers to the nearest tens, hundreds, thousands and up to millions.

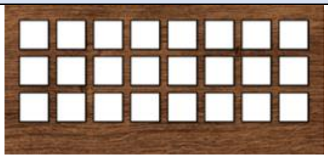
Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
Learners are expected to: **Knowledge** 1. Read and write numbers in words and figures up to 1 000 000 (seven digits) 2. State the face value, place value and total value of any digit in a whole number up to 999 999 999. 3. Identify and describe special sets of numbers (square, prime and composite) 4. Arrange in sequence, whole numbers and special sets of numbers (square, prime and composite). 5. Round off numbers to the nearest tens, hundreds and thousands up to millions. 6. Create a number sequence formed by counting on from any given number by 2's, 5's , 10's, 100's, and 1000's up to 10 000 **Skills** 7. Create a place value chart to show whole numbers up to 999 999 999. **Values** 8. Describe ways whole numbers up to a million are used in everyday life.	**Think Pair Share** Learners are given cards with different numbers written on them (e.g., 123,456) in figures. Learners take turns to write the numbers in words. Learners are given cards with the worded form of numbers (e.g., one hundred twenty-three thousand four hundred fifty-six). Learners write in figures the numbers represented by the worded form.  https://www.teacherspayteachers.com/Product/5-Digit-Number-Cards-2264494 **Worksheets** Learners are provided with worksheets with large numbers printed on them.	**Use Visual Aids and Manipulatives** Display a place value chart to learners. Starting with smaller numbers and progressively increasing the size, e.g. 345, 3 451, 12 345 etc., place the digits in the correct position of the place value chart. Demonstrate how to read the numbers paying close attention to the place values where each digit is placed. Learners will be shown how to write numbers using similar demonstrations with a place value chart.  https://kellis2015.blogspot.com/ **Discussion** Present learners with a place value chart and a number for example, 4 352 678.

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
9. Examine the importance of rounding off whole numbers in everyday life and mathematical contexts by developing a sense of practicality and accuracy in the use of numerical data. 10. Apply the concept of square numbers to the application of real-life situations by engaging in collaborative and communication activities.	Learners identify the face value, place value, and total value for specific digits in each number.  WORKSHEET Write the face value, place value and total value of each underlined digit. 1. 4, 452, 167 2. 5, 819 3. 234, 567, 892 4. 18, 623 5. 951 6. 745, 893 7. 84 8. 275, 689 9. 392, 468, 794 10. 19, 587 **Group Work** Square Numbers Learners are placed in small groups and provided with squared paper. Learners are to shade squares to obtain all square numbers up to 144. Prime and Composite Numbers Learners are provided with a hundreds chart, three crayons of different colours and beads or small square tiles. Learners will shade all prime numbers in one colour and all composite numbers with another colour using manipulatives to help them determine the type of number. The third colour will be used to shade the number 1, as this is neither prime nor composite.	Learners will place this number on the place value chart. Teacher will then have a discussion with learners on the terms face value, place value and total value.  Place Value Chart Use the chart below to help you with your place value work. TM (Tens of Millions) · M (Millions) · HTH (Hundreds of Thousands) · TTH (Tens of Thousands) · TH (Thousands) · H (Hundreds) · T (Tens) · O (Ones) https://www.tes.com/teaching-resource/place-value-chart-to-10-000-000-11365586 **Use of Manipulatives** Square Numbers Provide learners with square tiles (or beads or squared paper). Learners form squares with the tiles. Learners count the square tiles which form a square. The number of tiles counted is a square number. In addition, learners count the number of squares in one row, and count the number of squares in one column. Multiply the number of squares in the row by the number of squares in the column. The product is a square number.

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
	 HUNDREDS CHART 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 https://shop.luckylittlelearners.com/product/classroom-setup-math-bulletin-hundreds-chart/	For example: 1X1 = 1^2 = 1 2 X 2 = 2^2 = 4  https://helpingwithmath.com/square-numbers/ Prime and Composite Numbers Provide learners with a set of beads (or squares) so that the number of beads would represent square numbers, composite numbers and prime numbers. For the numbers given, learners must first try to form squares. If a square is formed, the number of beads used is a square number. If a square cannot be formed, learners then try to form a rectangle. All numbers that form a square or a rectangle are composite numbers. If the set of beads or squares cannot form a square or a rectangle then form a straight line. The number is therefore a prime number.

<table>
<tr><th>Specific Curriculum Outcomes</th><th>Inclusive Assessment Strategies</th><th>Inclusive Learning Strategies</th></tr>
<tr>
<td></td>
<td>
Observation Tool

Learners will be observed during the activity to assess if they have understood the concept.

<table>
<tr><td>CRITERIA</td><td>Yes</td><td>No</td></tr>
<tr><td>Learners are able to form squares, rectangles or straight lines with the manipulatives.</td><td></td><td></td></tr>
<tr><td>Learners are able to identify square numbers</td><td></td><td></td></tr>
<tr><td>Learners are able to identify composite numbers</td><td></td><td></td></tr>
<tr><td>Learners are able to identify prime numbers</td><td></td><td></td></tr>
<tr><td>Learners are able to identify the pattern for square numbers</td><td></td><td></td></tr>
</table>
</td>
<td>


https://www.iknowit.com/blog/number-investigators.html

Provide learners with exit cards at the end of the lesson.

Learners complete the card below:

<table>
<tr><td>Place the various special numbers in ascending order.
(i) Square Numbers: ___, ___, ___.
(ii) Prime Numbers: ___, ___, ___.
(iii) Composite Numbers: ___, ___, ___.</td></tr>
</table>
</td>
</tr>
</table>

<table>
<tr><th>Specific Curriculum Outcomes</th><th>Inclusive Assessment Strategies</th><th>Inclusive Learning Strategies</th></tr>
<tr>
<td></td>
<td>
<table>
<tr><td>Learners are able to identify the pattern for composite numbers</td><td></td><td></td></tr>
<tr><td>Learners are able to identify the pattern for prime numbers</td><td></td><td></td></tr>
</table>
<p>Games</p>
<p>Rounding Relay</p>
<p>Learners are placed in teams. Learners are given numbers and race to round off correctly to a given place.</p>
<p>Scavenger Hunt</p>
<p>In small groups, learners are given a starting point and a sequence to follow. Learners find numbers around the classroom or school that fit their given sequence.</p>
<p>Flashcards</p>
<p>Present number flashcards to learners. Learners place them in order on a board or wall given a particular sequence and starting point.</p>
</td>
<td>
<p>Working in pairs/Using Manipulatives</p>
<p>Complete the sequence and identify the pattern in the sequence</p>
<p>Square numbers ___, ____, ____</p>
<p>Composite numbers ___, ___, ___</p>
<p>Prime numbers ___, ___, _____</p>
<p>Learners are given bags containing different manipulatives (beads and square tiles).</p>
<p>Provide learners with a set of beads so that the number of beads would represent square numbers, composite numbers and prime numbers.</p>
<p>(<i>NB. Sets of beads must be able to form special numbers following a given pattern e.g. 2, 4, 9, 16 …. Or 13, 17, 19…)</i></p>
<p>Learners form either squares, rectangles or straight lines with these manipulatives and fill out the sequences stated and identify the pattern in the sequence.</p>
</td>
</tr>
</table>

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies

Worksheet

Match the items in Group A with their corresponding quantities in Group B

Note: Teachers could adapt to other countries if desired.

Group A	Group B
St. Lucia's national budget	Hundreds
Number of tourists who visited St. Lucia in 2023	Millions
Number of people in St. Lucia	Hundred thousands
Number of schools in St. Lucia	Thousands

Use of Rubrics

Learners' creative place value charts will be assessed using the following rubric.

Criteria	**4 marks**	**3 marks**	**2 marks**	**1 mark**
Completeness	All 9 place values are included	6 - 8 place values are included	3 -5 place values are included	1 - 2 place values are included

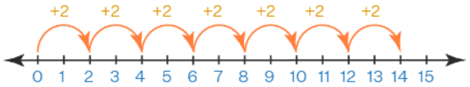
Use of Video/Use of Technology

Learners will view this short video after which they will round off numbers to the nearest 10 000, 100000 and 1000000.

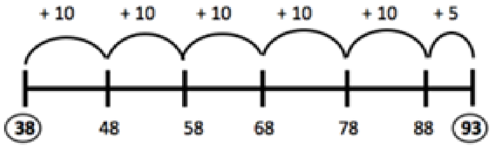
https://www.youtube.com/watch?v=AC3EcMu_Ea8

Using Manipulatives

Present learners with number lines. Learners use number lines to show how numbers increase by 2s, 5s, 10s, 100s and 1000s.



https://www.cuemath.com/numbers/skip-counting-by-2/



https://www.learningstreet.co.uk/articles/what-is-a-number-line/

<table>
<tr><th>Specific Curriculum Outcomes</th><th>Inclusive Assessment Strategies</th><th>Inclusive Learning Strategies</th></tr>
<tr>
<td></td>
<td>
<table>
<tr><td>Labels</td><td>All 9 place values are labelled correctly</td><td>6 - 8 place values are labelled correctly</td><td>3 - 5 place values are labelled correctly</td><td>1 - 2 place values are labelled correctly</td></tr>
<tr><td>Neatness and Clarity</td><td></td><td></td><td>Chart is neatly presented with clear and legible writing</td><td>Writing may be hard to read</td></tr>
</table>

Reflections

Learners write a short paragraph on how rounding off whole numbers can be useful in their lives. Include specific examples. Learners share their reflections with the class.

Observation Checklist

Learners will be observed during their group activity to assess if they have understood the concept of square numbers.
</td>
<td>
Learners use actual coins to count and observe sequences of 5s and 10s and play money for 100s.

https://www.banknoteworld.com/eastern-caribbean-1-cent-1-dollar-6-pieces-coin-set-2000-km-10-13-mint-1.html

Different starting points

Number Walk

Engage learners in activities with numbers. For example:

Number cards are placed on the floor. Learners walk on the cards while counting by 2s, 5s and 10s.

Count and Clap

Learners start counting at a particular number (as directed by teacher) and clap each time the next number in the sequence (as directed by teacher) is mentioned.
</td>
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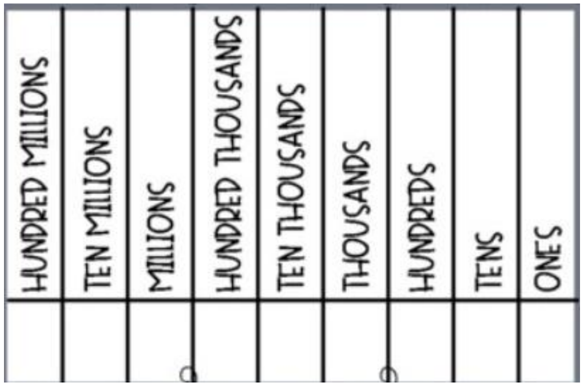
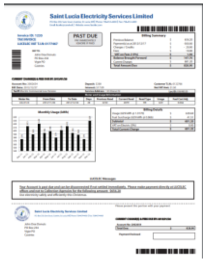
</table>

<table>
<tr><th>Specific Curriculum Outcomes</th><th>Inclusive Assessment Strategies</th><th>Inclusive Learning Strategies</th></tr>
<tr>
<td></td>
<td>
<table>
<tr><td>Criteria</td><td>Yes</td><td>No</td></tr>
<tr><td>Learners calculated the correct dimensions of the square plot.</td><td></td><td></td></tr>
<tr><td>Learners measured correctly and placed pegs at the appropriate points.</td><td></td><td></td></tr>
</table>
</td>
<td>
Using Manipulatives
Provide opportunities for learners to demonstrate their creativity while using large numbers. For example, let learners design creative place value charts up to Hundreds of Millions using Bristol board and markers.


https://www.teacherspayteachers.com/Product/Place-Value-Anchor-Chart-Ones-to-Hundred-Millions-7335172
Learners can also construct cards numbered 0 to 9 for use with the place value charts.
</td>
</tr>
</table>

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
		Discussion Invite learners to be engaged in a discussion of various scenarios where whole numbers are commonly used for example, population counts, money, sports statistics, and distances. Question learners about situations where they have encountered large numbers. ***For example:*** **Population:** ● How does the population of this city/country compare to others? ● What factors affect population growth or decline? ● How does population impact resources and the environment? **Money:** ● Where does all this money come from? ● How is money used to solve problems? ● What is the impact of inflation on large amounts of money? **Science:** ● How do scientists measure such large numbers? ● What tools do they use to count or estimate these numbers?

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
		- How accurate are these large numbers? **Technology:** - How many people use this technology? - How much data is created every day? - How does this large number impact our lives? **Discussion** Have learners work in small groups, and provide learners with a set of monthly utility bills from a household – electricity, telephone and water. For example:  Saint Lucia Electricity Services Limited PAST DUE Learners estimate the total spent by rounding off these bills to the nearest hundreds. Learners are also provided with a monthly salary for an individual and then estimate the amount left to spend after the bills are paid. **Activity using Technology** Invite learners to engage in research of the populations of some countries in the Caribbean.

<table>
<tr><th>Specific Curriculum Outcomes</th><th>Inclusive Assessment Strategies</th><th>Inclusive Learning Strategies</th></tr>
<tr><td></td><td></td><td>The population for each country is rounded off to the nearest ten thousand. Learners will complete the given table.
<table>
<tr><th>Country</th><th>Actual Population</th><th>Population to Nearest Ten Thousand</th></tr>
<tr><td>St. Lucia</td><td></td><td></td></tr>
<tr><td>St. Vincent</td><td></td><td></td></tr>
<tr><td>St. Kitts</td><td></td><td></td></tr>
<tr><td>Grenada</td><td></td><td></td></tr>
<tr><td>Dominica</td><td></td><td></td></tr>
</table>
Discuss with learners that instead of giving the exact value of a population, rounding gives an estimate of the island’s population. This is used to simplify interpretation and presentation of data.</td></tr>
</table>

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
		Field Trip Provide the opportunity for learners to go on field trips, For example, have learners go out into the school garden. In small groups, learners enclose a given area (square) of land for planting. Learners determine the appropriate dimensions and place pegs at the four corners of the square and ropes around the pegs.  https://sims.fandom.com/wiki/Garden_plot

Additional Resources and Materials

Abacus
Place value arrows
Digit cards
Place value mats
Magnetic digits and letters
Dice

Books:

Sir Cumference and all the King's Tens by Cindy Neuschwander

Monster Math by Anne Miranda

If You Made a Million by David M. Schwartz

A Dollar, a Penny, How Much and How Many? by Brian P. Cleary

https://www.youtube.com/watch?v=PI-uyxs-j4E

Additional Useful Content Knowledge for the Teacher:

Face Value is the digit itself, irrespective of its position in the number.

Place Value is the value of the position it holds in the number (ones, tens, hundreds, thousands, ten thousand, hundred thousand, millions)

Total Value is the digit multiplied by its place value.

4 x 1 000 000 = 4 000 000 000

3 X 100 000 = 300 000

Number patterns involve sequences of numbers that follow a specific rule or formula. By understanding number patterns learners can recognize relationships and make predictions.

Integers are all the whole numbers and their negative counterparts, including zero.

Negative numbers are numbers less than zero and are represented with a minus sign (-).

Whole numbers are all non-negative integers, including zero. They do not include fractions, decimals, or negative numbers.

A square root of a number is a value that, when multiplied by itself, gives the original number.

Opportunities for Subject Integration:

Social Studies

- interpreting national budget
- understanding population size of countries and continents
- distances between places

Language

- Create story problems which involve numbers in figures and words, and rounding off numbers

Science

- data such as distances in space
- volume of waste produced

Art

- creative skills displayed in creating place value charts
- creating patterns in designs

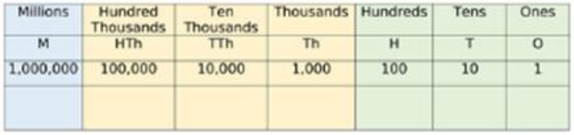
Music

- recognizing patterns and sequences in notes and beats

Physical Education

- counting sequences for exercise repetitions, timing

Essential Learning Outcome: N1.2. Whole Number – Representing and Partitioning Quantities
Grade Level Expectations and/or Focus Questions: • Read, represent and partition any given number to 1 000 000 concretely, pictorially, and symbolically • Read and write multi-digit whole numbers using base-ten numerals, number names, and expanded form to 1 000 000

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
Learners are expected to: **Knowledge** 1. Express multi digit numbers up to 1 000 000 in expanded form (partition) 2. Recompose multi digit numbers written in expanded form into standard form. **Skills** 3. Represent multi digit numbers up to 1 000 000 using manipulatives (place value charts, base ten blocks) diagrams (number lines) and digital tools. 4. Convert multi digit numbers up to 1000 000 from standard, word and expanded forms. **Values**	**Observation** Learners are each given a deck of cards where the face cards are removed, and aces represent 1. Learners draw 3 cards and form a three-digit number. Learner expresses that number in expanded form. This is repeated with 4 cards and four-digit numbers until 7 cards are drawn.  https://illustoon.com/?id=9547	**Use of Manipulatives** Invite learners to roll a die three times to form a three-digit number. Learners will then represent that multi-digit number on a place value chart. Learners write the number in expanded form. This is repeated with multi digit numbers up to 1 000 000.  https://www.tes.com/teaching-resource/visual-place-value-chart-millions-12765389

Millions	Hundred Thousands	Ten Thousands	Thousands	Hundreds	Tens	Ones
M	HTh	TTh	Th	H	T	O
1,000,000	100,000	10,000	1,000	100	10	1

<table>
<tr><th>Specific Curriculum Outcomes</th><th>Inclusive Assessment Strategies</th><th>Inclusive Learning Strategies</th></tr>
<tr>
<td>5. Cultivate an understanding of how to represent numerical values up to 1,000,000 in standard, word, and expanded forms.</td>
<td>
<p>Observation Checklist</p>
<table>
<tr><th>Criteria</th><th>Yes</th><th>No</th></tr>
<tr><td>Learners used manipulatives to place digits correctly</td><td></td><td></td></tr>
<tr><td>Learners expressed numbers correctly in expanded form</td><td></td><td></td></tr>
<tr><td>Learners provided accurate explanations</td><td></td><td></td></tr>
</table>
<p>Peer Assessment</p>
<p>Learners write numbers in expanded form and have their peers write the numbers in standard form. Learners discuss solutions with each other and present their work to the class with appropriate explanations</p>
</td>
<td>
<p>Show and Tell</p>
<p>Have learners take turns presenting multi-digit numbers written in expanded form and converting them to standard form for their classmates.</p>
<p>For example:</p>
<p>On Styrofoam cups label the bottom of each cup as ones, tens, hundreds, up to millions. Along the edges of the ‘ones’ cup, write numbers from 1 to 9. Along the edges of the ‘tens’ cup, write numbers from 10 +, 20 + etc. The same is done for the hundreds cups up to the million cups.</p>
<p>Cups are placed into each other, in the correct place value order. The cups are pulled out slightly to show a number in expanded form and then pushed back to show the number in standard form.</p>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</table>

<table>
<tr><th>Specific Curriculum Outcomes</th><th>Inclusive Assessment Strategies</th><th>Inclusive Learning Strategies</th></tr>
<tr><td></td><td>

Presentations

Learners are given cards with a multi-digit number written on it.

Each learner represents his digit using manipulatives of his choice. This is presented to the classroom with appropriate explanations.

Games

Number Matching Game

Learners pick cards from card decks with numbers in expanded form, worded form and standard form. Learners are to match numbers in standard form to their equivalents in expanded form and word form.

https://www.mathcoachscorner.com/2013/08/number-forms-place-value-match-up/

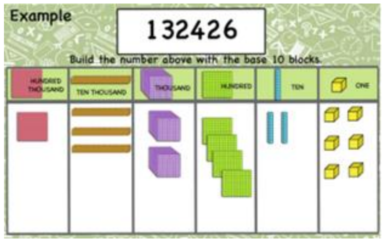
</td><td>

https://tinyurl.com/4hmsmbvf

Hands on Manipulatives

Have learners explore numbers up to one million using a variety of tools and representations, including place value charts, base ten blocks, number lines, and digital platforms. They will develop a deep understanding of place value by physically manipulating place value disks and

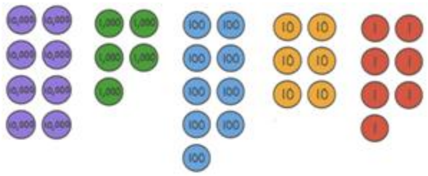
</td></tr>
</table>

<table>
<tr><th>Specific Curriculum Outcomes</th><th>Inclusive Assessment Strategies</th><th>Inclusive Learning Strategies</th></tr>
<tr>
<td></td>
<td>
Observation
Learners are observed as they perform the various transactions.
Observation Checklist
<table>
<tr><td>Criteria</td><td>Yes</td><td>No</td><td>Follow-Up</td></tr>
<tr><td>Learner follows the role play instructions</td><td></td><td></td><td></td></tr>
<tr><td>Learner writes the amount correctly in standard form</td><td></td><td></td><td></td></tr>
<tr><td>Learners writes the amount correctly in word form</td><td></td><td></td><td></td></tr>
<tr><td>Learner writes breakdown in budget correctly in expanded form</td><td></td><td></td><td></td></tr>
</table>
</td>
<td>
connecting them to the visual and digital representations.
Base Ten Blocks
Use the base ten blocks to represent each digit in the number. E.g. 3 452: 3 cubes (each representing 1000) for 3000, 4 flats (each representing 100) for 400, 5 rods (each representing 10) for 50 and 2 units (each representing 1) for 2. Learners lay out blocks in sequence to visually represent the magnitude of the number.
Extend to multi digits up to 1 000 000.


https://edit.mathcurious.com/2020/09/13/representing-numbers-using-base-10-blocks-6-digits-printable-and-virtual-task-cards/
Place Value Disks
Use place value disks to represent each digit in the number. Learners place the disks on a line to show the value. Count the disks to obtain the number represented.
</td>
</tr>
</table>

<table>
<tr><th>Specific Curriculum Outcomes</th><th>Inclusive Assessment Strategies</th><th>Inclusive Learning Strategies</th></tr>
<tr><td></td><td></td><td>
Example, 85 967

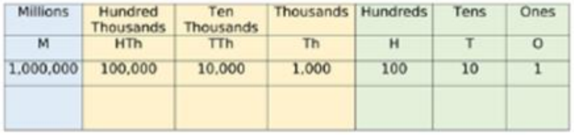
Form stacks of eight 10 000 disks, five 1 000 disks, nine 100 disks, six 10 disks, seven 1 disks.



https://media.nagwa.com/627124648475/en/thumbnail_1.jpeg

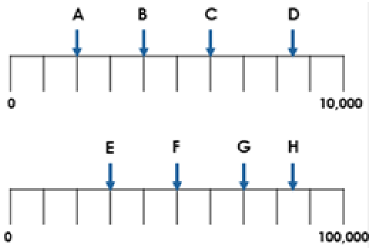
Place Value Charts

Learners represent numbers up to 1 000 000 using a place value chart. The digits in the number are placed correctly under the correct place value in the chart.


<table>
<tr><th>Millions</th><th>Hundred Thousands</th><th>Ten Thousands</th><th>Thousands</th><th>Hundreds</th><th>Tens</th><th>Ones</th></tr>
<tr><td>M</td><td>HTh</td><td>TTh</td><td>Th</td><td>H</td><td>T</td><td>O</td></tr>
<tr><td>1,000,000</td><td>100,000</td><td>10,000</td><td>1,000</td><td>100</td><td>10</td><td>1</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>
https://www.tes.com/teaching-resource/visual-place-value-chart-millions-12765389

Number Lines

Number lines are drawn on strips of paper. Mark and label specific points on the strip. Learners will
</td></tr>
</table>

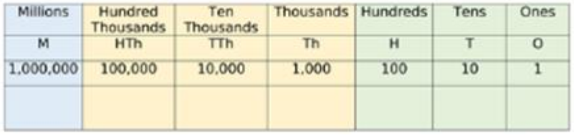
Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
		place pegs on the number line and find the number that it represents.  https://classroomsecrets.co.uk/number-line-to-1000000/ Digital Tools Using GeoGebra, create a number line using the tool's feature to create a line covering the required range. Learners use input bar or point tools to insert points on the number line to represent specific multi-digit numbers. **Manipulatives** Provide opportunity for learners to practice the following conversions through various activities and exercises: Begin by reviewing place value concepts for numbers up to 1,000,000. Use a place value chart to visually represent different numbers and emphasize the value of each digit based on its position.

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
		For example: Place Value Disks and Place Value Mat Present learners with a chart that matches digits with their corresponding words (1000 = one thousand; 10 000 = ten thousand etc.) **Standard to Word Form:** ● Provide learners with a multi-digit number in standard form (e.g., 345,789). ● Model how to write the number in word form (three hundred forty-five thousand, seven hundred eighty-nine). ● Guide learners to practice writing numbers in word form independently. **Word to Standard Form:** ● Present learners with a number written in word form (e.g., two hundred fifteen thousand, four hundred twelve). ● Demonstrate how to convert the word form to standard form using a place value chart. ● Have learners practice converting word form to standard form with partners or in small groups. **Expanded to Standard Form:** ● Introduce expanded form using examples (e.g., 300,000 + 40,000 + 5,000 + 700 + 80 + 9).

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
		- Explain how to combine the values to form the standard form number. - Provide learners with expanded form numbers to convert to standard form. **Standard to Expanded Form:** - Demonstrate how to break down a standard form number into its expanded form using place value understanding. - Offer learners practice opportunities to convert standard form to expanded form. Invite learners to start off with a number written in standard form. Learners represent the number on a place value mat using place value disks. Learners write the expanded form and the worded form of the given number. Learners use a number written in expanded form, represent the number on the place value mat and write the worded form and standard form of that number. Learners then use a number written in worded form, represent the number on the place value mat and write the standard and expanded form of the number.

<table>
<tr><th>Specific Curriculum Outcomes</th><th>Inclusive Assessment Strategies</th><th>Inclusive Learning Strategies</th></tr>
<tr><td></td><td></td><td>


https://www.teaching.com.au/product/place-value-discs-8211-set-of-280



<table>
<tr><th>Millions</th><th>Hundred Thousands</th><th>Ten Thousands</th><th>Thousands</th><th>Hundreds</th><th>Tens</th><th>Ones</th></tr>
<tr><td>M</td><td>HTh</td><td>TTh</td><td>Th</td><td>H</td><td>T</td><td>O</td></tr>
<tr><td>1,000,000</td><td>100,000</td><td>10,000</td><td>1,000</td><td>100</td><td>10</td><td>1</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>

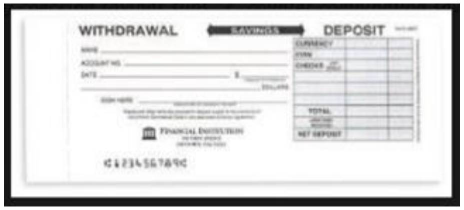
https://www.tes.com/teaching-resource/visual-place-value-chart-millions-12765389

Role Play

Bankers

Learners play roles as bankers – a customer and a teller. Learners are provided with sample withdrawal slips. Learners write up withdrawal slips in standard form and in words.

Learners write cheques in standard form and word form.
</td></tr>
</table>

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
		Budget Breakdown Learners break down a provided budget into expanded form.  WITHDRAWAL SAVINGS DEPOSIT https://www.netbankstore.com/counter-combination-savings-withdrawal-deposit-slips-18999.html  BANK NAME 01234 DATE PAY TO THE ORDER OF $ DOLLARS MEMO https://www.shutterstock.com/search/blank-check

Additional Resources and Materials

Place value mats
Expanded form cards
Digit and place value arrow cards
Linking cubes
Interactive digital tools

Book

The Best Vacation Ever by Stuart J Murphy

Additional Useful Content Knowledge for the Teacher:

Operations (addition, subtraction, multiplication and division) of large numbers.
Writing multi-digit numbers in expanded notation
Number sequence
Rounding off numbers
Comparing and ordering numbers

Opportunities for Subject Integration:

Language:
- Create word problems that involve expanded form
- Write stories that include large numbers

Physical Education
- Use expanded form to keep scores or times
- Record steps taken in expanded form

Social Studies
- Use expanded form to break down population numbers in different regions

Science
- Recoding scientific data in word form or standard form
- Represent measurements in word, expanded or standard form

Essential Learning Outcome: N1.3. Whole Number – Comparing and Ordering Quantities

Grade Level Expectations and/or Focus Questions:

- Read and write multi-digit whole numbers using base-ten numerals, number names, and expanded form to 1 000 000
- Compare two multi-digit numbers based on meanings of the digits in each place (to six place values)
- Use >, =, and < symbols to record the results of comparisons
- Apply strategies to contextual situations and create story problems involving the comparison of whole numbers.

<table>
<tr><th>Specific Curriculum Outcomes</th><th>Inclusive Assessment Strategies</th><th>Inclusive Learning Strategies</th></tr>
<tr>
<td>
Learners are expected to:

Knowledge

1. Read and write up to seven-digit numbers using base ten numerals and number names

2. Identify the face value, place value and total value of any digit in a seven-digit number

3. Write a seven-digit number in expanded form

Skills

4. Use concrete materials and visual aids (such as place value charts) to compare two whole numbers up to seven digits, using appropriate symbols (<, >, =)

Values

5. Compare multi digit numbers up to seven digits by creating and solving real-life story problems
</td>
<td>
<i><u>RATING SCALE</u></i>

Assess each learner by asking him/her to represent a given number using base ten blocks (Dienes blocks). Use a rating scale such as the one below.

<table>
<tr><th>LEARNER IS ABLE TO:</th><th>1</th><th>2</th><th>3</th><th>4</th></tr>
<tr><td>1. Use the correct number of blocks to represent
a) tens
b) hundreds
c) thousands
d) ten thousands
e) hundred thousands
f) millions

2. Represent any number correctly using dienes blocks.</td><td></td><td></td><td></td><td></td></tr>
</table>
</td>
<td>
<i><u>CONCRETE MATERIALS</u></i>

<i>Invite learners to use manipulatives while they achieve these SCOs. Teacher acts as the facilitator in these learner-centred activities. Ensure that mixed ability groups are formed so as to ensure conceptual understanding by all learners.</i>

-Manipulate <u>base ten blocks (Dienes blocks)</u> in pairs and/or small groups to represent given numbers. Learners can create question cards to be used with base ten blocks. Have them exchange cards with classmates. To cater for differentiated instruction, ensure that all questions on cards do not include millions.

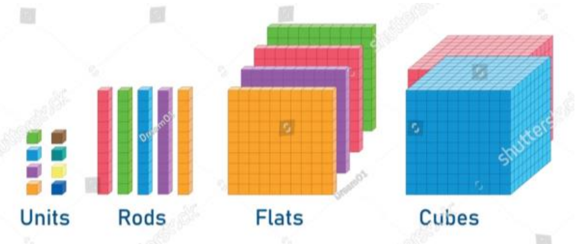
Examples of cards:
1. Write in words: 4 002 310
2. Write in figures:
Five million, one hundred and five thousand and ninety-nine.
</td>
</tr>
</table>

<table>
<tr><th>Specific Curriculum Outcomes</th><th>Inclusive Assessment Strategies</th><th>Inclusive Learning Strategies</th></tr>
<tr>
<td></td>
<td>
<table>
<tr><td>3. Provide reasonable explanation for the number of blocks used to represent each digit in a number.
4. Identify the face value of any digit in a seven-digit number.
5. Identify the place value of any digit in a seven-digit number.
6. Identify the total value of any digit in a seven-digit number.
7. Write a seven-digit number in expanded form</td><td></td><td></td><td></td><td></td></tr>
</table>

1- No understanding
2- Little understanding
3-Moderate understanding
4-Complete mastery

Use the results from the rating scale to categorize learners according to the following:

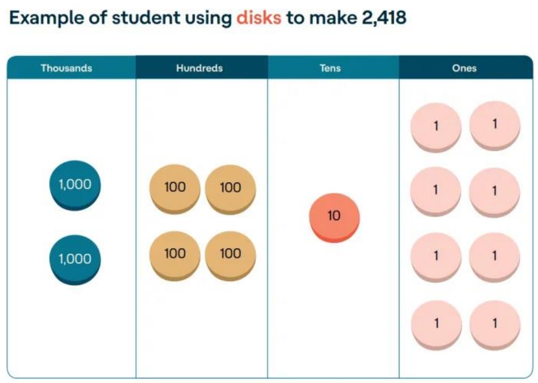
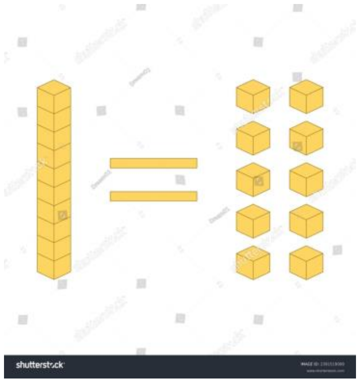
UNDERSTANDING -Learner provides the highest level of response and accuracy in explanation. Can represent any given number (including zeros) using
</td>
<td>
3. In the number below, state the face value, place value and total value of each underlined digit.
8 070 426
4. Write 7 628 029 in expanded form.
5. 8 000 000 + 50 000 + 60 + 5 = __________.

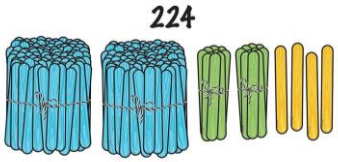
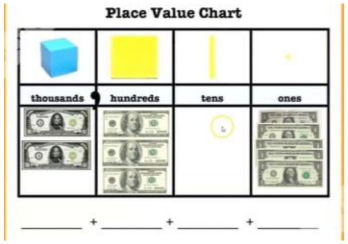


SOURCE: https://www.shutterstock.com/image-vector/place-value-base-10-units-rods-2223609409

- Invite learners to use **place value charts/mats** and **place value discs** to read and write numbers. Teacher should model how to use place value discs on a place value mat or chart. Have learners compose multi-digit numbers and have them discuss the value of each digit. Introduce expanded form and guide learners to discover the link between place/total value and expanded form.

Encourage peer tutoring and cooperative learning while engaging in this activity.
</td>
</tr>
</table>

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
	dienes blocks. Learner understands place value and expanded notation. *CONSTRUCTION* - Evidence of understanding, but lacks consistency. *EMERGENT* - Learner can represent numbers using dienes blocks but cannot provide meaningful explanation. Learner is unable to identify the face, place or total value of digits in a seven digit number. Learner is unable to write seven-digit numbers in expanded form. ***<u>EXIT CARDS</u>*** Have learners complete exit cards at the end of the lesson. They must get at least three correct before leaving. Use questions similar to those listed in ILS.	 SOURCE: https://www.understood.org/en/articles/place-value-disks-an-evidence-based-math-strategy  SOURCE: https://www.shutterstock.com/image-vector/ten-units-equal-one-rod-learning-2391519099

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
		- Have learners form bundles using **items in their environment** such as straws, tooth picks, popsicle sticks and match sticks. To understand the concept of place value, invite them to form bundles of up to thousands. Millions may not be possible but they can use thousands to conceptualize what one million looks like. Use understanding of place value and total value to write given numbers in expanded form.  -Form bundles using **play money** to encourage integration of mathematical concepts and to foster better understanding. Use questioning techniques to enable learners to see the relationship between finding the total amount of money given various notes and expanded notation.  https://www.youtube.com/watch?v=zCpRPM91_j8

<table>
<tr><th>Specific Curriculum Outcomes</th><th>Inclusive Assessment Strategies</th><th>Inclusive Learning Strategies</th></tr>
<tr>
<td></td>
<td>
Whole-group Class Discussion/Presentations

Ask each group of three or four to create and solve a word problem. Each group presents to the class and discusses the reason for their answer. Use the observation checklist below to assess.

<table>
<tr><th>CRITERIA</th><th>YES</th><th>NO</th><th>COMMENT</th></tr>
<tr><td>1. Problem involves a real-life scenario.

2. Problem is simple and easy to understand.

3. Solution is correct and uses correct symbols

4. Justification of solution is clear and thorough and demonstrates understanding of place value.

5. There is participation from all</td><td></td><td></td><td></td></tr>
</table>
</td>
<td>
GAMES
-Have learners rearrange number cards to form numbers that are bigger or smaller than given numbers.

-Form groups of three or four. Provide each group with a set of cards with a number written on each. Teacher calls out a number and asks learners to raise a card with a lower or higher value. The group with the highest score wins.

PLACE VALUE CHARTS
Have learners write each digit in a number on a place value chart and compare numbers based on the value of their digits. Have them write the statements using the correct symbols (<, >, =).

<u>Comparing Numbers to 1 000 000</u>

INTERACTIVE QUIZZES
Sample:
<u>https://www.iknowit.com/lessons/e-comparing-numbers-to-9999999.html</u>

STORY PROBLEMS

Create real-life story problems involving comparing numbers that learners can relate to. Have them read and solve these problems. This activity can be done individually, in pairs or in small, mixed ability groups.
</td>
</tr>
</table>

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
	group members.	Invite learners the opportunity to create and solve their own problems, then share with classmates. Samples of problems: 1. Mr. Pete wants to buy a car for GYD $2 316 768. His friend wants to buy a car for GYD $2, 361 769. Which car is cheaper? 2. The population of Country X is 6 060 006. The population of Country Y is 6 060 606. Which country has less people? See more samples in link below. https://www.khanacademy.org/math/arithmetic-home/arith-place-value/arith-comparing-multi-digit-numbers/v/comparing-multi-digit-numbers-word-problems

Additional Resources and Materials

- base ten blocks
- place value charts/mats
- place value discs
- straws
- popsicle sticks/ toothpicks/matches
- play money

Additional Useful Content Knowledge for the Teacher:

Model and write numbers using base ten blocks

Reading and Writing Numbers Up to Hundred Thousand in Words and in Symbols https://www.understood.org/en/articles/place-value-disks-an-evidence-based-math-strategy

https://classroomsecrets.co.uk/lesson/year-5-compare-and-order-to-a-million-lesson/

NOTE TO TEACHER:
When teaching place value, develop the understanding that in a multi-digit number, a digit in one place represents 10 times as much as it represents in the place to its right and 1/10 of what it represents in the place to its left)

Opportunities for Subject Integration:

Music- When counting beats in Music, large numbers are involved, for example, if a piece of music has 17 306 beats, learners can write this number in words and expanded form.

Physical Education - Learners can run short distances and record measurements in mm or cm. They can write these distances in words and figures and in expanded form.

Social Studies - Have learners' record populations of countries in the world in words and figures.

Language Arts - Create story problems involving large numbers.

Essential Learning Outcome: N1.4. Whole Number – Understanding Place Value

Grade Level Expectations and/or Focus Questions:

- Use place value understanding to round decimals to any place
- Represent the place value of numbers in base-ten groupings concretely, pictorially, contextually, verbally and symbolically
- Explain the pattern regularity of the place value system
- Identify the value of a digit as determined by its position.

<table>
<tr><th>Specific Curriculum Outcomes</th><th>Inclusive Assessment Strategies</th><th>Inclusive Learning Strategies</th></tr>
<tr>
<td>

Learners are expected to:

Knowledge

1. State the place value of digits in a decimal number up to the thousandths place

2. Round off a decimal number to the nearest whole number, tenth, hundredth and thousandth

3. State the value of any digit in a multi-digit number (up to seven digits), based on its position

Skills

4. Represent the place value of numbers in base-ten groupings concretely, pictorially, contextually, verbally and symbolically

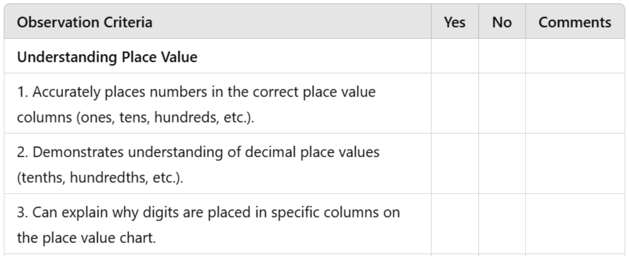
Values

</td>
<td>

<u>PRODUCT- THINK PAIR SHARE</u>

Observe learners while using place value charts/mats and decimal grids. Provide each pair or small group with question cards and have them discuss solutions with their partners. Have each group present to the class.

Use an observation checklist such as the one below to assess learners.



<table>
<tr><th>Observation Criteria</th><th>Yes</th><th>No</th><th>Comments</th></tr>
<tr><td>Understanding Place Value</td><td></td><td></td><td></td></tr>
<tr><td>1. Accurately places numbers in the correct place value columns (ones, tens, hundreds, etc.).</td><td></td><td></td><td></td></tr>
<tr><td>2. Demonstrates understanding of decimal place values (tenths, hundredths, etc.).</td><td></td><td></td><td></td></tr>
<tr><td>3. Can explain why digits are placed in specific columns on the place value chart.</td><td></td><td></td><td></td></tr>
</table>

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<td>

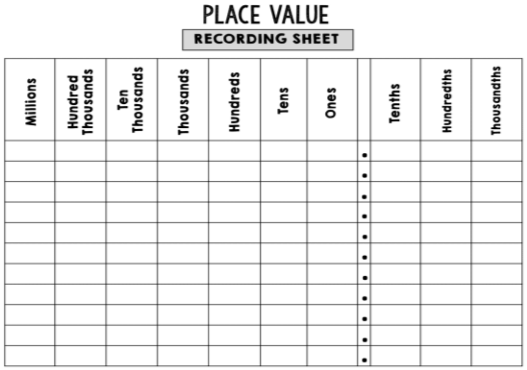
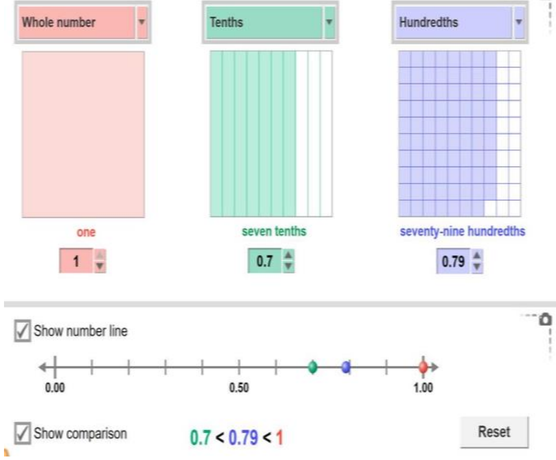
<u>PLACE VALUE CHARTS/MATS</u>

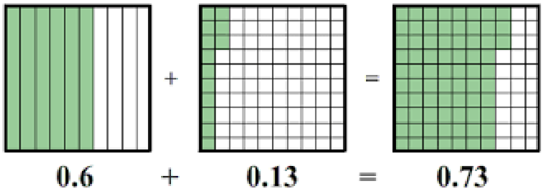
-Invite learners to place all the digits in a given number in the correct position in a place value chart.

-Engage them in reversible thinking by placing the digits, then asking them to state the place value of selected digits. .

-Have them discuss and compare the values of digits based on their positions. For example, In the number $2\underline{6}7.\underline{5}9$, find the difference in value between the two underlined digits.

</td>
</tr>
</table>

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
5. Create patterns involving the place value system using real life situations and concrete materials.	**PRODUCT- EXIT TICKETS** Have each learner answer the question on his/her card at the end of the class. Give questions according to the learner's ability. Slower learners can simply round off a given number to the nearest tenth, hundredth or thousandth. Others can be given word problems, some of which involve money or measurement. Some of the problems can be one-step while others can be two-step. Post solutions on the classroom wall before leaving. **INTERACTIVE GAMES** Provide learners with links for interactive games where self-assessment can take place. Encourage them to surf the web for more exciting games. Examples: **SCOOTER QUEST.** **SOCCER MATH** **RING TOSS**	PLACE VALUE RECORDING SHEET Millions | Hundred Thousands | Ten Thousands | Thousands | Hundreds | Tens | Ones | . | Tenths | Hundredths | Thousandths https://www.mathkidsandchaos.com/place-value-chart/ ***DECIMAL GRIDS*** -Provide learners with grids such as the following as have them identify the numbers represented. Guide them to discover the relationship between a number line and a decimal grid.  ☑ Show number line ☑ Show comparison 0.7 < 0.79 < 1

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
		https://gizmos.explorelearning.com/find-gizmos/lesson-info?resourceId=1007 -Provide them with blank grids and have them represent given numbers by colouring. Use base ten blocks alongside decimal grids so that learners can see the link between the concrete and pictorial representations, before moving to the abstract level. Build on this concept by inviting learners to understand what happens when decimals are added or subtracted.  https://34auburn.weebly.com/decimal-introduction.html ***PROBLEM SOLVING*** -Provide learners with scenarios involving money and measurement where they have to apply the skill of approximation. ***For example,*** ***1. Mom asks Peter to go to the supermarket to buy 2 lbs sugar for $2.85 and a can of milk for $2.08. How much money would she most likely give to Peter?*** ***2. Ms. John wants to buy two pieces of ribbon each measuring 96.5 cm.***

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
		a) How much ribbon does she need in all? ***b) If the store only sells ribbon in multiples of 100, how much ribbon does Ms. John buy?*** Ask probing questions to introduce the concept of rounding off.  https://www.mashupmath.com/blog/round-to-the-nearest-tenth

Additional Resources and Materials

place value chart/map

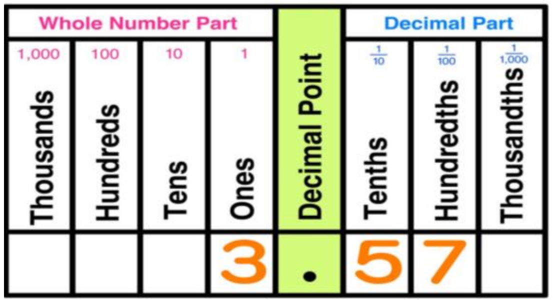
base ten blocks

decimal grids

play money

number lines

Additional Useful Content Knowledge for the Teacher:



Whole Number Part					Decimal Part		
1,000	100	10	1		$\frac{1}{10}$	$\frac{1}{100}$	$\frac{1}{1,000}$
Thousands	Hundreds	Tens	Ones	Decimal Point	Tenths	Hundredths	Thousandths
			3	.	5	7	

What is rounding off in math?

In math, rounding off is the process of approximating that involves changing a number to a close value that is simpler and easier to work with. Rounding is done by replacing the original number with a new number that serves as a close approximation of the original number.

For example, if a new pair of basketball sneakers costs $99.88, you could use rounding to conclude that you will need $100 to purchase the sneakers. In this example, you would be rounding to the nearest whole dollar and the purpose of rounding would be to replace the actual cost of “ninety-nine dollars and eight-eighty cents” with an approximated value of “one hundred dollars,” since it is simpler and easier to work with.

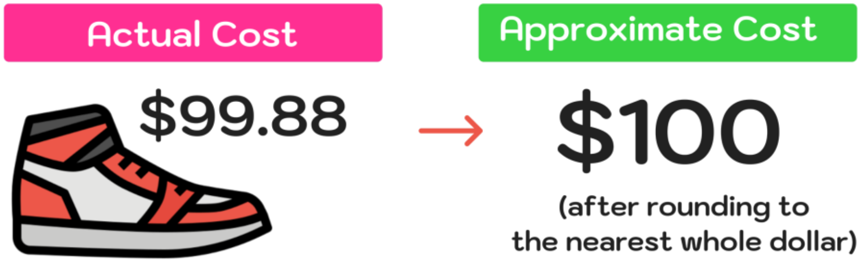


Figure 01: You could use rounding to say that a pair of sneakers that actually costs $99.88 has an approximate cost of $100, since one hundred is simpler and easier to work with.

SOURCE: https://www.mashupmath.com/blog/round-to-the-nearest-tenth

Opportunities for Subject Integration:

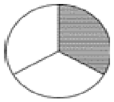
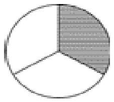
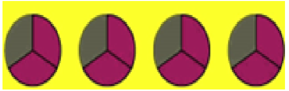
Food and Nutrition- Round off measurements to determine how much of each ingredient needs to be bought.

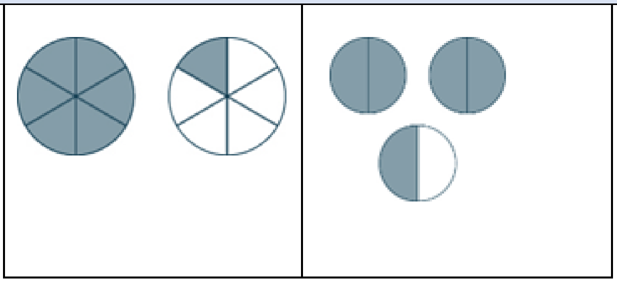
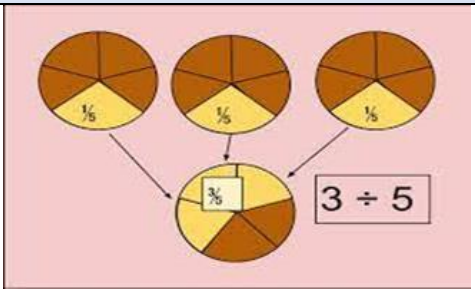
Language Arts- Write poems about place value of decimals and rounding off.

Essential Learning Outcome: N2.1. Fractions, Decimals and Rational Numbers– Representing Fractions

Grade Level Expectations and/or Focus Questions:

- Interpret a fraction as division of the numerator by the denominator (a/b = a ÷ b)
- Solve word problems involving division of whole numbers leading to answers in the form of fractions or mixed numbers, e.g., by using visual fraction models or equations to represent the problem;
- Understand a fraction as a ratio or rate.

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
Learners are expected to: **Knowledge** 1. Explain a fraction as the division of the numerator by the denominator using concrete, pictorial, verbal and symbolic representation. 2. Express a whole number division equation as a fraction. 3. Explain a fraction as a ratio showing part to part or part to whole relationship. **Skills** 4. Create games, puzzles and real world problems involving division of whole numbers expressing solutions as fractions.	***Fraction Matching Bingo Game*** Provide each child with a fraction card with four pictorial representations of fractions. Invite learners to match the fraction read to its pictorial representations when divided. Allocate enough time for learners to work out the answer using concrete, pictorial or symbolic reasoning to find the answer. **FRACTION DIVISION BINGO CARD** 	**Can it be Divided?** Have learners engage in concrete learning experiences by using manipulatives like counters, beads, playdough, pattern blocks and dominoes to explore the relationship between fractions and division. For example: Learners will choose a domino from a set of six and express it as a fraction. They will then articulate the fraction in words (e.g. four-sixths) and as a division problem (four divided by six) To solidify their understanding, learners will use playdough to model the fraction as the division of the numerator by the denominator. 3/5 as a fraction of a whole and 3 ÷ 5

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
5. Determine unknown values in equivalent ratios by applying the concept of unit rate as a multiplier. **Values** 6. Appreciate the value of sharing by representing real life applications as fractions and ratio equivalence **7.** Demonstrate sharing a total amount in a given ratio using part to whole relationship.	 **Think Pair Share** Invite each child to write a worded real life story problem. Have them exchange their problems with another learner and solve them. Provide opportunities for each pair of learners to discuss their solutions and make corrections if needed. **Follow up Activity:** Use each child story problem to create a booklet. Exit Ticket In pairs, have the learners complete a worksheet. Invite them to compare and discuss answers with the other pair of learners within their group.	 Retrieved from: https://roomtodiscover.com/fraction-visual-models/ **Can we Share Equally?** Have learners tackle division word problems using playdough as a visual aid. They will represent the division problem as a fraction to deepen their understanding of the connection between the two concepts. For example: Four friends bought 3 pizzas to share equally. How many slices of pizza will each friend get? Have learners create and separate pizzas. Invite learners to represent their division with an equation, then provide their answer as a fraction.

<table>
<tr><th>Specific Curriculum Outcomes</th><th>Inclusive Assessment Strategies</th><th>Inclusive Learning Strategies</th></tr>
<tr>
<td></td>
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Retrieved From: https://quizlet.com/365951139/ratios-and-proportions-flash-cards/

<table>
<tr><th>As a part to part ratio</th><th>As a unit rate fraction</th><th>As a part to whole ratio</th><th>As a Fraction of the whole</th></tr>
<tr><td>1.

2.</td><td>1.

2.</td><td>1.

2.</td><td>1.

2.</td></tr>
</table>

Observation

Learners will be observed as they solve real life problems and assessed using an observational checklist

<table>
<tr><th>Criteria</th><th>Yes</th><th>No</th></tr>
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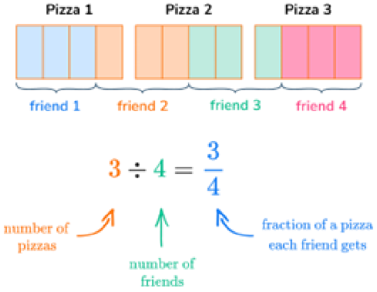
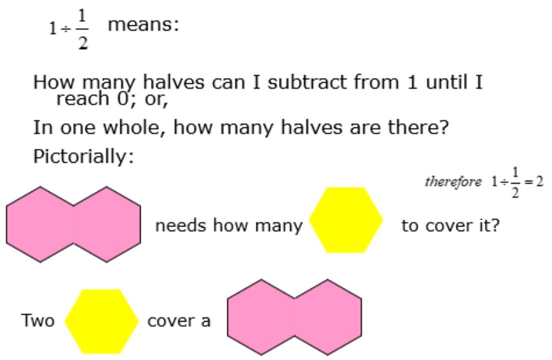
</td>
<td>


Retrieved from: https://thirdspacelearning.com/us/math-resources/topic-guides/number-and-quantity/fractions-as-division/

Provide other opportunities for practice. Ensure that you use questions where the dividend is greater than the divisor. Provide manipulatives where they can use wholes or sets to represent division. For example:



$1 \div \frac{1}{2}$ means:

How many halves can I subtract from 1 until I reach 0; or,

In one whole, how many halves are there?

Pictorially:

</td>
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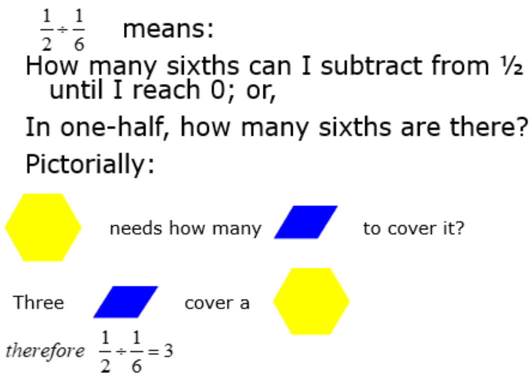
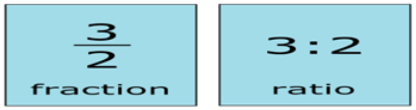
</table>

<table>
<tr><th>Specific Curriculum Outcomes</th><th>Inclusive Assessment Strategies</th><th>Inclusive Learning Strategies</th></tr>
<tr>
<td></td>
<td>
<table>
<tr><td>1. Learners identified the ratio
2. Learners identified the unit rates of each part of the ratio.
3. Learners used a unit rate to create a diagram or used manipulatives to find the missing part of the ratio.
4. Learners provided accurate explanations for their answers.</td><td></td><td></td></tr>
</table>

Peer Assessment
Give each group a story problem. Invite learners to solve the problem individually, then exchange with their peers for correction and feedback.
</td>
<td>

$\frac{1}{2} \div \frac{1}{6}$ means:
How many sixths can I subtract from ½ until I reach 0; or,
In one-half, how many sixths are there?
Pictorially:

Investigating Fractions as a ratio
<u>Part to Part</u>
Present learners with a fraction and ratio representation. Invite learners to use counters to represent them.
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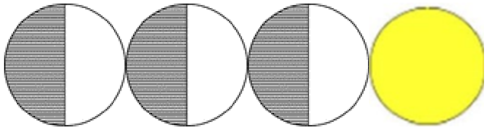
</table>

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
		Have learners explain what the fraction 3/2 represents. Example: There are 3/2 red balls to every 1 yellow ball. Using their knowledge of fractions as division, have learners divide 3 by 2. Invite learners to use play dough to show division.  1 ½ red balls to 1 yellow 3 red balls to 2 yellow balls Have learners swap the values in the ratio to represent yellow balls to red balls. Invite them to create the fraction and explain the value of each unit rate. Part to Whole

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
		Using the same diagram, ask learners to represent each colour as a fraction of the whole. Whole : 5 Red Balls : 3/5 Yellow Balls: 2/5 _Application of Part to Part Ratio Invite learners to work collaboratively to explore the concept of unit rates. After a brief review of part-to-part ratios, groups will be given two different items and tasked with determining the unit rate for each.  Retrieved From: https://brainly.com/question/11816632 Example: Football to rugby ball 2: 6 Baseball to football 6:2 Football is 2/6 of the rugby ball

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
		To every 1/3 of football, you have 1 rugby ball Baseball is 6/2 of football To every three-rugby ball, you have 1 football **Extending knowledge** Using the ratio of 2:6, if there are 30 rugby balls how many footballs are there? Invite learners to draw a diagram, or use manipulatives to represent the solution to the problem by using the unit rates of football to rugby ball. Pay careful attention to the strategies used. If necessary, use guided questioning to direct learners to the correct solution. Example: 1. What is the unit rate of rugby balls to football? 2. How many groups of three rugby balls can you get from a total of 30 balls? 3. If each group of 3 represents 1 football, how many footballs will we have?

<table>
<tr><th>Specific Curriculum Outcomes</th><th>Inclusive Assessment Strategies</th><th>Inclusive Learning Strategies</th></tr>
<tr><td></td><td></td><td>


Retrieved From: https://www.morrant.com/136-gilbert/rugby_balls/4370_0b.html

Using the unit rate of 3 to 1, for every three balls circled, learners will draw one football. This will give them a total of 10 footballs.

30 divided by 3 = 10

Using the second unit rate of 1/3 football to 1 baseball. Dividing the 30 in thirds

<table>
<tr><td> </td><td> </td><td> </td></tr>
<tr><td>10</td><td>10</td><td>10</td></tr>
</table>

Football is 1/3 of baseball, therefore football is 10 or 1/3 x 30 = 10
</td></tr>
</table>

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
		Provide learners with other examples to practice in their groups. Can I Share in a given Ratio? Present learner with manipulative and a story problem: Dora shared some sweets in the ratio 3:5 among Tom, Dick and Harry. What fraction of the sweets did each child get? In groups, invite learners to use different coloured counters to represent each part of the ratio. Invite learners to represent each part of the ratio as a fraction of the whole. Listen as learners explain what each fraction represents.  Retrieved From: https://www.hope-education.co.uk/product/curricular/mathematics/numicon/numicon-coloured-counters-pack-of-200/he1803877 Using the same problem, add 80 sweets and ask learners to calculate each person's share. Guide

<table>
<tr><th>Specific Curriculum Outcomes</th><th>Inclusive Assessment Strategies</th><th>Inclusive Learning Strategies</th></tr>
<tr><td></td><td></td><td>learners to use both methods to find the solution. Invite them to use manipulatives or diagrams to help them.
a. Multiplying the part to whole fraction by the total amount
b. Finding unit rate.
Example:
80 sweets to 8parts
Unit rate : 80/8 = 10/1
10 sweets to every part.
<table><tr><td>10</td><td>10</td><td>10</td><td>10</td><td>10</td><td>10</td><td>10</td><td>10</td></tr></table></td></tr>
</table>

Additional Resources and Material

Material

Playdough

Fraction cards

Counters

Beads

Dominoes

Popsicle sticks

Books

'If you hopped like a frog' by David M. Schwartz

Ratio and proportion by David A Adler

Websites

https://www.mathplayground.com/grade_6_games.html

https://www.commoncoresheets.com/rate-language/817/download

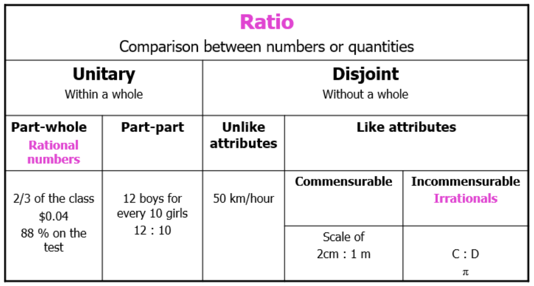
Additional Useful Content Knowledge for the Teacher:

Ratio: A comparison of two numbers or quantities. They are measured in the same or similar units. Example: The ratio of adults to children is 3:5.

Rate: A special ratio that compares two quantities measured in different types of units. Example: The water dripped at a rate of 2 litres every 3 hours.

Unit Rate: A rate with a denominator of 1. Example a car travelled at 60 mph. 60 miles/1hr

[Understanding Fractions as Division (mathteachercoach.com)](mathteachercoach.com)



<table>
<tr><td colspan="5">Ratio
Comparison between numbers or quantities</td></tr>
<tr><td colspan="2">Unitary
Within a whole</td><td colspan="3">Disjoint
Without a whole</td></tr>
<tr><td>Part-whole
Rational numbers</td><td>Part-part</td><td>Unlike attributes</td><td colspan="2">Like attributes</td></tr>
<tr><td rowspan="2">2/3 of the class
$0.04
88 % on the test</td><td rowspan="2">12 boys for every 10 girls
12 : 10</td><td rowspan="2">50 km/hour</td><td>Commensurable</td><td>Incommensurable
Irrationals</td></tr>
<tr><td>Scale of
2cm : 1 m</td><td>C : D
π</td></tr>
</table>

- **Ratios represent part-to-whole *and* part-to-part relationships.**
- **Fractions represent a part-to-whole relationship.**

Opportunities for Subject Integration:

Art and Craft

creating bingo games

creating puzzles

Creating shapes

Creating Charts

Science and Technology

Experimenting: Measuring ingredients in fractional quantities and discussing the unit rate or ratio of one quantity to another.

Social Studies

Work effectively in groups, accepting responsibility for their part of a task

Voting and representation: Calculating the fraction of vote a political party or candidate receives during an election

Demographics: Using ratio to represent the different demographic groups within a population

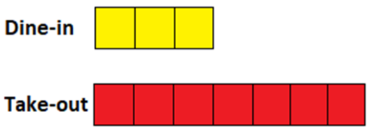
Language Arts

Determine how long it will take to read a book by calculating the unit rate of pages per hour.

Essential Learning Outcome: N2.2. Fractions, Decimals and Rational Numbers – Comparing and Ordering Fractions

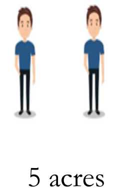
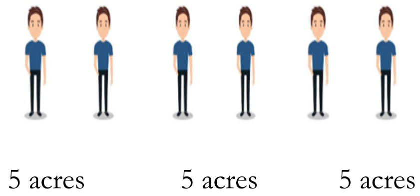
Grade Level Expectations and/or Focus Questions:

- Compare fractions as ratios. Read, represent, compare, and order decimal numbers up to thousandths, in various contexts.
- Describe relationships and show equivalences among fractions and decimal numbers up to thousandths, using appropriate tools and drawings, in various contexts.

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
Learners are expected to: **Knowledge** 1. Explain equal fractions and ratios as proportions using visual fraction models. 2. Examine the difference between proportional and inverse proportional relationships. 3. Determine the multiplicative relationship between two quantities by expressing part -to-part ratios as unit rates in fraction form and comparing them. 4. Solve real life story problems involving inverse proportional relationships. 5. Represent a decimal number up to thousandths using concrete, pictorial, verbal and symbolic representations.	Product: Completing the Ratio Equivalence Board. In pairs, play a game of completely covering the board as a whole class activity. To play the game, create a board with the answers to the questions given. Ensure that the answers are written in the form of a fraction. Then, give each pair of learners a card with a real-life story problem: <u>Example:</u> The ratio of orange juice to sugar in a jug of juice is 200 ml to 3 tbsp. of sugar. If a mother wants to use 9 tsp of sugar to make juice, how much orange juice should she use if she wants the juice to have the same taste? Invite learners to discuss and solve the problem. After finding the answer, learners will use the sticky paper to cover the answer on the equivalent fraction board.	Present learners with strip cards of two different colours representing the number of people who dine in and order takeout at a restaurant on Saturday. Instruct pupils to symbolically give a representation of the cards as a ratio and a fraction.  Retrieved From: https://study.com/skill/practice/using-tape-diagrams-that-represent-ratios-to-find-equivalent-ratios-questions.html 3: 7 = 3/7 Using the scenario; On Sunday the restaurant dine in number was doubled while the number of take-out increase proportionately. Ask them to use

<table>
<tr><th>Specific Curriculum Outcomes</th><th>Inclusive Assessment Strategies</th><th>Inclusive Learning Strategies</th></tr>
<tr>
<td>6. Compare decimal numbers up to thousandths as fraction equivalence using >, < or = signs.
7. Explain the relationship between fractions and decimals up to thousandths using concrete, pictorial, verbal and symbolic representations.
Skills
8. Create games, puzzles and real-life story problems involving comparing and ordering decimals up to thousandths.
9. Construct diagrams to show equivalence among fractions and decimal numbers up to thousandths.
Values
10. Justify the relationship which exists among a ratio, fraction and a decimal using real life problems.</td>
<td>Think, Pair, Share
In pairs, invite learners to write an inverse proportion real-life question. Then invite them to create a diagram to help explain their solution. Provide them with the opportunity to share with class.</td>
<td>strip diagrams to show the number of dine in and take out for Sunday.
Have learners write their ratio in the box below and compare the increase in the numbers. Help learners make the comparison between equivalent ratio and equivalent fractions.
Have learners write their ratio in the box below.
Continue to add increases to dine in and take outs proportionately for 5 days
<table>
<tr><td>3</td><td>6</td><td></td><td></td><td></td></tr>
<tr><td>7</td><td>14</td><td></td><td></td><td></td></tr>
</table>
Have learners examine the numbers in each ratio and describe any patterns they notice between the first numbers(antecedents) and the second numbers(consequents)
Provide opportunities for learners to show the values of the ratios by representing them as fractions and compare.
Through a series of questions, guide learners to discover the concept that both parts of a ratio</td>
</tr>
</table>

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
		must be multiplied or divided by the same number to maintain equivalence. Examples of questions may include: 1. If we double the number of marbles, what happens to the number of red marbles to keep the ratio the same? 2. How can we represent this new number of marbles as a fraction? 3. What did we do to the numerator and denominator of the original fraction to get the new fraction? 4. If we halved the number of red marbles, what would happen to the number of blue marbles? 5. How can we represent his new number of marbles as a fraction? 6. What did we do to the numerator and denominator of the original fraction to get the new fraction? More to More, More to Less Invite learners to use visual aids, manipulatives, or real-world examples to help learners understand the concepts.

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
		Example of a real-life story: It takes 2 people 3 hours to mow 5 acres of grass. Assuming that the people are working together at the same time and the same steady pace, how many acres will 6 people mow in the same 3 hours? Invite learners to use diagrams or concrete manipulatives to represent the information in the problem.   Retrieved From: https://www.freepik.com/premium-vector/man-male-young-person-icon_3155307.htm

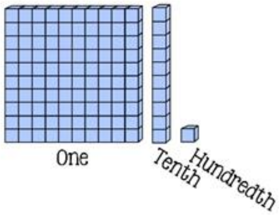
<table>
<tr><th>Specific Curriculum Outcomes</th><th>Inclusive Assessment Strategies</th><th>Inclusive Learning Strategies</th></tr>
<tr>
<td></td>
<td>
<p>Exit Ticket</p>
<p>In pairs, invite learners to use any of the methods taught to compare each ratio. Provide learners with the opportunity to discuss and present their solutions.</p>
<table>
<tr><th colspan="2">Which is Greater?</th></tr>
<tr><td>Class A has 9 boys and 12 girls and class B has 7 boys and 10 girls. Which class has a lesser ratio of boys to girls?</td><td>Timmy ordered 2 pieces of salmon and 5 pieces of lobster. Henry ordered 3 pieces of salmon and 6 pieces of lobster. Whose order has a greater ratio of salmon to lobster?</td></tr>
</table>
</td>
<td>
<p>Guide learners through questioning to explain the answer.</p>
<p><u>Example of Questions</u></p>
<p>1. What happened when the number of people increased?</p>
<p>2. Can the increase be considered as direct proportion?</p>
<p>Using the same question, have learners explore the relationship between the number of people and the time taken to mow the same number of acres.</p>
<p>How long will it take 6 people to mow the same 5 acres of grass?</p>

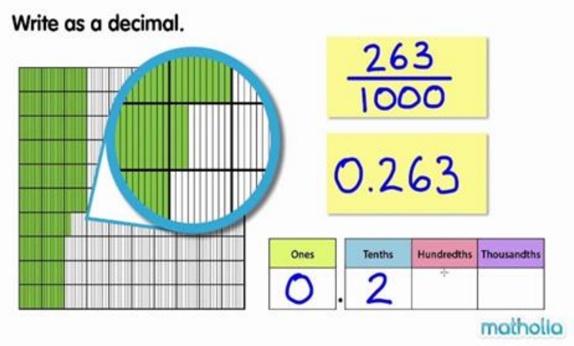
<p>3hr 3hrs each = 6hrs in total to mow the grass</p>

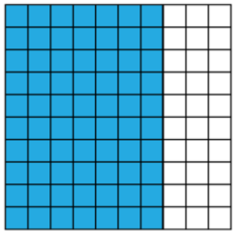
</td>
</tr>
</table>

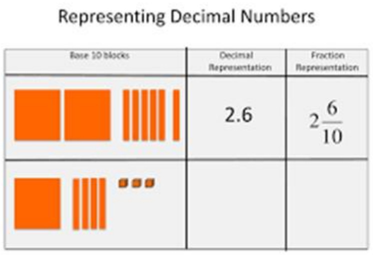
Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
	Play a game of show and tell Give each group two sets of ten cards. One with fraction equivalence and the other with diagrams representing decimals. Instruct learners to turn the cards one at a time. Invite learners to take turns to identify the diagram shown on the card as a decimal and find the matching fraction. Retrieved from: https://mathcurious.com/2020/09/28/representing-decimal-numbers-using-base-10-blocks-printable-and-digital-activity-cards/ Lucky Dip for Three In pairs, invite learners to dip for three decimals. Instruct them to draw a diagram or use base ten blocks to represent each decimal. Have learners represent decimals as fractions and order them in ascending order. Provide opportunities for learners to explain their solutions.	6 hrs divided by 6 = 1 hr per person **Example of Questions** 1. What happened when the number of people increased? 2. Can the increase be considered as direct proportion? Give reasons for your answer. 3. If twice as many people (4) were used to complete the same job, how much time would it take them? 4. What will happen to the time taken if one person was to complete the same job? Guide learners to make the generalizations. 1. In inverse proportion, if the number of people increases, the time taken decreases and vice versa. Additionally, if there are twice as many people then it takes half as long to complete the task and ½ the number of people take twice as long to complete the task.

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
		Shopping Smart Banana Bargain Invite learners to compare the price of items at two different stores. By determining the unit price (cost per item) at each store, they will decide which store offers the better deal. For example: At Jay's supermarket the price of bananas is 5 for \$2 whereas at Kay's minimart, bananas are sold at a price of 8 for \$4. Which supermarket is offering the best price? Have learners analyse the pricing of bananas at two different stores. They will explore the various strategies to determine which store offers the better deal. Encourage learners to represent the price information as ratios and unit rates. Facilitate class discussion about different solution methods and the efficiency of using ratios and unit rates for comparison. Ask learners to compare the two unit price rate fractions to determine which supermarket offers the better deal on bananas. Discuss the meaning of the comparison: Which fraction represents the lower cost per banana?

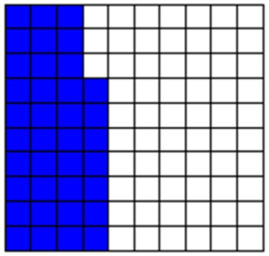
Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
		For Example: Make calculations and compare unit price rate fractions. Jay’s Supermarket Unit Price rate : 2/5 40 cents for 1 banana Kay’s Supermarket Unit Price rate: 4/8 50 cent for 1 banana Therefore, 2/5 is less than 4/8 Extend learners' knowledge by exploring alternative methods to compare ratios. https://youtu.be/E38yxW10Mfs https://youtu.be/jVr5s9fxbGc Representing Decimals Provide each group of learners with base ten block, 100 block worksheet and crayons. 

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
	Creating a Real-Life Story Booklet In pairs, Invite learners to write their real-life story problems. Learners are to create a pictorial representation of their story problem and show how the ratio, fraction, or decimal can be represented to show equivalence between the three concepts. Collect each pairs' work to create a class booklet	https://www.mathcoachscorner.com/2015/09/multiplying-decimals/ Invite learners to use the blocks to represent the decimal 0.32. Direct learners' attention to the relationship between 3/10 in the decimal as three groups of 10 out of the total of 10 groups. Through questioning, get learners to realize that these 3 groups of tenths can also be represented as 30 /100, whereas the 2 is 2/100. This can also be written as a total of 32/100. Provide learners with other examples for practice. Provide learners with a hundred block worksheet and crayons to represent decimals up to thousandths by shading the using coloured pencil to represent each decimal value. Invite learners to write the total as a fraction. 

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
		More, Less or Equal Organize learners into groups and provide each group with a visual representation of a decimal. Example:  Invite learners to represent this diagram as a decimal and a fraction. 0.7 7/10 Have learners work collaboratively in groups to interpret diagrams representing decimals. Using their understanding that each block within the diagram equals 0.01 or 1/100, groups will express the visual representation as both a decimal and a fraction out of one hundred. 0.70 70/100 Building on their previous work, invite learners to extend their understanding of decimals and

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
		fractions by converting the diagram into both decimal and fraction forms using the thousandths place. Remind learners that each hundredth block can be divided into ten thousandth parts. 0.700, 700 /1000 Invite learners to compare the three decimals and fractions and record their observations. Guide learners to make the generalization that a decimal can be written as tenths, hundredths or thousandths with equal value.  Retrieved From: https://www.slideserve.com/crete/modeling-decimals-with-base-10-blocks In groups provide learners with these two diagrams. Ask learners to represent diagrams as decimals and fractions. Using the diagram as well as decimal and fraction ask learners to compare

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
		the decimals using >, <, = signs. Provide opportunities for learners to justify their answer. Provide learners with two decimals with place value up to thousandths and one with place value of tenths. 2.3 And 2. 336 Ask learners to write these decimals as fractions and compare them. Use probing questions to get learners to recall how to compare fractions with unlike denominators. Direct learners' attention to tenths represented as hundredths and thousandths equivalence. 2 3/10 2 336/1000 2 300/1000 < 2 336/ 1000 Have learners begin the lesson by tackling a real-word problem that involves decimals. Example; On a test out of a hundred Tom got the following score. Represent Tom's score as a fraction, ratio and decimal. Invite learners to explain each of the methods used.

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
		 Tom got 0.37 of the answers correct. This means that he got 37/100 , 37 correct answers out of the total of 100 marks It also means that he got 37: 63; 37 correct answers and 63 wrongs. Provide learners with other examples for further practice.

Additional Resources and Material

<u>Material</u>

base ten blocks

hundred block chart

counters

decimal grid

fraction strips and bars

bingo card

decimal cards

<u>Books</u>

The Hershey's Milk Chocolate Fraction Boob by Jerry Pallotta

Sir Cumference and the Fraction Faire by Cindie Neuschwander

Websites

https://www.mathsisfun.com/decimal-fraction-percentage.html

https://www.khanacademy.org/math/cc-sixth-grade-math/x0267d782:cc-6th-rates-and-percentages

Additional Useful Content Knowledge for the Teacher:

Equivalent Ratios: Equivalent ratio can be obtained by multiplying and dividing the numerator and denominator with the same number.

Comparing ratios using unit rate: First, find the value of one unit and then the value of the required number of units. Example: Two pants cost $60. What will be the cost of 5 pants?

Unit rate: $60/2 = $30 per pants Therefore: 5 x $30 = $150

Comparing ratio using cross multiplicative comparison:

a/b =c/d

a x d = b x c

If a x d > than b x c, then a/b is the greater unit.

Example: Tom and David went bike riding on the weekend. Tom rode 6 miles in 2 hours and David rode 10 miles in 4 hours. Did Tom and David go the same rate of bike riding?

Tom a/b ; 6/2 ; 3/1
David c/d; 10/4 ; 5/2

3 x 2= 6 , 1x 5= 5

3/1 > 5/ 2 , Tom's riding rate was faster than David's

Comparing Ratio as Fractions using L.C. D

Example: Tom 6/2 ; 3/1

David 10/ 4, 5/2

L.C. D = 2

Tom : 3 x 2/2 = 6/2
David : 5/2

6/2 > 5/2

Proportion: An equation of two equivalent ratios. Example: 5 pounds of sugar cost $4. How much does a pound of sugar cost? $⅘ = n$/1

Opportunities for Subject Integration:

Art and Craft

Creating Art projects where learners divide shapes into fractional parts and represent them as decimals and ratios

Use proportion to scale up or down a pictures or shapes

Science and Technology

Use fraction and decimal to analyse data and to make statements of comparison.

Relate fraction and decimals to the use of scientific measurements of volume, temperature etc.

Social Studies

Explore the concept of equality and fairness through the concept of comparing fraction, decimals and ratios.

Language Arts

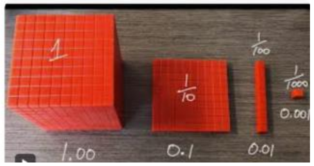
Have learners write explanations or stories using decimals and fractions

Invite them to create riddles based on comparing and ordering decimals

Essential Learning Outcome: N2.3. Fractions, Decimals and Rational Numbers – Representing Decimals

Grade Level Expectations and/or Focus Questions:

- Represent decimals using concrete materials and pictorials (tenths, hundredths, thousandths); Describe decimals in context, verbally and symbolically;
- Use decimal notation for fractions with denominators 10, 100 or 1 000.

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
Learners are expected to: **Knowledge** 1. Represent decimals using concrete materials and pictorials for tenths, hundredths, and thousandths. 2. Demonstrate understanding by retrieving and representing decimals using pictorials for given fractions. 3. Describe decimals in real-world contexts both verbally and symbolically. 4. Convert fractions with denominators 10, 100, or 1,000 into decimal notation. 5. Analyse the relationship between fractions and decimals with denominators of 10, 100, or 1000. 6. Create a visual representation that showcases the conversion of fractions with denominators of 10, 100, or 1000 into decimal form. **Values**	Observation: Monitor learner participation and understanding during group work and individual practice. Worksheet: Collect and review the conversion worksheet for accuracy. Exit Slip: Have each learner write one fraction with a denominator of 10, 100, or 1,000, convert it to a decimal, and describe the relationship (e.g., "When the denominator is 100, the decimal has two places"). Extensions	Use a visual model (like a decimal grid) to illustrate tenths, hundredths, and thousandths places and introduce the terms. Demonstration how to use base-ten blocks and decimal grids to represent decimals like 0.1, 0.01, and 0.001  https://youtu.be/yDa0ytNgbJI?si=f5xve9jryj__zegh Give learners decimal cards (e.g., 0.2, 0.05, and 0.003) and have them use base-ten blocks and grids to represent each value. Check for Understanding: Move around to observe learners' representations and guide as needed. Show the connection between fractions and decimals (e.g., 1/10 = 0.1, 1/100 = 0.01). Use examples on the board.

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
7. Apply knowledge of decimal representations to solve real-world problems. 8. Justify the importance of understanding decimals in everyday life situations.		Provide worksheets with fractions, and ask learners to convert these fractions to decimals and represent each with pictorial grids (e.g., shading tenths, hundredths). Have a few learners share their pictorial representations on the board to reinforce the concept. Ask learners where they see decimals in real life (e.g., money, measurement in cooking, temperature). Demonstrate converting fractions with 10, 100, and 1,000 denominators into decimals (e.g., 3/10 = 0.3, 45/100 = 0.45). Learners convert fractions together and then independently practice on a worksheet. Discuss and identify the relationship between fraction denominators and decimal places. In small groups, learners convert fraction cards and observe that 10, 100, and 1,000 denominators have 1, 2, and 3 decimal places, respectively. Groups share observations. Demonstrate fraction-to-decimal conversions using decimal grids (e.g., shade 3/10 as 0.3). Learners practice shading grids to represent converted fractions and then present their grids to explain their conversions.

Additional Resources and Materials

Whiteboard and markers
Decimal grids (tenths, hundredths, thousandths)
Fraction-to-decimal conversion chart
Visual aids/posters showing fraction-to-decimal examples (e.g., 1/10 = 0.1, 1/100 = 0.01, etc.)
Blank decimal grids for learner practice
Coloured pencils or markers
Worksheets with conversion exercise

Additional Useful Content Knowledge for the Teacher

The place value of the first position to the right of the decimal point is tenths. The second position to the right of the decimal point is hundredths. The third position to the right of the decimal point is thousandths.

Decimal numbers can be less than one (e.g., 0.654) or greater than one (e.g., 24.723).

The one whole needs to be shown or explicitly indicated when decimal numbers are represented visually since their representation is relative to the whole.

Decimal numbers can be represented as a composition or decomposition of numbers according to their place value. For example, decimals can be written in expanded notation 3.628 = 3 + 0.6 + 0.02 + 0.008, or 3 × 1 + 6 × 0.1 + 2 × 0.01 + 8 × 0.001.

Decimal numbers can be compared by their place value. For example, when comparing 0.8250 and 0.845, the greatest place value where the numbers differ is compared. For this example, 2 hundredths (from 0.825) and 4 hundredths (from 0.845) are compared. Since 4 hundredths is greater than 2 hundredths, 0.845 is greater than 0.825.

Numbers can be ordered in ascending order – from least to greatest or can be ordered in descending order – from greatest to least.

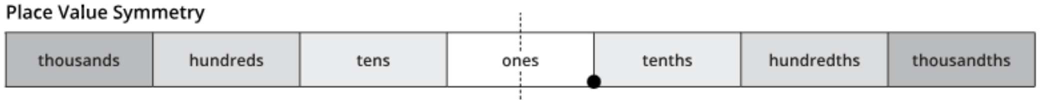
Note

Between any two consecutive whole numbers are decimal thousandths. For example, the number 3.628 describes a quantity between 3 and 4, more precisely, between 3.6 and 3.7, and between 3.62 and 3.63.

Decimals are sometimes called decimal fractions because they represent fractions with denominators of 10, 100, 1000, and so on. Decimal place value columns are added to describe smaller partitions. Decimals, like fractions, have a numerator and a denominator; however, with decimals, only the numerator is visible. The denominator (or unit) is "hidden" within the place value convention.

Decimals can be composed and decomposed like whole numbers. Expanded notation shows place value subdivisions (e.g., 3.628 = 3 + 0.6 + 0.02 + 0.008, or 3 × 1 + 6 × 0.1 + 2 × 0.01 + 8 × 0.001).

The decimal point indicates the location of the unit. The unit is always to the left of the decimal point. There is symmetry around the unit column, so tenths match tens, and hundredths match hundreds. Note that the symmetry does not revolve around the decimal, so there is no "oneth":



A chart with the names of the place-value columns from left to right: thousands, hundreds, tens, ones, tenths, hundredths, and thousandths. A line of symmetry is drawn at one, showing the symmetry around the one column.

Between any two places in the base ten system, there is a constant 10-1 ratio, which is true for decimals. As a digit shifts one space to the right, it becomes one-tenth as great, and if it shifts two spaces to the right, it becomes one hundredth as great. So, 0.005 is one-tenth as great as 0.05, one hundredth as great as 0.5, and one-thousandth as great as 5. This also means that 5 is 1000 times as great as 0.005.

As with whole numbers, a zero in a decimal indicates that there are no groups of that size in the number:

5.007 means that there are 5 wholes, 0 tenths, 0 hundredths, and 7 thousandths.

5.100 means that there are 5 wholes, 1 tenth, 0 hundredths, and 0 thousandths.

5.1 (five and one tenth), 5.10 (5 and 10 hundredths), and 5.100 (5 and 100 thousandths) are all equivalent (although writing zero in the tenths and hundredths position can indicate the precision of a measurement; for example, the race was won by 5.00 seconds and the winning time was 19.29 seconds). Writing zero in the tenths, hundredths, and thousandths position can indicate the precision of a measurement (e.g., baseball batting averages are given to the nearest thousandths).

Decimals are read in a variety of ways in everyday life. Decimals like 2.5 are commonly read as two point five; in math, the term pi (π) is commonly approximated as three point one four; the decimal in baseball averages is typically ignored. However, to reinforce the decimal's connection to fractions, and to make visible its place value denominator, it is recommended that decimals be read as their fraction equivalent. So, 2.573 is read as "2 and 573 thousandths."

Opportunities for Subject Integration:

Mathematics and Science: Use measurement and data analysis in experiments; reinforce fractions, decimals, and graphing with scientific data.

Mathematics and Social Studies: Apply ratios and percentages to historical economics and population trends; integrate geography with mapping coordinates and statistics.

Mathematics and Language Arts: Use narrative-based word problems; explore symmetry and sequences in poetry.

Mathematics and Physical Education: Analyse fitness stats with averages and percentages; connect geometry to body movement in sports and dance.

Mathematics and Art: Study symmetry, scaling, and proportions through art projects; apply geometry for realism in visual works.

Mathematics and Technology: Use digital tools for data analysis and graphing; introduce coding with logical patterns and sequences.

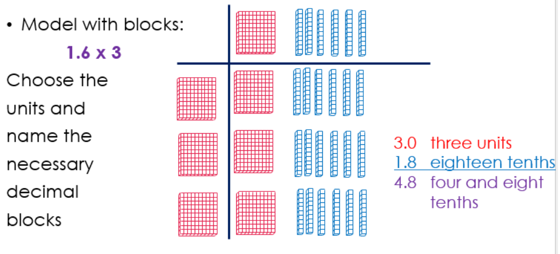
Mathematics and Music: Explore rhythms as fractions and scales as sequences, connecting math with music theory.

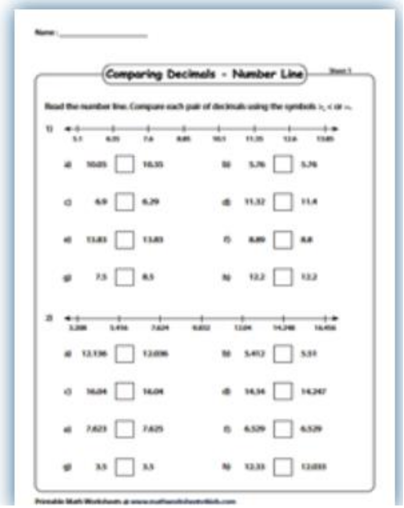
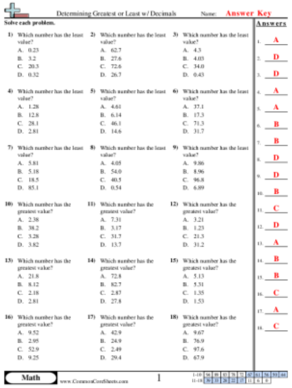
These integrations make math more engaging and relatable across subjects.

Essential Learning Outcome: N2.4. Fractions, Decimals and Rational Numbers – Comparing and Ordering Decimals

Grade Level Expectations and/or Focus Questions:

- Compare two decimals to thousandths based on meanings of the digits in each place, using >, =, and < symbols to record the results of comparisons
- Order decimals to thousandths based on place value understanding.

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
Learners are expected to: **Knowledge** 1. Describe the process of comparing two decimals to thousandths. **Skills** 2. Demonstrate using the >, =, and < symbols to compare different decimals to thousandths. 3. Generate a set of decimal numbers to thousandths and arrange them in ascending and descending order to show their understanding of ordering decimals to thousandths. **Values** 4. Solve comparison problems involving two decimals to thousandths using >, =, and < symbols. 5. Analyse the similarities and differences	Conversation: Present the following situation: Books from the library must be returned to the shelves according to their Dewey decimal number, with smaller codes first. Ask learners to consider the following: A learner says code 599.3 should go before 599.234 because 3 is smaller than 234. Her friend disagrees. Who do you think is correct and why? Explain your reasoning Product Introduce comparing decimals with different place values	Ask learners what they would enter on a calculator to generate the number sequence 7, 0.7, 0.07, 0.007. Support them in recognizing that each number is one-tenth the previous one and that dividing by 10 shifts a digit to the right. To extend their thinking, have learners see if they can create this sequence using multiplication (i.e., × 0.1) and discuss why multiplying 7 by 0.1 (which is the same as dividing 7 by 10) produces a smaller number.  Provide learners with a series of numbers, such as those below, and have them determine which is the greatest in each set and explain their thinking: 4328 or 434 or 48 43.6 or 4.25 or 345 8.3 or 8.257 or 8.45 5.008 or 5.09 or 5.7

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
between ordering decimals and comparing decimals to thousandths.	 Comparing Decimals - Number Line https://www.mathworksheets4kids.com/comparing-decimals.php Think Pair share multiple-choice worksheets: 	Listen to learners as they explain the reason behind their choice, particularly those who have made an incorrect choice. Encourage them to use their number sense and guide those who need support to recognize that having more digits after the decimal point does not mean a greater number. Decimal numbers can be represented as a composition or decomposition of numbers according to their place value. For example, decimals can be written in expanded notation 3.628 = 3 + 0.6 + 0.02 + 0.008, or 3 × 1 + 6 × 0.1 + 2 × 0.01 + 8 × 0.001. Decimal numbers can be compared by their place value. For example, when comparing 0.8250 and 0.845, the greatest place value where the numbers differ is compared. For this example, 2 hundredths (from 0.825) and 4 hundredths (from 0.845) are compared. Since 4 hundredths is greater than 2 hundredths, 0.845 is greater than 0.825. Numbers can be ordered in ascending order – from least to greatest or in descending order – from greatest to least.

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
	https://www.commoncoresheets.com/decimal-worksheets/sbh/comparing-decimals Have learners create word problems involving decimal comparisons	

Additional resources

Whiteboard and markers
Place value chart (up to thousandths)
Worksheets with decimal comparison and ordering exercises
Decimal number cards
Small group activities handouts
Exit slips for assessment

Additional Useful Content Knowledge for the Teacher

Numbers with the same units can be compared directly (e.g., 72.5 cm2 compared to 62.4 cm2).
Sometimes numbers without the same unit can be compared, such as 6.2 kilometres and 6.2 metres. Knowing that the unit kilometre is greater than the unit metre can invite one to infer that 6.2 kilometres is greater than 6.2 metres.
Sometimes numbers without the same unit may need to be rewritten with the same unit in order to be compared. For example, 1.2 metres and 360 centimetres can be compared as 120 centimetres and 360 centimetres. Thus, 360 centimetres is greater than 1.2 metres.
Whole numbers (zero and positive integers) and decimal numbers can be compared and ordered according to their place value.
Benchmark numbers can be used to compare quantities. For example,
5/6 is greater than ½ and o, 25 is less than ½ so 5/6 is greater than 0.25.

If two fractions have the same denominator, then the numerators can be compared. In this case the numerator with the greater value is the greater fraction because the number of parts considered is greater (e.g., 2/3>1/3)

If two fractions have the same numerators, then the denominators can be compared. In this case the denominator with the greater value is the smaller fraction because the size of each partition of the whole is smaller (e.g., 5/6<5/3)

Having more digits does not necessarily mean that a number is greater. For example, −7528 has four digits but it is less than +3 because −7528 is less than zero and +3 is greater than zero.

Any positive number is greater than any negative number.
When comparing positive numbers, the greater number is the number with the greater magnitude. On a horizontal number line, the greater number is the farthest to the right of zero. On a vertical number line, the greater number is the farthest above zero.
When comparing negative integers, the least number is the negative integer with the greater magnitude. On a horizontal number line, the lesser number is the farthest to the left of zero. On a vertical number line, the lesser number is the farthest below zero.
Numbers can be ordered in ascending order – from least to greatest – or can be ordered in descending order – from greatest to least.

Opportunities for Subject Integration:

Here are ways to integrate decimal comparison and ordering across subjects:

Science & Geography: Compare and order measurements (e.g., temperatures, distances, and elevations) for real-world data analysis.

Financial Literacy: Use decimals in budgeting, price comparison, and calculations involving taxes or savings.

Art & PE: Apply decimals for accuracy in scale drawings and in tracking progress in timed activities.

Technology & Data Analysis: Work with precise measurements in design software and interpret real-world data using decimal comparisons and ordering.

These integrations make decimal skills relevant across disciplines, reinforcing their real-world applications.

Essential Learning Outcome: N2.5. Fractions, Decimals and Rational Numbers – Decimal Place Value

Grade Level Expectation:

- Extend the positional structure of the place value system to include decimals (tenths, hundredths, thousandths); Read and write decimals to thousandths using base-ten numerals, number names, and expanded form, e.g., 347.392 = 3 × 100 + 4 × 10 + 7 × 1 + 3 × (1/10) + 9 × (1/100) + 2×(1/1000)

<table>
<tr><th>Specific Curriculum Outcomes</th><th>Inclusive Assessment Strategies</th><th>Inclusive Learning Strategies</th></tr>
<tr>
<td>Learners are expected to:

Knowledge

1. Read and write decimals to thousandths using base-ten numerals, number names, and expanded form, e.g.,347.392 = 3 × 100 + 4 × 10 + 7 × 1 + 3 × (1/10) + 9 × (1/100) + 2×(1/1000)

2. Represent base ten numerals up to thousandths in a place value chart using numerals and place value counter representations.

Skills

3. Convert the given expanded form of decimal numbers from millions to thousandths as their base-ten numeral representations.

4. Interpret the decimal representation up to thousandths using a place value chart</td>
<td>Observational Checklist for reading decimal numbers.

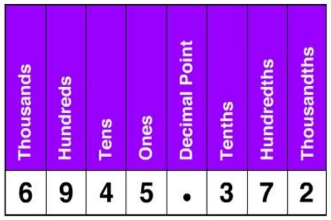
<table>
<tr><th colspan="3">Checklist for Reading Decimal Numbers</th></tr>
<tr><th>Criteria</th><th>✓</th><th>Comments</th></tr>
<tr><td>The learner reads the whole number part of the number correctly.</td><td></td><td></td></tr>
<tr><td>The learner reads the numbers after the decimal point correctly.</td><td></td><td></td></tr>
<tr><td>The learner demonstrates understanding of the place values of the digits in the whole number part of the numeral.</td><td></td><td></td></tr>
<tr><td>The learner demonstrates understanding of the place values of the digits after the decimal point.</td><td></td><td></td></tr>
</table>
</td>
<td>Use of Video and Place Value Chart
The learner is Engaged learners in viewing the video attached in the link below to reinforce reading decimal numbers up to hundredths and extend their knowledge of reading decimal numbers up to thousandths.
https://youtu.be/Kdu3CEAq7V0

Then the learners are engaged in reading decimal numbers up to thousandths with the aid of a place value chart.
The number <i>6945.372</i> is represented on a place value chart as shown below. The learners study the position of the values. After they are taught how to read a decimal number up to thousandths with the steps explained by their instructor.

How do we read the following number shown on the place value chart below?</td>
</tr>
</table>

<table>
<tr><th>Specific Curriculum Outcomes</th><th>Inclusive Assessment Strategies</th><th>Inclusive Learning Strategies</th></tr>
<tr>
<td>and place value counter as a written numeral and expanded form.

Values

5. Justify the correct expanded form representations of decimal numbers up to thousandths among incorrect decimal representations.</td>
<td>Assessment Rubric for writing decimal numbers.
<table>
<tr><td rowspan="4">The learner demonstrates understanding of place value of whole numbers</td><td>All the digits were written in the correct place value</td><td>4</td></tr>
<tr><td>Less than 100% but more than 75% of the digits were written in the correct place value</td><td>3</td></tr>
<tr><td>More than 50% but less than 75% of the digits were written in the correct place value.</td><td>2</td></tr>
<tr><td>Less than 50% of the digits are written in the correct place value.</td><td>1</td></tr>
<tr><td rowspan="3">The learner demonstrates understanding of place value of numbers after the decimal point.</td><td>All the digits were written in the correct place value</td><td>3</td></tr>
<tr><td>2/3 of the digits were written in the correct place value</td><td>2</td></tr>
<tr><td>⅓ of the digits was written in the correct place value.</td><td>1</td></tr>
<tr><td colspan="3">Teacher’s Comments</td></tr>
</table>
</td>
<td>
<table>
<tr><th>Thousands</th><th>Hundreds</th><th>Tens</th><th>Ones</th><th>Decimal Point</th><th>Tenths</th><th>Hundredths</th><th>Thousandths</th></tr>
<tr><td>6</td><td>9</td><td>4</td><td>5</td><td>•</td><td>3</td><td>7</td><td>2</td></tr>
</table>
1. Read the whole number
Six thousand, nine hundred, forty five
2. At the decimal point say and
Six thousand, nine hundred, forty five and
3. Read the number after the decimal point as the whole number you see.
Six thousand, nine hundred, forty five and three hundred, seventy two
4. At this point look at the place value of the digit farthest from the decimal point and say that place value.
Six thousand, nine hundred, forty five and three hundred, seventy two thousandths.

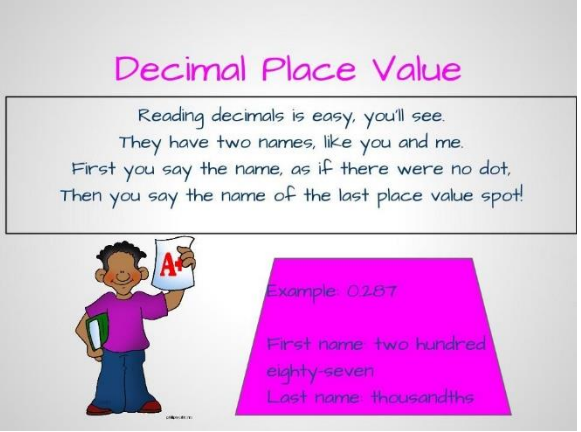
As the number is read they are asked to write in words what they are saying. Through this exercise the learners should realize that they write what they say in words to write the number in words.

Provide the opportunity for learners to reinforce the concept of decimal place value. For example, have. The learners recite the following poem to reinforce the concept.</td>
</tr>
</table>

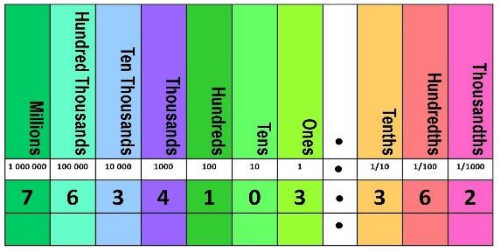
<table>
<tr><th>Specific Curriculum Outcomes</th><th>Inclusive Assessment Strategies</th><th>Inclusive Learning Strategies</th></tr>
<tr>
<td></td>
<td>
Class Presentation
The learner present their place value chart representation of a given number to the class. They explain to the class the reason placing the digits in the place value options they choose.

The class provides feedback to the learner. They state if the representation is correct and if not they state where the learner went wrong with an explanation.

Talking Circles
The learners sit in a circle to discuss how they were able to convert numbers written in expanded form to standard form. The learner with the given stick, makes the contribution while the other learners listen. Every learner gets to share their process, In this way if any other strategy was developed, the learners can learn from each other.
The objective of the activity is to:
1. Understand whether the learners can correctly identify the total values of the digits.
2. Correctly find the sum of the total values
3. Correctly state the standard form of the number.
The learners will be able to use the white board to explain any point they need to elaborate on.

Game
The learners are placed into four equal teams. If the teams have five players, they are numbered from 1 to 5. All number ones get a chance at the same turn, Number two's play with number twos etc.
The objective of the game is to determine the number represented on the place value counter chart. The teacher changes the number representation on the place value counter chart, after every turn.
</td>
<td>

Decimal Place Value
Reading decimals is easy, you'll see.
They have two names, like you and me.
First you say the name, as if there were no dot,
Then you say the name of the last place value spot!
Example: 0.287
First name: two hundred eighty-seven
Last name: thousandths

Learners write numbers in expanded form using the place value chart through guided discussion


<table>
<tr><th>Millions</th><th>Hundred Thousands</th><th>Ten Thousands</th><th>Thousands</th><th>Hundreds</th><th>Tens</th><th>Ones</th><th>•</th><th>Tenths</th><th>Hundredths</th><th>Thousandths</th></tr>
<tr><td>1 000 000</td><td>100 000</td><td>10 000</td><td>1000</td><td>100</td><td>10</td><td>1</td><td>•</td><td>1/10</td><td>1/100</td><td>1/1000</td></tr>
<tr><td>7</td><td>6</td><td>3</td><td>4</td><td>1</td><td>0</td><td>3</td><td>•</td><td>3</td><td>6</td><td>2</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>•</td><td></td><td></td><td></td></tr>
</table>

How to write numbers in expanded form?

1. Identify the standard form.
- 7634103.362

2. Identify the place value of each digit.
- 7 - million
</td>
</tr>
</table>

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
	At start, the teacher presents the learners with the counter representation. The first number 1 player to put up their hand, get the chance to get the points for the correct answer. If the first player does not get the answer, another number 1 player from another team gets the chance to get the point. This continues until the first representation is matched to the correct number. Then number 2 players of every team gets the next chance. This process continues until every player get a chance at a turn. When you get to the last player of the teams, round two begins at number one again. The game can have as many rounds as the teacher wishes. The team with the most correct answers wins the game. **Class Presentation** The objective is for the learner to justify the expanded form chosen for the given number. In the presentations the learners must explain why the chosen option correct and what makes the other options incorrect. The learners can use strategies of their choice. Every learner in the group gets to explain one card. ***Assessment Checklist to Justify Expanded Form of Numbers*** - ☐ The learner has the correct option.	- 6 - hundred thousand - 3 - ten thousand - 4 - thousand - 1 - hundred - 0 - ten - 3 - one After decimal point take the face value of the number - .3 - tenths - .06 - hundredths - .002 - thousandths 3. Write an addition number sentence with all the digits multiplied by their place value - (7 x 1 000 000) + (6 x 100 000) + (3 x 10 000) +(4 x 1000) + (1 x 100) + (3 x 1) + (3 x 1/10) + (6 x 1/100) + (2 x 1/1000) Using the above steps the learners are guided in writing several numbers in expanded form. **Place Value Chart** Have the learners representing numbers in a place value chart. They start with the first number on the left of the decimal point to find the place values of the digits in the whole number. They continue left until they have aligned the digits with its correct place value. After, they move to the first number on the right and continue right until they have identified the place values of the decimal number digits.

<table>
<tr><th>Specific Curriculum Outcomes</th><th>Inclusive Assessment Strategies</th><th>Inclusive Learning Strategies</th></tr>
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- ☐ The reasons for choosing are valid.
- ☐ The explanation for not choosing the other options demonstrates understanding of place value.
- ☐ The learner demonstrates understanding of the value of the position of the numbers.
- ☐ The learner made effective use of the strategies learnt to explain the option chosen

Teacher's Comments

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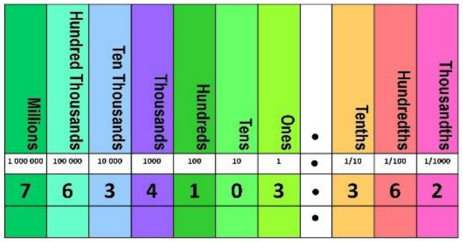
The place value chart below represents the position of the digits. The learners should use the decimal point as their guide to accurately position the numbers.

Provide opportunities for the learners to represent the decimal number on the place value chart like shown below.

7 634 103.362



<table>
<tr><td>Millions</td><td>Hundred Thousands</td><td>Ten Thousands</td><td>Thousands</td><td>Hundreds</td><td>Tens</td><td>Ones</td><td>•</td><td>Tenths</td><td>Hundredths</td><td>Thousandths</td></tr>
<tr><td>1 000 000</td><td>100 000</td><td>10 000</td><td>1000</td><td>100</td><td>10</td><td>1</td><td>•</td><td>1/10</td><td>1/100</td><td>1/1000</td></tr>
<tr><td>7</td><td>6</td><td>3</td><td>4</td><td>1</td><td>0</td><td>3</td><td>•</td><td>3</td><td>6</td><td>2</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>•</td><td></td><td></td><td></td></tr>
</table>

Invite the learners to practice representing numbers ranging from millions to thousandths on a place value chart like the one shown above.

SCO 3
Convert from expanded form to standard form through guided discussion

Engage the learners in activities learn on how to convert numbers from expanded form to standard form.

Firstly the learners recap what is meant by the term standard form of a number?

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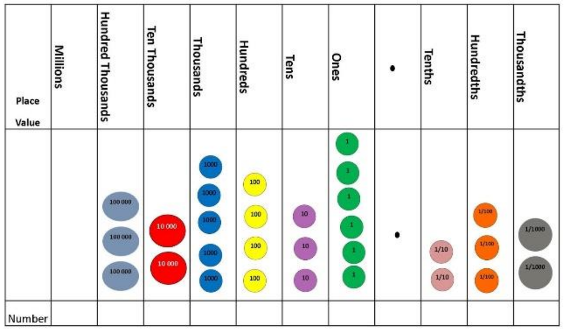
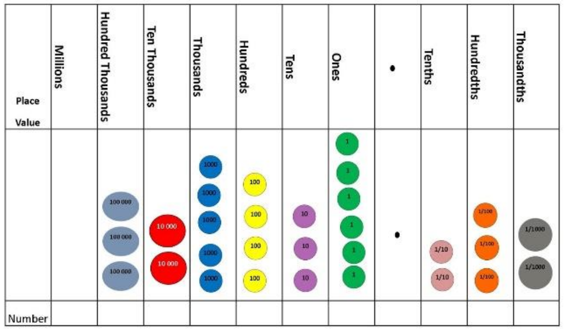
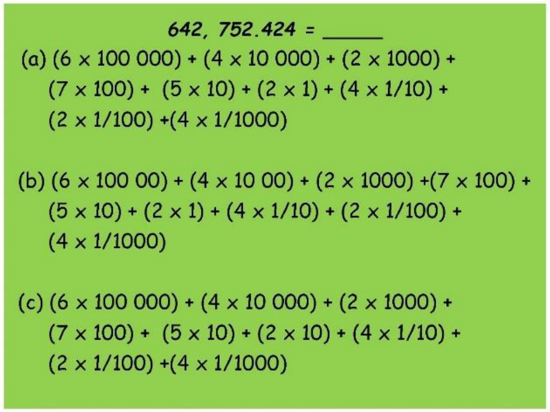
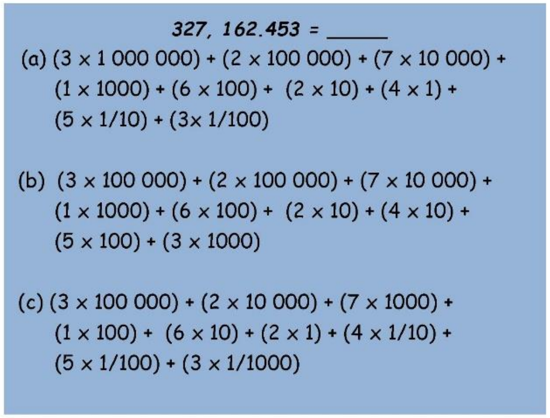
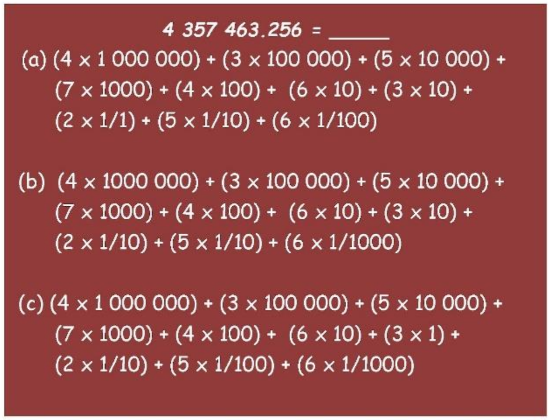
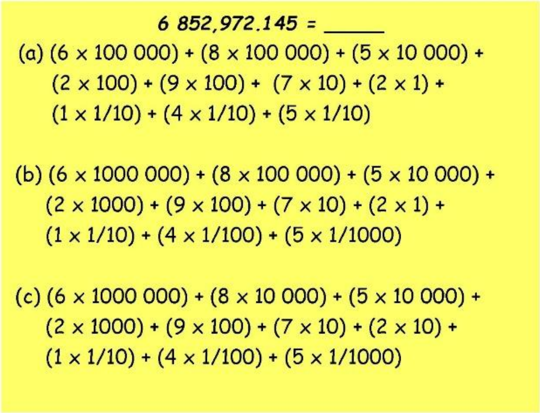
Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
		Standard Form :(Standard form of a number is the normal way we write numbers, with the largest place value on the left and working towards smaller place values at the right of the number. This form includes a comma at every 3 digits from the right, for example, to separate hundreds from thousands). **Demonstrate to learners how to write numbers in standard form step-by-step.** **How to convert decimal numbers from expanded form to standard form?** 1. Identify the expanded form of the decimal number. • (7 x 1 000 000) + (6 x 100 000) + (3 x 10 000) +(4 x 1000) + (1 x 100) + (3 x 1) + (3 x 1/10) + (6 x 1/100) + (2 x 1/1000) 2. Find the products of the equations in each bracket. • (7 x 1 000 000) = 7 000 000 • (6 x 100 000) = 600 000 • (3 x 10 000) = 30 000 • (4 x 1000) = 4 000 • (1 x 100) = 100 • (3 x 1) = 3 • (3 x 1/10) = 0.3 • (6 x 1/100) = 0.06 • (2 x 1/1000)= 0.002 3. Find the sum of all the products. 7 000 000 600 000

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
		30 000 4 000 100 3 0.3 + 0.06 0.002 **7 634 103.362** Using the above steps the learners are guided in converting numbers from expanded notation to standard form. **SCO 4** Provide opportunities for learners to Interpret place value counter chart to identify the number presentation representation.  For example: 1. The learners study a place value counter chart with a number representation. 2. The learners, starting with the highest place value column, identify the number represented in each place value column.

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
		After, all the values are added to determine the number represented. For example: Studying the diagram above; 300 000 20 000 5 000 400 30 6 0.20 0.03 0.002 325 436.232 **Using Place Value Count Chart number representation to write a number in expanded notation.**  1. The learners study the place value counter chart. 2. Starting from the column with the highest place value, each column in represented as the number of counters times the place value.

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
		For example: 3 x 100 000 2 x 10 000 5 x 1 000 4 x 100 3 x 10 6 x 1 2 x 0.1 3 x 0.03 2 x 0.002 3. The representations for each place value are placed in brackets and separated with the addition sign to write the number in expanded form. (3 x 100 000) + (2 x 10 000) + (5 x 1 000) + (4 x100) + (3 x 10) + (6 x 1) + (2 x 0.1) + (3 x 0.03) + (2 x 0.002) = **325 436.232** **SCO 5** **Differentiating examples from non-examples on flash cards.** Provide the opportunity for learners to collaborate in groups. For example, place The learners are placed in groups of four. Each group is given four flash cards. Each flash card contains an objective type question where the learners have to determine the expanded notation representation of a given number. The learners then share their responses with the class explaining the reason for each choice. The learners choose the tool and strategy of their

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
		choice to find the matching expanded form for the given numbers. Examples of flash cards:  642, 752.424 = _____ (a) (6 x 100 000) + (4 x 10 000) + (2 x 1000) + (7 x 100) + (5 x 10) + (2 x 1) + (4 x 1/10) + (2 x 1/100) +(4 x 1/1000) (b) (6 x 100 00) + (4 x 10 00) + (2 x 1000) +(7 x 100) + (5 x 10) + (2 x 1) + (4 x 1/10) + (2 x 1/100) + (4 x 1/1000) (c) (6 x 100 000) + (4 x 10 000) + (2 x 1000) + (7 x 100) + (5 x 10) + (2 x 10) + (4 x 1/10) + (2 x 1/100) +(4 x 1/1000)  327, 162.453 = _____ (a) (3 x 1 000 000) + (2 x 100 000) + (7 x 10 000) + (1 x 1000) + (6 x 100) + (2 x 10) + (4 x 1) + (5 x 1/10) + (3x 1/100) (b) (3 x 100 000) + (2 x 100 000) + (7 x 10 000) + (1 x 1000) + (6 x 100) + (2 x 10) + (4 x 10) + (5 x 100) + (3 x 1000) (c) (3 x 100 000) + (2 x 10 000) + (7 x 1000) + (1 x 100) + (6 x 10) + (2 x 1) + (4 x 1/10) + (5 x 1/100) + (3 x 1/1000)

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
		 4 357 463.256 = _____ (a) (4 x 1 000 000) + (3 x 100 000) + (5 x 10 000) + (7 x 1000) + (4 x 100) + (6 x 10) + (3 x 10) + (2 x 1/1) + (5 x 1/10) + (6 x 1/100) (b) (4 x 1000 000) + (3 x 100 000) + (5 x 10 000) + (7 x 1000) + (4 x 100) + (6 x 10) + (3 x 10) + (2 x 1/10) + (5 x 1/10) + (6 x 1/1000) (c) (4 x 1 000 000) + (3 x 100 000) + (5 x 10 000) + (7 x 1000) + (4 x 100) + (6 x 10) + (3 x 1) + (2 x 1/10) + (5 x 1/100) + (6 x 1/1000)  6 852,972.145 = _____ (a) (6 x 100 000) + (8 x 100 000) + (5 x 10 000) + (2 x 100) + (9 x 100) + (7 x 10) + (2 x 1) + (1 x 1/10) + (4 x 1/10) + (5 x 1/10) (b) (6 x 1000 000) + (8 x 100 000) + (5 x 10 000) + (2 x 1000) + (9 x 100) + (7 x 10) + (2 x 1) + (1 x 1/10) + (4 x 1/100) + (5 x 1/1000) (c) (6 x 1000 000) + (8 x 10 000) + (5 x 10 000) + (2 x 1000) + (9 x 100) + (7 x 10) + (2 x 10) + (1 x 1/10) + (4 x 1/100) + (5 x 1/1000)

Additional Resources and Materials
Decimal flash cards, decimal place value blocks and chart.

Additional Useful Content Knowledge for the Teacher:

Standard Form: Standard form of a number is the normal way we write numbers, with the largest place value on the left and working towards smaller place values at the right of the number. This form includes a comma at every 3 digits from the right, for example, to separate hundreds from thousands.

To write the expanded form of a number, identify the place value of each digit. Then multiply each digit by a corresponding multiple of 10 and add them. To convert numbers in expanded form to the normal form, place the digits in the proper places.
For e.g. 300 + 20 + 6 = 326 because 300 is 3 hundreds, 20 is 2 tens, 6 is 6 ones.

Opportunities for Subject Integration:

Literacy: Write explanations for decimal concepts to build vocabulary and clarity in communication.

Science: Use decimals in measurements (e.g., volume, temperature) to emphasize precision.

Art: Create visual grid representations for decimals, fostering creativity in understanding place value.

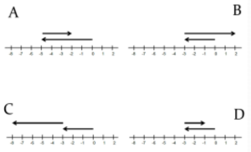
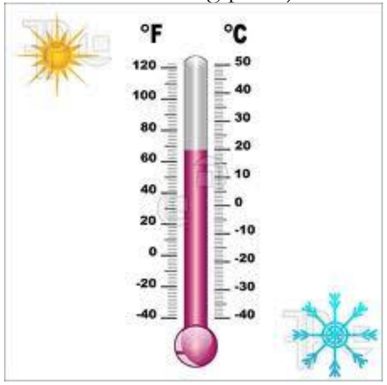
Technology: Utilize digital tools (like spreadsheets) to reinforce decimal operations and conversions.

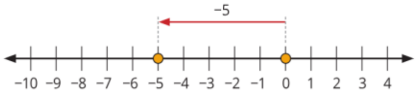
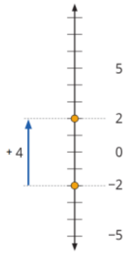
Financial Literacy: Apply decimals to money for budgeting and understanding financial calculations.

Essential Learning Outcome: N3.1. Integers – Representing Integers

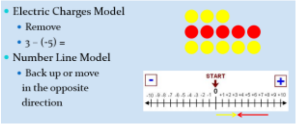
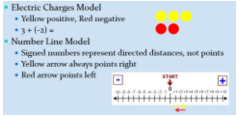
Grade Level Expectations and/or Focus Questions:

- Understand that positive and negative numbers are used together to describe quantities having opposite directions or values (e.g., temperature above/below zero, elevation above/below sea level, credits/debits, positive/negative electric charge)
- Use positive and negative numbers to represent quantities in real-world contexts, explaining the meaning of 0 in each situation.

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies:
Learners are expected to: **Knowledge:** 1. read and represent integers using a variety of tools and strategies, including horizontal and vertical number lines 2. Identify and Interpret Positive and Negative Values 3. Use Positive and Negative Numbers in Context 4. Explain the Role of Zero in Real-World Scenarios **Skills** 5. Demonstrate opposing Quantities Using Number Lines **Values** 6. Analyse Contextual Scenarios Involving Positive and Negative Numbers	**Conversation** Have students create poems, songs, advertisements, or monologues to identify key points of using positive and negative integers, placing zero in real-world contexts, and interpreting numbers on a number line. **Oral questioning:** Ask questions to assess comprehension, such as, “What does a negative value represent in a bank account?” or “How does zero act as a balance point?” **Which does not belong and why?**  Product: **Exit Ticket**: Have learners write a short response to the question: “Explain a real-world situation where you would use positive and negative numbers and why zero is important.”	Whole-Class Discussion on Integers: Begin with a discussion about integers, recording what learners already know. List their examples, such as -20°C for cold weather or +57°C for extreme heat. Discuss the meaning of zero in each context (e.g., 0°C as the freezing point).  Plot these integers on vertical and horizontal number lines. Financial Context of Integers

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies:
		Explain “credit” as positive and “debit” as negative in a bank context. Create scenarios where learners log credits for tasks and debits for “purchases” in a bank register. Have learners calculate their final balance to practice combining positive and negative numbers. Personal Number Lines Have learners draw horizontal and vertical number lines in their notebooks.   Encourage them to plot integers from real-life examples, such as elevator levels or temperatures. Integer Representation with Physical and Visual Models Classroom Floor Number Line: Place tape on the floor with zero as the start and markers for positive and negative values. Learners step forward or backward as directed, reinforcing integer movement and zero pairs.

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies:

		Two-Colour Integer Tiles: Provide tiles in two colours (e.g., red for negative, yellow for positive) to represent integers like -4 (four red) or +2 (two yellow). Have learners combine tiles to see how integers can balance to zero, supporting number line concepts. For example:
		
		- Electric Charges Model
		  - Remove
		  - 3 – (-5) =
		- Number Line Model
		  - Back up or move in the opposite direction
		
		
		- Electric Charges Model
		  - Yellow positive, Red negative
		  - 3 + (-2) =
		- Number Line Model
		  - Signed numbers represent directed distances, not points
		  - Yellow arrow always points right
		  - Red arrow points left
		
		Analysing Contextual Scenarios
		Provide scenarios (e.g., a hiker starting at sea level going up and down, temperature changes in a day).
		Divide learners into groups to analyse each scenario, identifying the positive and negative changes and the role of zero (e.g., sea level, freezing point).
		Have each group share their scenario interpretation and explain how positive and negative values represent real-world changes.

Additional Resources and Materials

Number line posters (horizontal and vertical)
Markers
Two-colour counters or integer tiles (e.g., red for negative, yellow for positive)
Tape for floor number line
Real-life integer scenario cards (e.g., temperature changes, bank account balances)
Chart paper and markers for group work

Additional Useful Content Knowledge for the Teacher:

Integers include whole numbers and their opposites, with zero as a neutral point (neither positive nor negative). On a horizontal number line, positive integers appear to the right of zero, and negatives to the left; on a vertical line, positives are above zero, and negatives below.

Each integer has an opposite, equidistant from zero (e.g., +4 and -4). Zero pairs, such as (+3) and (-3), balance each other to make zero. Integers represent quantities relative to a reference point; for example, in temperature, +10°C is 10 degrees above freezing, while -10°C is 10 degrees below.

Using real-world contexts like temperature changes, bank transactions, and elevations helps learners understand integers and their opposites. In the Cartesian plane, positive and negative values on horizontal and vertical lines are used to plot points, adding context for understanding positive and negative integers.

Opportunities for Subject Integration:

Mathematics and Science
Temperature Studies: Use temperature data to illustrate positive (above zero) and negative (below zero) integers.
Physics: Discuss integers in the context of vectors, showing magnitude and direction (e.g., forces).
2. Mathematics and Social Studies
Financial Literacy: Teach credits (positive) and debits (negative) through budgeting lessons.
Historical Analysis: Use historical temperature records and statistics to illustrate changes over time.
3. Mathematics and Art
Coordinate Graphing: Have learners plot points on the Cartesian plane to create visual art.
Symmetry: Explore how integers relate to symmetry and reflections in art.
4. Mathematics and Physical Education
Sports Statistics: Analyse game scores using positive and negative integers.
Movement Activities: Engage learners in activities that involve forward and backward movement on a number line.
5. Mathematics and Technology
Coding: Use programming to teach conditional statements based on integer values.
Game Development: Create simple games that incorporate integer mechanics.

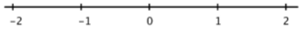
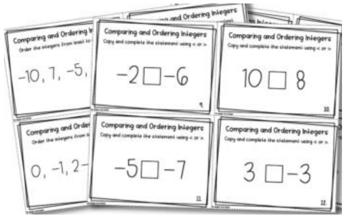
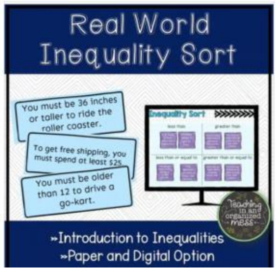
6. Mathematics and Language Arts
Storytelling: Encourage learners to write narratives using positive and negative integers.
Vocabulary Development: Introduce math terms through reading and comprehension activities.
7. Mathematics and Environmental Studies
Climate Change: Discuss data on sea levels and temperature changes using integers.
Geography: Examine elevations above and below sea level with integers.
These integrations help learners understand the relevance of integers in various contexts.

Essential Learning Outcome: N3.2. Integers – Comparing and Ordering Integers

Grade Level Expectation:

- Interpret statements of inequality as statements about the relative position of two numbers on a number line diagram. For example, interpret -3 > -7 as a statement that -3 is located to the right of -7 on a number line oriented from left to right.

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
Learners are expected to: **Knowledge:** 1. Explain the concept of inequalities and their significance in comparing numbers. **2.** Accurately interpret statements of inequality on a number line. **Skills** **3.** Create and analyse number line diagrams to represent inequalities. **4.** Use mathematical language to describe relationships in inequalities. **5.** Apply understanding of inequalities to real-world contexts. **Value** **6.** Evaluate and compare different inequality statements for accuracy.	**Conversation: Oral questioning** 1. Is a temperature of -11 degrees warmer or colder than a temperature of -15 degrees? 2. Is an elevation of -10 feet closer or farther from the ocean's surface than an elevation of -8 feet? 3. It was 8 degrees at nightfall. The temperature dropped 10 degrees by midnight. What was the temperature at midnight? 4. A diver is 25 feet below sea level. What is his elevation after he swims up 15 feet toward the surface? **Product**: Worksheet Activity: Distribute worksheets with a mix of inequality statements and number line diagrams. Learners will: Interpret the inequalities and place them on the number line. Use comparative language to explain their placements. Evaluate given statements to determine their accuracy. Decide whether each inequality statement is true or false. Explain your reasoning. 1. -5>2 2. 3>-8	Begin with a quick review of numbers and their placement on a number line. Ask learners to share what they know about comparing numbers. Explain what inequalities are and the symbols used (>, <). Provide examples using simple numbers (e.g., 2 > 1). Visual Representation: Display a number line on the board. Show examples of inequalities such as -3 > -7 and illustrate their positions on the number line. Discuss Relative Position: Explain that the number on the left is less than the number on the right. Highlight how -3 is located to the right of -7 on the number line. Group Activity: Divide learners into small groups. Provide each group with a set of inequality cards. Have them place the cards on a number line poster or the floor number line, discussing the relative positions as they do so. For example,

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
	3. -12>-15 4. -12.5>-12 Plot each of the following numbers on the number line. Label each point with its numeric value. 0.4, -1.5, - 1 7/10, - 11/10 	 https://classful.com/product/comparing-and-ordering-integers-task-cards-6th-grade-2/ Class Discussion: Have each group present one inequality and explain the reasoning for the placement on the number line. Real-World Scenarios: Provide learners with real-world context cards. For example, "The temperature is -3°C and -7°C. Which temperature is warmer?" Learners will create their inequalities and plot them on number lines. 

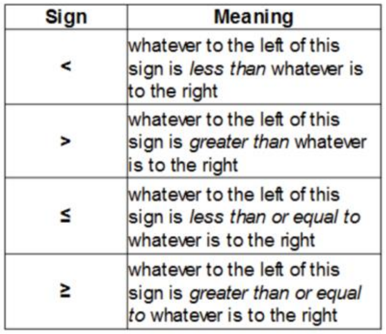
Additional Resources and Materials

Whiteboard and markers
Number line posters or tape on the floor to create a large number line
Inequality cards (e.g., -3 > -7, 2 < 5, 0 > -1)
Graph paper
Rulers
Worksheets with inequality problems and number line diagrams
Real-world scenario cards involving inequalities

Additional Useful Content Knowledge for the Teacher:

Inequalities are similar to equations because they provide information about the relationship between two numbers or expressions (which may include variables). However, unlike equations, inequalities do not indicate equality; instead, they show that one expression is greater than or less than another.

While equations use the equal sign, inequalities use four distinct symbols to represent these relationships.



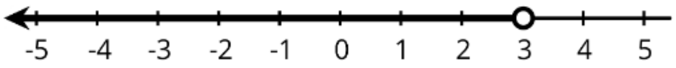
Sign	Meaning
<	whatever to the left of this sign is *less than* whatever is to the right
>	whatever to the left of this sign is *greater than* whatever is to the right
≤	whatever to the left of this sign is *less than or equal to* whatever is to the right
≥	whatever to the left of this sign is *greater than or equal to* whatever is to the right

.

An inequality indicates that one value is either less than or greater than another.

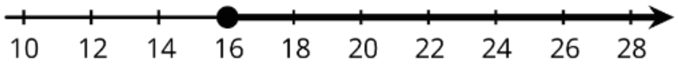
For example, if we know the temperature is below 3°F but not the exact value, we can express this with the inequality:
$t < 3$

On a number line, this temperature can be represented graphically. Any point to the left of 3 signifies a possible value for t. The open circle at 3 indicates that t cannot equal 3, as the temperature must be less than 3°F.



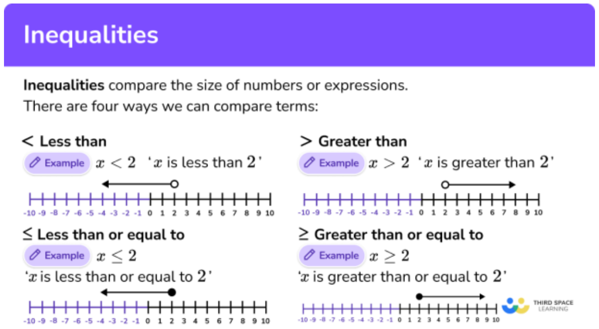
Here's another example: A young traveller must be at least 16 years old to fly on an airplane without an adult accompanying them.

Let **a** represent the traveller's age. Any age greater than 16 is a valid value for **a**, and 16 itself is also acceptable. This can be illustrated on a number line by placing a closed circle at 16, indicating that a 16-year-old can travel alone. From this point, we draw a line extending to the right.



An inequality and equation can be written to show possible values for a:

$$a>16$$
$$a=16$$



Inequalities

Inequalities compare the size of numbers or expressions.
There are four ways we can compare terms:

< Less than
Example $x < 2$ 'x is less than 2'

> Greater than
Example $x > 2$ 'x is greater than 2'

≤ Less than or equal to
Example $x \leq 2$
'x is less than or equal to 2'

≥ Greater than or equal to
Example $x \geq 2$
'x is greater than or equal to 2'

Opportunities for Subject Integration:

1. **Science**: Model temperature ranges and measurement tolerances with inequalities.
2. **Geography**: Use inequalities to compare elevations above/below sea level.
3. **Economics/Finance**: Set financial goals and spending limits through inequalities.
4. **Physical Education**: Represent fitness targets, such as minimum lap counts.
5. **Art/Design**: Apply inequalities to set spatial limits for design projects.

These integrations make inequalities practical, showing how they express real-world constraints and relationships across disciplines.

Operations with Numbers

Introduction to Strand

This strand focuses on building a solid foundation in number operations, explicitly understanding and applying addition and subtraction with decimals. Teaching decimal operations enhances learners' mathematical proficiency and real-life problem-solving skills. Decimal usage is integral to daily activities, from managing finances and budgeting to measuring in fields like cooking, science, and engineering. Mastery of decimal calculations enables learners to perform precise computations, a skill that supports careers in finance, technology, and engineering.

Understanding decimals also prepares learners for advanced math topics, fostering critical thinking and logical reasoning skills. With a firm grasp of decimal concepts, learners are positioned for academic achievement and practical, real-world application. Therefore, it's essential that educators cultivate a comprehensive understanding of decimal operations, aligning with the vision and essential competencies of mathematical education to support both present and future success.

Essential Learning Outcome O1.1: Additive Thinking – Understanding the Meaning of Addition and Subtraction and how They Relate

Grade Level Expectation:

- Add and subtract decimals to thousandths, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method and explain the reasoning used.

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
Learners are expected to: **Skills** 1. Add decimals up to the thousandth place. 2. Subtract decimals up to the thousandth place.	***1. Formative Assessments*** **Observation** **Observations and Anecdotal Records** Observe learners as they work with concrete models, drawings, and number lines. Take notes on their problem-solving processes, strategies used, and any difficulties encountered.	**EXPLICIT INSTRUCTIONS :** **Concrete Models and Manipulatives** (**Base-ten blocks**) Invite learners to use base-ten blocks to represent units, tenths, hundredths, and thousandths. ***Example**: To add 0.3 and 0.9.*

Specific Curriculum Outcomes

Knowledge

3. Use properties of operations and explain the inverse relationship between addition and subtraction.

4. Use mathematical vocabulary to explain the strategies applied in solving problems involving decimals.

Value

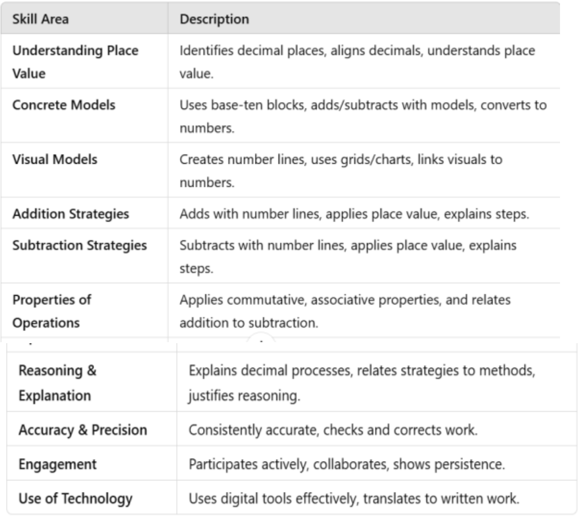
5. Recognize and explain the importance of the inverse relationship between operations, such as addition and subtraction, when solving problems with decimal numbers.

Inclusive Assessment Strategies

Learner Information

- **Name:**
- **Date:**
- **Observer:**

Checklist Categories



Skill Area	Description
Understanding Place Value	Identifies decimal places, aligns decimals, understands place value.
Concrete Models	Uses base-ten blocks, adds/subtracts with models, converts to numbers.
Visual Models	Creates number lines, uses grids/charts, links visuals to numbers.
Addition Strategies	Adds with number lines, applies place value, explains steps.
Subtraction Strategies	Subtracts with number lines, applies place value, explains steps.
Properties of Operations	Applies commutative, associative properties, and relates addition to subtraction.
Reasoning & Explanation	Explains decimal processes, relates strategies to methods, justifies reasoning.
Accuracy & Precision	Consistently accurate, checks and corrects work.
Engagement	Participates actively, collaborates, shows persistence.
Use of Technology	Uses digital tools effectively, translates to written work.

Product

Exit Tickets

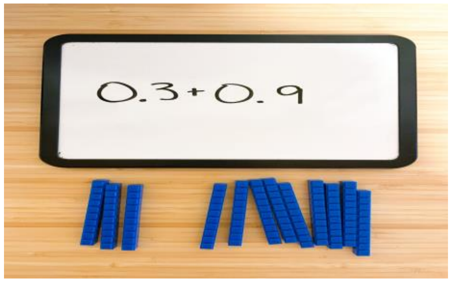
Strategy:

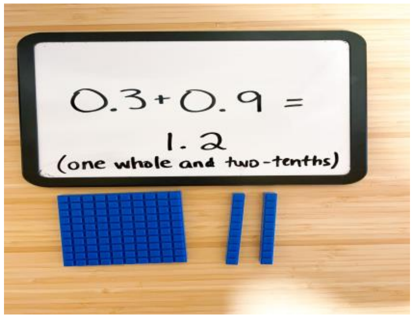
- At the end of a lesson, ask learners to solve a problem or explain a concept in writing.

Example: "Add 0.456 and 0.389 using a number line. Explain your steps."

Inclusive Learning Strategies

- Have learners select three rods for 0.3 and nine rods for 0.9.
- Combine the blocks and count them together (12 rods, which equals 1.2).
- One flat base 10 blocks is used to represent the whole then 2 rods to represent 2 tenths.





Interactive digital manipulatives: Use Online tools that simulate physical manipulatives for

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
	Inclusion Tactics: ● Invite learners to choose between writing, drawing, or orally explaining their answer. ● Provide sentence starters or guiding questions to support learners who struggle with open-ended responses. **Product** **Summative Assessments** Apply addition and subtraction of decimals in real-life contexts, such as measurements, money, and other practical situations. ***Quizzes and Tests*** Include a mix of question types: multiple-choice, short answer, and practical problems involving concrete models or drawings. *Example: "Subtract 0.754 from 1.231 using a place value chart. Show your work."* https://www.k5learning.com/free-math-worksheets/sixth-grade-6/decimals-addition-subtraction https://www.liveworksheets.com/w/en/math/203962 **Product** **Decimal Matching Activity** ***How***: Create cards with different addition and subtraction decimal problems (up to the thousandths). Learners have to find pairs of cards that demonstrate the	learners who benefit from technology-based learning **Multi-sensory Learning** **Strategy:** **Real-life objects**: Invite learners to use money or measurement tools to solve problems involving decimals in a practical context. **Example Activity:** ● **Money Manipulation**: Invite learners to use coins and bills to simulate decimal addition and subtraction, helping them see the practical application. Example - \$ 20.00 +\$ 2.00 + \$ 0.50 + \$ 0.20 +\$ 0.10 = \$ 22. 80

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
	inverse relationship (e.g., 2.356 + 1.234 = 3.590 and 3.590 - 1.234 = 2.356). ***Why***: This tactile, matching approach works well for kinesthetic learners and learners who need more hands-on interaction with the material **Product** **Reflective Journals** Learners keep a journal where they reflect on their learning, challenges, and strategies used. **Inclusion Tactics:** ● Invite learners to use a combination of drawings, words, and numbers to express their reflections. ● Provide sentence starters or guiding questions for learners who need more structure	 https://www.globocambio.co/en/currencies-of-the-world/east-caribbean-dollar **Visual Representations** ***Number Line*** Invite learners to use number lines to provide visual and concrete representation of decimal subtraction, helping learners, especially those with learning difficulties, understand the relationship between numbers. It allows them to see how the values are spaced and how subtraction involves moving left along the line. Incorporating number lines as a strategy can provide multiple entry points into understanding

<table>
<tr><th>Specific Curriculum Outcomes</th><th>Inclusive Assessment Strategies</th><th>Inclusive Learning Strategies</th></tr>
<tr>
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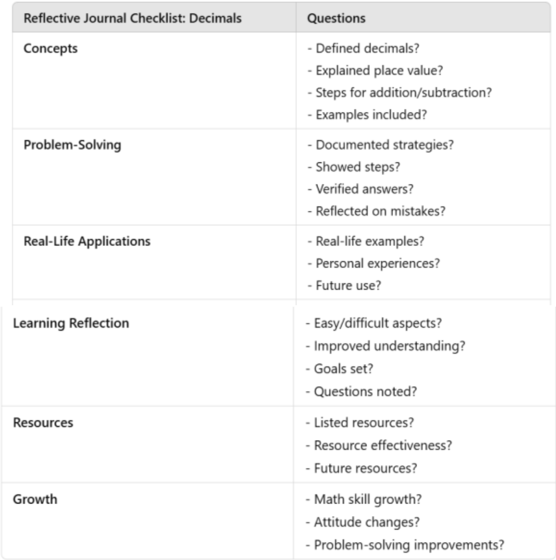
<td>

<table>
<tr><th>Reflective Journal Checklist: Decimals</th><th>Questions</th></tr>
<tr><td>Concepts</td><td>- Defined decimals?
- Explained place value?
- Steps for addition/subtraction?
- Examples included?</td></tr>
<tr><td>Problem-Solving</td><td>- Documented strategies?
- Showed steps?
- Verified answers?
- Reflected on mistakes?</td></tr>
<tr><td>Real-Life Applications</td><td>- Real-life examples?
- Personal experiences?
- Future use?</td></tr>
<tr><td>Learning Reflection</td><td>- Easy/difficult aspects?
- Improved understanding?
- Goals set?
- Questions noted?</td></tr>
<tr><td>Resources</td><td>- Listed resources?
- Resource effectiveness?
- Future resources?</td></tr>
<tr><td>Growth</td><td>- Math skill growth?
- Attitude changes?
- Problem-solving improvements?</td></tr>
</table>

Journal Presentation

Did I organize my journal entries in a clear and logical manner?
Did I use proper grammar, spelling, and punctuation throughout my entries?
Did I include diagrams, charts, or drawings to illustrate my points where applicable?
Did I review and revise my journal entries to improve clarity and completeness?

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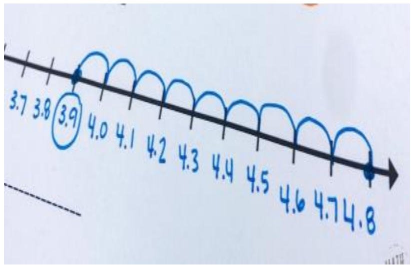
decimal subtraction, supporting a range of learning abilities and preferences

Subtract 4.8 – 0.9 =3.9



https://mathgeekmama.com/add-subtract-decimals-number-line/

Auditory Supports: Have learners compose songs, rhymes, or mnemonic devices to help remember rules for decimal operations. For example:

https://www.youtube.com/watch?v=oChQzB8nrYU

https://www.youtube.com/watch?v=WP_f4EXp-Mg

Math Centres with Tiered Activities
Provide math centres with varying difficulty levels to cater to different levels of understanding. Activities range from manipulatives for decimal addition to advanced word problems applying
</td>
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</table>

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
		inverse relationships, inviting learners to engage at their readiness level. **Performance-Based Learning**: Choice Boards: Let learners pick activities that match their interests, enhancing engagement and ownership, especially for those less motivated by traditional tasks. **Game Design:** Learners design and play a board game involving decimal operations up to the thousandths place. **Real-Life Scenarios**: Learners write stories using decimal operations in daily tasks (e.g., shopping, cooking). **Art Projects:** Learners create artwork with patterns incorporating decimal addition and subtraction.

Additional Useful Content Knowledge for the Teacher

For teachers, additional content knowledge for teaching fractions and decimals includes using real-life objects (e.g., pizzas, money) to introduce these concepts and show how wholes are divided into parts. Clear definitions are essential: fractions represent parts of a whole with a numerator and denominator, while decimals represent parts of a whole using a decimal point. Visual aids like fraction bars and grids can help students see these relationships. Highlight the link between fractions and decimals, such as how 1/2 equals 0.5, and explore place value in decimals to clarify tenths, hundredths, etc. Emphasize real-world applications (e.g., measurements, recipes) to demonstrate relevance, and use interactive activities and regular assessments with feedback to reinforce understanding and address misconceptions.

Additional Resources and Materials: Virtual Base 10 Blocks, Digital Number Lines, Interactive Place Value Charts, Money Manipulation, Number Line.

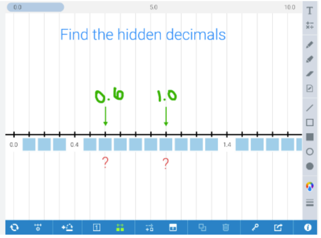
Guidelines for using digital manipulatives:

When teaching decimal addition, select an interactive digital tool that will help learners visualize and understand the concept. Look for tools with features like these:

Virtual Base 10 Blocks: Tools that include base 10 blocks for representing decimals. These allow learners to physically manipulate blocks to see how decimals combine in real-time.

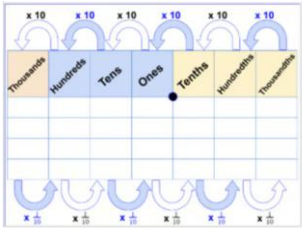
https://mathtechconnections.com/2020/03/04/using-manipulatives-to-represent-decimals/

Digital Number Lines: Choose a tool with a number line where learners can place markers or move points to visually represent the addition of decimals. This helps learners see the incremental increase as they add each decimal.



https://www.mathlearningcenter.org/apps/number-line

Interactive Place Value Charts: Opt for charts that let learners manipulate digits in various place value positions. This feature enables them to directly see the effect of adding each decimal place, reinforcing understanding of place value in decimal operations.



https://www.teacherspayteachers.com/Product/FREE-Interactive-Place-Value-Chart-Progression-5947290

Using these tools can make decimal addition more engaging and provide hands-on experience, enhancing learners' comprehension of decimal operations.

https://shelleygrayteaching.com/teaching-decimals-hands-on/

Opportunities for Subject Integration: *(Additional ideas about how the inclusive learning strategies might be adapted and/or applied to include other subjects in the curriculum)*

SCIENCE

Learners are given the task to calculate total cost of items when prices are in decimal form.

Plan a budget for a school event or personal project.

Planned, designed, and constructed valuable items from discarded objects and materials.

Design, construct, and demonstrate a device's use to determine water's turbidity.

Construct and use models of various systems in humans.

SOCIAL STUDIES

Plan a budget for a school event or personal project.

Identify areas of business where youth may wish to be engaged (e.g., hair salons, locally designed and made clothing, cash crops, art and craft for tourism).

LANGUAGE

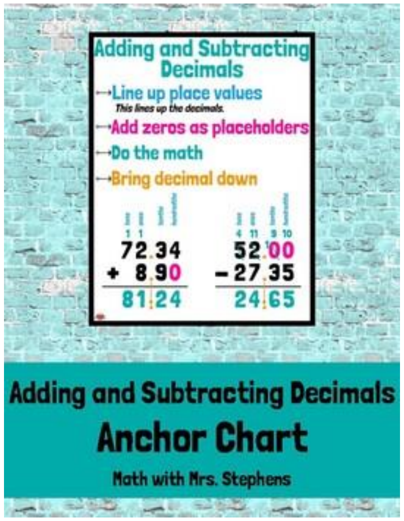
- Ask learners to write about their own word problems that incorporate multiplying or dividing decimals. This enhances their comprehension and allows them to practice math in a narrative context.
- Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

Vocabulary Building:

- Introduce math-specific vocabulary like "product," "quotient," "decimal point," and "place-value" within reading assignments. Encourage learners to use these terms correctly in their writing.

- Write an expository essay on the steps to multiply or divide decimals
- Write jingles or poems on the steps to multiply or divide decimals

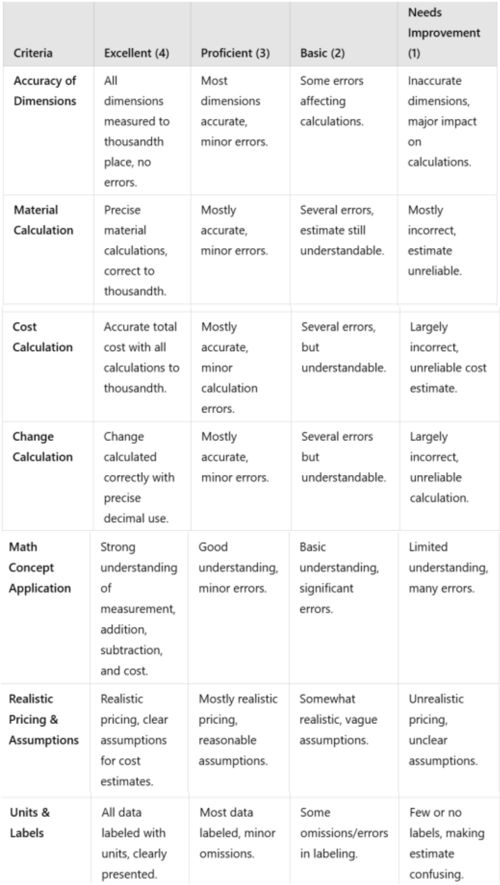
Essential Learning Outcome: O1.2. Additive Thinking – Compute Fluently Using Operations (+,-)
Grade Level Expectation: - Fluently add and subtract multi-digit decimals and fractions using a standard algorithm for each operation.

Specific Curriculum Outcomes	**Inclusive Assessment Strategies**	**Inclusive Learning Strategies**
Learners are expected to: **Skills** 1. Align multi-digit decimals by place values (tenths, hundredths, thousandths, etc. **Knowledge** 2. Use varied strategies to add subtract multi-digit decimals 3. Use varied strategies to subtract multi digit decimals. 4. Add and subtract fractions with like denominators 5. Add and subtract fractions with unlike denominators using different strategies 6. Add and subtract mixed numbers Value	**Conversation** **Peer Review** ***Format:*** Have learners exchange their work with a peer for review. Each learner checks their peer's alignment of decimals and provides feedback. ***Assessment:*** Assess both the accuracy of the alignment and the learner's ability to critically evaluate another's work. **Oral Explanations with demonstrations** ***Format:*** Ask learners to verbally explain the process of aligning multi-digit decimals. They should describe the importance of aligning the decimal points and the significance of each place value. ***Assessment***: Evaluate the learner's understanding of the concept and their ability to articulate the steps involved. **Product** **Project Based Learning** Learners given projects to test their ability to add and subtract decimal numbers up to the thousandth place. ***For example,***	Use of Anchor Charts *Visual Reminders:* Demonstrate and guide learners in creating anchor charts that display the steps for aligning decimals. Hang these in the classroom as a continual visual reminder for learners.  https://www.teacherspayteachers.com/Product/Adding-and-Subtracting-Decimals-Anchor-Chart-4925005

<table>
<tr><th>Specific Curriculum Outcomes</th><th>Inclusive Assessment Strategies</th><th>Inclusive Learning Strategies</th></tr>
<tr>
<td>7. Create real life problems involving the addition and subtraction of fractions with like and unlike denominators</td>
<td>

The woodwork learners are required to write an estimate for the construction of a coop with specified height, width and length for the school's poultry farm. Learners will be expected to calculate the total amount of materials that are needed up to thousandth's place as well as the total cost and change

Rubric



<table>
<tr><th>Criteria</th><th>Excellent (4)</th><th>Proficient (3)</th><th>Basic (2)</th><th>Needs Improvement (1)</th></tr>
<tr><td>Accuracy of Dimensions</td><td>All dimensions measured to thousandth place, no errors.</td><td>Most dimensions accurate, minor errors.</td><td>Some errors affecting calculations.</td><td>Inaccurate dimensions, major impact on calculations.</td></tr>
<tr><td>Material Calculation</td><td>Precise material calculations, correct to thousandth.</td><td>Mostly accurate, minor errors.</td><td>Several errors, estimate still understandable.</td><td>Mostly incorrect, estimate unreliable.</td></tr>
<tr><td>Cost Calculation</td><td>Accurate total cost with all calculations to thousandth.</td><td>Mostly accurate, minor calculation errors.</td><td>Several errors, but understandable.</td><td>Largely incorrect, unreliable cost estimate.</td></tr>
<tr><td>Change Calculation</td><td>Change calculated correctly with precise decimal use.</td><td>Mostly accurate, minor errors.</td><td>Several errors but understandable.</td><td>Largely incorrect, unreliable calculation.</td></tr>
<tr><td>Math Concept Application</td><td>Strong understanding of measurement, addition, subtraction, and cost.</td><td>Good understanding, minor errors.</td><td>Basic understanding, significant errors.</td><td>Limited understanding, many errors.</td></tr>
<tr><td>Realistic Pricing & Assumptions</td><td>Realistic pricing, clear assumptions for cost estimates.</td><td>Mostly realistic pricing, reasonable assumptions.</td><td>Somewhat realistic, vague assumptions.</td><td>Unrealistic pricing, unclear assumptions.</td></tr>
<tr><td>Units & Labels</td><td>All data labeled with units, clearly presented.</td><td>Most data labeled, minor omissions.</td><td>Some omissions/errors in labeling.</td><td>Few or no labels, making estimate confusing.</td></tr>
</table>

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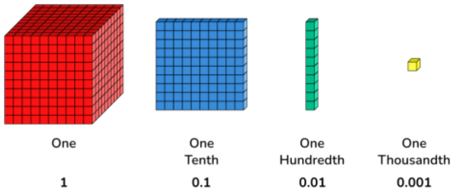
Integrated Technology

Use videos that demonstrates the steps in aligning digits when adding or subtracting decimals up to thousandths

https://www.youtube.com/watch?v=zNfO09maGPU

Integrated technology
Use interactive whiteboards to visually demonstrate the addition and subtraction of decimals. Write problems on the board and use tools to highlight and move decimal points, showing how alignment works.

Guided Discovery
Present pupils with a problem
Invite learners to manipulate the blocks to find a sum
Teacher scaffolds learners as they manipulate and identify the steps



https://wippich.weebly.com/2017-2018-blog/ordering-decimals

Introduce the Concept of Place Value with Base Ten Blocks

Provide opportunities for learners to review Place Value: using questioning have learners explain that each type of base ten block represents a different place value:

- ○ Unit cubes = 0.001 (thousandths)

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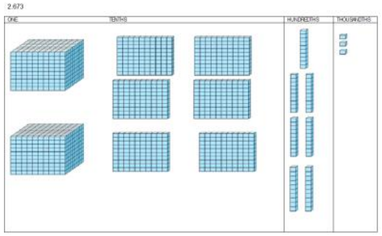
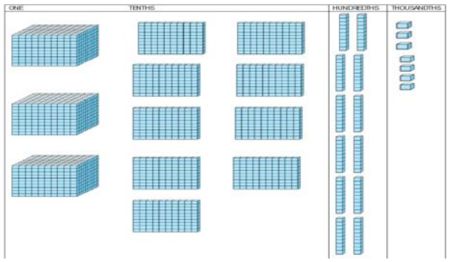
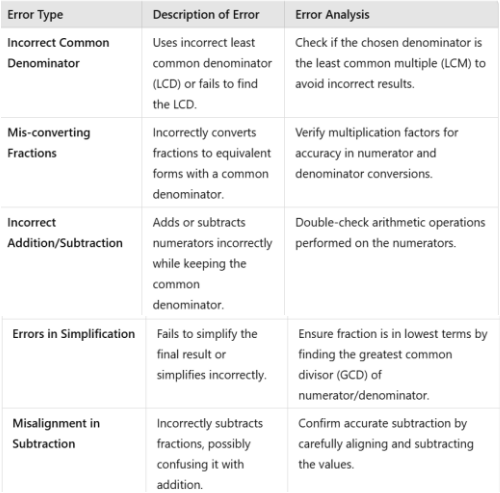
Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
	Product **Games and Puzzles:** Use educational games and puzzles to make learning fractions fun and interactive. ***Like and unlike denominator Fraction Matching*** *Materials:* Cards with fraction addition/subtraction problems and corresponding answers. *How to Play:* Shuffle the cards and lay them face down. Players take turns flipping over two cards, trying to find matching problems and solutions. The player with the most matches at the end wins. ***Create a Maze Layout:*** ● Design a simple maze with multiple paths leading from the start to the finish. ● At each junction or decision point in the maze, include a fraction problem that learners must solve to determine the correct path. ● Include a variety of fraction addition and subtraction problems, ensuring that some require finding a common denominator. **SCO5** **Conversation/ observation** **See Rubric below:**	○ Rods = 0.01 (hundredths) ○ Flats = 0.1 (tenths) ○ Large Flats = 1 (ones) Invite learners the opportunity to observe as well as engage in demonstrations with examples: Showing how numbers like 1.234 can be represented with base ten blocks: 1 large flat, 2 flats, 3 rods, and 4 unit cubes. *Represent the Decimals to be added* Example: add 1.354 and 2.673 using base ten blocks. *Have learners use the blocks to represent the given numbers*  https://wippich.weebly.com/2017-2018-blog/ordering-decimals *Combine the Base Ten Blocks* 

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies



Error Type	Description of Error	Error Analysis
Incorrect Common Denominator	Uses incorrect least common denominator (LCD) or fails to find the LCD.	Check if the chosen denominator is the least common multiple (LCM) to avoid incorrect results.
Mis-converting Fractions	Incorrectly converts fractions to equivalent forms with a common denominator.	Verify multiplication factors for accuracy in numerator and denominator conversions.
Incorrect Addition/Subtraction	Adds or subtracts numerators incorrectly while keeping the common denominator.	Double-check arithmetic operations performed on the numerators.
Errors in Simplification	Fails to simplify the final result or simplifies incorrectly.	Ensure fraction is in lowest terms by finding the greatest common divisor (GCD) of numerator/denominator.
Misalignment in Subtraction	Incorrectly subtracts fractions, possibly confusing it with addition.	Confirm accurate subtraction by carefully aligning and subtracting the values.

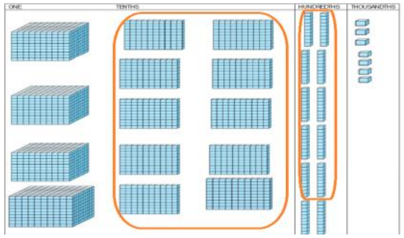
SCO 6

Product

WRITING PORTFOLIO

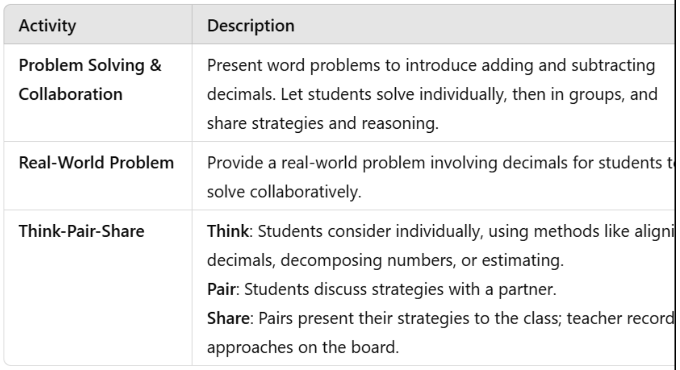
Components

Pre-Assessment: Include an initial assessment to gauge learners' prior knowledge of fractions and their ability to perform basic operations with them.
Work Samples: Classwork and Homework: Collect various assignments that show learners' work on adding and subtracting fractions with like and unlike denominators.
Problem-Solving Tasks: Include problems that require learners to apply their knowledge in different contexts, such as word problems or real-life scenarios.
Projects: Assign a project where learners create their own word problems or real-world applications involving fraction operations.



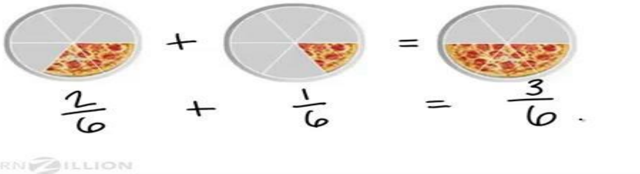
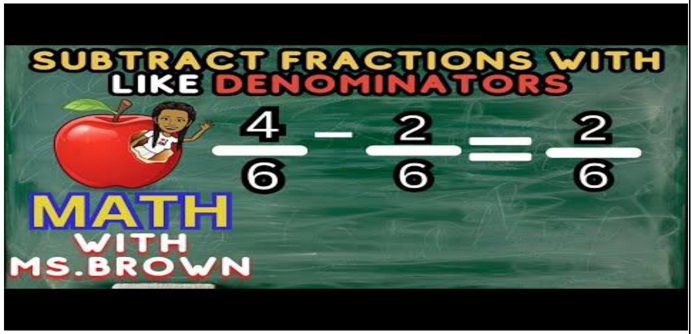
4. 0 2 7

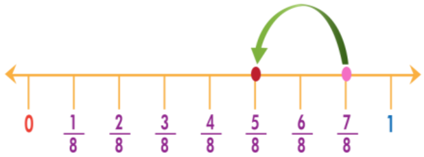
Answer =4.027

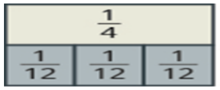
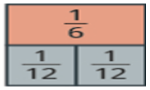
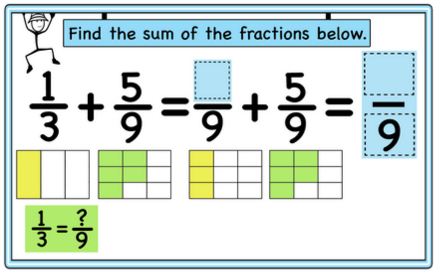


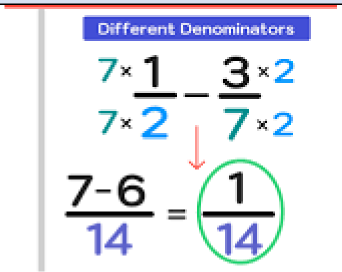
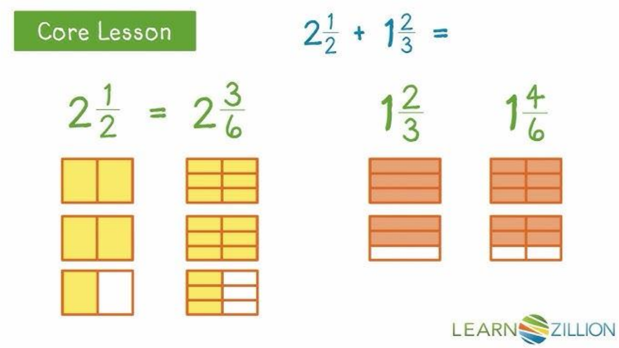
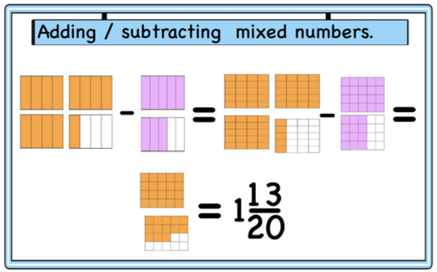
Activity	Description
Problem Solving & Collaboration	Present word problems to introduce adding and subtracting decimals. Let students solve individually, then in groups, and share strategies and reasoning.
Real-World Problem	Provide a real-world problem involving decimals for students t solve collaboratively.
Think-Pair-Share	**Think**: Students consider individually, using methods like aligni decimals, decomposing numbers, or estimating. **Pair**: Students discuss strategies with a partner. **Share**: Pairs present their strategies to the class; teacher record approaches on the board.

Visual aids
Engage learners in hands-on activities to explore fractions using materials like fraction strips or circles.
Apply fractions to real-life scenarios, such as cooking or dividing items, to see how fractions are used daily.

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
	Reflections: Encourage learners to write reflections on their learning process, describing what they found easy or difficult and how they have improved over time. ***Portfolio Assessment Criteria*** - Accuracy: Correct use of the standard algorithm to add and subtract fractions. - Understanding: Demonstration of understanding through explanations and reflections. - Problem-Solving: Ability to apply fraction operations in various contexts and solve complex problems. - Growth: Evidence of progress and learning over time. - Communication: Clarity and completeness in explanations and reflections	Use visual aids like charts and diagrams to make learning fractions clearer and more meaningful.  https://whalenhoganteam.wordpress.com/math-2/add-and-subtract-fractions/  https://www.geeksforgeeks.org/addition-of-fractions/  https://www.youtube.com/watch?v=1EEUaIM6NuY Number Line Invite learners to represent fractions on a number line for subtraction, they move to the left. This helps them visualize how fractions can be reduced.

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
		The subtrahend is 2/8. So, it means that we have to subtract two parts out of 7/ 8.Two parts are removed, so we'll have to "jump" backwards two steps from the minuend  https://byjus.com/us/math/addition-and-subtraction-of-fraction-using-like-denominators/ Storytelling: Have learners create word problems (e.g., "You used 2/5 of grapes, and a friend used 3/6. How much did you use together?") to contextualize fractions, making the learning experience more relatable and engaging. HTTPs Have learners solve real-life problems and scenarios involving fractions. For example: The Tale of the Magical Cupcake: In the lively village of Fraction Ville, Mrs. Fraction owned a bakery famous for her magical cupcakes. As the Summer Festival approached, she prepared to bake a special batch. The recipe required 1¼ cups of batter, but she needed to reserve ⅔ cup for a topping. Concerned she wouldn't have enough, Mrs. Fraction called for help. Luckily, a group of

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
		Grade 6 learners passing by came to her aid. Let's find out what they did! Fraction Tiles Have learners use fraction tiles to model finding the common denominator and finding a standard fraction tile that can be used to match *both* ¼ and ⅙ exactly.   Area Model: Encourage learners to apply the area model for problem-solving.  https://mathcurious.com/2021/07/23/adding-and-subtracting-fractions/

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
		 https://www.mashupmath.com/blog/tag/subtracting+fractions+with+unlike+denominators  https://www.youtube.com/watch?v=Nh7maVysqG8 Subtract 3 ¼ from 1 ⅗ 

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
		https://mathcurious.com/2021/07/23/adding-and-subtracting-fractions/ **Simulation of Addition and Subtraction with Mixed Numbers** Engage learners in Real-World Addition/Subtraction: Participate in a simulated environment with real-world scenarios that involve adding or subtracting mixed numbers. Hands-On Problem-Solving: Invite learners to solve practical problems within contexts like cooking or construction. For example, calculate, "If a recipe calls for 3 1/2 cups of flour and you only have 2 2/3 cups, how much more do you need?" Collaborative Application: Have learners work with peers to apply addition and subtraction of mixed numbers, using practical examples to enhance understanding.

Additional Resources and Materials: Number lines, place value blocks

Additional Useful Content Knowledge for the Teacher:

Addition of Decimals Using Different Strategies

Decimals can be added like the way we add whole numbers. There are different ways of adding decimals.

1. Lining them using place values
2. Using properties of numbers (Commutative property and Associative property)
3. Using number line
4. Using partial sum

Lining them using place value

Write down the numbers one under the other, with the decimal points lined up

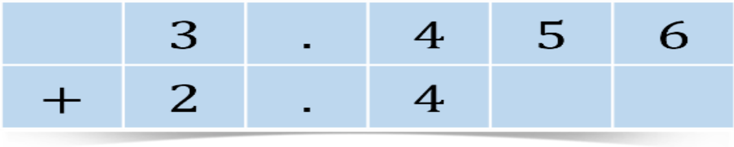
Add zeros to the right of the number so that the number to be added are of same digits

Then add using column addition and remember to put the decimal point in the answer

For example,

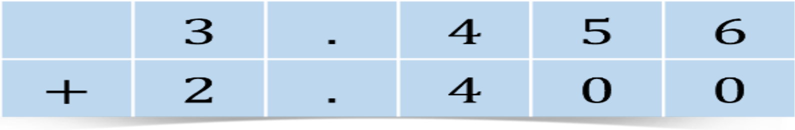
Add 3.456 to 2.4

Step 1: Line up the decimals



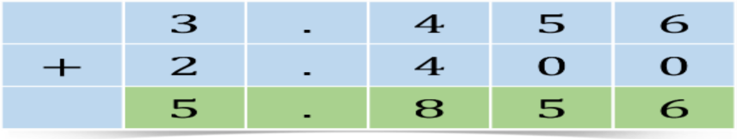
	3	.	4	5	6
+	2	.	4		

Step 2: Add zeros to the right side of the number if needed



	3	.	4	5	6
+	2	.	4	0	0

Step 3: Add using column addition



	3	.	4	5	6
+	2	.	4	0	0
	5	.	8	5	6

Using properties of numbers

The two properties of numbers are:

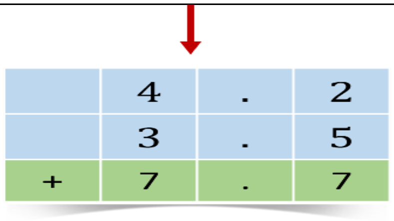
Commutative property of addition

Associative property of addition

Commutative property of addition means that you can switch the order of any of the numbers in an addition, the answer remains the same.

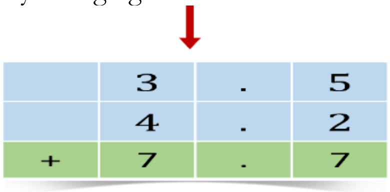
For example:

Sum of 4.2 + 3.5 = 7.7



	4	.	2
	3	.	5
+	7	.	7

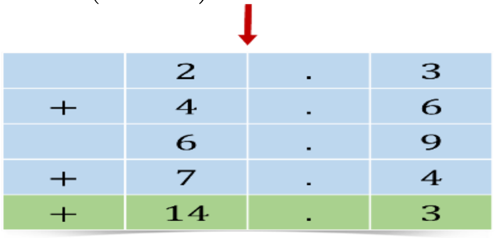
By changing the order of the addends, 3.5 + 4.2 = 7.7



	3	.	5
	4	.	2
+	7	.	7

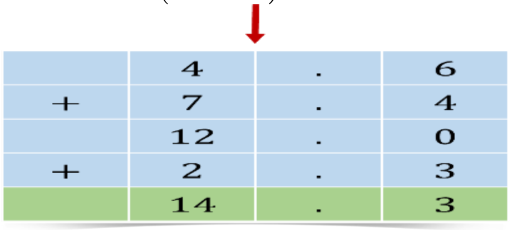
That is, 4.2 + 3.5 = 3.5 + 4.2 = 7.7

- Associative property of addition means that you can change the groupings of numbers being added and it does not change the result.
  For example, (2.3 + 4.6) + 7.4 = 2.3 + (4.6 + 7.4)
  Let us check
  LHS = (2.3 + 4.6) + 7.4 = 14.3



	2	.	3
+	4	.	6
	6	.	9
+	7	.	4
+	14	.	3

RHS = 2.3 + (4.6 + 7.4) = 14.3

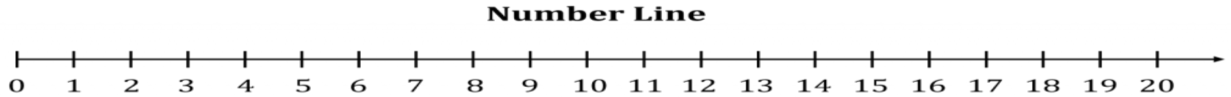


	4	.	6
+	7	.	4
	12	.	0
+	2	.	3
	14	.	3

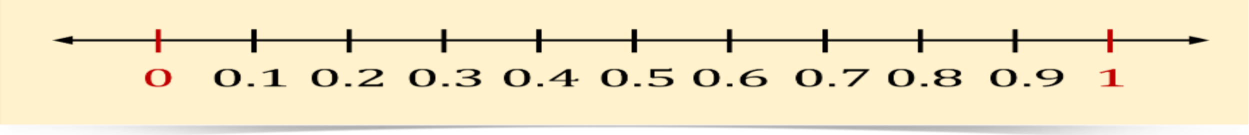
∴ (2.3 + 4.6) + 7.4 = 2.3 + (4.6 + 7.4) = 14.3

Using number line

To add decimals using number line, labelling the number line with decimals is very important. We know how to label a number line using whole numbers.



The number line with decimals will look like this

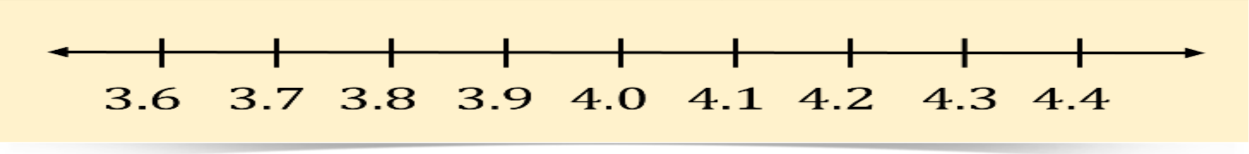


Here, we started labelling the number line with zero and increase by 0.1. We can label the number line increased by 0.25 or 0.5 or 0.75 etc. We can also start the number line with the numbers given in the question.

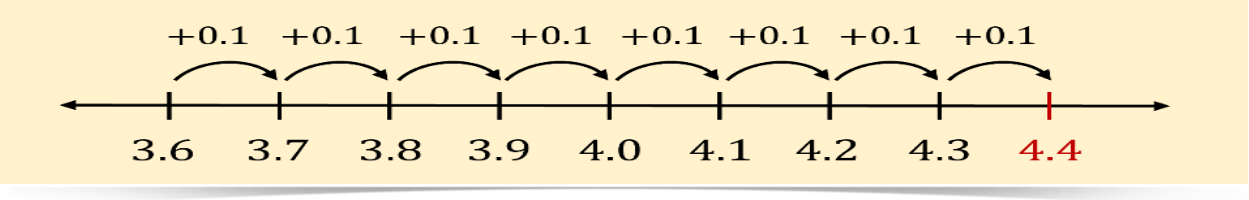
For example:

Add 3.6 + 0.8

Draw and label the number line starting with 3.6 and increase by 0.1



Then start adding 0.8 to 3.6, we get 4.4



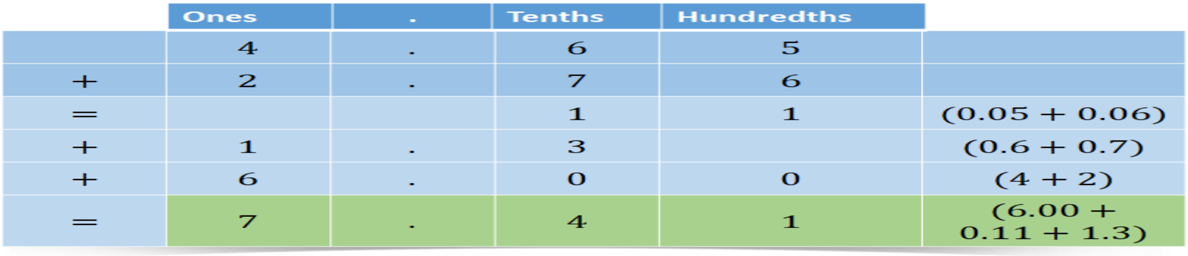
∴ 3.6 + 0.8 = 4.4

Using Partial sums

In this we use what we already know about adding decimals. But in partial addition, we break the numbers up in the individual places and add.

For example:

Add 4.65 + 2.76 using partial addition



	Ones	.	Tenths	Hundredths	
	4	.	6	5	
+	2	.	7	6	
=			1	1	(0.05 + 0.06)
+	1	.	3		(0.6 + 0.7)
+	6	.	0	0	(4 + 2)
=	7	.	4	1	(6.00 + 0.11 + 1.3)

https://www.turito.com/learn/math/strategies-to-add-and-subtract-decimals-grade-5

How to add decimals?

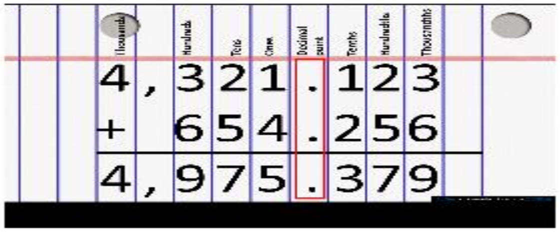
- When using the standard algorithm to add or subtract fractions with unlike denominators, start with related denominators e.g. 2 and 4; 3 and 6; 2, 4 and 8;
- Write the numbers in a vertical list, lining up the decimal points.
- If the numbers have a different amount of digits, there may be some gaps in the columns. Fill in any gaps with a zero so that each number has the same number of decimal places.
- Start at the right, the column with the least place value
- Add or subtract the numbers as if they are whole numbers
- Place decimal point in the sum or difference answer space, lined up with the others.

Or subtracted.

EXAMPLE 1: Add 0.56 + 9 + 6.287

```
     0.560
     9.000
 +   6.287
    15.847 ← Place the decimal point in the sum so that it lines up vertically.
```

https://www.palmbeachstate.edu/prepmathlw/Documents/operationswithdecimals.pdf

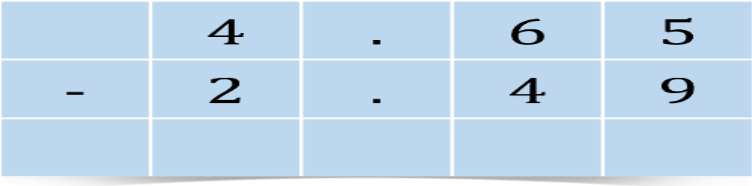


Thousands		Hundreds	Tens	Ones	Decimal point	Tenths	Hundredths	Thousandths
4	,	3	2	1	.	1	2	3
+		6	5	4	.	2	5	6
4	,	9	7	5	.	3	7	9

https://wippich.weebly.com/2017-2018-blog/february-12th-2018

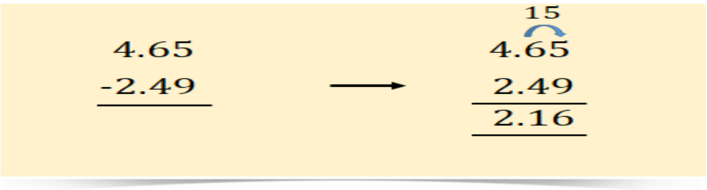
Lining them using place values

This is the same as addition. But instead of adding, we subtract the decimals.
To <u>subtract decimals</u> by lining them using place values, we follow the following steps:
Step 1: Line up the decimal points in a column. When needed add a zero to the left of the number to match the number of digits.



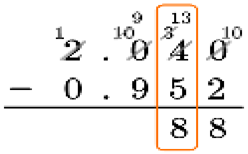
	4	.	6	5
-	2	.	4	9

Step 2: Start on the right, and subtract each column in turn. Remember, we are subtracting digits in the same place value position.
Step 3: If the digit you are subtracting is bigger than the digit you are subtracting from, you have to borrow a group of ten from the column to the left.



For example:
Subtract 4.65 – 2. 49
Example A

$$\begin{array}{r} 2.536 \\ -\ 0.590 \\ \hline 1.946 \end{array}$$



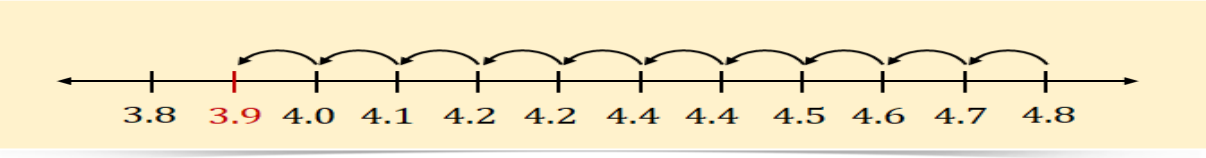
https://thirdspacelearning.com/us/math-resources/topic-guides/number-and-quantity/adding-and-subtracting-decimals/

Using number line

To subtract decimal numbers using a number line. Start on the far-right side on the number line and label it backwards by tenths. This is nothing but counting back.

For example:
Subtract 4.8 – 0.9
Draw the number line labelling backward starting from 4.8

Then count backwards by tenths, 9 times

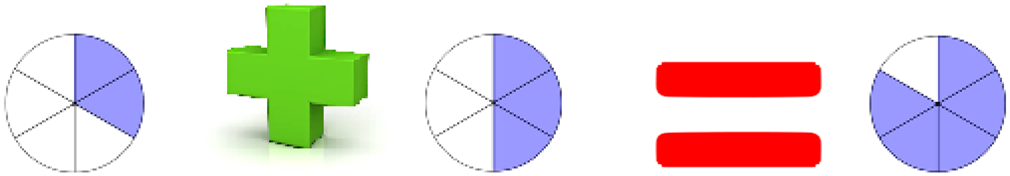


∴ 4.8 – 0.9 = 3.9
https://www.turito.com/learn/math/strategies-to-add-and-subtract-decimals-grade-5

ADDING AND SUBTRACTING FRACTIONS WITH UNLIKE DENOMINATORS

1/3 + 3/6

When fractions have unlike denominators, a common denominator must be found



https://www.istockphoto.com/photos/green-plus-sign
https://openclipart.org/detail/271722/fraction-56
https://www.splashlearn.com/math-vocabulary/subtraction/subtract-fractions-with-unlike-denominators

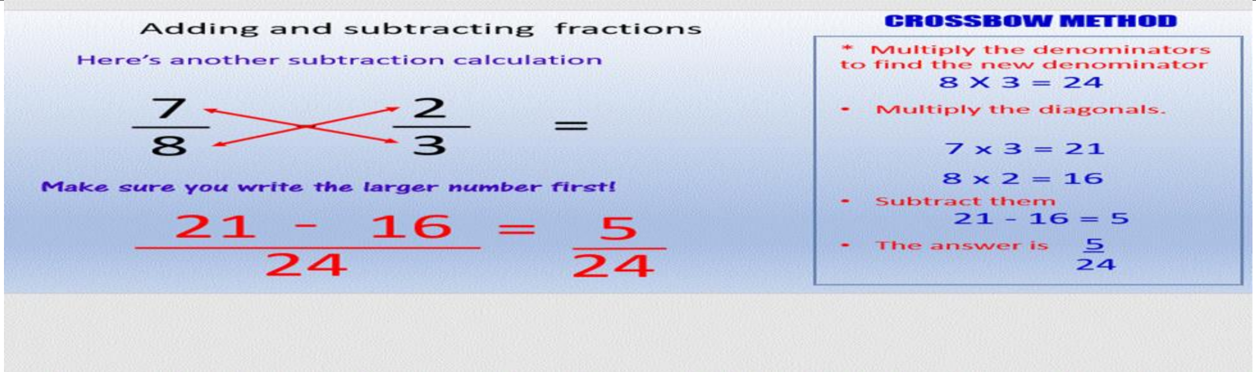
METHOD 2 CROSS MULTIPLICATION

For example, say you need to add $\frac{1}{3} + \frac{2}{5} =$ ______________

1. Cross multiply $\frac{1}{3} + \frac{2}{5}$ _________: 1 x 5 = 5 and 3 x 2 = 6
2. Add: 5 + 6 = 11 (numerator).
3. Multiply the denominators: 3 x 5 = 15 (denominator)

Answer: $\frac{1}{3} + \frac{2}{5} = \frac{11}{15}$

https://www.myqbook.com/MathConcept/495/Adding-and-subtracting-fractions-using-cross-products



Adding and subtracting fractions

Here's another subtraction calculation

$$\frac{7}{8} \quad \frac{2}{3} =$$

Make sure you write the larger number first!

$$\frac{21 - 16}{24} = \frac{5}{24}$$

CROSSBOW METHOD

- Multiply the denominators to find the new denominator 8 X 3 = 24
- Multiply the diagonals.

7 x 3 = 21

8 x 2 = 16

- Subtract them 21 - 16 = 5
- The answer is $\frac{5}{24}$

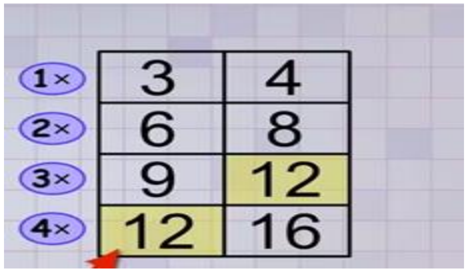
https://www.tes.com/teaching-resource/adding-and-subtracting-fractions-crossbow-method-11865525

FINDING THE LOWEST COMMON DENOMINATOR

¾ + 1/6

https://vimeo.com/427840033

Find the lowest common denominator



1×	3	4
2×	6	8
3×	9	12
4×	12	16

Make equivalent fractions with the new denominator:

$$\frac{3}{4} + \frac{1}{6} = \frac{\quad}{12} + \frac{\quad}{12}$$

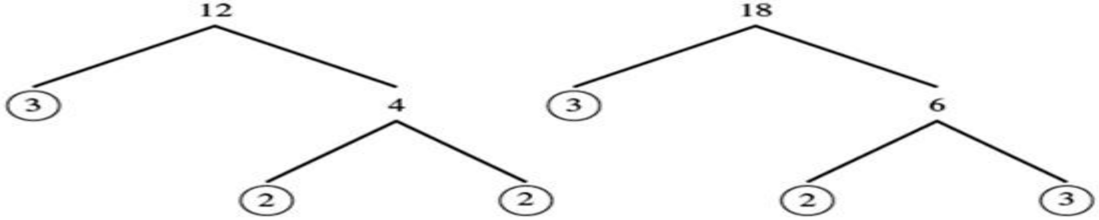
$$\frac{3}{4} = \frac{3x3}{4x3} = \frac{9}{12} \text{ and } \frac{1}{6} = \frac{1x2}{6x2} = \frac{2}{12}$$

Add the numerators:

$$\frac{9}{12}+\frac{2}{12}=\frac{11}{12}$$

https://mathgoodies.com/lessons/adding-subtract-unlike-fractions/

Another way of finding LCD



Determine the value of 1 ¾ +2 ⅚

Method 1

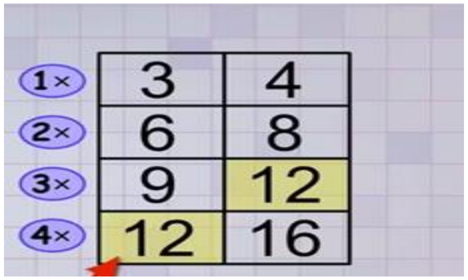
Convert all mixed numbers to improper fractions.

1 ¾ = 4x 1 +3 = 7/4   2 ⅚ =6x2 +5 =17/6

We now have the two fractions 7/4+17/6

Ensure the fractions have a common denominator.

These fractions have different denominators, therefore we need to use equivalent fractions to write them with a common denominator. The common denominator we should use will be the lowest common multiple of the denominators.



1×	3	4
2×	6	8
3×	9	12
4×	12	16

7/4+17/6   12/4 = 3 3x 7 = 21   12/6 =2 2x 7 =14

21 + 34 = 55/12

Change to a mixed number 55/12 = 4 7/12

METHOD 2

1 ¾ +2 ⅚

Add or Subtract the whole numbers 1+2 =3

Find the LCD LCD is 12

1 ¾ +2 ⅚ 12/4 =3 3x 3 =9 12/6 =2 2x5 =10

$\underline{\ 9\ +\ 10\ }$ = 3 19/12

Change to a mixed number 19/12 = 1

Add 1 to 3 = 4 4 7/12

Opportunities for Subject Integration:

Social Studies

Learners will carry out a survey on the villages in the parish to determine the fraction of people engaged in various professions. They will find out the fraction of people in each village who do each job and then calculate the total fraction of the parish involved in each profession.

Learners will analyse population changes in different regions, adding and subtracting fractions with unlike denominators.

Science

Learners will practice adding and subtracting fractions by mixing different solutions in a science experiment.
Instructions:
Provide learners with different liquid solutions measured in fractions with unlike denominators (e.g., 1/3 cup of vinegar, 1/4 cup of baking soda solution). Have learners combine the solutions and calculate the total volume.

Language Arts
Write an expository paragraph on how to add and subtract fractions with unlike denominators
Write an expository paragraph on how to add and subtract decimals through thousandth

Essential Learning Outcome: O1.3. Additive Thinking – Make a Reasonable Estimation When Using Operation

Grade Level Expectations and/or Focus Questions:

- Addition/subtraction of tenths, hundredths, and thousandths; Mentally adding and subtracting tenths, hundredths, and thousandths
- Estimating with addition and subtraction of hundredths and thousandths.

<table>
<tr><th>Specific Curriculum Outcome:</th><th>Inclusive Assessment Strategies</th><th>Inclusive Learning Strategies</th></tr>
<tr>
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Learners are expected to:

Skills

1. Use place value knowledge to represent and compare decimals
2. Create mental strategies for adding and subtracting decimals with tenths, hundredths, and thousandths.
3. Perform addition and subtraction of decimals accurately.

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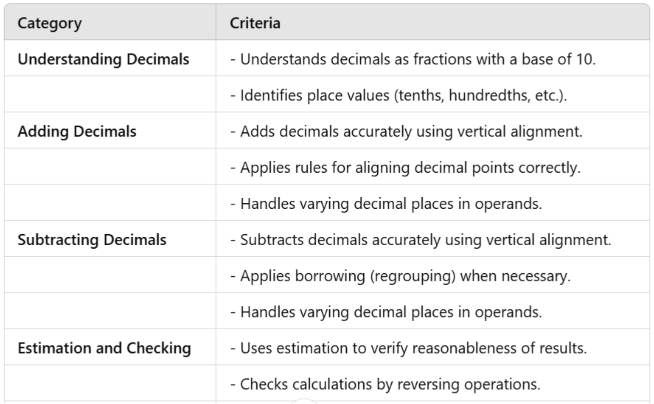
Observation Checklist

Use this checklist during classwork, homework, quizzes, tests, etc. to observe learners' performance.

Differentiation: Modify checklist items or expectations based on individual learner needs.



<table>
<tr><th>Category</th><th>Criteria</th></tr>
<tr><td>Understanding Decimals</td><td>- Understands decimals as fractions with a base of 10.</td></tr>
<tr><td></td><td>- Identifies place values (tenths, hundredths, etc.).</td></tr>
<tr><td>Adding Decimals</td><td>- Adds decimals accurately using vertical alignment.</td></tr>
<tr><td></td><td>- Applies rules for aligning decimal points correctly.</td></tr>
<tr><td></td><td>- Handles varying decimal places in operands.</td></tr>
<tr><td>Subtracting Decimals</td><td>- Subtracts decimals accurately using vertical alignment.</td></tr>
<tr><td></td><td>- Applies borrowing (regrouping) when necessary.</td></tr>
<tr><td></td><td>- Handles varying decimal places in operands.</td></tr>
<tr><td>Estimation and Checking</td><td>- Uses estimation to verify reasonableness of results.</td></tr>
<tr><td></td><td>- Checks calculations by reversing operations.</td></tr>
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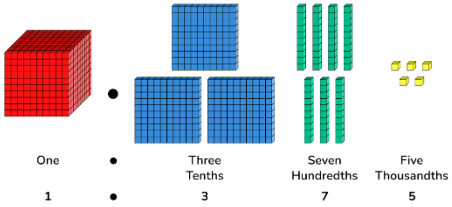
Explicit instructions

Use Place Value knowledge (Visual Aids and Manipulatives)

How: Help to reinforce learners' knowledge of the place value system by using visuals like place value charts, grids, or base-ten blocks.

Have learners break down decimals into tenths, hundredths, and thousandths (e.g., 0.234 = 2 tenths + 3 hundredths + 4 thousandths). They can then mentally add or subtract by focusing on one place value at a time.



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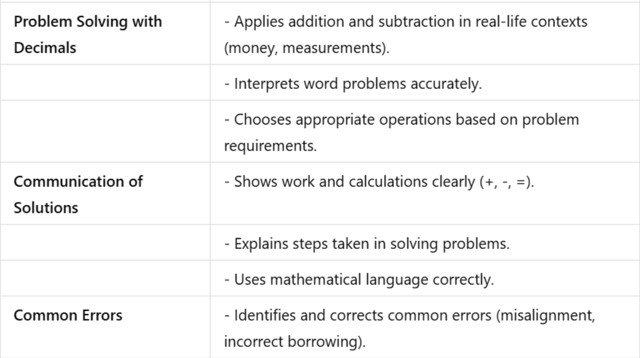
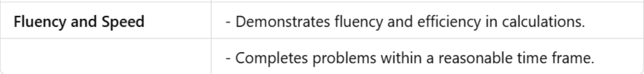
Specific Curriculum Outcome:	Inclusive Assessment Strategies	Inclusive Learning Strategies



Problem Solving with Decimals	- Applies addition and subtraction in real-life contexts (money, measurements).
	- Interprets word problems accurately.
	- Chooses appropriate operations based on problem requirements.
Communication of Solutions	- Shows work and calculations clearly (+, -, =).
	- Explains steps taken in solving problems.
	- Uses mathematical language correctly.
Common Errors	- Identifies and corrects common errors (misalignment, incorrect borrowing).



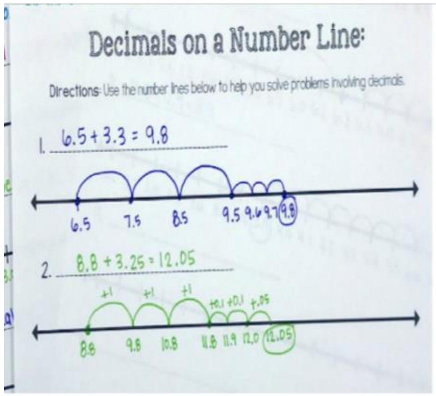
Fluency and Speed	- Demonstrates fluency and efficiency in calculations.
	- Completes problems within a reasonable time frame.

Differentiated Tasks:
Tiered Assignments: Offer assignments with varying levels of complexity or scaffolding to accommodate different learning levels.

Tier 1: Low Complexity
Objective: To reinforce basic understanding of decimal place value and practice adding and subtracting decimals with simpler numbers.
Task: Shopping Scenario
Scenario: Imagine you are shopping online. Calculate the total cost of two items with prices like $4.50 and $3.25. Then, subtract a discount of $1.20.

Tier 2: Medium Complexity
Objective: To apply addition and subtraction of decimals in real-life contexts with multiple steps and varying decimal places.
Task: Cooking Challenge

https://thirdspacelearning.com/us/blog/what-are-base-ten-blocks/



Estimation and Rounding
How: Teach learners to round decimals to the nearest tenth or hundredth for quick mental calculations. After estimating, learners can adjust their answer if needed. For example, 0.456 + 0.237 can be estimated as 0.5 + 0.2 = 0.7, then adjusted to reflect the exact value.

Decimal Story Problems
Provide story problems involving decimals and have learners create their own, explaining solutions and exchanging with classmates to build math and literacy skills.

Mathematics - Shopping Spree
Using online shopping sites, learners plan a shopping spree within a budget, adding and subtracting decimal prices to stay within limits.

<table>
<tr><th>Specific Curriculum Outcome:</th><th>Inclusive Assessment Strategies</th><th>Inclusive Learning Strategies</th></tr>
<tr><td></td><td>
<p>Scenario: You are planning a recipe that requires adding and subtracting ingredient quantities. For instance, add 1.25 cups of flour, 0.75 cups of sugar, and then subtract 0.50 cups for adjustments.</p>
<p>Tier 3: High Complexity
Objective: To extend understanding by solving complex problems involving decimals with larger numbers and real-world applications.
Task: Budgeting Project
Scenario: Plan a budget for a school event or personal project.
Calculate expenses involving decimals (e.g., $125.75 for venue, $45.25 for decorations) and subtract from a set budget of $500.00.</p>
<p>Rubric for Assessing Addition and Subtraction of Decimals in Real-Life Scenarios</p>
<table>
<tr><td>Criteria</td><td>Excellent (4)</td><td>Proficient (3)</td><td>Basic (2)</td><td>Below Basic (1)</td></tr>
<tr><td>Mathematical
Accuracy</td><td>Accurately adds and subtracts decimals in various real-life scenarios, demonstrating deep understanding of the operations and their application</td><td>Mostly accurate in adding and subtracting decimals in real-life scenarios, with minor errors that do not significantly affect the overall solution.</td><td>Demonstrates partial accuracy in adding and subtracting decimals, with noticeable errors that occasionally affect the correctness of the solutions.</td><td>Shows little understanding of how to add and subtract decimals in real-life scenarios, resulting in frequent and significant errors.</td></tr>
<tr><td>Application of Decimals</td><td>Applies decimals</td><td>Generally applies</td><td>Demonstrates</td><td>Shows little understandin</td></tr>
</table>
</td><td>
<p>STEAM - Scientific Measurements
Provide decimal-based scientific data for learners to analyse and calculate, linking to experiments or data analysis (e.g., adding volumes, subtracting measurements).</p>
<p>Technology and Digital Learning
Use educational apps and interactive sites for decimal practice with instant feedback, supporting personalized learning paths. Examples: Math Playground, Splash Learn.
Examples of interactive sites :
https://www.mathplayground.com/ASB_Hungry_Puppies_Decimals.html
https://www.splashlearn.com/s/math-games/add-decimals-less-than-1-using-model</p>
</td></tr>
</table>

Specific Curriculum Outcome:	Inclusive Assessment Strategies					Inclusive Learning Strategies
		appropriately in real-life contexts, showing a clear understanding of when and how decimals are used in practical situations.	decimals correctly in real-life contexts, with occasional misapplications that do not hinder understanding or solution accuracy.	inconsistent application of decimals in real-life contexts, with several instances of misapplication that affect understanding or solution accuracy.	g of how to apply decimals in real-life contexts, resulting in frequent misapplications that significantly affect understanding and solution accuracy.	
	Problem Solving	Effectively identifies and interprets real-life problems that require addition or subtraction of decimals, providing thorough and logical solutions.	Generally identifies and interprets real-life problems that require addition or subtraction of decimals, providing solutions that are mostly thorough and logical.	Shows partial ability to identify and interpret real-life problems that require addition or subtraction of decimals, with solutions that may lack thoroughness or logic.	Has difficulty identifying and interpreting real-life problems that require addition or subtraction of decimals, providing solutions that are often incomplete or illogical.	
	Communication of Solution	Clearly communicates the process and reasoning behind adding or subtracting decimals in real-life scenarios, using	Mostly communicates the process and reasoning behind adding or subtracting decimals in real-life scenarios, with some	Communicates the process and reasoning with limited clarity or detail, making it difficult to follow the steps taken	Struggles to communicate the process and reasoning behind adding or subtracting decimals in real-life scenarios, lacking	

Specific Curriculum Outcome:	Inclusive Assessment Strategies	Inclusive Learning Strategies

	appropriate mathematical language.	gaps in clarity or detail.	to arrive at the solution.	clarity and detail.
Use of Mathematical Strategies	Effectively selects and applies appropriate mathematical strategies (e.g., estimation, checking for reasonableness) to add or subtract decimals in real-life scenarios.	Generally selects and applies appropriate mathematical strategies, with occasional instances where strategies chosen are less effective or not fully utilized.	Shows partial ability to select and apply appropriate mathematical strategies, with instances where strategies chosen are ineffective or not fully utilized.	Has difficulty selecting and applying appropriate mathematical strategies, often choosing ineffective strategies or not applying them at all
Overall Performance	Consistently demonstrates thorough understanding and mastery of adding and subtracting decimals in real-life scenarios, with solutions that are accurate and well-reasoned.	Demonstrates understanding and proficiency in adding and subtracting decimals in real-life scenarios, with solutions that are mostly accurate and well-reasoned.	Demonstrates partial understanding and proficiency in adding and subtracting decimals in real-life scenarios, with solutions that are somewhat accurate and occasionally well-reasoned.	Shows limited understanding and proficiency in adding and subtracting decimals in real-life scenarios, with solutions that are often inaccurate and poorly reasoned.

Conversation

Think-Aloud Assessments

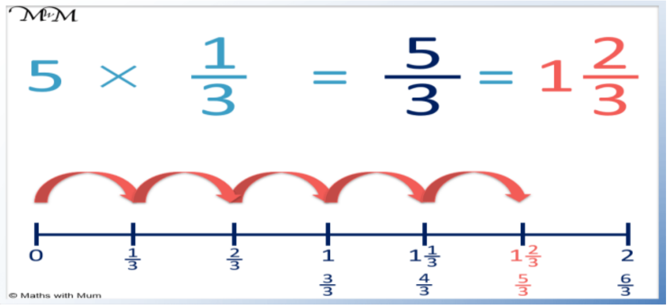
Why: Think-aloud assessments allow teachers to hear how learners approach problems and make decisions. This is

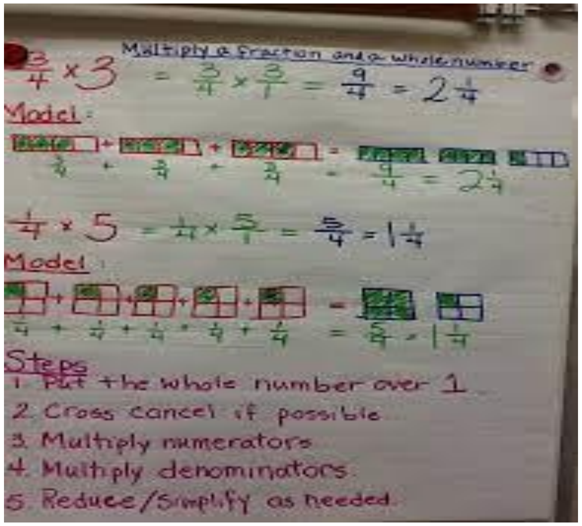
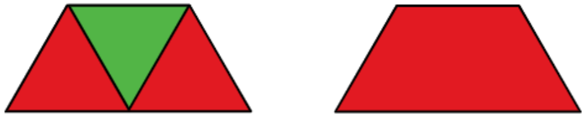
Specific Curriculum Outcome:	Inclusive Assessment Strategies	Inclusive Learning Strategies
	particularly helpful for assessing learners' mental strategies and can provide insights into misconceptions or areas of struggle. ***How***: Have learners perform a mental math task while thinking aloud and explaining their thoughts. *For example*, a learner could add 0.375 + 0.125 and explain how they mentally combined tenths, hundredths, and thousandths.	

Essential Learning Outcome: O2.1. Multiplicative Thinking – Understanding the Meaning of Multiplication and Division and How They Relate

Grade Level Expectations and/or Focus Questions:

- Understandings of multiplication to multiply a fraction or whole number by a fraction
- Apply and extend previous understandings of division to divide unit fractions by whole numbers and whole numbers by unit fractions
- Multiply and divide decimals to thousandths, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between multiplication and division; relate the strategy to a written method and explain the reasoning used

Specific Curriculum Outcome	Inclusive Assessment Strategies	Inclusive Learning Strategies
Learners are expected to: **Knowledge** 1. multiply whole numbers by proper fractions, using appropriate tools and strategies 2. Divide whole numbers by proper fractions using appropriate tools and strategies 3. Divide unit fractions by whole numbers **Skills** 4. Use multiple strategies to model multiplication of decimals up to the thousandths	**Observation** **1. Observational Assessment** *Objective:* Assess learners' ability to use fraction strips or number lines to model the multiplication of whole numbers by fractions. *Method:* Observe learners as they use visual models to solve problems. Look for: ● Correct alignment and placement of fraction strips or number lines. ● Accurate representation of the multiplication process. ● Ability to explain their reasoning verbally. *Example Task:* Ask learners to demonstrate 3×2/5 using fraction strips and describe how they arrived at the answer. **Product** **Performance Tasks:** ***Real-Life Scenarios***	Use Visual Models and Discussion Using Manipulatives: Objective: Provide learners with a tangible way to understand multiplication of fractions.  https://www.mathswithmum.com/multiply-fractions-whole-numbers/

Specific Curriculum Outcome	Inclusive Assessment Strategies	Inclusive Learning Strategies
5. Use multiple strategies to illustrate division of decimals to the thousandths. 6. Multiply and divide decimals up to the thousandths place using the varied strategies (including standard algorithm)	Create problems that relate to real-world contexts. *For example,* "You are having a birthday party for your child and you have bought 8 pizzas of which you want to give each person attending ¼. How many slices of pizza will be shared? **Conversation** **Reflection and Explanation** ***Objective:*** Encourage learners to articulate their understanding and the reasoning behind their methods. ***Task:*** Ask learners to write a reflection or explanation about a division problem they solved, focusing on their use of visual models. - **Questions:** ***Question 1:*** Explain how using a fraction bar helped you understand dividing 1/4by 3. ***Question 2:*** Describe a strategy that helps you divide a whole number by a unit fraction. Why is it effective? **Observation** **Modelling Multiplication with Explicit Explanation** **Objective:** Learners model the multiplication of two decimal numbers using base-ten blocks and grid paper. **Instructions:** Multiply 1.23 by 0.45 using base-ten blocks.	 Multiply a fraction and a whole number $\frac{3}{4} \times 3 = \frac{3}{4} \times \frac{3}{1} = \frac{9}{4} = 2\frac{1}{4}$ Model: $\frac{3}{4} + \frac{3}{4} + \frac{3}{4} = \frac{9}{4} = 2\frac{1}{4}$ $\frac{1}{4} \times 5 = \frac{1}{4} \times \frac{5}{1} = \frac{5}{4} = 1\frac{1}{4}$ Model: $\frac{1}{4} + \frac{1}{4} + \frac{1}{4} + \frac{1}{4} + \frac{1}{4} = \frac{5}{4} = 1\frac{1}{4}$ Steps 1. Put the whole number over 1 2. Cross cancel if possible 3. Multiply numerators 4. Multiply denominators 5. Reduce/Simplify as needed https://www.pinterest.com/pin/math--229050331024920248/ Use pattern blocks or relational rods to create problems that involve multiplying a whole number by a fraction, such as the following: A green triangle covers 1/3 of a trapezoid:  A red trapezoid pattern block with one green triangle pattern block placed on top of it. Next to it is another red trapezoid pattern block.

<table>
<tr><th>Specific Curriculum Outcome</th><th>Inclusive Assessment Strategies</th><th>Inclusive Learning Strategies</th></tr>
<tr>
<td></td>
<td>
Use grid paper to draw and label the blocks as you model each step.
Start by multiplying the tenths, then hundredths, and so on.

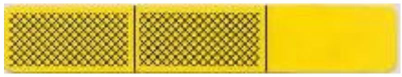
Rubric for Assessment of the assessment above (modelling with explanation)
<table>
<tr><th>Criteria</th><th>4 - Excellent</th><th>3 - Good</th><th>2 - Satisfactory</th><th>1 - Needs Improvement</th></tr>
<tr><td>Representation of Decimals</td><td>Accurately represents all decimals with base-ten blocks and labels correctly.</td><td>Represents most decimals accurately with few errors in labelling.</td><td>Represents some decimals accurately, with several labelling errors.</td><td>Significant errors in representing and labelling decimals.</td></tr>
<tr><td>Modelling Multiplication</td><td>Models multiplication accurately using base-ten blocks, demonstrating</td><td>Models multiplication mostly accurately with minor errors.</td><td>Models multiplication with some understanding but makes</td><td>Fails to model multiplication correctly.</td></tr>
</table>
</td>
<td>
How many whole trapezoids can you cover with 10 green triangles? (10 × 1/3=10/3); they will cover three trapezoids, plus one third of another).
One blue rhombus covers 2/3 of a trapezoid:


Place one blue rhombus (2/3 of a trapezoid) on each red trapezoid pattern block. With 20 rhombuses, learners find they cover 13 full trapezoids plus 1/3 of another (20 × 2/3 = 40/3, or 13 1/3). As they work, have them write the multiplication sentence, identify the relationship between factors and product, and recognize that 20 two-thirds equals 40 thirds in total.

Encourage learners to predict with similar pattern block problems (e.g., if one green triangle is 1/3 of a trapezoid, then 8 triangles would cover 8/3, or 2 2/3 trapezoids).

<i>Fraction Strips:</i>

<i>Objective:</i> Help learners visualize how a fraction of a whole number is obtained.

<i>Activity:</i> Use fraction strips to show repeated addition. 5 x 2/3.

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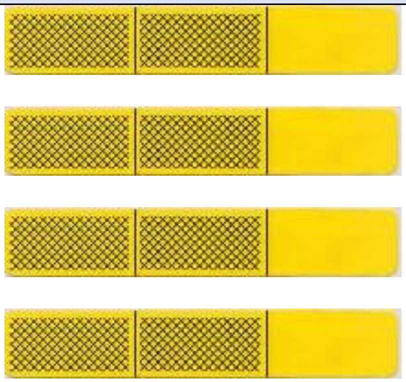
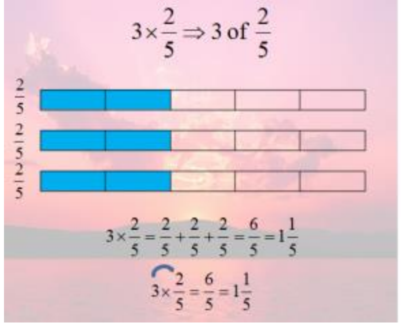
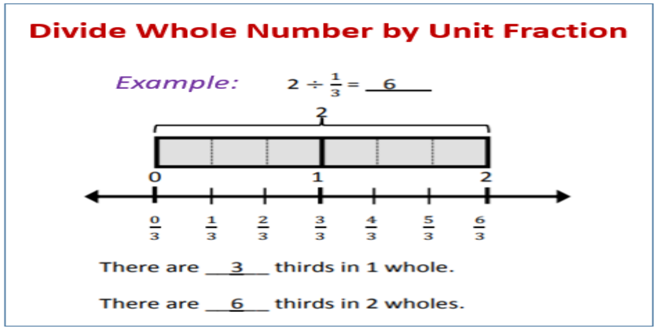
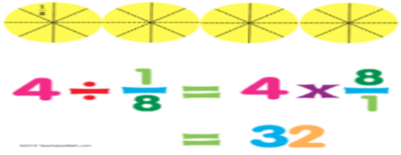
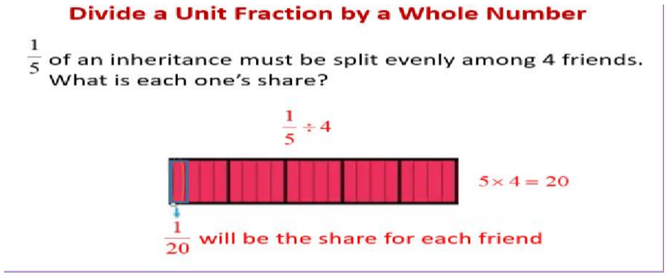
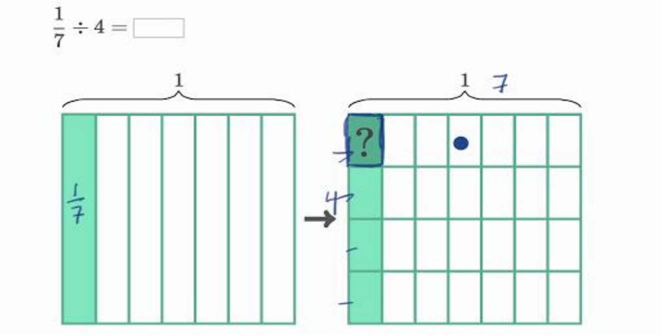
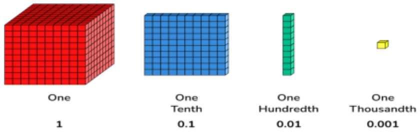
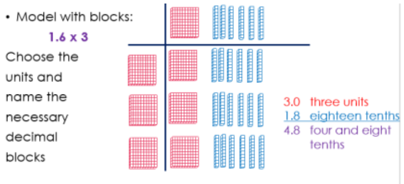
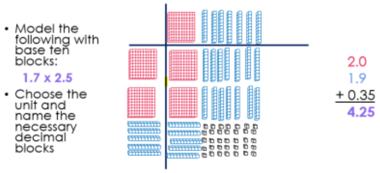
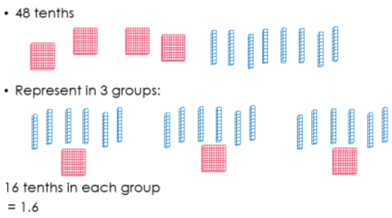
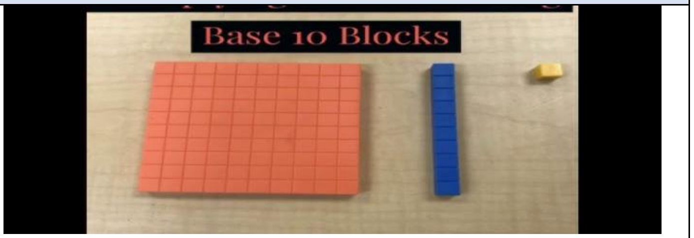
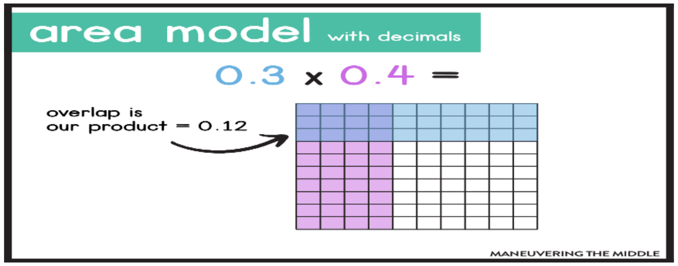
<tr><th>Specific Curriculum Outcome</th><th>Inclusive Assessment Strategies</th><th>Inclusive Learning Strategies</th></tr>
<tr><td></td><td><table>
<tr><td></td><td>clear understanding.</td><td></td><td>significant errors.</td><td></td></tr>
<tr><td>Accuracy of Calculation</td><td>Calculates the product correctly and verifies with a calculator.</td><td>Calculates product with minor errors but verifies and corrects them.</td><td>Calculates with errors and struggles to verify.</td><td>Incorrect calculation and verification.</td></tr>
<tr><td>Explanation and Reflection</td><td>Provides a clear and detailed explanation with thoughtful reflection.</td><td>Provides a mostly clear explanation with some reflection.</td><td>Provides a basic explanation with little reflection.</td><td>Provides unclear explanation and lacks reflection.</td></tr>
</table>
Conversation
Group Discussions and Peer Teaching</td><td>
https://fractionbars.com/Grades5to8/FracBarOperations/Multi.html


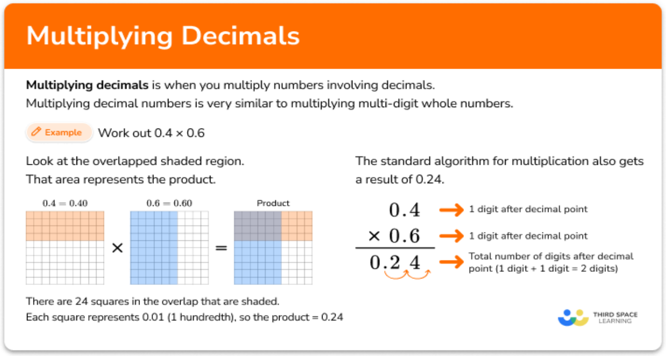
https://yanyulius.weebly.com/class-projects-and-assignment/math-multiply-fraction-using-fraction-bar
Have learners explore the following scenarios:
Birdseed: Filling bird feeders with 3/4 cup requires 9 cups, allowing for 12 feeders.</td></tr>
</table>

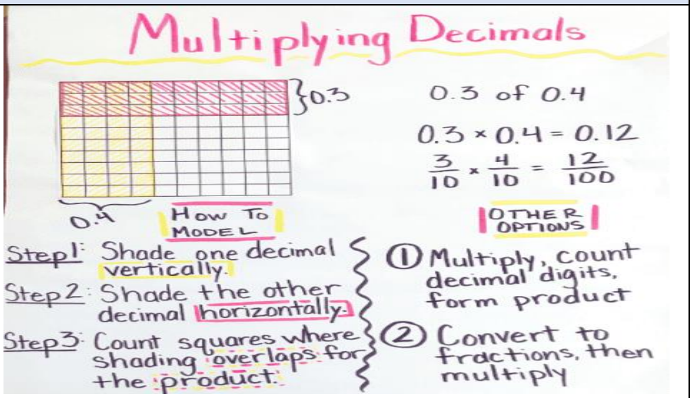
Specific Curriculum Outcome	Inclusive Assessment Strategies	Inclusive Learning Strategies
	***Task*:** Have learners work in pairs or small groups to solve problems and explain their methods to one another. ***Example*:** "Solve 3.6 ÷ 0.4 together and discuss how you approached the problem." ***Expected Response*:** Learners can share different methods (direct calculation, tape diagram, or models) and discuss the advantages of each approach. **SCO6** **Product** **Decimal Bingo** **Objective:** Decimal multiplication and division through a fun and interactive bingo game. **Materials Needed:** ● Bingo cards with decimal products and quotients ● A set of problem cards with multiplication and division problems ● Markers or chips **How to Play:** 1. Each learner receives a bingo card with answers to decimal multiplication and division problems. 2. The teacher draws a problem card, reads it aloud, and learners solve the problem.	Wool: Making beanie hats takes 2/3 of a ball; with 6 balls, learners can make 9 hats. Salt: Creating playdough needs 3/8 cup per batch, so 3 cups yield 8 batches. Paint: Covering walls requires 5/8 of a can; 5 cans can cover 8 walls. Rice: A large pot holds 12 cups; with each serving at 4/5 cup, there are 15 servings. Learners should visually represent each situation using drawings or number lines and write division statements to reflect the scenarios. Encourage them to use addition or subtraction for their strategies, highlighting the relationship between repeated equal groups and division. Division  https://www.onlinemathlearning.com/divide-number-fraction.html

Specific Curriculum Outcome	Inclusive Assessment Strategies	Inclusive Learning Strategies
	3. Learners mark the answer on their bingo card if they have it. 4. The first learner to mark five in a row (horizontally, vertically, or diagonally) calls out "Bingo!" and wins. **Variations:** - Use different levels of difficulty by including more complex decimals. - Create themed bingo cards based on classroom topics. **5. Online Decimal Games** **Objective:** Use digital platforms to practice decimal multiplication and division. **Recommended Websites:** **Math Playground**: Offers interactive decimal games and puzzles. **Khan Academy**: Provides practice problems and interactive exercises. **SplashLearn**: Features engaging games for decimal operations.	 https://teachablemath.com/dividing-with-fractions/ Divide a Unit Fraction by a Whole Number $\frac{1}{5}$ of an inheritance must be split evenly among 4 friends. What is each one's share? https://www.onlinemathlearning.com/divide-fractions-5nf7a.html  https://www.khanacademy.org/math/cc-fifth-grade-math/divide-fractions/imp-dividing-unit-fractions-by-

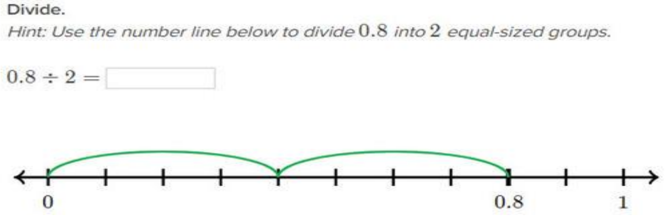
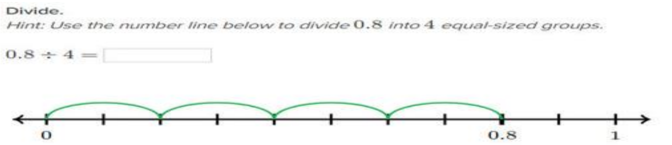
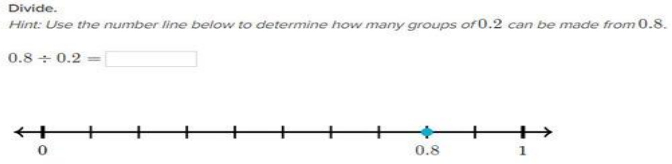
Specific Curriculum Outcome	Inclusive Assessment Strategies	Inclusive Learning Strategies
		whole-numbers/e/dividing-fractions-by-whole-numbers-introduction **Multiplication and Division of decimals**  Have learners represents decimal multiplication and division with manipulatives. For example:   

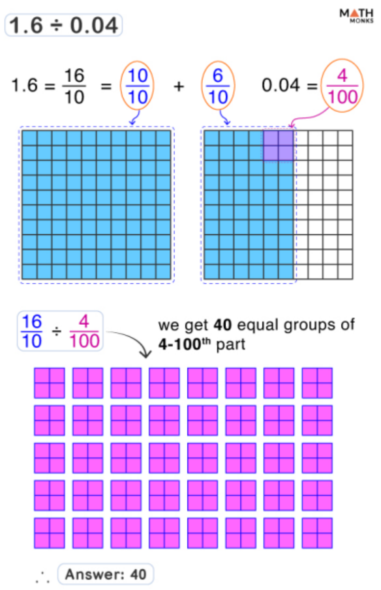
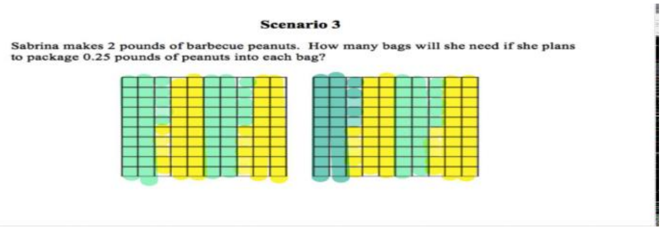
Specific Curriculum Outcome	Inclusive Assessment Strategies	Inclusive Learning Strategies
		 https://www.youtube.com/watch?v=ddhJIZdXRGU https://www.youtube.com/watch?v=L2oWQZaJxNo ***Representational Stage:***  https://www.maneuveringthemiddle.com/6-strategies-for-multiplying-decimals/ Transition to using drawings on grid paper. Learners sketch base-ten blocks and label each section to visualize multiplication. Use coloured pencils or markers to highlight different decimal places (tenths, hundredths, thousandths). https://www.youtube.com/watch?v=8B2CpiJO-uI

Specific Curriculum Outcome	Inclusive Assessment Strategies	Inclusive Learning Strategies
		Abstract Stage: Move to using numbers and the standard algorithm. Emphasize aligning decimal points and understanding place value. Have learners write out each step and solve without physical aids.  Multiplying Decimals **Multiplying decimals** is when you multiply numbers involving decimals. Multiplying decimal numbers is very similar to multiplying multi-digit whole numbers. Example Work out 0.4 × 0.6 Look at the overlapped shaded region. That area represents the product. 0.4 = 0.40 × 0.6 = 0.60 = Product There are 24 squares in the overlap that are shaded. Each square represents 0.01 (1 hundredth), so the product = 0.24 The standard algorithm for multiplication also gets a result of 0.24. 0.4 → 1 digit after decimal point × 0.6 → 1 digit after decimal point 0.2 4 → Total number of digits after decimal point (1 digit + 1 digit = 2 digits) THIRD SPACE LEARNING https://thirdspacelearning.com/us/math-resources/topic-guides/number-and-quantity/multiplying-decimals/

Specific Curriculum Outcome	Inclusive Assessment Strategies	Inclusive Learning Strategies
		 Multiplying Decimals 0.3 0.4 0.3 of 0.4 $0.3 \times 0.4 = 0.12$ $\frac{3}{10} \times \frac{4}{10} = \frac{12}{100}$ How To Model Step 1: Shade one decimal vertically. Step 2: Shade the other decimal horizontally. Step 3: Count squares where shading overlaps for the product. Other Options ① Multiply, count decimal digits, form product ② Convert to fractions, then multiply https://desertdesigned.net/2021/10/10/multiplying-decimal-models-how-to-teach-learners-to-multiply-decimals/ **SCO 4** **Guided Practice:** Work through problems step-by-step with the class, emphasizing the importance of aligning decimal points and carrying digits correctly. Use colour coding to highlight different place values and steps in the algorithm. **SCO5** NUMBER LINE Provide learners with a division equation that has the decimal point missing, such as 4.389 ÷ 2 = 21.945.

Specific Curriculum Outcome	Inclusive Assessment Strategies	Inclusive Learning Strategies
		Ask them to estimate where the decimal point should be placed and then solve related problems: 43.89 ÷ 2 =? 438.9 ÷ 2 =? 0.4389 ÷ 2 =? Learners should justify their estimates and check their answers with a calculator, analysing any errors to adjust their reasoning. Emphasize the importance of estimation for correctly placing decimal points in division problems involving decimals (up to thousandths) divided by whole numbers (up to 10). Additionally, explain that dividing 4.2 by 0.3 asks how many times 0.3 fits into 4.2. Marking Interval**s:** Use a number line to add 0.3 repeatedly from 0 until reaching or exceeding 4.2. Count Steps: Determine how many intervals of 0.3 it takes to reach 4.2, which in this case is 14. Finally, clarify that the number of intervals (14) represents the quotient, so 4.2 ÷ 0.3 = 14.

Specific Curriculum Outcome	Inclusive Assessment Strategies	Inclusive Learning Strategies
		 Divide. *Hint: Use the number line below to divide* 0.8 *into* 2 *equal-sized groups.* $0.8 \div 2 =$ ☐  Divide. *Hint: Use the number line below to divide* 0.8 *into* 4 *equal-sized groups.* $0.8 \div 4 =$ ☐  Divide. *Hint: Use the number line below to determine how many groups of* 0.2 *can be made from* 0.8. $0.8 \div 0.2 =$ ☐ https://www.ck12.org/user:bs10zwftqgljc3ouy2g./book/integrated-mathematics-i-myp1/section/5.9/

Specific Curriculum Outcome	Inclusive Assessment Strategies	Inclusive Learning Strategies
		Area Models  https://mathmonks.com/decimal/how-to-divide-decimals  Scenario 3 Sabrina makes 2 pounds of barbecue peanuts. How many bags will she need if she plans to package 0.25 pounds of peanuts into each bag? https://www.youtube.com/watch?app=desktop&v=mL4OFKTa9i0

Specific Curriculum Outcome	Inclusive Assessment Strategies	Inclusive Learning Strategies
		Represent the decimals on a grid Repeatedly take out 0.25 Count the number of times 0.25 is taken out Guide learners from concrete to abstract understanding: Concrete Stage: Use base-ten blocks to represent decimals (e.g., 1.234 as one "hundred block," two "ten blocks," three "one blocks," and four "tenths blocks") for hands-on multiplication and division. Representational Stage: Transition to drawing models, such as grid paper and number lines, to visualize multiplication (area models) and division (repeated subtraction). Abstract Stage: Teach the standard algorithm, focusing on aligning decimal points and positioning the decimal correctly based on place value.

Additional Resources and Materials

https://www.youtube.com/watch?app=desktop&v=GLRJ25qZr5w

https://www.youtube.com/watch?app=desktop&v=2gFCEY9Hxas

https://www.youtube.com/watch?v=bWJizgCMO7Q

https://www.youtube.com/watch?v=cgCe9wenawI

There are two things to remember when dividing fractions. The first is that we can solve the problem by using the inverse operation. The inverse or opposite of division is multiplication. The second is that we will multiply by the reciprocal of the divisor. Remember that the reciprocal of a fraction is a fraction with the numerator and denominator change places.

Thus, dividing a fraction by a whole number is the same as multiplying the fraction by the reciprocal of the same whole number.
Here is the division problem again.
1/3÷2
First, change the operation to multiplication and change 2 to its reciprocal. 2 can be written as the fraction
2/1.
The reciprocal of 2/1 is 1/2. 1/3÷2=1/3×1/2
Then, multiply the fractions to solve 1/3×1/2=/16
The answer is the same as the diagram above.

https://flexbooks.ck12.org/cbook/ck-12-cbse-maths-class-7/section/2.4/primary/lesson/division-of-fractions/

Additional Useful Content Knowledge for the Teacher:

Multiplication of fractions by whole numbers with fractions

When you multiply a fraction by a whole number, you can think of the problem as repeated addition.
⅖ x 3 is the same as ⅖ + ⅖ +⅖ = 6/5
The same quantity is added 3 times therefore we can multiply ⅖ by 3
https://www.ixl.com/math/lessons/multiplying-fractions-and-whole-numbers

Multiplying fractions and whole numbers
How do you multiply a fraction by a whole number?
You can follow these steps to multiply a fraction by a whole number:
Write the whole number as a fraction with a denominator of 1.
Multiply the numerators.
Multiply the denominators.
Simplify, if needed. If your answer is greater than 1, you may want to write your answer as a mixed number.

Let's try it with ⅖ X 3
First, write the whole number as a fraction with a denominator of 1. 3/1 = 3
Now, multiply the numerators and the denominators.
⅖ ×3/1= 2×3
5X 1 = 6/5 = 1 1/5
Last, simplify. Since 6/5
is greater than 1, change it to a mixed number.

A fraction of a whole number

Let's say there are 8 apples in a basket, and ½ of those apples are red. How many of the apples are red? Finding 1/2 of 8 is the same as multiplying ½ ×8. Follow the steps above to solve! ½ X 8/1
1X 8
2X1 =4 So, 4 of the apples are red.
https://www.ixl.com/math/lessons/multiplying-fractions-and-whole-numbers

Division of a Fraction by a Whole Number

Think about what is happening when we divide a fraction by a whole number. We are taking a part of something and splitting it up into more parts. Here is a division problem.

1/3÷2

This problem is asking us to take one-third and divide it into two parts. Here is a picture of one-third.

[Figure 1]

Divide each third into two parts.

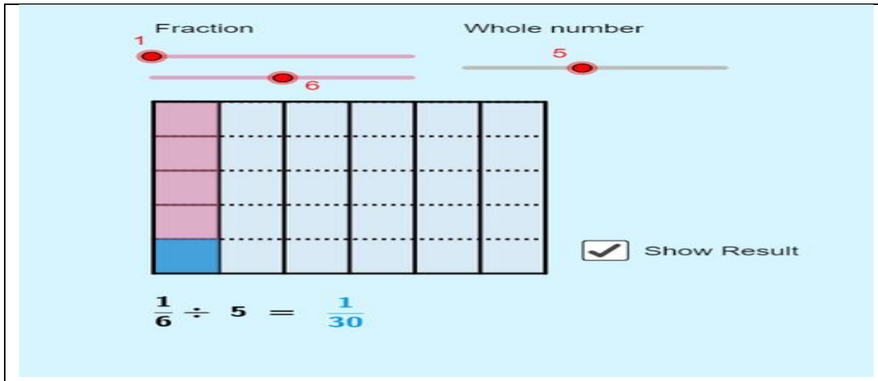
[Figure 2]

Each section is ⅙ of the whole. One-third divided by 2 is 1/6.

∴/13÷2=1/3×1/2 It means that dividing ⅓ by 2 is the same as multiplying ⅓ by 1/2
(Where ½ is the reciprocal of 2).

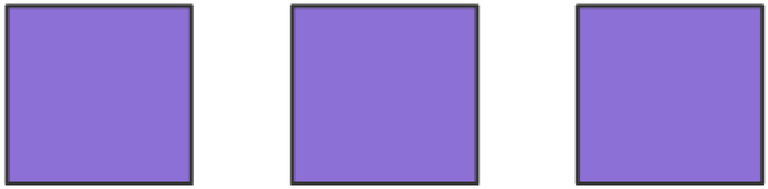
CK-12 Interactive: Division of a Fraction by a Whole Number

INTERACTIVE
Dividing a Fraction by a Whole Number
Try It

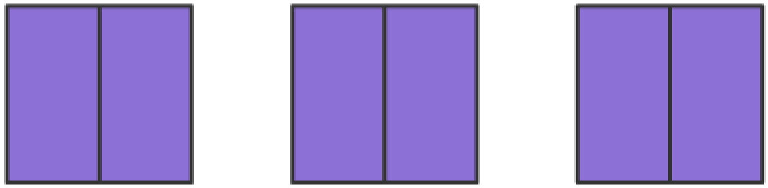


$\frac{1}{6} \div 5 = \frac{1}{30}$

Division of a Whole Number by a Fraction
Sometimes you will need to divide a whole number by a fraction. Here is an example.
3÷1/2
In the problem, it is asking for how many
1/2
s are in 3. Here is a diagram of 3 whole.



[Figure 3]
Divide each whole into equal halves.



[Figure 4]
Clearly, there are 6 one-halves in 3 wholes. So 3÷1/2=6 Also,

$3\times2=6\therefore3\div1/2=3\times2/1$

We learnt that when you divide a fraction by a whole number, we instead multiply by the reciprocal of the divisor. The same applies to dividing a whole number by a fraction. Change the operation to multiplication and change the divisor to its reciprocal.

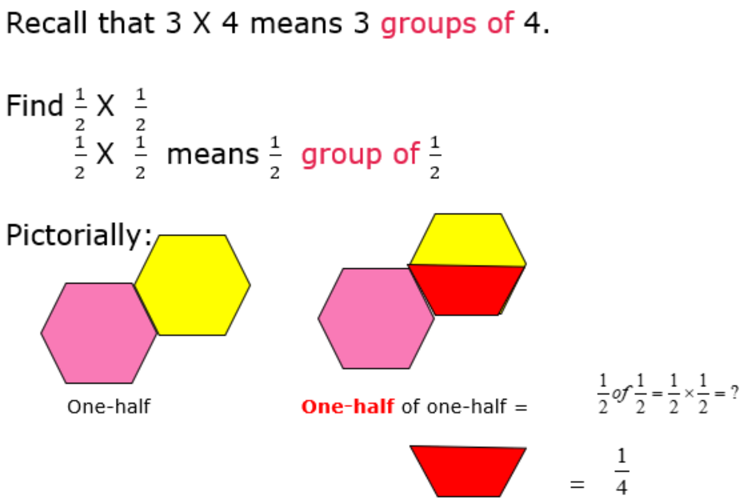
Here is the division problem again.

$3\div1/2$

First change the operation to multiplication and ½ to its reciprocal. $3\div1/2=3\times2/1$

Then, multiply. Remember that any whole number can be written as a fraction,

$n=n/1$.

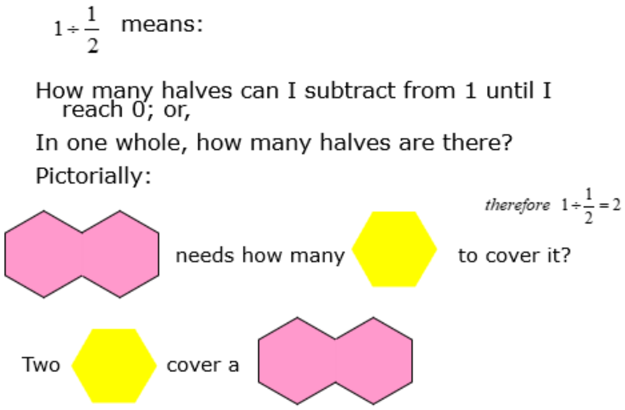


Recall that 3 X 4 means 3 groups of 4.

Find $\frac{1}{2}$ X $\frac{1}{2}$

$\frac{1}{2}$ X $\frac{1}{2}$ means $\frac{1}{2}$ group of $\frac{1}{2}$

Pictorially:



$1\div\frac{1}{2}$ means:

How many halves can I subtract from 1 until I reach 0; or,

In one whole, how many halves are there?

Pictorially:

$3/1\times2/1=6/1=6$

The answer is the same as the diagram above.

Steps to Divide a Whole Number by a Fraction

We can use the following steps to divide a whole number by a fraction:

Step 1: Convert the whole number to an improper fraction.

Step 2: Find the reciprocal of the second fraction (divisor).

Step 3: Change the division sign to a multiplication sign and multiply.

Step 4: Express the fraction in the simplest form. If the answer is an improper fraction, change it into a mixed fraction.

https://flexbooks.ck12.org/cbook/ck-12-cbse-maths-class-7/section/2.4/primary/lesson/division-of-fraction

Division of Fractions with Whole Numbers

For the division of fractions with whole numbers, we need to multiply the denominator of the given fraction with the given whole number. In the general form, if x/y is the fraction and a is the whole number, then x/y ÷ a = x/y × 1/a = x/ya.

Dividing Fractions with Whole Numbers

$$\frac{x}{y} \div a = \frac{x}{y} \times \frac{1}{a}$$

$$= \frac{x}{ya}$$

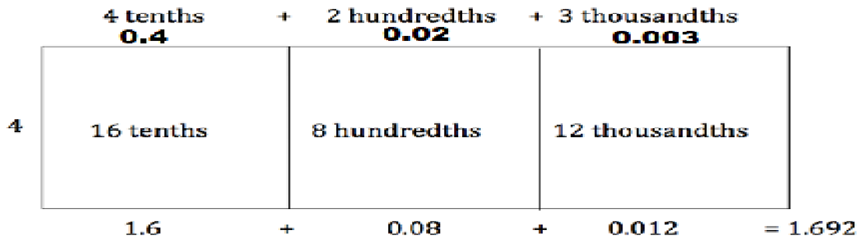
Let us take an example and divide 2/3 with 4.

2/3 ÷ 4 = 2/3 × 1/4

= 1/6

https://www.cuemath.com/numbers/division-of-fractions/

MULTIPLYING DECIMALS USING THE AREA MODEL



https://lessons.unbounded.org/content_guides/6/number-operations-in-base-ten-unbound-a-guide-to-grade-5-mathematics-standards

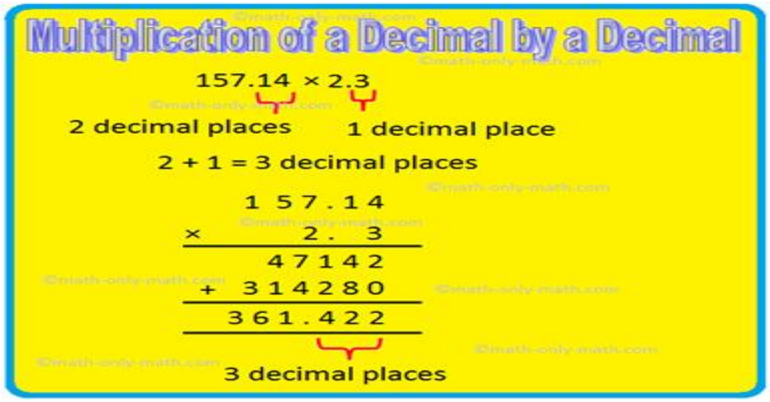
In order to multiply decimals using the standard algorithm.

- Stack the number with the most digits on top.
- Multiply as if the numbers were multi-digit whole numbers, regrouping when necessary.
- Count the number of digits after the decimal point for each factor.

- Place point on the right side or behind the last digit and move the number points the number of decimals in the factors
- Put the same number of digits after the decimal point for the product.

https://thirdspacelearning.com/us/math-resources/topic-guides/number-and-quantity/multiplying-decimals/

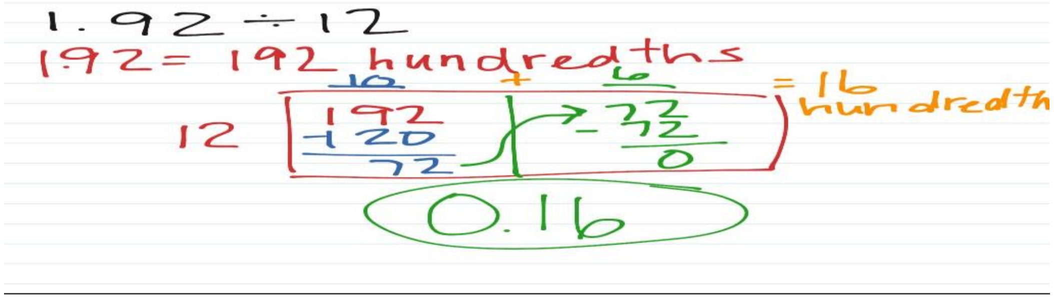
EXAMPLE



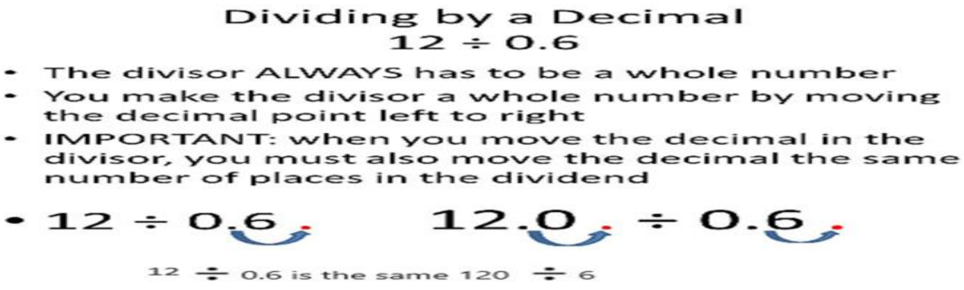
https://www.math-only-math.com/multiplication-of-a-decimal-by-a-decimal.html

DIVISION OF DECIMALS

AREA MODEL



https://www.showme.com/sh/?h=Hw4I8bw
When dividing decimals and the divisor is decimal, it must be converted to a whole number.
To convert the divisor to whole number must be multiplied by its denominator
E.g. 12 / 0.6   0.6 is the same as 6 /10. The denominator is ten therefore 0.6 is multiplied by 10 to make it a whole number. This means that the decimal is moved 1 place to the right.
Anything done to the divisor must be done to the dividend AS SHOWN IN THE FIGURE BELOW

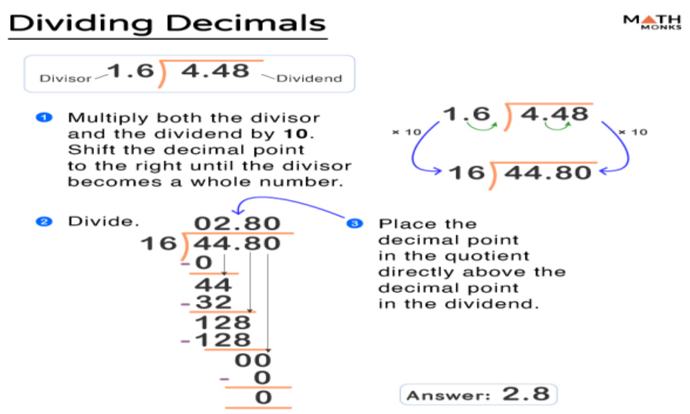


Dividing by a Decimal
12 ÷ 0.6

- The divisor ALWAYS has to be a whole number
- You make the divisor a whole number by moving the decimal point left to right
- IMPORTANT: when you move the decimal in the divisor, you must also move the decimal the same number of places in the dividend
- 12 ÷ 0.6.   12.0. ÷ 0.6.

12 ÷ 0.6 is the same 120 ÷ 6

https://slideplayer.com/slide/5964854/
Divide as usual
If the dividend has a point., place point in quotient as you multiply



Dividing Decimals

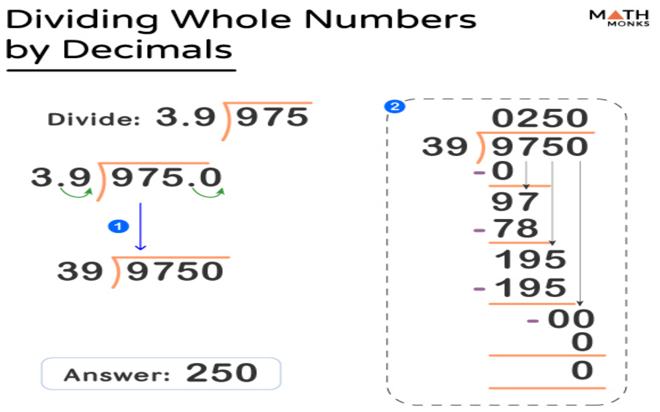
Divisor 1.6)4.48 Dividend

① Multiply both the divisor and the dividend by **10**. Shift the decimal point to the right until the divisor becomes a whole number.

② Divide.

③ Place the decimal point in the quotient directly above the decimal point in the dividend.

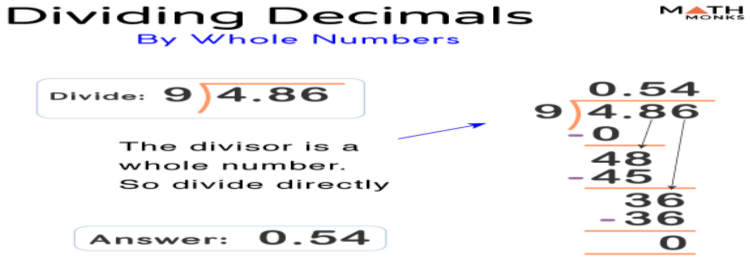
Answer: 2.8



Dividing Whole Numbers by Decimals

Divide: 3.9)975

Answer: 250



https://mathmonks.com/decimal/how-to-divide-decimals

Opportunities for Subject Integration:

Social Studies

Learners will carry out a survey on the villages in the parish to determine the fraction of people engaged in various professions. They will find out the fraction of people in each village who do each job and then calculate the total fraction of the parish involved in each profession.

Learners will analyse population changes in different regions, adding and subtracting fractions with unlike denominators.

Science

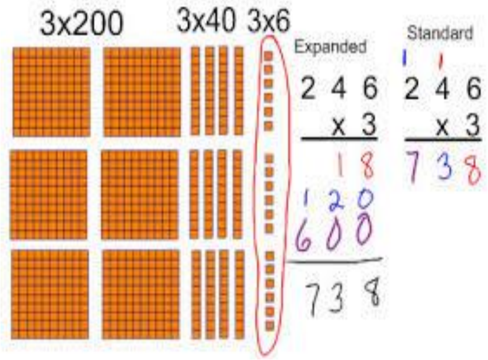
Learners will practice adding and subtracting fractions by mixing different solutions in a science experiment.
Instructions:
Provide learners with different liquid solutions measured in fractions with unlike denominators (e.g., 1/3 cup of vinegar, 1/4 cup of baking soda solution).
Have learners combine the solutions and calculate the total volume.

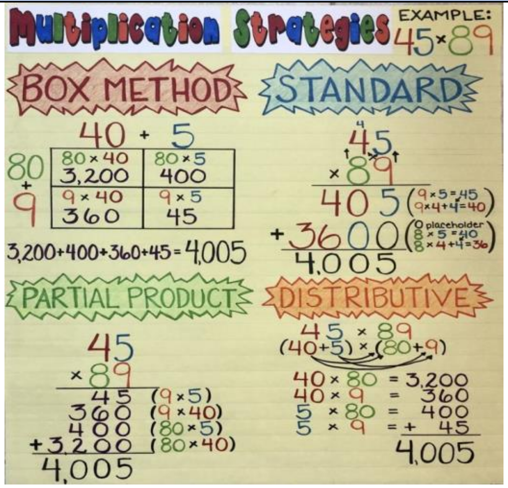
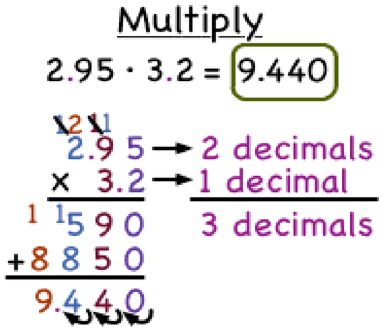
Language Arts
Write an expository paragraph on how to add and subtract fractions with unlike denominators
Write an expository paragraph on how to add and subtract decimals through thousandth

Essential Learning Outcome: O2.2. Multiplicative Thinking – Compute Fluently with Operations (x&÷)

Grade Level Expectations and/or Focus Questions:

- Multiply and divide multi-digit whole numbers, decimals and fractions using the standard algorithm for each operation.
- Use the properties of operations, and the relationships between operations, to solve problems involving whole numbers, decimal numbers, fractions, ratios, rates, and whole number percentages, including those requiring multiple steps or multiple operations
- Represent composite numbers as a product of their prime factors, including through the use of factor trees

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
Learners are expected to: **Knowledge** 1. Multiply multi-digit whole numbers. 2. Multiply multi-digit decimals using the standard algorithm for each operation. 3. Multiply fractions using the standard algorithm for each operation. 4. Divide multi-digit whole numbers using the standard algorithm for each operation.	**Conversation** **Open-Ended Questions** Include open-ended assessment tasks where learners must explain different strategies for solving a multi-digit multiplication problem. This encourages critical thinking and allows you to assess their conceptual understanding. **Conversation** **Error Analysis** Present learners with multiplication problems that have been solved incorrectly. Ask them to identify and correct the errors. This allows learners to demonstrate understanding by recognizing common mistakes, such as incorrect decimal placement or misaligned digits.	**Visual and Concrete Representations** Base-Ten Blocks: Have learners use physical manipulatives to help them understand multiplication of whole numbers.  https://youtu.be/HVQqdLABsGo?t=119

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
5. Divide multi-digit decimals using the standard algorithm for each operation. 6. Divide fractions using the standard algorithm for each operation. 7. Apply the concept of ratios and unit rates to solve real-world and mathematical problems. **Skills** 8. Solve problems involving whole number percentages, using the distributive property to simplify calculations where multiple steps are needed. 9. Apply proportional reasoning to solve problems involving ratios, rates, and percentages, recognizing and using the properties of operations. 10. Solve problems that involve calculating percent increases or decreases, 11. Represent composite numbers as a product of their prime factors, including through the use of factor trees	**Product** **Real-World Application Problems** ***Contextual Word Problems:*** Assess learners using word problems that apply fraction multiplication to real-life situations, like cooking, sharing items, or measuring. Encourage learners to explain their reasoning and show their work. ***Group Projects:*** Give learners a project where they must apply fraction multiplication in a scenario, like adjusting a recipe. Assess both the final product and their problem-solving process. **Product** **Scaffolder Assessments**: Provide learners with partially completed division problems, inviting them to focus on specific steps (e.g., completing the division of the final digits). Use step-by-step questioning to guide learners through the division process and assess their ability to explain their thinking at each stage. Written Explanations: Invite learners to write about their process and reasoning in working out the division problem **Conversation** **Reflective Assessment**: After solving a problem, ask learners to explain or reflect on how they applied the division algorithm, particularly focusing on the handling of decimal points. This can be done verbally or in written form. **SCO6** **Product**	 https://wegrowthinkers.weebly.com/5nbt5-multiply-multi-digit-whole-numbers.html  https://virtualnerd.com/common-core/grade-7/7_NS-number-system/A/3/decimal-multiplication-method

<table>
<tr><th>Specific Curriculum Outcomes</th><th>Inclusive Assessment Strategies</th><th>Inclusive Learning Strategies</th></tr>
<tr><td></td><td>

Self-Assessment:
Provide checklists or rubrics that guide learners in evaluating their own work on dividing fractions. Encourage them to reflect on whether they applied the algorithm correctly and understood the outcome.

<table>
<tr><th>Step</th><th>Yes</th><th>No</th><th>Comments</th></tr>
<tr><td>1. Did I correctly identify the division problem?</td><td></td><td></td><td></td></tr>
<tr><td>2. Did I keep the first fraction the same (do not change it)?</td><td></td><td></td><td></td></tr>
<tr><td>3. Did I change the division sign to a multiplication sign?</td><td></td><td></td><td></td></tr>
<tr><td>4. Did I correctly flip (find the reciprocal of) the second fraction?</td><td></td><td></td><td></td></tr>
<tr><td>5. Did I multiply the numerators correctly?</td><td></td><td></td><td></td></tr>
<tr><td>6. Did I multiply the denominators correctly?</td><td></td><td></td><td></td></tr>
<tr><td>7. Did I simplify the fraction if needed?</td><td></td><td></td><td></td></tr>
<tr><td>8. Did I check my answer by multiplying the result by the divisor (reversing the operation)?</td><td></td><td></td><td></td></tr>
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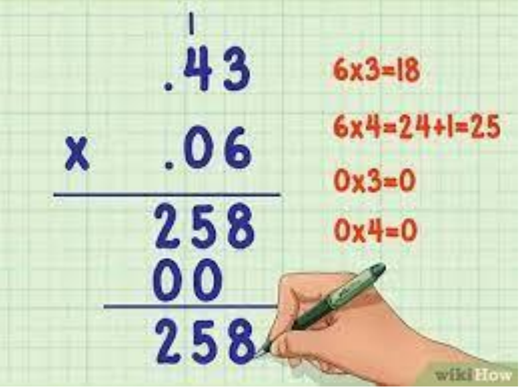
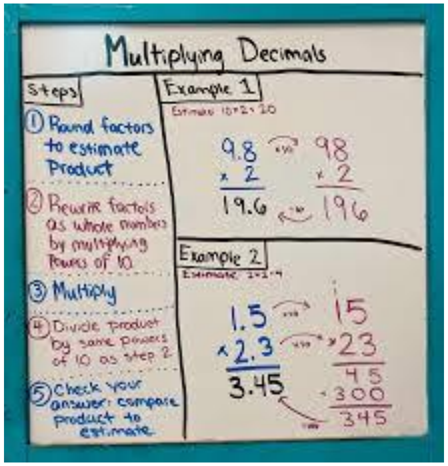


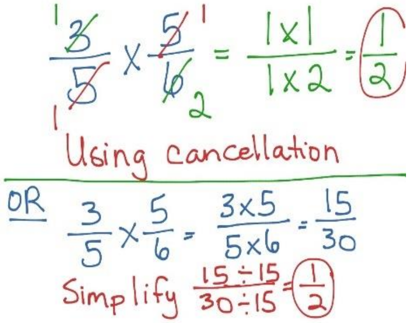
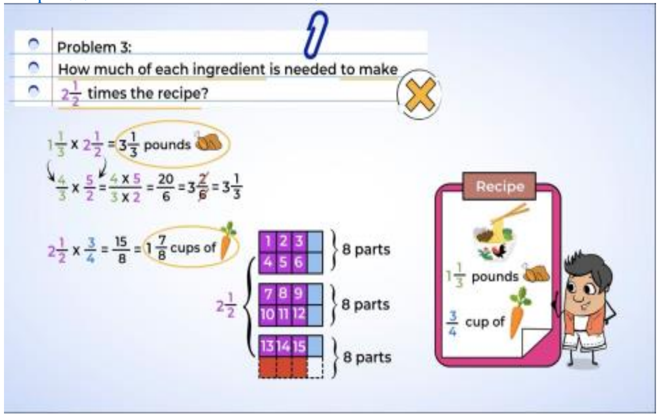
https://www.wikihow.com/Multiply-Decimals

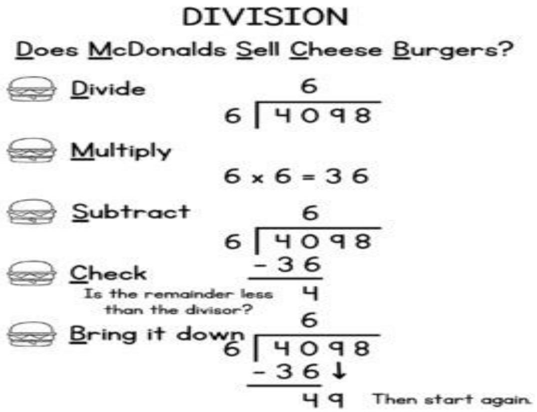


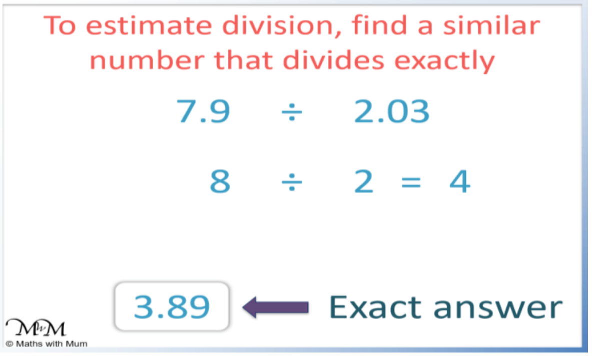
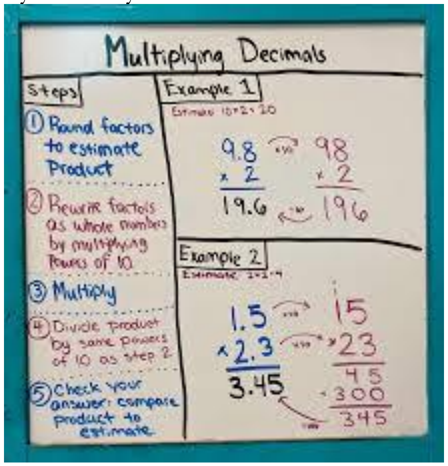
https://flipbarnwell.weebly.com/unit-1.html
Video explaining process.
https://youtu.be/WcpRmQfFzFY

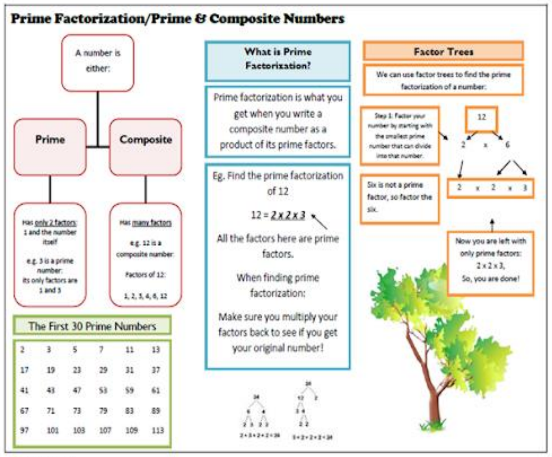
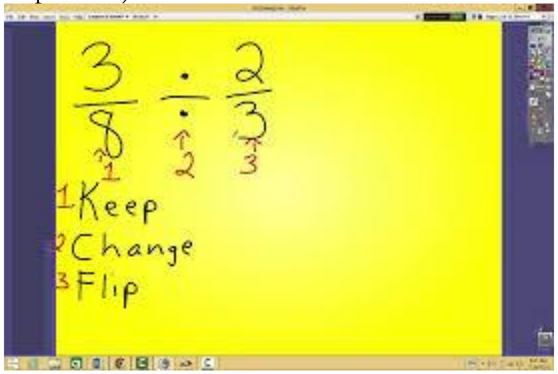
Step-by-Step Guided Practice

</td></tr>
</table>

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
	Product **Number Line Assessment:** ***Goal:*** Assess learners' understanding of how ratios scale up visually. ***Instructions:*** • Provide a blank or partially filled number line with increments of sugar (2, 4, 6, 8 cups). • Ask learners to plot the corresponding flour amounts (3, 6, 9, 12 cups) for each sugar value on the number line. • Encourage them to explain in words or draw arrows between points to highlight the proportional relationship between sugar and flour. ***Assessment Criteria:*** ***Accurate Representation:*** Correct placement of sugar and flour values on the number line. ***Use of Inverse Operations:*** Demonstrating the connection between multiplication and division as the ratio scales up (e.g., "I multiply the cups of sugar by 2, so I need to multiply the cups of flour by 2"). ***Verbal or Written Explanation:*** Encouraging learners to verbally explain their thinking or write a brief sentence about the relationship they see between sugar and flour. **Product** **Visual Models and Manipulatives Example:** ***Problem***: Find 30% of 120 using the distributive property.	***Explicit Instruction***: Break down the steps of multiplying fractions into clear, small steps. Have learner's complete one step at a time, checking their understanding at each point. ***Color-Coding***: Use colours to differentiate between numerators and denominators when multiplying fractions. This helps learners visually track each part of the operation.  https://www.showme.com/sh?h=rhkBr3A  https://www.mightyowl.com/units/multiplying-fractions-using-area-models-and-standard-algorithm

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
	Assessment Task: Provide learners with a 100-grid or a number line. Ask them to break down the percentage: 30%=10%+10%+10% Then, find 10% of 120 (which is 12) and multiply by 3 to get 36. ***Visual:*** Learners can shade 10% of the grid three times and count the total to get the answer. ***Assessment:*** Grade learners on how well they use the model to represent the problem and correctly apply the distributive property. • Reinforce that breaking down percentages into smaller, more manageable parts (10%) and using visual tools (the grid or number line) helps simplify multi-step percentage problems. • You can assess learners based on how well they break down the problem, their correct use of the visual model, and whether they arrive at the correct final answer. This approach visually and conceptually reinforces how 30% of a number can be calculated by finding smaller chunks, making it easier for all learners to grasp the concept. **Conversation** **Error Analysis** ***Task:*** Present a completed but incorrect solution to the problem. For example: "A learner found that the car travelled 280 miles in 7 hours by dividing 120 by 7." ***Assessment:*** Ask learners to identify the error, explain what the mistake was (wrong operation),	**Use of Mnemonics**: Provide learners with a mnemonic such *as "Does McDonald's Sell Cheese Burgers?"* (Divide, Multiply, Subtract, Check, and Bring down) to help them remember the steps of the division algorithm.  **Scaffolder Practice**: Start with simpler division problems (e.g., 3-digit by 1-digit) and gradually increase the complexity (e.g., 4-digit by 2-digit) as learners gain mastery. Provide guided practice with teacher support before moving to independent practice. **Estimation**: Teach learners to estimate answers before solving division problems with decimals. This helps them develop number sense and verify the reasonableness of their results.

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
	and how they would correctly solve the problem using the properties of multiplication and division. ***Assessment Criteria:*** Assess how well learners can recognize mistakes and articulate the correct solution process. **Product** **Diagnostic and Formative Assessments:** ***Pre-Assessments:*** Before starting a unit on percent increases and decreases, assess learners' prior knowledge of percentages and their ability to use multiplication and addition in basic percent problems. Use this information to guide differentiated instruction and provide scaffolds for learners who need additional support. ***Exit Tickets:*** At the end of a lesson, provide short problems related to percent increases or decreases to quickly assess learner understanding. For example, "If a $200 item is discounted by 15%, what is the new price?" Review the exit tickets to adjust the next lesson based on learner progress. **Product** **Differentiated Assessments** ***Tailored Assessments:*** Provide different levels of difficulty for factorization problems based on learner readiness. Assess understanding with simpler composite numbers for those needing more support and more complex numbers for advanced learners. ***Choice Boards:*** Create a choice board with different activities related to prime factorization and factor trees, inviting learners to select the tasks that resonate with them.	 https://www.mathswithmum.com/estimating/ Interactive Whiteboards: Use these to demonstrate the algorithm dynamically.  https://flipbarnwell.weebly.com/unit-1.html Video: https://youtu.be/DFvPnh5jnvY?t=26

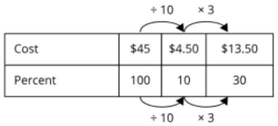
Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
	 **Prime Factorization/Prime & Composite Numbers** A number is either: Prime Composite Has only 2 factors: 1 and the number itself e.g. 3 is a prime number: its only factors are 1 and 3 Has many factors e.g. 12 is a composite number Factors of 12: 1, 2, 3, 4, 6, 12 The First 30 Prime Numbers 2 3 5 7 11 13 17 19 23 29 31 37 41 43 47 53 59 61 67 71 73 79 83 89 97 101 103 107 109 113 What is Prime Factorization? Prime factorization is what you get when you write a composite number as a product of its prime factors. Eg. Find the prime factorization of 12 12 = 2 x 2 x 3 All the factors here are prime factors. When finding prime factorization: Make sure you multiply your factors back to see if you get your original number! Factor Trees We can use factor trees to find the prime factorization of a number: Step 1: Factor your number by starting with the smallest prime number that can divide into that number. 12 2 x 6 Six is not a prime factor, so factor the six. 2 x 2 x 3 Now you are left with only prime factors: 2 x 2 x 3, So, you are done! 2010 Talbiddeen Jr. http://www.mr-vango.com/prime-factorization.html	**Step-by-Step Breakdown:** Clearly outline each step of the standard algorithm, using worked examples. (Use Keep Change Flip -KFC)  https://www.youtube.com/watch?v=XWodZTKtezU ***Steps:*** ***After KCF use the multiplication of fraction steps.*** **Ratio, rates and percentage:** **Visual Representation (Visual Learners)** Have learners engage with various situations involving ratios, rates, and percentages, such as those outlined below. Support them as they model the situation with diagrams, counters, ratio tables, or double number lines, in order to help visualize the relationships between the quantities and understand the problem. For example, a learner trying out cross-country running practiced 4 out of every 5 days during her training period. If she practiced 28 days, how many days was her training period?

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies

Number of days practised	4	8	12	16	20	24	28
Total number of days	5	10	15	20	25	30	35

It takes 32 strawberries to make 4 smoothies. How many strawberries will it take to make 6 smoothies? If there are only 24 strawberries, how many smoothies can be made?

The cost of a sweater at a department store was $45. During a sale, it was marked 30% off the original price. What was the price of the sweater during the sale?



Cost	$45	$4.50	$13.50
Percent	100	10	30

Discount = $13.50   sale price = $45.00 − $13.50 = $31.50

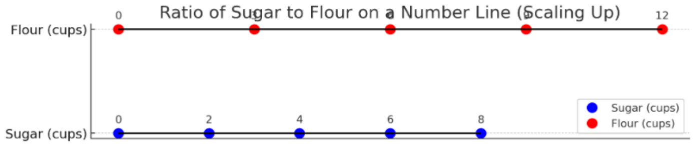
Guide learners to write the appropriate multiplication or division equation for their model and support them in seeing how these operations can be used to represent and solve ratio problems.

Ratio Table or Chart: Create a simple chart that shows the relationship between the amount of sugar and flour:

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies

Sugar (cups)	Flour (cups)
2	3
4	6
6	9
8	12

Number Line: Use a number line to show the scaling of the ratio, highlighting that for every 2 cups of sugar, you add 3 cups of flour. Move up the number line until you reach 8 cups of sugar and 12 cups of flour.



Visual Models Example: use visual models like grids or arrays to represent percentages. This helps learners visualize how percentages can be broken down and distributed. For example, 25% of a number can be shown as dividing a grid into four equal parts.

- **Problem**: Find 25% of 80.
- **Approach**: Use a grid with 80 squares, and split it into four equal parts (each representing 25%). By colouring in one part (25%), learners can see that 25% of 80 is 20.

Explicit Instruction with Think-Alouds:

- Model solving problems involving whole number percent using the distributive property through think-alouds. For example, explain:
  "I know that 35% of 200 can be broken into 30% + 5%. I'll first find 10%, which is 20. Then I'll multiply by 3 for

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies

30%, giving me 60. Finally, I'll find 5% (half of 10%) and get 10. Adding 60 and 10 gives me 70."

- Encourage learners to use think-alouds during problem-solving to verbalize their thought process.

Visual Aids:
A car travels 120 miles in 3 hours. How far will it travel in 7 hours?"
Find the Unit Rate (Miles per Hour):

- First, determine how many miles the car travels in 1 hour by dividing the total distance by the total time:
  Unit rate=120 miles 3 hours=40 miles per hour

120 \3 = 40

- This shows that the car travels 40 miles in 1 hour.

Use the Unit Rate to Find the Distance for 7 Hours:

- Car travels 40 miles per hour, multiply the unit rate by the number of hours (7 hours):
  40 miles per hour×7 hours=280 miles

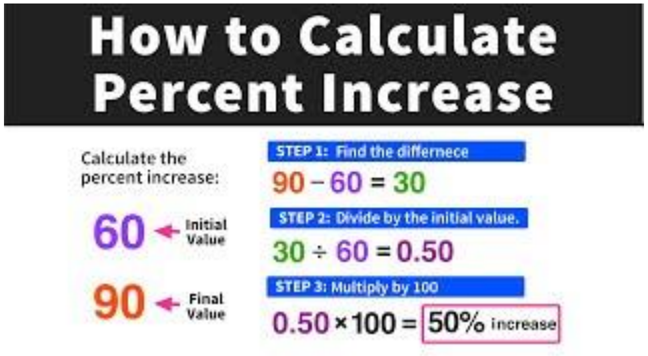
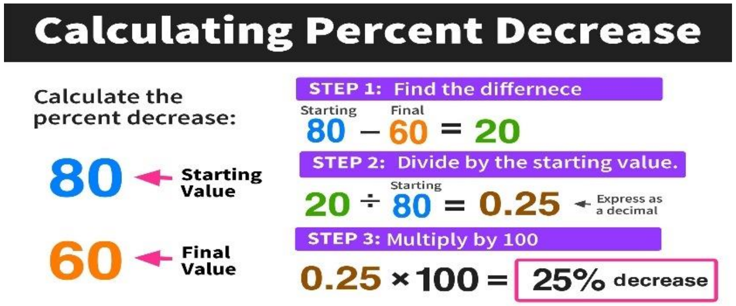
- Use a bar model or ratio table where learners can see the relationship between hours and miles. Create a table showing how many miles the car travels for each hour:

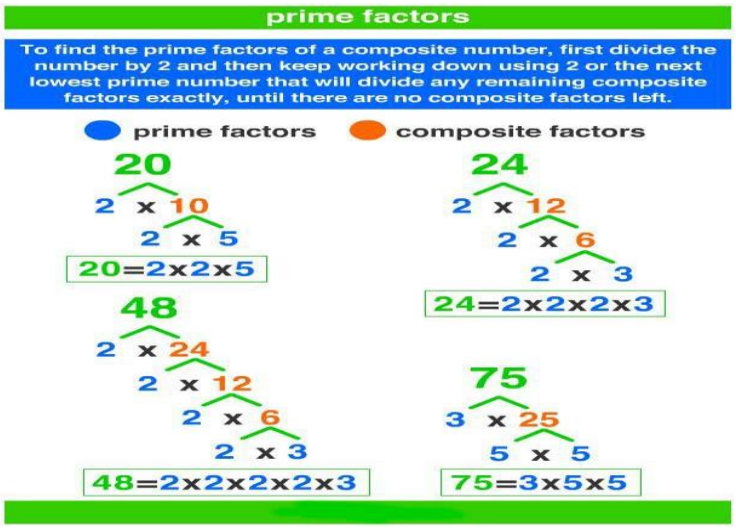
Hours:	1	2	3	4	5	6	7
Miles:	40	80	120	160	200	240	280

This shows a clear linear relationship and helps learners visualize multiplication as repeated addition.

SC010
Step-by-Step Scaffolding:
Provide structured problems with clear steps that scaffold the process of calculating percent increases or decreases:

1. **Identify the percent change** (increase or decrease).
2. **Convert the percent to a decimal**.

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
		3. **Multiply the percent by the original value** to find the change. 4. **Add or subtract the change** from the original amount. • Include visual aids (like a chart or checklist) to support learners who need additional guidance.   https://www.mashupmath.com/blog/tag/calculating+percent+increase

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
		SCO 11 **Visual Representation with Factor Trees** ***Step-by-Step Visuals*:** Use large posters, digital slides, or handouts that show a clear step-by-step process for constructing a factor tree. Start with the composite number at the top, and break it down into two factors until all the prime factors are found. ***Colour Coding*:** Use different colours to highlight prime numbers as they emerge. This helps learners visually differentiate between composite numbers (which are broken down further) and prime numbers (which end the factor tree).  prime factors To find the prime factors of a composite number, first divide the number by 2 and then keep working down using 2 or the next lowest prime number that will divide any remaining composite factors exactly, until there are no composite factors left. https://www.pinterest.com/pin/how-to-find-the-prime-factors-using-factor-tree--229120699783305670/

Additional Resources and Materials:

Place value blocks

Number lines

Additional Useful Content Knowledge for the Teacher:

Multiplication and Division of Multi-Digit Whole Numbers

Standard Algorithm for Multiplication: When teaching multiplication of multi-digit whole numbers, it is essential to ensure learners understand place value. The standard algorithm involves multiplying each digit of the multiplicand by each digit of the multiplier and adding the partial products. Teachers should model the steps carefully:

- Line up the numbers by place value.
- Multiply each digit of the bottom number by each digit of the top number.
- Add the products, being careful to keep track of place value.

Standard Algorithm for Division: For division, the long division method is commonly used. Teachers should emphasize:

- Dividing the dividend by the divisor starting with the highest place value.
- Multiplying the quotient by the divisor and subtracting the result from the dividend.
- Bringing down the next digit and repeating the process until all digits are used.
- Understanding the remainder, and interpreting it as a decimal or a whole number depending on the context of the problem.

Multiplication and Division of Decimals

Multiplying Decimals: Teachers need to emphasize:

- Ignoring the decimal point initially and multiplying the numbers as if they were whole numbers.
- Counting the total number of decimal places in the factors and placing the decimal point in the product so that it has the same number of decimal places.
- Example: 2.35×1.2=2.820, where the total number of decimal places in the factors is 3 (2 from 2.35 and 1 from 1.2), so the product has 3 decimal places.

Dividing Decimals: Key steps include:

Moving the decimal point in the divisor and dividend to make the divisor a whole number, then using the standard long division algorithm.

Placing the decimal point in the quotient directly above the decimal point in the dividend.

Example: To divide 6.75÷1.5, first multiply both by 10 to get 67.5÷15=4.5

Multiplication and Division of Fractions

Multiplying Fractions: The key to multiplying fractions is multiplying the numerators and denominators:

Example: 2/3×4/5=8/15.

Teachers should also introduce simplifying fractions before multiplying if possible, by finding common factors in the numerator and denominator across the fractions.

Dividing Fractions: When dividing fractions, use the reciprocal of the divisor and multiply:

Example: 2/3÷4/5= 2/3×5/4= 10/12= 5/6

Teachers should ensure learners understand the rationale behind "multiplying by the reciprocal" and model the steps carefully.

Use the Properties of Operations and Relationships Between Operations

Understanding the **properties of operations** is fundamental for solving problems with whole numbers, decimals, fractions, ratios, rates, and percentages. These properties include:

Properties of Operations

Commutative Property: This property states that the order in which two numbers are added or multiplied does not affect the result. This property holds for addition and multiplication, but not for subtraction and division.

Example: 3+5=5+3 or 4×7=7×4.

Associative Property: This property refers to the grouping of numbers in addition or multiplication without changing the result. Like the commutative property, it holds for addition and multiplication, but not for subtraction and division.

Example: (2+3)+4=2+(3+4) or (3×4)×5=3×(4×5).

Distributive Property: This property is essential for simplifying expressions and solving multi-step problems. It states that $a(b+c)=ab+ac$.

Example: 3(5+2)= 3×5+3×2= 15+6= 21

Using Relationships Between Operations

Inverse Relationships: Understanding the inverse relationships between operations (e.g., multiplication and division, addition and subtraction) allows learners to check their work and solve equations.

Example: To solve 12÷4=3, learners can check by verifying 3×4=12.

For decimals and fractions, learners can see how multiplying by a number's reciprocal reverses division.

Multi-Step Problem Solving

When solving problems involving ratios, rates, and percentages, learners often need to apply the properties of operations to simplify and solve equations.

Ratios and Rates: Solving problems that involve comparing two quantities using multiplication or division.

Example: "A car travels 120 miles in 3 hours. How far will it travel in 7 hours?" Use unit rates to find the answer.

Percentages: Use properties like the distributive property to break down calculations involving percentages.

Example: Finding 15% of 80 can be broken down as 10%×80+5%×80= 8+4= 12.

Representing Composite Numbers as a Product of Prime Factors (Prime Factorization)

Prime Factorization:

Prime factorization involves breaking down a composite number into a product of prime numbers. For example, the number 60 can be expressed as 60=2x2x3x5=60

Factor Trees:

- Teachers can use factor trees to visually represent the prime factorization of a number.
- Start by dividing the number by the smallest prime factor.
- Continue breaking down each factor until all remaining numbers are prime.

Example: 60⟶2×30⟶2×15⟶3×5 Thus, the prime factorization of 60 is 2x2x3x5.

Using Prime Factorization to Find GCF and LCM:

- **Greatest Common Factor (GCF)**: The GCF of two numbers can be found by comparing their prime factorizations and taking the lowest powers of the common primes.
- **Least Common Multiple (LCM)**: The LCM can be found by taking the highest powers of all primes that appear in the factorizations of the numbers.

Opportunities for Subject Integration
Measurement in Experiments: Use fractions and decimals for precise measurements in science.

Mathematics and Technology:

Digital Graphing: Input data to create graphs, showing math applications.
Prime Factorization: Essential for engineers in gear design.
Mathematics and Social Studies:

Historical Figures: Learn about mathematicians like Euclid and their impact.
Economics: Use percentages and ratios to analyse trade and finance.
Mathematics and Literature:

Storytelling: Incorporate math into narratives through word problems.
Poetry: Connect patterns in poetry to math concepts.
Mathematics and Art:
Artistic Designs: Use prime factorization and ratios for creative work.
Mathematics and Music:

Fractions in Music: Understand rhythms through fractional notes.
Patterns: Explore musical scales and ratios.

Essential Learning Outcome: 2.3. Multiplicative Thinking – Make Reasonable Estimation When Using the Operation (x&÷)

Grade Level Expectations and/or Focus Questions:

- Mentally dividing with 2-, 3-, and multi-digit numbers- quick division, no regrouping by a 1-digit number; Estimating with division of 2-, 3-, and multi-digit numbers by a 1-digit number.
- Understand the divisibility rules and use them to determine whether numbers are divisible by 2, 3, 4, 5, 6, 8, 9, and 10
- Use mental math strategies to calculate the percent of whole numbers, including 1%, 5%, 10%, 15%, 25%, and 50%, and explain the strategies used

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
Learners are expected to: **Skills** 1. Mentally divide with 2-, 3-, and multi-digit numbers- quick division, no regrouping by a 1-digit number. 2. Use divisibility rules to determine whether numbers are divisible by 2, 3, 4, 5, 6, 8, 9, and 10. 3. Use mental math strategies to calculate percent of whole numbers, including 1%, 5%, 10%, 15%, 25%, and 50%, and explain the strategies used	**Product** **Oral Assessments** **Speed Drills**: Conduct timed oral quizzes where learners quickly answer division questions. For example, ask questions like "What is 56 ÷ 7?" and keep track of how many they get right in a set time. **Think-Pair-Share**: Have learners work with a partner to verbally explain their mental division strategies, fostering discussion and collaborative learning. Bingo and domino game created by teachers and learners in dividing with 2-, 3-, and multi-digit numbers- quick division (no regrouping). A record of learner's correct answers and incorrect answers is noted for future work with the learners.	**Modelling and Guided Practice** ***Demonstrate Strategies***: Show various mental math strategies for division, such as breaking down numbers (e.g., 72 ÷ 8 can be thought of as 64 ÷ 8 + 8 ÷ 8). Use clear step-by-step modelling. ***Guided Practice:*** Work through problems as a class, inviting learners to contribute ideas and methods. Gradually release responsibility, moving from teacher-led to learner-led practice. **Visual Aids and Graphic Organizers** ***Fact Families:*** Use fact family charts to illustrate relationships between multiplication and division. For example, for 56 and 7, show that 7×8=56 and 56÷7=8. ***Division Charts:*** Create visual charts that list common division facts. Display these in the classroom as reference tools for learners.

<table>
<tr><th>Specific Curriculum Outcomes</th><th>Inclusive Assessment Strategies</th><th>Inclusive Learning Strategies</th></tr>
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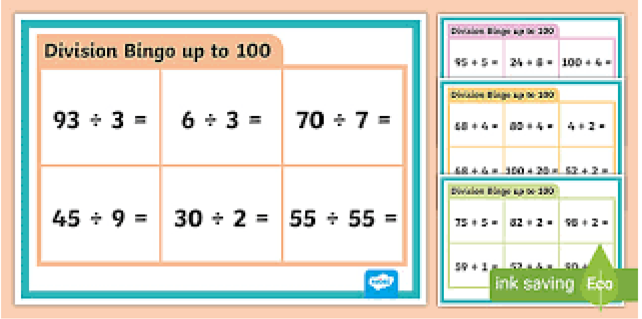

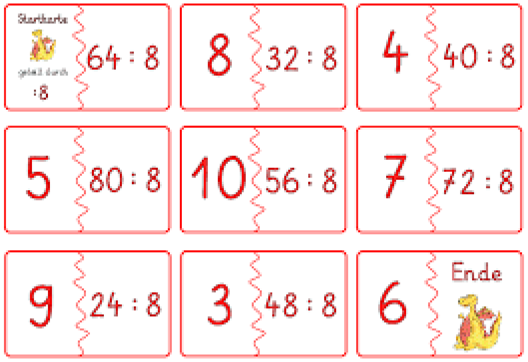

Conversation

Peer Assessments

Peer Review: Invite learners to exchange their work on divisibility problems and assess each other's understanding. They can provide feedback on clarity and accuracy.

Teach-Back Sessions: Pair learners and have them teach each other about a specific divisibility rule. Assess their ability to explain concepts clearly and accurately.

Product

Differentiated Tasks

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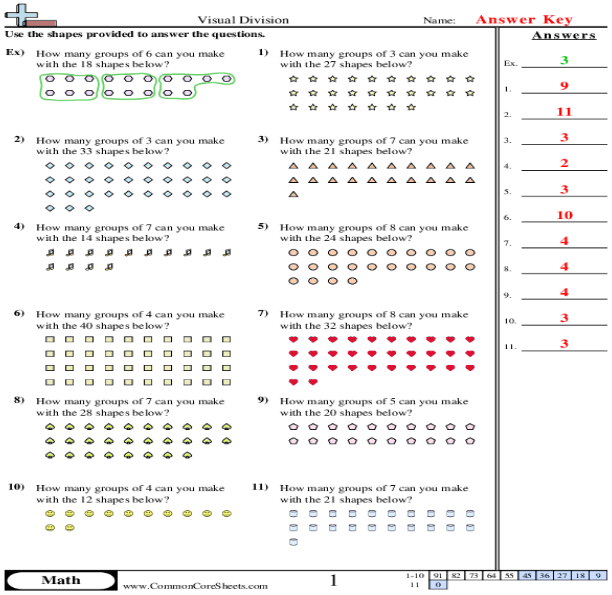

Visual Division Name: Answer Key

Use the shapes provided to answer the questions.

Ex) How many groups of 6 can you make with the 18 shapes below?

1) How many groups of 3 can you make with the 27 shapes below?

2) How many groups of 3 can you make with the 33 shapes below?

3) How many groups of 7 can you make with the 21 shapes below?

4) How many groups of 7 can you make with the 14 shapes below?

5) How many groups of 8 can you make with the 24 shapes below?

6) How many groups of 4 can you make with the 40 shapes below?

7) How many groups of 8 can you make with the 32 shapes below?

8) How many groups of 7 can you make with the 28 shapes below?

9) How many groups of 5 can you make with the 20 shapes below?

10) How many groups of 4 can you make with the 12 shapes below?

11) How many groups of 7 can you make with the 21 shapes below?

Answers

Ex. 3
1. 9
2. 11
3. 3
4. 2
5. 3
6. 10
7. 4
8. 4
9. 4
10. 3
11. 3

Math www.CommonCoreSheets.com 1

1-10 91 82 73 64 55 45 36 27 18 9
11 0

https://www.commoncoresheets.com/division-worksheets/sbh/visual-division

Direct Instruction

Explain Each Rule: Start with clear, concise explanations of each divisibility rule. For example:

Divisibility by 2: A number is divisible by 2 if its last digit is even (0, 2, 4, 6, or 8).

Divisibility by 3: A number is divisible by 3 if the sum of its digits is divisible by 3.

Divisibility by 4: A number is divisible by 4 if the last two digits form a number that is divisible by 4.

Divisibility by 5: A number is divisible by 5 if its last digit is 0 or 5.

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<tr><th>Specific Curriculum Outcomes</th><th>Inclusive Assessment Strategies</th><th>Inclusive Learning Strategies</th></tr>
<tr><td></td><td>***Tiered Assignments:*** Create tasks with varying complexity levels based on learners' abilities. For instance, some learners can work on calculating basic percentages (e.g., 10% of a number), while others tackle more complex percentages (e.g., 15% of a larger number).
Choice Boards: Offer a selection of activities related to calculating percentages. Learners can choose how they want to demonstrate their understanding, whether through worksheets, presentations, or creative projects.
<table>
<tr><th>Choice</th><th>Activity Description</th></tr>
<tr><td>**1**</td><td>**Real-World Percentages**: Find an item on sale online. Calculate the original price if the item is discounted by **10%**. Present your findings to the class.</td></tr>
<tr><td>**2**</td><td>**Percentage Poster**: Create a poster showing examples of different percentages (1%, 5%, 10%, etc.) using visuals like pie charts or bar graphs to represent these percentages in real-life scenarios.</td></tr>
<tr><td>**3**</td><td>**DIY Percent Problem**: Write a short story that includes a percentage problem (e.g., "If 25% of my allowance is $5, how much is my total allowance?"). Share it with a partner and have them solve it.</td></tr>
<tr><td>**4**</td><td>**Interactive Game**: Use an online math game focused on calculating percentages. Track your scores and share the strategies you used to improve your performance.</td></tr>
</table></td><td>**Divisibility by 6**: A number is divisible by 6 if it is divisible by both 2 and 3.

Divisibility by 8: A number is divisible by 8 if the last three digits form a number that is divisible by 8.

Divisibility by 9: A number is divisible by 9 if the sum of its digits is divisible by 9.

Divisibility by 10: A number is divisible by 10 if its last digit is 0.

Collaborative Learning

Group Work: Have learners work in small groups to create examples and non-examples for each divisibility rule. They can present their findings to the class.

Division by 100: Used to find 1%.

Example: To find 1% of 200, divide 200 by 100. So, 1% of 200 is 2.

Division by 10: Used to find 10%.

Example: To find 10% of 70, divide 70 by 10. So, 10% of 70 is 7.

Halving: Used to find 5%, 50%, and 25% (since 25% is half of 50%).</td></tr>
</table>

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
	5 **Create a Video Tutorial**: Make a short video explaining how to calculate a specific percentage (like 25% of a number) using a real-life example. Share it with the class.	***Example:*** To find 5% of 80, first find 10% (8). Then, divide 8 by 2. So, 5% of 80 is 4. **Addition of percentages: Used to find percentages like 15% by adding 10% and 5%.** ***Example:*** To find 15% of 60, find 10% (6) and 5% (3). Add 6 and 3. So, 15% of 60 is 9.

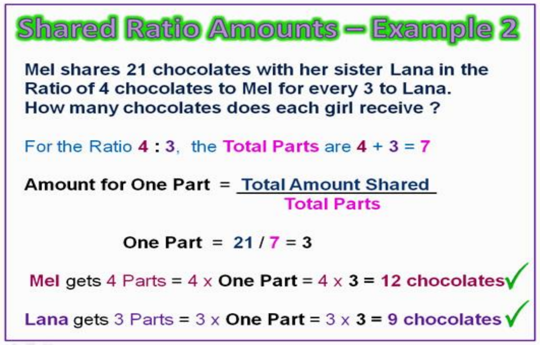
Essential Learning Outcome: O3.1. Proportional Reasoning – Representing and Working with Rates and Ratios - Use ratio and rate reasoning to solve real-world and mathematical problems, e.g., by reasoning about tables of equivalent ratios, tape diagrams, double number line diagrams, or equations.

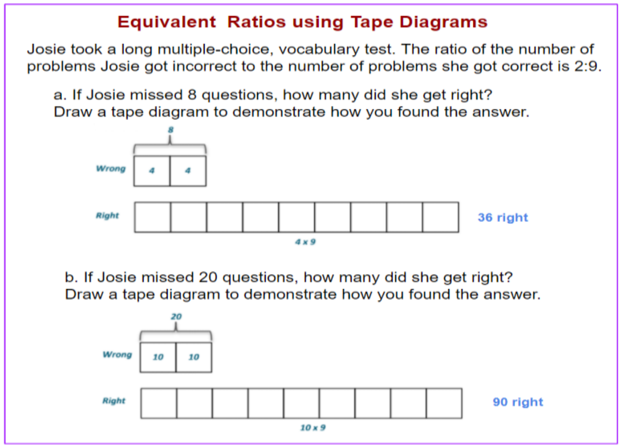
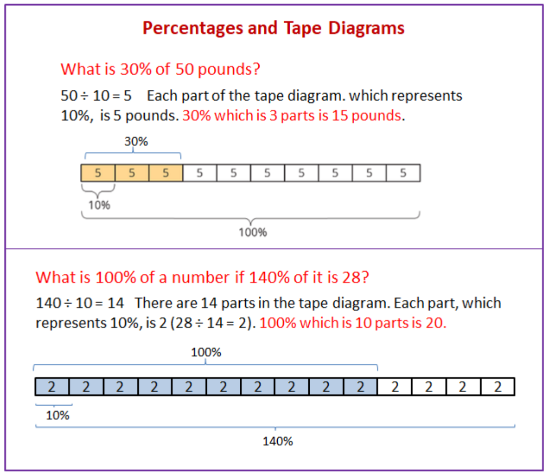
Grade Level Expectations and/or Focus Questions:

- Solve unit rate problems including those involving unit pricing and constant speed.
- Solve problems involving ratios, including percentages and rates, using appropriate tools and strategies
- Find a percent of a quantity as a rate per 100 (e.g., 30% of a quantity means 30/100 times the quantity)
- Solve problems involving finding the whole, given a part and the percent using a standard algorithm.

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
Learners are expected to: **Skills** 1. Calculate the unit rate by dividing the total quantity by the number of units. 2. Solve real-world problems involving unit pricing by finding the cost per item. 3. Solve problems involving constant speed by calculating how far something travels per unit of time (e.g., per hour). 4. Set up and solve problems using ratios to compare quantities in real-life contexts. **Knowledge** 5. Explain that a ratio can be written as a fraction.	**Product** **Open-Ended Problems** ***Multiple Solutions:*** Give learners open-ended problems where they can arrive at the solution using different methods (e.g., ratio tables, division, or graphs). Assess their reasoning and problem-solving process, not just the final answer. ***<u>Example</u>*** ***Unit Pricing Problem*** ***Problem:*** You are shopping for oranges, and two stores have different offers: Store A sells 6 oranges for $4.50. Store B sells 8 oranges for $6.40. Which store has the better deal? ***Open-Ended Nature:*** Learners can solve the problem using **division** to calculate the price per orange for each store. Alternatively, they could create a **ratio table** for each store to find the unit price.	**Hands-On Learning Activities** ***Unit Rate Shopping:*** Bring in grocery store ads and ask learners to calculate the unit price of items (e.g., $3 for 5 apples, what is the price per apple?). This real-world context is relatable and engaging. ***Speed Comparison:*** Have learners compare speeds in a simulated race where each "car" (learners in small groups) travels different distances in different times. They will calculate the unit rate (miles per hour) and compare their results. **Example**: *Learners will calculate that if a car travels 150 miles in 3 hours, it is traveling at 50 miles per hour.* **Differentiated Instruction**: **Strategy**: Provide multiple approaches to learning the concept of simplifying ratios (e.g., manipulatives, diagrams, or number lines).

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
6. Solve problems by converting ratios to fractions when appropriate. 7. Apply the concept of sharing quantities in a given ratio by solving problems. 8. Solve problems involving finding the whole, given a part and the percent using a standard algorithm. **Value** 9. Create real life problems involving ratios	Some learners may choose to **graph** the price vs. quantity for both stores and compare the slopes (unit rates). Product Real-Life Context Assessments Practical Scenarios: **Assess learners' ability to solve unit rate problems using real-world examples such as: *Calculating the speed of a car traveling a certain distance over time.*** **Task-Based Learning**: Create assessment tasks that involve learners solving a scenario, like determining speed for different vehicles. Have learners justify their reasoning in writing. **Product/ Conversation** **Flexible Assessment Methods**: ***Strategy***: Invite learners to demonstrate their understanding of ratios in different ways (e.g., drawing, explaining orally, or using manipulatives). ***Example***: Some learners may simplify the ratio 15:20 by drawing groups of marbles, while others might explain their reasoning verbally or write the steps **Product** **Performance-Based Assessments**: ***Real-Life Projects***: Assign a project where learners create a recipe or a budget that requires them to use	***Example:*** ***Diagram with Groups of Marbles (Manipulative Approach)*** Learners can visualize the marbles by grouping them into sets that represent the ratio: **Step 1: *Original Ratio (15 Red Marbles, 20 Blue Marbles)*** Red Marbles: ○○○○○○○○○○○○○○○ (15) Blue Marbles: ●●●●●●●●●●●●●●●●●●●● (20)
		Step 2: Group the Marbles into Smaller Sets by Dividing by 5 Each group should contain the same ratio (3 red marbles to 4 blue marbles): Group 1: ○○○ ●●●● Group 2: ○○○ ●●●● Group 3: ○○○ ●●●● ***Simplified Ratio: 3:4*** This diagram shows that after grouping, we have three sets of 3 red marbles and 4 blue marbles, representing the simplified ratio 3:4. **Collaborative Learning (Group Problem Solving)** ***Solve Problems by Converting Ratios to Fractions:*** Converting ratios to fractions helps solve real-world problems by enabling you to work with the numbers more easily.

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
	ratios and express them as fractions. They can present their work to the class. ***Create a Ratio Story***: Have learners write a story that involves ratios and include questions that require their peers to convert those ratios into fractions **Product** **Real-World Projects**: ***Performance Tasks***: Assign learners a project where they apply ratio concepts to real-life situations, such as: ***Example:*** "Plan a party for 10 people with a budget of $100, splitting costs for food, drinks, and decorations in the ratio 3:2:1." Learners create a plan, explaining how they divided the money according to the ratio. This assesses their ability to apply math to practical situations. **Product** **Visual Representation and Manipulatives** Use **visual aids** like pie charts or grids to represent the percentage. For example, divide a circle into four equal parts to show that 25% is one-fourth of the class. Learners can use counters or manipulatives to physically represent the problem. This helps **kinesthetic learners** and those who benefit from hands-on activities. ***Guided Practice with Step-by-Step Scaffolding***: If 25% of a class is 10 learners, learners will solve for the total number of learners in the class using the formula:	***Examples: Recipe Problem***: ***Problem:*** A recipe calls for 2 cups of sugar for every 3 cups of flour. If you want to make half of the recipe, how much sugar do you need? ***Solution***: The ratio of sugar to flour is 2:3 As a fraction, this is 2/3. To find half the sugar, multiply the fraction by ½. **Hands-On Activities:** **Example:** Provide learners with physical manipulatives (like counters or blocks) to represent the 21 chocolates. Invite them to physically group the manipulatives into parts that correspond to the ratio 4:3, which helps kinesthetic learners engage with the content.  Shared Ratio Amounts – Example 2 Mel shares 21 chocolates with her sister Lana in the Ratio of 4 chocolates to Mel for every 3 to Lana. How many chocolates does each girl receive ? For the Ratio 4 : 3, the Total Parts are 4 + 3 = 7 Amount for One Part = $\frac{\text{Total Amount Shared}}{\text{Total Parts}}$ One Part = 21 / 7 = 3 Mel gets 4 Parts = 4 x One Part = 4 x 3 = 12 chocolates ✓ Lana gets 3 Parts = 3 x One Part = 3 x 3 = 9 chocolates ✓ https://passyworldofmathematics.com/sharing-using-ratios/ Modelling the Problem • Example Problem: Present a problem such as, what is 30% of 50 • Creating the Diagram:

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
	Whole$=10/25\times100=40$ = Thus, the whole class has 40 learners.  **Equivalent Ratios using Tape Diagrams** Josie took a long multiple-choice, vocabulary test. The ratio of the number of problems Josie got incorrect to the number of problems she got correct is 2:9. a. If Josie missed 8 questions, how many did she get right? Draw a tape diagram to demonstrate how you found the answer. b. If Josie missed 20 questions, how many did she get right? Draw a tape diagram to demonstrate how you found the answer. https://www.onlinemathlearning.com/equivalent-ratios-tape-diagrams.html	***Discussion:*** Have learners discuss what they see in the diagram and how it relates to the problem.  **Percentages and Tape Diagrams** What is 30% of 50 pounds? 50 ÷ 10 = 5 Each part of the tape diagram. which represents 10%, is 5 pounds. 30% which is 3 parts is 15 pounds. What is 100% of a number if 140% of it is 28? 140 ÷ 10 = 14 There are 14 parts in the tape diagram. Each part, which represents 10%, is 2 (28 ÷ 14 = 2). 100% which is 10 parts is 20. https://www.onlinemathlearning.com/percentages-tape-diagram-illustrative-math.html

Additional Resources and Materials

Manipulatives (counters) Number Line, Maths Worksheets, Maths Story Books, Educational Games (card games, board games, Math War, Online Math Games. Graph papers, Diagrams. Using Technology: Online Games.

Additional Useful Content Knowledge for the Teacher:

Ratios compares quantities and shows the relationship between them.

There are three ways of writing ratios using a colon e.g. 4: 3 As a fraction 2/5 or 3 to 4.

When it comes to writing, ratio order is very important.

Ratio should always be written in its simplest. E.g. the ratio 4: 6 can be simplified to 2: 3.

Equivalent Ratios: have different numbers but show the same comparison or relationship. They are very similar to equivalent fractions. We can used multiplication and or division to find equivalent ratios. Whenever we multiply or divide the terms by the same number we have created equivalent ratios.

Simplifying Ratios means reducing ratios to a form where the only divisible common factor is one.

There are 6 mangoes to 8 apples in a box. What is the ratio of apples to mangoes?

Share $30 between Tom and Peter in the ratio 2:3. How much money does each boy get?

Opportunities for Subject Integration:

Language Arts:

- Reading word problems that involve math operations.
- Writing word problems to reinforce understanding.
- Practicing mathematical vocabulary.
- Mathematics Storybook Form

Science:

- Measuring and recording data, then performing basic calculations.
- Studying patterns and sequences in nature that involve math concepts.
- Using math in science experiments and data analysis

Social Studies:

- Cooperative learning among learners in completing group projects.
- Promoting social interaction among learners as they learn.
- Sharing of ideas, strategies when solving real life problems

<table>
<tr><td>Essential Learning Outcome: 3.2. Proportional Reasoning - Use a variety of representations and models of percentages to solve real-world mathematical problems.</td></tr>
<tr><td>Grade Level Expectations and/or Focus Questions:

Find a percent of a quantity as a rate per 100 (e.g., 30% of a quantity means 30/100 times the quantity)
Solve problems involving finding the whole, given a part and the percent using a standard algorithm.
</td></tr>
</table>

<table>
<tr><th>Specific Curriculum Outcomes</th><th>Inclusive Assessment Strategies</th><th>Inclusive Learning Strategies</th></tr>
<tr>
<td>Learners are expected to:

Knowledge

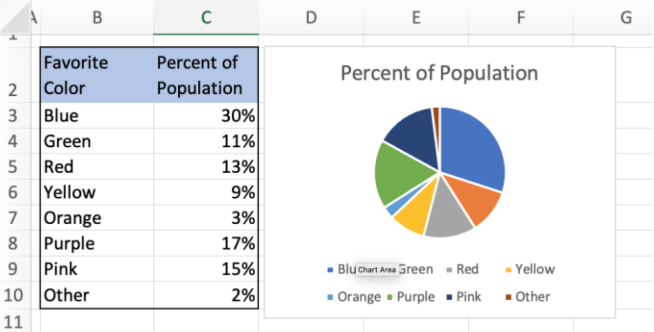
1. Define a percentage as a part of 100.
2. Express a number as a percentage of another number.

Skills

3. Calculate a percentage of a given quantity.
4. Use different methods to convert percentages to decimals and fractions, and vice versa.
5. Create and interpret visual models of percentages, such as pie charts, bar graphs, and 100 grids.
6. Explain reasoning and approach to solving percentage problems, both in writing and orally.

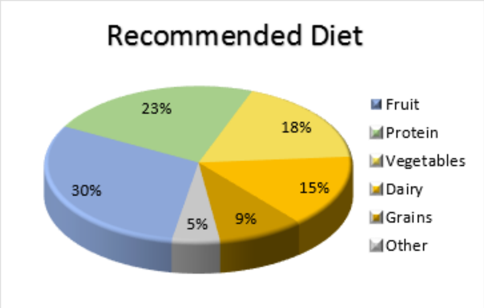
Values

7. Create real-life problems involving percentages of quantities.</td>
<td>Product
Choice Boards: Provide learners with a choice of activities to demonstrate their understanding of percentages. For example, learners could choose to create a pie chart, write a word problem involving percentages, or develop a digital presentation.



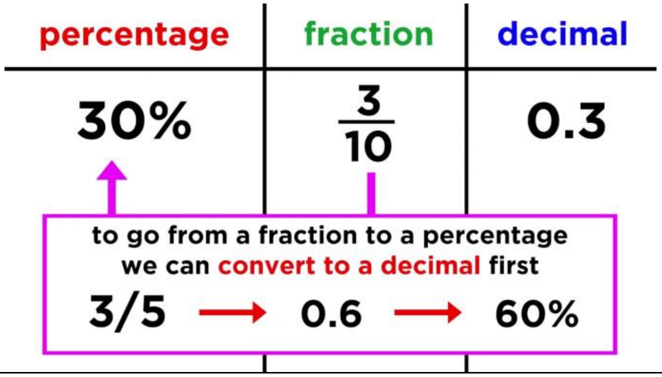
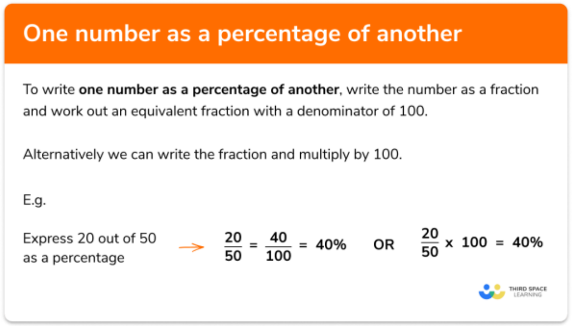
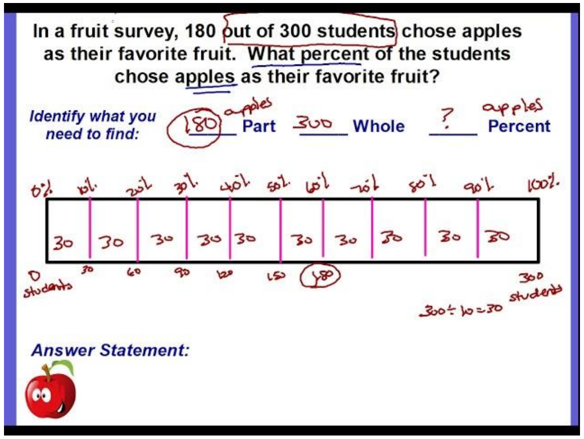
<table>
<tr><th>Favorite Color</th><th>Percent of Population</th></tr>
<tr><td>Blue</td><td>30%</td></tr>
<tr><td>Green</td><td>11%</td></tr>
<tr><td>Red</td><td>13%</td></tr>
<tr><td>Yellow</td><td>9%</td></tr>
<tr><td>Orange</td><td>3%</td></tr>
<tr><td>Purple</td><td>17%</td></tr>
<tr><td>Pink</td><td>15%</td></tr>
<tr><td>Other</td><td>2%</td></tr>
</table>

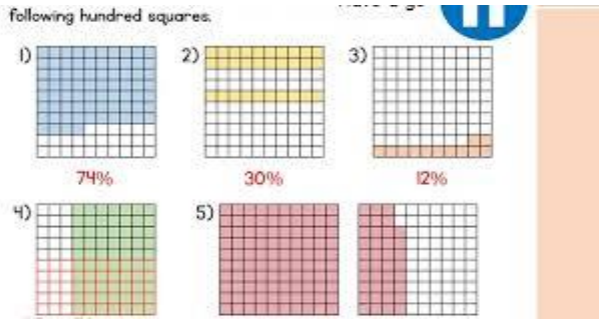
This list of percentages add up to 100%, so our pie chart is an accurate representation of the percentages. If they didn't add up to 100%, then the wedges of the pie chart would be different from the percentages listed. https://content.byui.edu/file/b8b83119-9acc-4a7b-bc84-efacf9043998/1/Excel-1-3-3.html</td>
<td>Visual Aids: Use pie charts, bar graphs, and percentage grids to visually represent percentages. Visual aids help learners who learn best through seeing information.

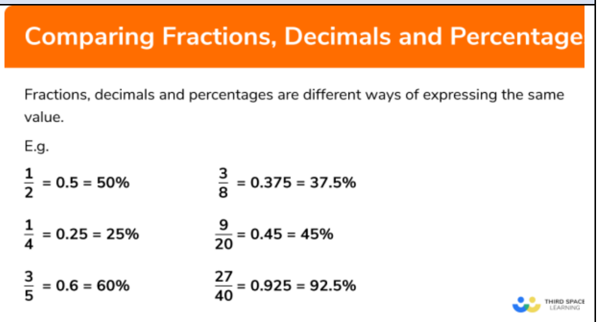
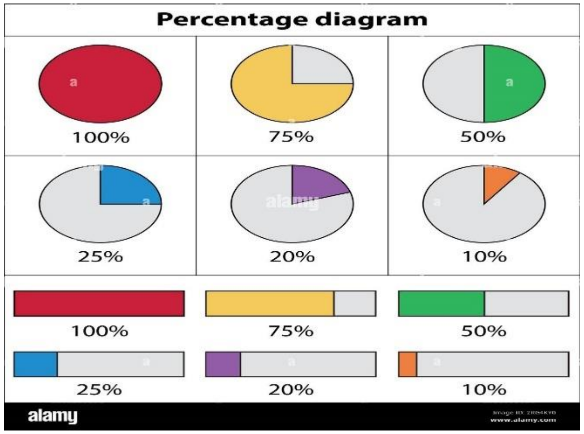


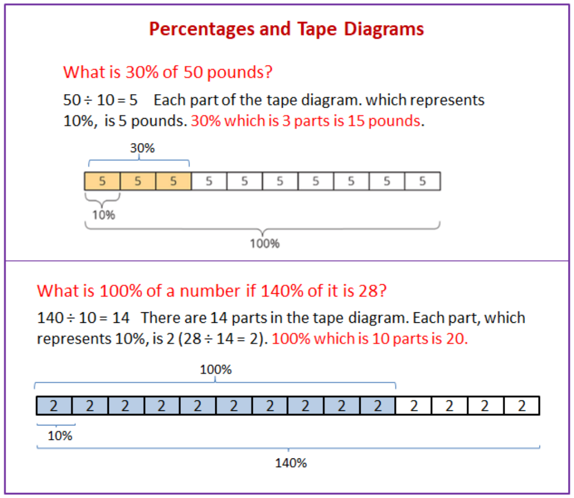
https://www.ablebits.com/office-addins-blog/make-pie-chart-excel/

Use of Visual Aids (e.g., Percentage Bars or Pie Charts):
<i>Example:</i> Provide learners with visual models like bar diagrams or pie charts to represent percentages. For example, show 180 out of 300 shaded portions on a bar to illustrate that 180 is 60% of 300. This helps visual learners see how parts relate to the whole.</td>
</tr>
</table>

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
	Product **Varied Assessment Formats:** ***Example:*** Invite learners to demonstrate their understanding in different ways, such as through written responses, diagrams, or oral explanations. For instance, some learners might write the steps to express 40 out of 200 as a percentage, while others may explain their process verbally. ***Activity:*** Assess learners by having them solve a percentage problem in writing or drawing a visual model to show the relationship between two numbers. **Product** **Real-Life Problem Assessments:** ***Example:*** Use practical assessments where learners calculate percentages in real-world contexts, such as finding a discount on an item or the percentage of time spent on homework compared to other activities. ***Activity:*** Ask learners to bring in advertisements showing sale prices and have them calculate the percentage discount and the final price of an item. **SCO4** 	**Activity:** Learners can use manipulatives or colour segments on paper to represent the percentage visually (e.g., colouring 40% of a grid representing a number). **One number as a percentage of another** To write **one number as a percentage of another**, write the number as a fraction and work out an equivalent fraction with a denominator of 100. Alternatively we can write the fraction and multiply by 100. E.g. Express 20 out of 50 as a percentage → $\frac{20}{50} = \frac{40}{100} = 40\%$ OR $\frac{20}{50} \times 100 = 40\%$ https://thirdspacelearning.com/gcse-maths/number/one-number-as-a-percentage-of-another/ In a fruit survey, 180 out of 300 students chose apples as their favorite fruit. What percent of the students chose apples as their favorite fruit? Identify what you need to find: 180 apples Part 300 Whole ? apples Percent Answer Statement: https://www.youtube.com/watch?v=QMyi6dj8zgE

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
	Have learners write a percentage as a fraction out of 100. E.g. 20% is written as 20/100. Reduce to 2/10. As a decimal=0.2 https://www.youtube.com/watch?v=-Xt4UDk7Kzw **Product** **Real-World Problem Assessment:** ***Example:*** Give learners real-world data, such as the results of a classroom survey or sports statistics, and ask them to create a pie chart or bar graph to represent the percentages. ***Activity:*** Have learners analyse data from a classroom vote (e.g., favourite subject) and create a bar graph showing the percentage of learners who chose each option. They should interpret what their graph tells them about the most and least popular subjects.  https://vimeo.com/414894706 What percentage of the diagram is (a) Shaded (b) Unshaded	**Real-World Contexts:** **Example:** Introduce real-life scenarios such as discounts, taxes, or tips. For instance, "If an item costs $100 and it's on sale for 15% off, how much do you save?" This makes the concept of calculating percentages more tangible. **Activity:** Ask learners to calculate a 15% tip on a restaurant bill, a 20% discount at a store, or the amount of tax added to a purchase. **Activity:** Pupils use different types of manipulatives to calculate percentages of a given quantity. For Example: Find 25% of 200 marbles. Pupils will group manipulatives and solve the problem. 25% means 25 out of every 100 25 for the first 100 marbles 25 for the second 100 marble **25……………… 100** **25………………100** **Total: 50 marbles** So 25% of 200 marbles=50 marbles SCO4 Pupils will use Visual aid and charts to explain the relationship among fractions, decimals and percentages.

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
	Conversation **Interviews and Conferences**: Conduct one-on-one or small group interviews to discuss learners' understanding and strategies for solving percentage problems. This can be particularly useful for learners who struggle with written assessments **Math Journals**: Encourage learners to keep journals where they reflect on their learning, solve problems, and explain their reasoning. This can provide insights into their thought processes and understanding.	 **Comparing Fractions, Decimals and Percentage** Fractions, decimals and percentages are different ways of expressing the same value. E.g. $\frac{1}{2}$ = 0.5 = 50% $\frac{3}{8}$ = 0.375 = 37.5% $\frac{1}{4}$ = 0.25 = 25% $\frac{9}{20}$ = 0.45 = 45% $\frac{3}{5}$ = 0.6 = 60% $\frac{27}{40}$ = 0.925 = 92.5% https://thirdspacelearning.com/gcse-maths/number/comparing-fractions-decimals-and-percentages/  https://www.alamy.com/stockphoto/percentageinfographic.html?sortBy=relevant

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
		 Percentages and Tape Diagrams What is 30% of 50 pounds? $50 \div 10 = 5$ Each part of the tape diagram. which represents 10%, is 5 pounds. 30% which is 3 parts is 15 pounds. What is 100% of a number if 140% of it is 28? $140 \div 10 = 14$ There are 14 parts in the tape diagram. Each part, which represents 10%, is 2 ($28 \div 14 = 2$). 100% which is 10 parts is 20. https://www.onlinemathlearning.com/percentages-tape-diagram-illustrative-math.html **Collaborative Projects:** Have learners work together on projects that require them to teach each other different aspects of percentages and their applications. **Learner Choice:** Invite learners to choose how they demonstrate their understanding of percentages, such as through written explanations, drawings, or digital presentations.

Additional Resources and Materials

Manipulatives (counters) Number Line, Maths Worksheets, Maths Story Books, Educational Games (card games, board games, Math War, Online Math Games. Graph papers, Diagrams. Using Technology: Online Games. Percentage chart.

Additional Useful Content Knowledge for the Teacher:

Percent means for every hundred. The symbol % is read as percent and it shows you are dealing with a percentage.
A Percentage is a fraction with a denominator of 100. For example 60/100 = 60%.
100% is the whole. 100/100 =1
5/100 can be written as 0.05 or 5% As a fraction = 5/100. As a decimal= 0.05 As a percentage = 5%

Opportunities for Subject Integration
Mathematics and Economics:

Calculate percentages for budgeting and interest rates.
Mathematics and Science:

Analyse species growth and habitat loss using percentages; interpret nutrition labels.
Mathematics and Social Studies:

Apply percentages to election results and historical population changes.
Mathematics and Technology:

Use spreadsheets for calculating and organizing percentages.
Mathematics and Art:

Scale artwork using percentages and analyse patterns.
Mathematics and Health/Physical Education:

Calculate heart rate percentages and analyse BMI.
Mathematics and Business:

Understand profit margins and market share through percentages.
Mathematics and Environmental Studies:

Calculate percentages of water conservation and energy efficiency.

Pattern and Relationship

Introduction to the Strand: Teaching patterns and relationships in grade 6 helps learners develop critical thinking and problem-solving skills as they learn to recognize and analyse mathematical structures. Understanding patterns lays the foundation for algebraic concepts, enabling learners to express mathematical ideas using variables and equations. Additionally, exploring patterns fosters a deeper appreciation for the interconnectedness of mathematics, which is essential for real-world applications in various fields, such as science and engineering.

Essential Learning Outcome: P1.1. Recognizing, describing and extending patterns – Repeating Patterns

Grade Level Expectations and/or Focus Questions:

Identify and describe patterns in tables of values and graphs involving problems in perimeter, area and volume calculations; Translate a pattern from one representation to another and describe a pattern rule using symbols and one or more operations.

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
Learners are expected to: **Knowledge:** 1. Interpret the basic geometric concepts (perimeter, area, volume). 2. Interpret tables of values and simple graphs. 3. Identify and describe patterns in tables of values and graphs involving problems in perimeter, area and volume calculations 4. Interpret and describe application of patterns in problem solving.	**Think Pair Share Race** In groups, using the real world pictures, have the groups work collaboratively to find the pattern for the scenario cards Below.  *Retrieved from:* *https://x.com/KiciaRashid/status/999678500721262592*	***Real world Decimal patterns*** ***See the Pattern in the Table*** Present learners with the problem below. The perimeter of a square is 8 cm. What would the perimeter of 5 squares be? Hint Do you see a pattern? What is the pattern rule? Can I use a table of values to solve? Model how to represent the data on the tables of values.

<table>
<tr><th>Specific Curriculum Outcomes</th><th>Inclusive Assessment Strategies</th><th>Inclusive Learning Strategies</th></tr>
<tr>
<td>

Skills:

5. Create or analyse a pattern with decimals.
6. Recognize patterns in tables of values, graphs, perimeter, area, and volume calculations
7. Apply knowledge of pattern to calculate the perimeter, area and volume of a shape.
8. Identify and describe complex patterns in tables and graphs, including relationships between perimeter, area, and volume
9. Translate patterns into mathematical expressions and equations.

Values:

10. Apply the pattern rules they have learned to solve real-world problems.
11. Create real-life problem that will utilize pattern rules to solve the problem.

</td>
<td>

The price of the meat in the store changed to $1.78 lb on Monday, $1.98 lb on Tuesday and $2.08 lb on Wednesday. What would be the price of the meat on Thursday? (Hint: What is the Pattern rule?)

Learners will use a table of value to solve.

<table>
<tr><td>input</td><td>output</td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
</table>

Decimal Detectives

Learners will solve the problem using a table of value.

Learners will watch the video below guiding them on how to represent the data on the table of values on a line graph.

https://www.youtube.com/watch?v=Nros-CYgssQ

Using grid paper, Learners will represent the data on a line graph. Learners will identify whether the graph shows an increasing or decreasing pattern and identify the pattern rule.

</td>
<td>

<table>
<tr><td>Number of squares</td><td>perimeter</td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
</table>

Show learners the video below for further consolidation.

Word Problem Strategy, Tables & Patterns Video

https://www.youtube.com/watch?v=nCtRpelFZlA

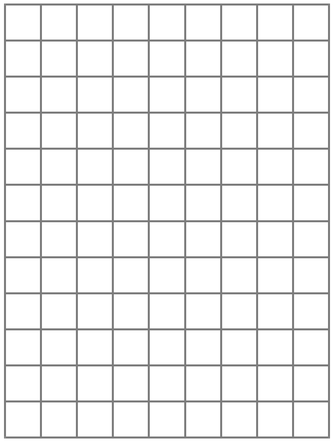
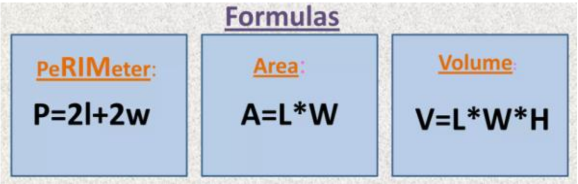
Guided Questions:

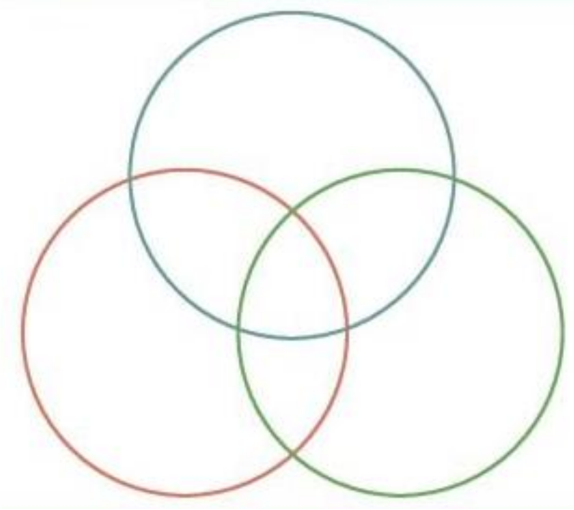
1. *How can understanding decimal patterns help us in everyday life?*
2. *What strategies can we use to predict future values in a decimal pattern?*
3. *Can you explain the connection between creating and analysing decimal patterns?*

Decimal Detectives

Present a Real-World Scenario: Provide learners with a real-world problem that involves a numerical pattern with decimals. For example:

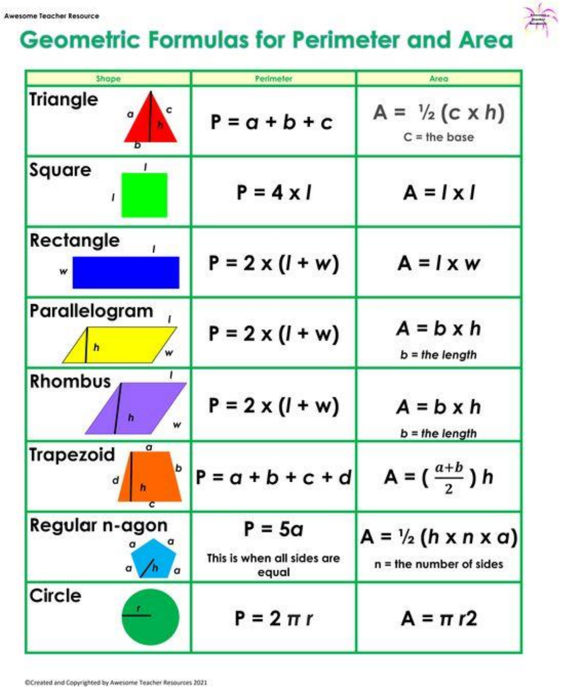
</td>
</tr>
</table>

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
	 *Retrieved from:* *https://print-graph-paper.com/details/1-4-inch*  Formulas PeRIMeter: P=2l+2w Area: A=L*W Volume: V=L*W*H Have learners use a Venn diagram to compare and contrast the patterns in calculating the area, perimeter and volume.	A savings account starts with $10.00. Each week, $0.25 is added. How much money will be in the account after 5 weeks? 10 weeks? Identify the Pattern: Guide learners to recognize the pattern in the decimal values. In the example, learners would see that $0.25 is added each week. Make Predictions: Ask learners to predict the amount of money in the account for future weeks based on the identified pattern. Extend the Pattern: Challenge learners to continue the pattern beyond the given data points. For example, how much money would be in the account after 20 weeks? Justify Reasoning: Encourage learners to explain their predictions and the reasoning behind their thinking. *Have a review session of basic concepts of perimeter, area, and volume calculations. For example, let learners view a video followed by a class discussion.* *Patterns in calculating Area, Perimeter and Volume.* Review Video https://www.youtube.com/watch?app=desktop&v=sBE82nTWUZs 1. Introduce a table showing different shapes and their corresponding perimeters, areas.

<table>
<tr><th>Specific Curriculum Outcomes</th><th>Inclusive Assessment Strategies</th><th>Inclusive Learning Strategies</th></tr>
<tr>
<td></td>
<td>


Area And Perimeter comparison Game
https://wordwall.net/resource/7035111/math/area-vs-perimeter

1. Pattern Hunt: Learners work in teams to identify patterns in real-world scenarios and present their findings.

The picture below shows 5 gardens. Learners will use a table of value to identify the pattern rule.
</td>
<td>


Awesome Teacher Resource

Geometric Formulas for Perimeter and Area

<table>
<tr><th>Shape</th><th>Perimeter</th><th>Area</th></tr>
<tr><td>Triangle</td><td>P = a + b + c</td><td>A = ½ (c x h)
C = the base</td></tr>
<tr><td>Square</td><td>P = 4 x l</td><td>A = l x l</td></tr>
<tr><td>Rectangle</td><td>P = 2 x (l + w)</td><td>A = l x w</td></tr>
<tr><td>Parallelogram</td><td>P = 2 x (l + w)</td><td>A = b x h
b = the length</td></tr>
<tr><td>Rhombus</td><td>P = 2 x (l + w)</td><td>A = b x h
b = the length</td></tr>
<tr><td>Trapezoid</td><td>P = a + b + c + d</td><td>A = ($\frac{a+b}{2}$) h</td></tr>
<tr><td>Regular n-agon</td><td>P = 5a
This is when all sides are equal</td><td>A = ½ (h x n x a)
n = the number of sides</td></tr>
<tr><td>Circle</td><td>P = 2 π r</td><td>A = π r2</td></tr>
</table>

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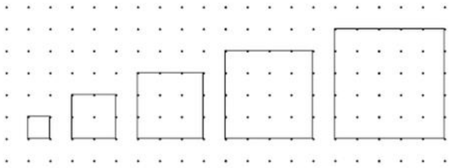
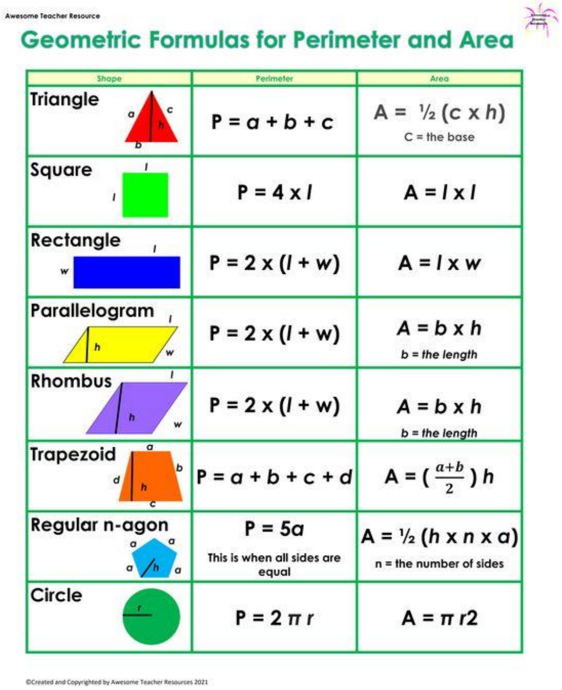
Retrieved from:
https://www.pinterest.com/pin/610730399476190217/
</td>
</tr>
</table>

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
	Using the picture: ➤ Here is a pattern of squares drawn on dot paper.  Create a table of value to determine the pattern rule for the perimeter of the gardens. (hint use the dots on outer "rim" of the gardens) Create a table of value to identify the pattern rule for the gardens. (Hint: Use the square on the inside of the gardens) 2. Pattern Rule Puzzles: Groups solve puzzles where they have to articulate pattern rules using symbols and operations. 3. Design Challenge: Teams create a project incorporating patterns in tables and graphs for a given scenario.	Imagine you are designing a garden with different shapes for the flower beds. How would you use pattern rules to optimize the use of space while considering perimeter and area calculations?

Additional Resources and Materials
Dot paper
Graph paper and grid worksheets
Rulers, calculators
Shape models (rectangles, triangles, cubes, etc.)
Whiteboard and markers

Worksheets with pre-designed tables of values for perimeter, area, and volume

Additional Useful Content Knowledge for the Teacher:



Awesome Teacher Resource

Geometric Formulas for Perimeter and Area

Shape	Perimeter	Area
Triangle	$P = a + b + c$	$A = ½ (c \times h)$ C = the base
Square	$P = 4 \times l$	$A = l \times l$
Rectangle	$P = 2 \times (l + w)$	$A = l \times w$
Parallelogram	$P = 2 \times (l + w)$	$A = b \times h$ b = the length
Rhombus	$P = 2 \times (l + w)$	$A = b \times h$ b = the length
Trapezoid	$P = a + b + c + d$	$A = (\frac{a+b}{2})h$
Regular n-agon	$P = 5a$ This is when all sides are equal	$A = ½ (h \times n \times a)$ n = the number of sides
Circle	$P = 2 \pi r$	$A = \pi r2$

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Retrieved from: https://www.slideshare.net/slideshow/perimeter-area-volume/21061547#2

Opportunities for Subject Integration:
Science: Use decimals for measuring volume, mass, and density in experiments.
Technology: Create graphs and tables with spreadsheets; program robots using decimal-based distances.
Engineering: Apply decimals in design and 3D modelling for accurate measurements.
Art: Scale drawings and patterns with decimals to explore symmetry and proportions.
Social Studies: Calculate map distances and population density using area and volume.
Physical Education: Track performance metrics, distances, and averages with decimal values.

Essential Learning Outcome: P1.2. Recognizing, describing and extending patterns – Increasing and Decreasing Patterns

Grade Level Expectations and/or Focus Questions:

- Demonstrate an understanding of the role of patterns in multiplication/division situations involving multiplication by 0.1, 0.01, 0.001; division by 0.1, 0.01, 0.001.
- Determine pattern rules and use them to extend patterns, make and justify predictions, and identify missing elements in repeating, growing, and shrinking patterns, and use algebraic representations of the pattern rules to solve for unknown values in linear growing patterns

<table>
<tr><th>Specific Curriculum Outcomes</th><th>Inclusive Assessment Strategies</th><th>Inclusive Learning Strategies</th></tr>
<tr>
<td>Learners are expected to:

Knowledge
- Identify patterns in multiplication and division situations
- Determine the pattern rules

Skills
- Apply patterns rules when solving problems involving multiplication/ division situations; multiplication /division by 0.1, 0.01, and 0.001.

Skills
- Extend patterns using pattern rules, make and justify predictions

- Identify missing elements in repeating, growing and shrinking patterns

- Use algebraic representations of patterns to solve for unknown values in linear growing patterns</td>
<td><u>Observation</u>

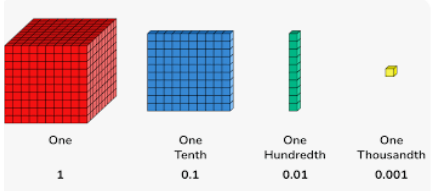
Use a large paper/ cardboard to make a multiplication grid. Example:
<table>
<tr><td></td><td>1</td><td>2</td><td>3</td><td>4</td></tr>
<tr><td>1</td><td>1</td><td>2</td><td>3</td><td>4</td></tr>
<tr><td>2</td><td>2</td><td>4</td><td>6</td><td>8</td></tr>
<tr><td>3</td><td>3</td><td>6</td><td>9</td><td>12</td></tr>
</table>

Place learners in groups of 4 or 5. Ask each group to choose a pattern and explain it.
Checklist:
- Can learners identify a multiplication pattern?
- Can learners explain the pattern?

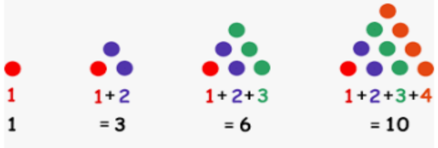
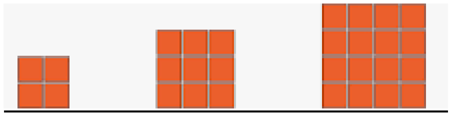
<u>Product</u>

Provide learners with materials such as base 10 blocks and ask them to show a pattern involving multiplication or division by 0.1, 0.01, and 0. 001</td>
<td>Provide learners with opportunities to identify patterns using concrete materials, pictorial representations or diagrams.
For example:

● Array Exploration:
○ Provide learners with counters or blocks.
○ Ask them to create different arrays (rectangular arrangements) and count the total number of objects.
○ Discuss the relationship between the number of rows, columns, and the total number of objects.
○ Introduce multiplication as a shortcut for counting arrays.
● Division with Sharing:
○ Use manipulatives like counters or small objects.
○ Give learners a specific number of objects to share equally among a given number of people.
○ Discuss how many objects each person receives and any leftovers.</td>
</tr>
</table>

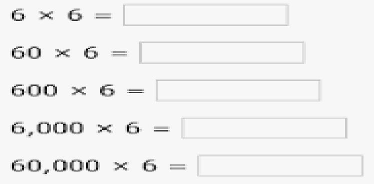
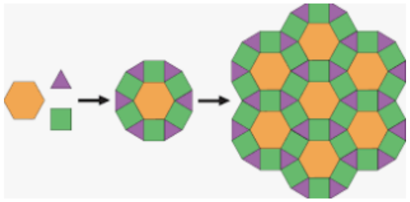
Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
Values - Justify the relevance of patterns/rules in real-life situations.	For example 3 X 0.1, 3 X 0.01 Do learners recognize each step is 10 times greater or smaller?  Google image: https://www.google.com/search?q=base+ten+blocks <u>Product: Game</u> Use cards with various patterns in different forms such as pictorial, concrete and numerical and have learners work in groups to determine the pattern rules. <u>Observation</u> Invite learners to use both concrete materials and work cards with varied patterns (repeating, growing and shrinking). Observe learners as they complete patterns by extending or inserting the missing elements. Listen as they discuss rules and justify answers for missing elements. Checklist Behaviour Comments yes/ no Can the learner identify the pattern rule? Was the learner able to extend the pattern correctly?	○ Introduce division as the process of sharing equally. **Visual Activities** ● **Number Line Patterns:** ○ Create number lines and mark multiples of a specific number. ○ Ask learners to identify the patterns in the numbers. ○ Discuss the relationship between multiplication and division on the number line. ● **Multiplication Chart Exploration:** ○ Provide learners with a multiplication chart. ○ Ask them to identify patterns in the rows, columns, and diagonals. ○ Discuss the relationship between multiplication and division facts. **Abstract Activities** ● **Pattern Puzzles:** ○ Create puzzles with missing numbers in multiplication or division equations. ○ Invite learners to identify the pattern and fill in the missing numbers. ● **Number Sentence Patterns:**

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
	Are the missing elements accurate? <u>Think- Pair- Share</u> Invite learners to work in pairs or small groups to solve for unknowns using algebraic representations of patterns. Listen as learners	○ Provide learners with a series of related multiplication or division equations. ○ Ask them to identify the patterns and write the next few equations in the sequence. ● **Real-World Problem Solving:** ○ Present real-world problems involving multiplication and division. ○ Encourage learners to identify patterns in the data and use them to solve the problems. **Game-Based Activities** ● **Multiplication Bingo:** ○ Create bingo cards with multiplication problems and answers. ○ Call out multiplication problems and learners cover the correct answer on their cards. ● **Division War:** ○ Distribute cards with division problems. Learners solve their problems and the player with the highest quotient wins. ● **Pattern Finding Games:** ○ Let learners interact with games where they must identify patterns

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
		in a series of numbers and use those patterns to solve problems. Give learners opportunities to divide and multiply by 0.1, 0.01, 0.001 using concrete materials such as base 10 blocks and counters Example: 3 × 0.1 3 × 0.01 0.3 ÷ 0.1 0.3 ÷ 0.01 Provide learners with opportunities to explore and extend patterns and determine the rules. Invite learners to make and justify predictions. For example:  Google image: https://www.google.com/search?q=triangular+numbers 2, 7, 12,19  Google image:

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
		https://www.google.com/search?q=square+numbers+array For example: 1. **Concrete exploration:** ○ Provide learners with pattern blocks or counters. ○ Ask them to create their own patterns, focusing on growing or shrinking patterns. ○ Encourage learners to share their patterns and explain the rule governing the pattern. 1. **Table of values:** ○ Introduce the concept of a table of values to represent patterns. ○ Create a table with columns for the pattern number and the number of elements in each pattern. ○ Guide learners to complete the table for their created patterns. 2. **Rule discovery:** ○ Ask learners to identify the pattern rule in their tables of values. ○ Encourage them to express the rule using words and symbols (e.g., "add 2 to the previous number"). ○ Introduce the concept of variables (e.g., using "n" to represent the pattern number). 3. **Prediction and justification:**

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
		○ Ask learners to predict the number of elements in the next few terms of their pattern. ○ Challenge them to justify their predictions using the pattern rule. ○ Introduce the concept of extending the pattern beyond the given data points. 4. **Visual representation:** ○ Use graph paper to plot the points from the table of values. ○ Discuss the shape of the graph and how it relates to the pattern rule. **Example:** ● A growing pattern starts with 3 blocks, then 6 blocks, then 9 blocks. ● Learners create a table: | Pattern number | Number of blocks | |---|---| | 1 | 3 | | 2 | 6 | | 3 | 9 | ● They identify the pattern rule: add 3 to the previous number. ● They predict the next number of blocks: 12. ● They justify their prediction by explaining that they added 3 to 9 **SCO: 5**

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
		Invite learners to extend patterns and identify missing elements in repeating, growing and shrinking patterns using varied forms. For example:  6 × 6 = 60 × 6 = 600 × 6 = 6,000 × 6 = 60,000 × 6 = Google image: https://www.google.com/search?q=patterns+in+multipication  Google image: https://www.google.com/search?q=increasing+patterns+in+tessalations

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies


Name ______________

Patterns in Numbers
Tell what rule was used to make the pattern. What are the next two numbers?

1. 30, 40, 50, 60, ______, ______
Rule: ______
2. 1; 10; 100; 1,000; ______; ______
Rule: ______
3. 2, 4, 8, 16, ______, ______
Rule: ______
4. 25; 250; 2,500; 25,000; ______; ______
Rule: ______
5. 22,195; 22,190; 22,185; 22,180; ______; ______
Rule: ______
6. 3; 30; 300; 3,000; ______; ______
Rule: ______
7. 360,000; 36,000; 3,600; ______; ______
Rule: ______
8. 520,000; 52,000; 5,200; ______; ______
Rule: ______

Make up your own number patterns. Leave some blank spaces. Give them to a classmate to solve.

9. ______; ______; ______; ______; ______
10. ______; ______; ______; ______; ______

Google image:
https://www.google.com/search?q=number+patterns+and+rules+worksheets

1. Matching Activity:

- Provide learner with a set of cards with patterns containing missing elements.
- Invite learner the opportunity to engage in match the missing elements with cards containing answer choices.
- This activity can be done individually or in pairs.

Pattern	Missing Element
[1, 2, 3, _, 5]	4

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
		[5, 8, _, 14, 17] 11 [10, _, 4, 1, -2] 7 [1, 4, 2, _, 3] 5 **2. Fill-in-the-Blank Worksheets:** ● Provide learners with worksheets that contain patterns with missing elements. ● Learners can fill in the missing elements by identifying the pattern and continuing the sequence. ● Provided learners with worksheets that include answer keys for self-checking. **3. Pattern Drawing:** ● Provide learners with a starting part of a pattern (repeating, growing, or shrinking). ● Ask them to continue the pattern by drawing the missing elements. ● This activity can be done with concrete materials (counters, blocks) or on paper. **4. Interactive Games:** ● Use online or offline interactive games that involve identifying missing elements in patterns.

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
		- These games can provide immediate feedback and make learning more engaging. **5. Real-World Applications:** - Present learners with real-world scenarios that involve patterns, such as calendar patterns (months of the year), musical scales, or geometric sequences. - Ask learners to identify missing elements or predict what comes next in the **Pattern Puzzles** ○ Provide learners with patterns represented by tables of values or graphs. ○ Some values in the table or points on the graph will be missing. ○ Invite learners to identify the pattern, write an algebraic equation, and use it to find the missing values. **Graphing Linear Patterns** ○ Provide learners with algebraic equations representing linear patterns. ○ Create a table of values based on the equation. ○ Plot the points on the graph and connect them to form a line.

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
		○ Discuss the relationship between the equation, table of values, and graph. ○ Use the graph to find unknown values. **Error Analysis** ○ Provide learners with solved problems involving algebraic representations of patterns. ○ Introduce intentional errors in the solutions. ○ Learners must identify the errors, explain the correct process, and find the correct answer.

Additional Resources and Materials

Pattern blocks or counters
Graph paper
Whiteboards or large paper
Markers

Additional Useful Content Knowledge for the Teacher:

To effectively teach learners about patterns in multiplication and division, teachers should understand key concepts related to these operations. They need to emphasize multiplication patterns through multiplication tables, repeated addition, and skip counting while highlighting properties such as commutative, associative, and distributive properties. For division, it's essential to present it as the inverse of multiplication, using repeated subtraction and fact families to illustrate relationships.

Teachers should also be familiar with identifying patterns in products and quotients, discussing multiples, and teaching divisibility rules. Examples of number, shape, and growing patterns can help learners practice recognizing and predicting outcomes based on established rules. Finally, understanding linear growing patterns and algebraic representations will enable teachers to guide learners in solving for unknown values effectively.

Opportunities for Subject Integration:

Measurement and Units:

  - *Use multiplication and division by decimals to convert between units, such as centimetres to meters (multiplying by 0.01) or grams to kilograms (dividing by 1000).*

Social Studies:

- ***Scale and Distance:***
  - *Use map scales to calculate real-world distances. For example, if 1 cm on a map equals 0.01 km in real life, learners can multiply or divide to find actual distances.*
- ***Population Density:***
  - *Calculate population density by dividing population numbers by area sizes, often requiring division by decimal values.*

Health and Family Life Education:

- ***Dosage Calculations:***
  - *Calculate medication dosages based on weight, often requiring multiplication or division by decimals to get accurate amounts.*
- ***Nutritional Information:***
  - *Use division to convert serving sizes and nutritional values (e.g., dividing total calories by number of servings).*

Essential Learning Outcome: P 2.1. Variables and Relationships – Representing Unknowns

Grade Level Expectations and/or Focus Questions:

- Writes and solves problems with expressions and equations using unknowns in all four operations with whole numbers.

Specific Curriculum Outcome	Inclusive Assessment Strategies	Inclusive Learning Strategies
Learners are expected to: **Knowledge** - Identify and construct expressions/ equations with unknowns from given situations **Skills** - Write and solve problems with expressions/equations with unknowns for addition, subtraction, multiplication, and or division **Values** - Identify and solve a real- life situation with expression/equations using unknowns for any of the four operations.	**Think - Pair - Share** Distribute cards with situations and have learners work in small groups to read and record each situation using a variable with pictures, numbers and words. Invite learners to share their equations with a partner. For example: 19 decreased by a number Lorni has 18 273 mangoes in a basket. 8 492 of the mangoes are ripe and the rest are green. 1. $19 - x$ 2. $18\ 273 - x = 8\ 492$ **Product** Display work cards or situations and invite learners to write an expression or equation and solve with unknowns for addition, subtraction, multiplication and division. Have learners use the expressions or equations with unknowns and generate situations for each.	**Exploration of Representing unknowns in situations** Provide learners with experiences to determine the expressions or equations with unknowns using at least one variable. Give learners situations in context and invite them to identify the expression or equation and recording using at least one variable. Example: Tomas has 275 pencils. His friend gave him some more pencils. Write an expression to show how many pencils Tomas has. **Problem Solving** Provide learners with opportunities to generate situations for unknowns and solve situations. Let learners exercise their creativity. Provide learners with expressions or equations and let them create the situations to represent them.

Specific Curriculum Outcome	Inclusive Assessment Strategies	Inclusive Learning Strategies
	Product Invite learners to work in small groups and research real - life situations where solving for unknowns in any four operations is applicable. Let learners share and justify their findings. Questions learners about the relevance and accuracy of their findings.	For example: $240 \div \boldsymbol{x} = 16$ $\boldsymbol{x} =$ Use the following equation to write a situation and solve. **Research** Invite learners the opportunity to research and share real - life situations using expressions and equations using unknowns. For example: **Baking**: Mother used some flour to bake bread. From her 25 kg bag, she has 16 kg left. How much flour did Mother use?

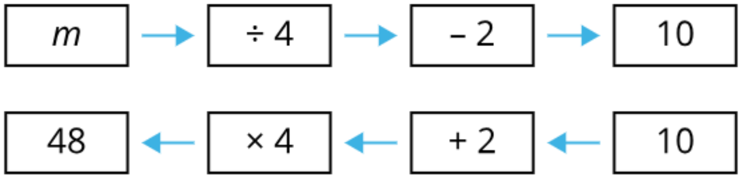
Additional Resources and Materials:
cards
counters
internet (online support)

Additional Useful Content Knowledge for the Teacher:
A monomial with a degree of 1 has a variable with an exponent of one. For example, the exponent of m for the monomial $2m$ *is 1. When the exponent is not shown, it is understood to be one.*
Monomials with a degree of 1 with the same variables can be added together; for example, $2m$ *and* $3m$ *can be combined as* $5m$*.*
To evaluate an algebraic expression, the variables are replaced with numerical values, and calculations are performed based on the order of operations.

Equations are mathematical statements such that the expressions on both sides of the equal sign are equivalent.
In equations, variables are used to represent unknown quantities.

There are many strategies to solve equations including guess-and-check, the balance model, and the reverse flow chart.
The strategy of using a reverse flow chart can be used to solve equations like

$m/4 - 2 = 10$*. The first diagram shows the flow of operations performed on the variable* m *to produce the result 10. The second diagram shows the reverse flow chart, or flow of the reverse operations, in order to identify the value of the variable* m*.*



A flow chart with two rows. The top row goes from left to right. "m". Divide by 4. Subtract 2. Result is 10. The bottom row goes right to left. 10. Plus 2. Multiply by 4. Result is 48.
Formulas are equations in which any of the variables can be solved for. When solving for a variable in a formula, values for the variables are substituted in, and then further calculations may be needed depending on which variable is being solved for. For example, for $A = lw$*, if* $l = 10$ *and* $w = 3$*, then* $A = (10)(3) = 30$*. If* $A = 50$ *and* $l = 10$*, then* $50 = 10w$*, and solving this will require either using known multiplication facts or dividing both sides by 10 to solve for* w*.*

Opportunities for Subject Integration:

- **Science**: Use equations to predict experimental outcomes (e.g., mass, volume).
- **Technology**: Apply coding or formulas to solve unknowns.
- **Social Studies**: Analyse historical data with population growth equations.
- **Physical Education**: Calculate unknowns in fitness metrics like speed or distance.

Language Arts:

- Writing: Developing situations
- Comprehension: Inferences,

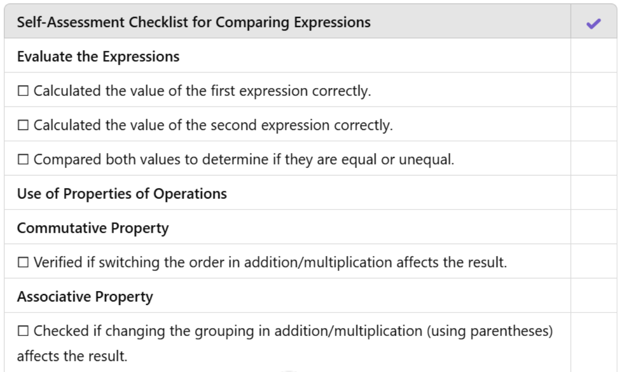
Art and Craft:

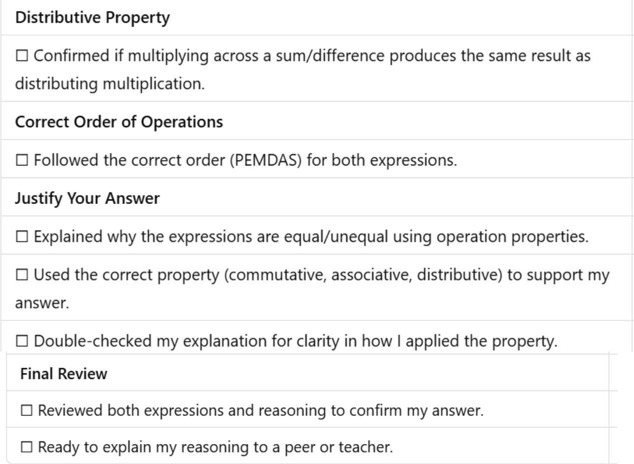
- Draw representations for situations

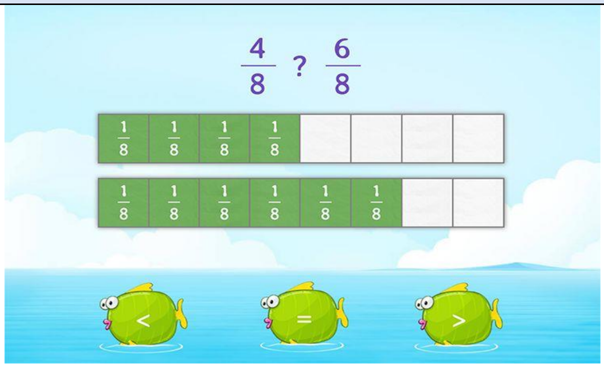
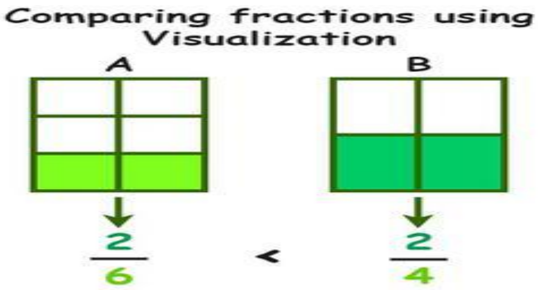
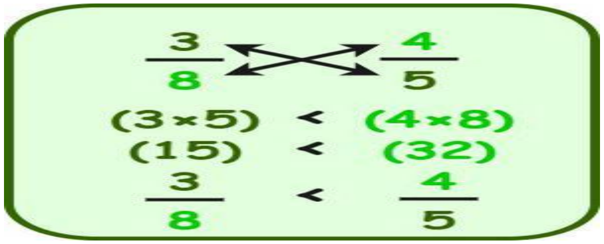
Essential Learning Outcome P2.2 : Variables and Relationships - Understanding and Representing Equivalence

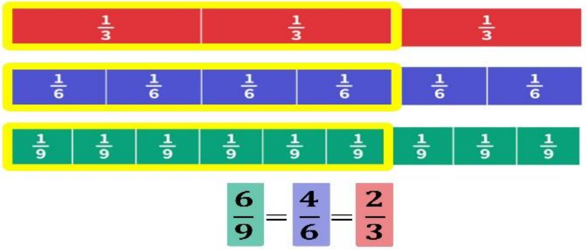
Grade Level Expectation:

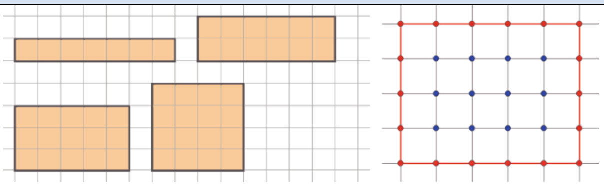
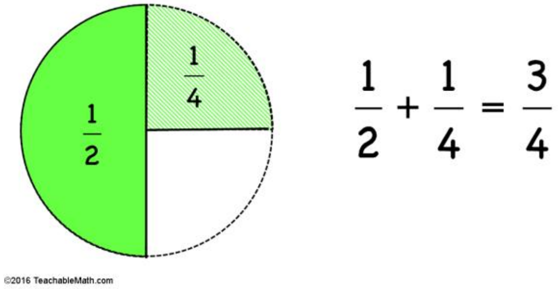
- Determine if and explain why two given quantities or measures are equal or unequal using measurement formulae, arithmetic expressions involving four operations for whole numbers, addition and subtraction of decimals, equivalence and comparison of fractions and arithmetic expressions involving addition and subtraction of fractions concretely
- Apply the properties to determine equality or inequality

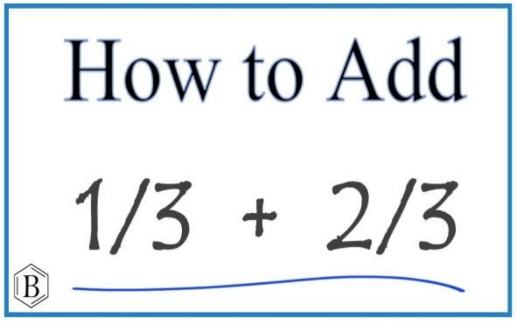
Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
Learners are expected to: **Knowledge** 1. Identify whether two expressions using addition, subtraction, multiplication, or division with whole numbers are equal or unequal. Justify your conclusion by applying operations properties, including commutative, associative, and distributive. 2. Add and subtract decimals up to the thousandth place and compare the results to determine if two decimal expressions are equal or unequal. **Skills** 3. Compare fractions by finding common denominators or using visual fraction models to determine if they are equal or unequal and explain their reasoning.	**Product**  Self-Assessment Checklist for Comparing Expressions ✓ Evaluate the Expressions ☐ Calculated the value of the first expression correctly. ☐ Calculated the value of the second expression correctly. ☐ Compared both values to determine if they are equal or unequal. Use of Properties of Operations Commutative Property ☐ Verified if switching the order in addition/multiplication affects the result. Associative Property ☐ Checked if changing the grouping in addition/multiplication (using parentheses) affects the result.	**Interactive Number Sentences:** Provide learners with the opportunity for learners to create an interactive activity where they have to use cards with numbers and operation symbols to build expressions and physically compare them. This allows hands-on exploration of whether the expressions are equal or unequal. *For example,* ***Number cards:*** Cards with numbers (0–20) for simplicity. ***Operation cards:*** Cards for each operation (+, –, ×, ÷). ***Equal/Unequal cards***: Cards with "=" and "≠". ***Property cards:*** Optional cards labelled "Commutative," "Associative," and "Distributive." ***Build an Expression:*** Each learner or pair of learners selects number cards and operation cards to create two expressions. For example: Expression 1: (3 + 4) × 2 Expression 2: 3 + (4 × 2) ***Compare the Expressions:*** Learners place the "=" or "≠" card between the two expressions after calculating the value of each. They

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
4. Use measurement formulae (such as area and perimeter) to calculate and compare the quantities of two objects to determine if they are equal or unequal. 5. Add and subtract fractions with unlike denominators by finding equivalent fractions and determining if the results of two expressions are equal or unequal.	 **Distributive Property** ☐ Confirmed if multiplying across a sum/difference produces the same result as distributing multiplication. **Correct Order of Operations** ☐ Followed the correct order (PEMDAS) for both expressions. **Justify Your Answer** ☐ Explained why the expressions are equal/unequal using operation properties. ☐ Used the correct property (commutative, associative, distributive) to support my answer. ☐ Double-checked my explanation for clarity in how I applied the property. **Final Review** ☐ Reviewed both expressions and reasoning to confirm my answer. ☐ Ready to explain my reasoning to a peer or teacher. **Product** **Multiple Representations:** In addition to the number line, you can use fraction strips or pie charts (where 0.75 and 0.25 make up one full part) to show visually why the sum is 1. Invite learners to choose the representation that helps them understand best. **Similar can be done for subtraction of decimals** **Conversation** **Error Analysis**: Present learners with pre-worked examples that contain errors in comparing fractions. Have them identify and explain the mistake. For example, if a problem shows that 2/5>3/4, learners must explain why this comparison is incorrect using either common denominators or a visual model.	compare to determine if the expressions are equal or unequal. In this example: (3 + 4) × 2 = 14, and 3 + (4 × 2) = 11, so they would use the "≠" card. ***Justification Using Properties****:* Learners use the property cards (commutative, associative, and distributive) to explain why the expressions are equal or unequal. In this case, the distributive property applies to explain why the expressions are unequal: one expression adds first, while the other multiplies first. ***Example:*** Compare 0.75 + 0.25 and 1 and explain why they are equal using a visual model like a number line. **Hands-On Exploration**: Provide learners with individual or group number lines, where they can physically move a marker or counter from 0 to 0.75 and then add 0.25, landing on 1. This tactile experience supports visual and kinesthetic learners. **Multiple Representations:** Model to learners how to compare fractions using both methods: finding common denominators and using visual models. This helps cater to different learning styles. Let learners choose their preferred method when solving problems to increase engagement.

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
	Conversation **Real-World Connections** Connect the task to real-life situations by allowing for practical applications of area, such as measuring floors for carpeting. Ask learners which room (the rectangular or square one) would require more material based on the area calculation. **Conversation** **Justification Writing**: Have learners write a justification for their conclusion. After comparing the sums, they should explain whether the sums are equal or unequal and why. For example: "The sum 1/2+1/4=3/4 which is less than 1, while 2/3+1/3=1. Therefore, the sums are unequal."	 https://www.splashlearn.com/s/math-games/compare-fractions-using-fraction-strips  

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
		 $\frac{3}{5} = 0.6$, $\frac{2}{4} = 0.5$ $0.6 > 0.5$ $\frac{3}{5} > \frac{2}{4}$ https://www.geeksforgeeks.org/comparing-fractions/  $\frac{6}{9} = \frac{4}{6} = \frac{2}{3}$ https://www.mashupmath.com/fraction-strips-printable-and-virtual **Example:** Calculate the area of a rectangle with dimensions 9 m x 4 m and compare it to the area of a square with dimensions 6 m. Determine if the areas are equal and justify the answer. **Grid Paper/Tile Models**: Give learners grid paper or manipulatives like square tiles to represent the dimensions of both the rectangle and the square. Learners can arrange the tiles to visualize the area of the 9 m x 4 m rectangle (9 rows of 4 tiles) and the 6 m x 6 m square (6 rows of 6 tiles). They can then count and compare the total number of tiles.

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
		 https://link.springer.com/chapter/10.1007/978-3-662-62689-4_11 **Digital Tools**: Use interactive digital tools like virtual geoboards or area models, where learners can draw and compare the areas by adjusting dimensions and seeing the impact on the area. **Fraction Circles:** Use fraction circles where each part represents a fraction of the whole. For example, divide one circle into two halves and another into quarters to represent 1/2+1/4. Another circle can be divided into thirds to show 2/3+1/3.The learners will observe that both sums fill an entire circle, indicating equality.  ©2016 TeachableMath.com

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
		 How to Add 1/3 + 2/3 https://www.youtube.com/watch?v=cmLiNDgdChE

Useful Content Knowledge for the Teacher about the Outcome

1. Using Measurement Formulae

Learners use common measurement formulae (e.g., area and perimeter of rectangles, squares, triangles) to determine if two measurements are equal or unequal.

- **Example**: Compare the area of a rectangle (length = 8 m, width = 5 m) with a square (side = 6 m).
  - Rectangle Area: $A=l\times w=8\times 5=40\text{ m}^2$
  - Square Area: $A=s^2=6^2=36\text{ m}^2$
  - Since $40\text{ m}^2\neq 36\text{ m}^2$.

2. Arithmetic Expressions with Whole Numbers

Learners use the four operations (addition, subtraction, multiplication, and division) to compare whole number quantities.

Example: Determine whether 8×5 is equal to 10×4.
  - $8\times 5=40$
  - $10\times 4=40$
  - The quantities are equal because both expressions result in 40.

3. Addition and Subtraction of Decimals

Learners learn to add and subtract decimals to determine equality or inequality.

Example: Compare $5.6-2.3$ and 3.1

$5.6-2.3=3.3$, and since $3.3\neq 3.1$, the quantities are unequal.

4. Equivalence and Comparison of Fractions

Learners compare fractions by finding common denominators or using visual fraction models.

- **Example**: Compare 3/4and 5/6by finding a common denominator.
    - Common denominator: 12
    - 3/4=9/12, 5/6=10/12
    - Since 912≠10/12, the fractions are unequal.

5. Arithmetic Expressions Involving Addition and Subtraction of Fractions

Learners apply arithmetic to add and subtract fractions to determine equality.

- **Example**: Compare 1/2+1/4 and 3/4.
    - 1/2+1/4= 2/4+1/4=3/4
    - Since both expressions equal 3/4, the quantities are equal.

6. Applying Properties of Operations

Learners apply properties of operations (commutative, associative, and distributive) to determine equality or inequality.

Example: Use the distributive property to determine if 3× (4+2) is equal to 3×4+3×2.

- 3×(4+2)=3×6=18
- 3×4+3×2=12+6=18
- Since both sides equal 18, the expressions are equal.

Strategies for Explaining Equality or Inequality

- **Use models and diagrams**: Visual models, like fraction bars or number lines, help learners concretely compare quantities.
- **Verbal explanations**: Encourage learners to explain their thinking step by step, focusing on how they used operations or properties to determine equality.
- **Use technology**: Tools like calculators or math apps can assist in checking equality when working with complex calculations.

Additional Resources and Materials

Whiteboard, markers, manipulatives (such as counters or blocks), worksheet with sample expressions

Opportunities for Subject Integration:

Science: Measurement and Data
Activity: Calculate area and perimeter of models in science to understand dimensions and capacity.

Art: Geometry and Patterns
Activity: Create geometric designs or tessellations, calculating areas and perimeters to fit shapes into a mural.

Social Studies: Data Representation
Activity: Analyse and compare demographic data using fractions and decimals, creating graphs for income distribution.

Language Arts: Mathematical Storytelling
Activity: Write stories or word problems involving measurements, integrating narrative with math concepts.

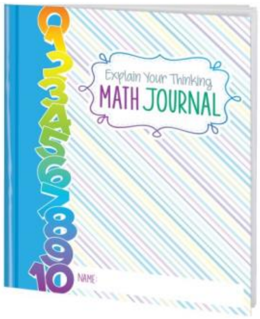
Physical Education: Measuring Distances
Activity: Measure distances for tracks or sports fields, calculating total distances run using fractions and decimals.

Technology: Data Collection and Analysis
Activity: Use spreadsheets to organize and analyse measurement data, creating graphs for visual comparison.

Essential Learning Outcome: P 2.3. Variables and Relationships - Writing Expressions and Equations

Grade Level Expectation:

- Create story problems involving open sentences in all four operations and whole numbers with explanation of what a variable is and how it is used in a given expression or equation.

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
Learners are expected to: **Knowledge** 1. Explain what a variable is and its usage in a given expression or equation. **Skills** 2. Create story problems involving open sentences (equations with variables) in all four operations (addition, subtraction, multiplication, and division) using whole numbers. 3. Solve for the unknown variable in the open sentences derived from story problems using appropriate strategies	**Product** **Learner Journals** ● Ask learners to maintain a math journal where they explain in their own words what a variable is and how it is used in an expression or equation. ● Periodically review these journals to assess understanding and provide feedback.  **Product** **Self-Assessment and Reflection:** ● Encourage learners to assess their own story problems and reflect on their problem-solving process. ● Provide a self-assessment checklist for learners to review their own work.	**Manipulatives and Hands-On Activities** ● **Equation Balance Scales:** Provide learners with a physical balance scales to demonstrate the concept of variables and balancing equations. Learners can place weights representing numbers and variables on each side of the scale to visualize how to solve for the unknown variable. Explain to learners that in an equation, both sides must balance, just like a scale. When one side changes, the other side must also change to keep the balance. *Setting Up the Equation:* *Write a simple equation on the board, such as:* $x+3=7$ **Step-by-Step Problem Design:** *Break down the process of creating a story problem into clear steps.* **Use a template or guide such as:** 1. Identify a real-life scenario. 2. Decide on the quantities involved. 3. Choose the appropriate operation (addition, subtraction, multiplication, division). 4. Formulate an open sentence (equation) to represent the problem. 5. Write a clear and complete story problem.

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
	● Ask learners to reflect on what worked well and what could be improved in their problem creation. ***Example Self-Assessment Checklist:*** ***Checklist Items:*** a. Did I clearly describe the scenario? b. Did I choose the correct operation for the problem? c. Is the equation I created correct and solvable? d. Did I use the variable effectively? **Product** **Summative Assessments** **Performance Tasks:** Create real-life scenarios where learners need to solve for an unknown variable. *For example, calculating the missing side length of a rectangle given the perimeter or area.* **Quizzes and Tests:** Include a mix of multiple-choice, short answer, and extended response questions that require learners to solve for unknowns in different contexts. **Project-Based Assessments:** Have learners work on a project where they need to apply their knowledge of solving for unknowns. *For example, designing a budget for a school event with unknown costs for certain items.*	*Example:* Sarah has some stickers in her collection. After she buys 15 more stickers, she now has a total of 42 stickers. How many stickers did Sarah originally have? **Open Sentence**: $x+15=42$ Where x represents the number of stickers Sarah originally had. **Guided Practice with Scaffolding** ● Provide guided practice with step-by-step instructions to help learners learn how to solve for variables. ● Offer scaffolded worksheets with step-by-step problems. ● Provide a clear strategy for isolating the variable (e.g., inverse operations). **Example of Worksheet Step-by-Step:** *Problem:* $x-4=10$ ● Steps: 1. Identify the operation being performed (subtraction). 2. Use the inverse operation (addition) to isolate the variable. Solve: $x=10+4$

Additional Resources and Materials
Resources
Worksheets:

Education.com: Story problem worksheets with open sentences for all operations.
Game-based story problems for equation formulation.

Mathway: Input word problems to see equations.
Books:

Math Story Problems by William L. Smith: Varied story problems for creating open sentences.
Word Problems Made Easy by Terry Stickels: Strategies for solving story problems.
Materials
Prompts: Create real-world scenario prompts for equation formulation.

Graphic Organizers:

Equation Framework: Template for breaking down word problems.
Variable Concept Map: Definitions and examples of variables.
Manipulatives: Use counters or blocks for visualizing story problems.

Real-World Scenarios: Gather scenarios relating variables to learners' experiences.

Assessment Tools
Quizzes: Include story problems requiring open sentences.
Rubrics: Assess understanding of variables in expressions.
Classroom Activities
Story Problem Creation: Learners create and exchange story problems.
Classroom Discussion: Identify variables in various contexts to represent unknown quantities.

Opportunities for Subject Integration:

Math & Language Arts:

Variable Explanation: Have learners narrate what a variable is through stories or poems.
Story Problems: Create narrative-based math problems to blend storytelling with mathematical reasoning.
Math & Science:

Real-World Applications: Use variables in science experiments (e.g., temperature changes) to illustrate quantities.
Data Analysis: Collect data and create equations to describe scientific findings.
Math & Social Studies:

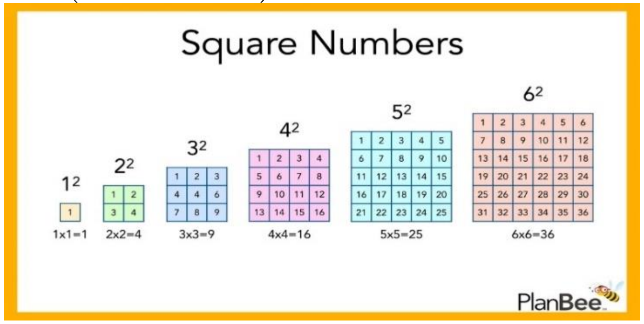
Economic Concepts: Develop story problems on budgeting or expenses involving variables.
Historical Events: Model historical data (e.g., population) with equations to analyse trends.

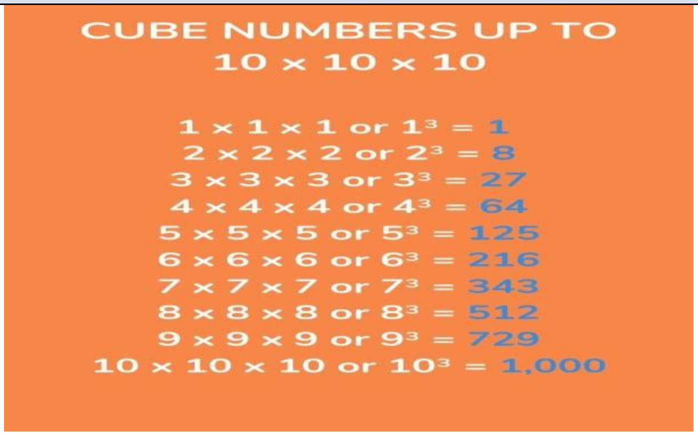
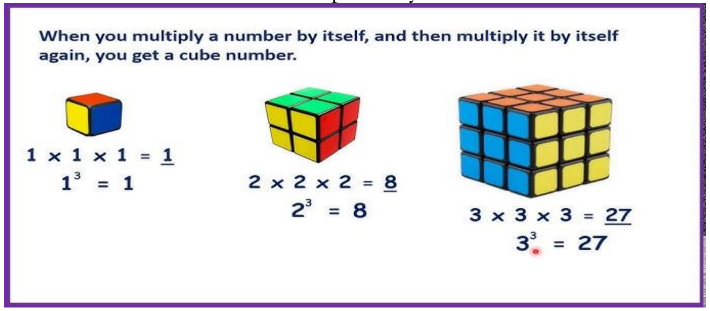
Math & Art:

Graphing and Visualization: Illustrate equations with graphs or geometric designs.
Pattern Recognition: Identify patterns in art that can be expressed with variables.
Math & Physical Education:

Sports Statistics: Use sports data to create variable-based story problems (e.g., points scored).
Game Strategies: Discuss scoring strategies in games, employing variables to represent unknown scores.
These integrations help deepen learners' understanding of variables while enhancing skills across disciplines.

Essential Learning Outcome: P 3.1. Modelling Quantitative Relationships and Analysing Change – Modelling Patterns and Relationships with Equations and Functions
Grade Level Expectations and/or Focus Questions: • Write and evaluate numeric expressions involving whole-number exponents; Apply the properties of operations to generate equivalent expressions

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
Learners are expected to: **Knowledge** 1. Write numeric expressions involving whole-number exponents. 2. Evaluate numeric expressions involving whole-number exponents. **Skills** 3. Apply properties of operations (commutative, associative, and distributive) to generate equivalent expressions.	**Conversation/ Product** **Writing Expressions with Exponents** ***Description:*** Provide learners with verbal descriptions and ask them to write corresponding expressions with exponents. ***Example Prompt:*** Write an expression for "5 squared plus 4 cubed." ***Expected Expression:*** 5^2+4^3 **Product** **Performance Tasks:** Create tasks where learners must apply their knowledge **Expressions with Exponents** in real-world contexts. ***Task: Collecting Stamps*** ***Scenario:*** You start with 5 stamps and collect twice as many stamps each month. Write and evaluate the expression to find the number of stamps you have after 4 months. • **Expression:** 5×2^4 • **Solution:** o Calculate $2^4=16$ o Multiply by 5: $5\times16=80$ **Instructions for Completing Tasks:** ***Read the Scenario:*** Carefully read each real-world context scenario.	**Differentiated Instruction** ***Visual Learners:*** Use visual aids such as charts or diagrams to show what "squared" and "cubed" mean. **Example:** Show a chart with 5^2 and 4^3 along with the expanded form (5×5 and $4\times4\times4$).  https://planbee.com/blogs/news/square-numbers

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
	Use manipulative to represent and solve the scenario. ***Write the Expression:*** Write the appropriate mathematical expression using exponents to model the scenario. ***Evaluate the Expression:*** Calculate the value of the expression step-by-step. Compare answer with concrete representation ***Check Your Work:*** Ensure that each step is correct and the final answer makes sense in the context of the problem. **Assessment Criteria:** ***Correct Expression:*** Did the learner write the correct mathematical expression to model the scenario? ***Accurate Calculation:*** Did the learner accurately calculate the value of the expression? ***Logical Reasoning***: Did the learner demonstrate logical reasoning and understanding of the problem context? ***Clear Explanation:*** Did the learner clearly explain each step of their solution process? **Product** **Choice Boards** ***Description:*** Provide a choice board with different activities related to the properties of operations. Learners can choose the activities they feel most comfortable with. ***Example:*** ***Choice Board Options:*** ***Option 1:*** Create a poster explaining the commutative property. ***Option 2:*** Solve a series of problems using the associative property. ***Option 3:*** Write a story problem that can be solved using the distributive property.	 CUBE NUMBERS UP TO 10 × 10 × 10 $1 \times 1 \times 1$ or $1^3 = 1$ $2 \times 2 \times 2$ or $2^3 = 8$ $3 \times 3 \times 3$ or $3^3 = 27$ $4 \times 4 \times 4$ or $4^3 = 64$ $5 \times 5 \times 5$ or $5^3 = 125$ $6 \times 6 \times 6$ or $6^3 = 216$ $7 \times 7 \times 7$ or $7^3 = 343$ $8 \times 8 \times 8$ or $8^3 = 512$ $9 \times 9 \times 9$ or $9^3 = 729$ $10 \times 10 \times 10$ or $10^3 = 1{,}000$ https://thirdspacelearning.com/us/blog/what-are-cube-numbers/ ***Auditory Learners:*** Explain the concepts out loud, emphasizing the terminology and steps. ***Example:*** "Five squared means five multiplied by itself, and four cubed means four multiplied by itself three times."  When you multiply a number by itself, and then multiply it by itself again, you get a cube number. https://www.youtube.com/watch?v=iTUxCiBpOZc ***Kinesthetic Learners:*** Use manipulatives like blocks or counters to represent the exponents physically.

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
		Example: Give learners 5 blocks and have them create a square, then give them 4 blocks to create a cube. **Think-Pair-Share (Example):** ***Scenario:*** Imagine a colony of bacteria doubles in size every hour. If there are initially 10 bacteria, write an expression to show the number of bacteria after 4 hours. ***Think:*** Learners consider the scenario and start formulating an expression. ***Pair:*** Learners collaborate, discussing their ideas and building on each other's understanding. ***Share:*** Pairs share their expressions and reasoning with the class. Teacher facilitates discussion, highlighting different approaches (e.g., starting with 10 and multiplying by 2 four times, using 10 x 2^4). Apply properties of operations (commutative, associative, and distributive) to generate equivalent expressions. https://www.youtube.com/watch?v=_3Eio-hjrGs **Scaffolded Instruction** ***Description:*** Break down learning into manageable chunks and provide support at each step. ***Example:*** Start with basic examples of each property, such as $2+3=3+2$ (commutative), then gradually increase the complexity, moving towards expressions like $3(2+4) =3\times2+3\times4 =3\times2+3\times4$ (distributive).

Additional Resources and Materials

Materials

1. **Manipulatives**
    - **Base 10 Blocks**: Use these to visualize multiplication and exponents (e.g., showing 10210^2102 as a 10x10 square).
    - **Expression Cards**: Create cards with different expressions for learners to sort and compare to find equivalent expressions.
2. **Graphic Organizers**
    - **Exponent Charts**: Provide learners with charts that display bases and their exponents to help visualize powers of numbers.
    - **Properties of Operations Posters**: Create posters that outline the commutative, associative, and distributive properties for reference during activities.
3. **Real-World Application Materials**
    - **Data Sets**: Provide data on population growth, financial investments, or physical phenomena that require learners to use exponents and operations to analyse.
    - **Formulas and Equations**: Handouts with various real-world formulas (e.g., area, volume, interest) that learners can use to practice writing and evaluating expressions.
4. **Assessment Tools**
    - **Quizzes and Tests**: Create assessments focusing on writing and evaluating expressions with exponents and applying properties of operations.
    - **Rubrics**: Develop rubrics to evaluate learners' understanding and ability to create equivalent expressions and solve problems.
5. **Books and Literature**
    - **Math Textbooks**: Utilize Grade 6 math textbooks that cover exponents and properties of operations.
    - **Math Puzzles and Brain Teasers**: Include puzzles that involve exponent rules and equivalent expressions for critical thinking practice.

Additional Useful Content Knowledge for the Teacher:

Properties of Operations:

1. **Identity Property:**
    - $a+0=a$
    - $a-0=a$
    - $a\times1=a$
    - $a\div1=a$
2. **Commutative Property:**
    - $a+b=b+a$
    - $a\times b=b\times a$
3. **Associative Property:**
    - $(a+b)+c=a+(b+c)$
    - $(a\times b)\times c=a\times(b\times c)$
4. **Distributive Property:**

  - $a\times(b+c)=(a\times b)+(a\times c)$

Order of Operations:

- Perform calculations in brackets first, then multiplication and division (left to right), followed by addition and subtraction (left to right).

Problem-Solving Strategies:

- Multi-step problems may include whole numbers, decimals, fractions, ratios, rates, and percentages. There can be multiple solutions.
- Identify actions, quantities, knowns, and unknowns in a problem.
- Represent actions with diagrams and choose operations to write equations.
- Solve using diagrams or equations.
- Multi-step problems often have an ultimate question (final result) and a hidden question (intermediate step).

Operations and Situations:

- Actions in a situation guide the operation:
  - **Changing:** Use addition/subtraction.
  - **Equal Groups/Comparisons:** Use multiplication/division.

Using equations to represent situations clarifies the structure based on known and unknown values, reinforcing problem-solving skills across various mathematical concepts.

Opportunities for Subject Integration:

- **Science: Energy and Exponents**
  Concept: Explore different forms of energy (e.g., potential and kinetic energy).
- **Social Studies: Population Growth Models**
  Concept: Understand how populations grow using exponential models.
- **Environmental Science: Carbon Footprint**
  Concept: Understand the impact of different activities on carbon emissions.
- **Economics: Interest Rates**
  Concept: Explore how interest compounds over time.
- **History: Ancient Civilizations and Architecture**
  Concept: Study the architecture of ancient civilizations and their use of geometric shapes.

Essential Learning Outcome 3.2: Modelling Quantitative Relationships and Analysing Change – Representing Functions and Relationships

Grade Level Expectations and/or Focus Questions:

- Create and use tables and graphs to determine a number pattern;
- Evaluate expressions at specific values of their variables.
- Include expressions that arise from formulae used in real-world problems.
- Perform arithmetic operations, including those involving whole-number exponents, in the conventional order when there are no parentheses to specify a particular order (Order of Operations)

Specific Curriculum Outcomes

Learners are expected to:

Skills

1. Collect and organize data into tables to identify number patterns
2. Create graphs (bar graphs, line graphs) to identify and interpret number patterns.
3. Analyse patterns in tables and graphs to make predictions about future values.
4. Apply the order of operations in complex expressions involving multiple operations and exponents.

Inclusive Assessment Strategies

Product

Project-Based Assessments

Description: Use projects to integrate skills and assess understanding

Bar Graph

The bar graph visually represents the screen time for each day of the week, with each bar's height corresponding to the number of minutes spent on screen.

Line Graph

The line graph shows the trend in screen time over the week, with points connected by lines to indicate changes from day to day.

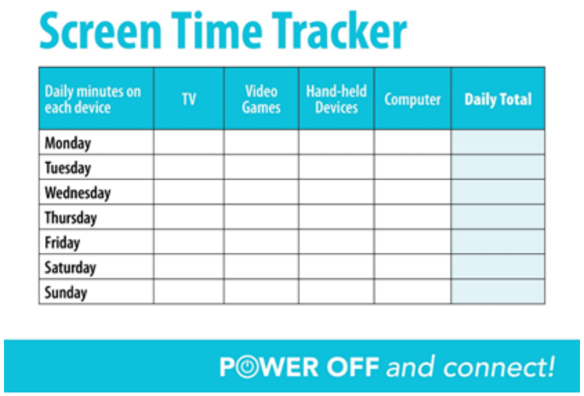
Inclusive Learning Strategies

Real-World Connections

Description: *Make learning relevant by connecting it to real life.*

Example:

Have learners track their own screen time for a week, create a table.



Screen Time Tracker

Daily minutes on each device	TV	Video Games	Hand-held Devices	Computer	Daily Total
Monday					
Tuesday					
Wednesday					
Thursday					
Friday					
Saturday					
Sunday					

https://x.com/superkidsck/status/990975208222789632

Day	Screen Time (minutes)
Monday	120
Tuesday	90
Wednesday	110

Specific Curriculum Outcomes

Knowledge

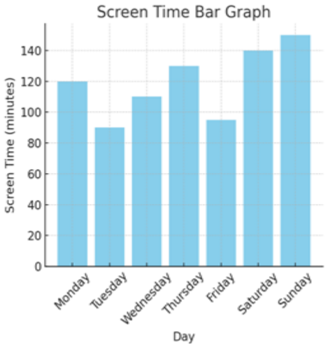
5. Substitute specific values for variables in algebraic expressions and evaluate the resulting expressions.

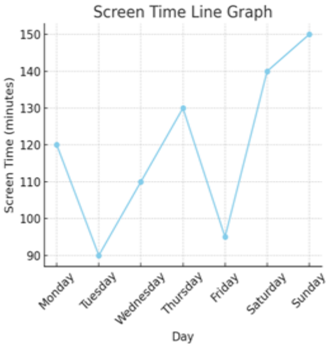
6. Interpret and evaluate expressions that arise from real-world problems, such as those involving distance, time, and rate.

Value

7. Create real life situations that can be written as expressions.

Inclusive Assessment Strategies





Product

Project-Based Assessment: Have learners collect data from a real-life context (e.g., tracking the growth of a plant) and create a graph. They analyse the pattern, make predictions, and explain their reasoning.

Support diverse needs: Invite learners to choose topics of personal interest and present their work in various formats (written, oral, digital).

Criteria	**4 - Excellent**	**3 - Good**	**2 - Satisfactory**	**1 - Needs Improvement**
Data Collection	Accurate and consistent data.	Mostly accurate with minor issues.	Incomplete or inconsistent data.	Inaccurate or incomplete data.
Graph Creation	Clear, accurate, well-labelled graph.	Good graph, but some	Graph unclear or missing key info.	Graph is inaccurate or unclear.

Inclusive Learning Strategies

Thursday	130
Friday	95
Saturday	140
Sunday	150

Pattern Identification Through Visuals: Use color-coding or shapes to highlight trends in data sets (e.g., increasing, decreasing, or steady patterns).

For visual learners: Present data using manipulatives (blocks, counters) to represent values before transitioning to graphs.

https://mathisvisual.com/growing-geometric-patterns/

Real-World Connections:

Relate algebraic expressions to real-life scenarios (e.g., calculating total costs based on the number of items bought). This helps learners see the relevance of math in everyday life, which can increase engagement.

Scenario:

Imagine you are organizing a party, and you need to buy pizzas. Each pizza costs **$12**. You don't know how many pizzas you need yet, but you know you will figure it out based on the number of guests.

<table>
<tr><th>Specific Curriculum Outcomes</th><th>Inclusive Assessment Strategies</th><th>Inclusive Learning Strategies</th></tr>
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<tr><td></td><td></td><td>labels missing.</td><td></td><td></td></tr>
<tr><td>Pattern & Prediction</td><td>Identifies pattern and logical prediction.</td><td>Pattern and prediction mostly correct.</td><td>Limited or unclear pattern/prediction.</td><td>No clear pattern or prediction.</td></tr>
<tr><td>Reasoning</td><td>Strong, clear explanation.</td><td>Reasonable but lacks detail.</td><td>Explanation is unclear or brief.</td><td>No clear explanation.</td></tr>
<tr><td>Presentation</td><td>Engaging and well-organized.</td><td>Organized, with minor gaps.</td><td>Somewhat incomplete or unclear.</td><td>Disorganized or hard to follow.</td></tr>
</table>

Conversation
Open-Ended Questions:
Include questions that allow for multiple ways of solving the problem, enabling learners to use strategies that suit their individual strengths. *For example, "How would you solve this expression using substitution? Explain your steps."*

Product
Real-World Problem Solving:
Create assessments that require learners to solve real-life problems involving distance, time, and rate. *For example,*
</td><td>
Let the number of pizzas be represented by **p**. The total cost of the pizzas can be represented by the algebraic expression:
Total Cost=12p
Example Problem:
If you need 5 pizzas, how much will the total cost be?
Substitute p=5p into the expression: 12(5)=60

Concrete Examples and Real-Life Scenarios:
Use relatable scenarios, such as planning a family trip or participating in a school event, to make the concepts of distance, time, and rate relevant. This can help engage learners and build context.

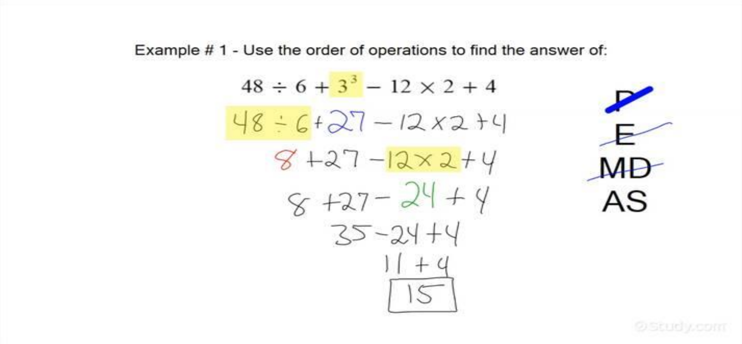
Scenario:
Imagine you are planning a trip to visit a friend who lives 150 miles away. You need to figure out how long it will take you to get there, depending on your speed.

Variables:

- Let **d** represent the distance (in miles).
- Let **r** represent the rate or speed (in miles per hour).
- Let **t** represent the time (in hours).

Relationship:
The formula to find the time based on distance and rate is:
t=d/r

Example Problem:
If you drive at a speed of 50 miles per hour, how long will it take to reach your friend's house?
Substitute d=150 miles and r=50 miles/hour into the formula:
t=150/50
Evaluate:
t=3
</td></tr>
</table>

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
	"How long will it take to travel 200 miles at a speed of 60 miles per hour?" **Product** **Reflection and Self-Assessment**: Encourage learners to reflect on their learning process. Have them write about what strategies helped them understand the order of operations or areas where they still need improvement.	**Collaborative Learning:** Encourage group work where learners can discuss and solve problems together. This promotes peer teaching and allows learners to learn from one another. Please - Parentheses - () Excuse - Exponent - a^n My - Multiplication - x Dear - Division - ÷ Aunt - Addition - + Sally - Subtraction - – https://www.math.net/pemdas  Example # 1 - Use the order of operations to find the answer of: $48 \div 6 + 3^3 - 12 \times 2 + 4$ $48 \div 6 + 27 - 12 \times 2 + 4$ $8 + 27 - 12 \times 2 + 4$ $8 + 27 - 24 + 4$ $35 - 24 + 4$ $11 + 4$ $\boxed{15}$ ~~P~~ ~~E~~ ~~MD~~ AS https://study.com/skill/learn/using-the-order-of-operations-without-parentheses-explanation.html

Additional Resources and Materials

Graph paper
Rulers
Markers or coloured pencils
Data collection sheets
A variety of data sources (e.g., surveys, environmental data, sports statistics)

Additional Useful Content Knowledge for the Teacher:

Patterns can be extended because they are repetitive by nature.

Pattern rules are generalizations about a pattern, and they can be described in words.

Patterns can be extended in multiple directions, showing what comes next and what came before.

To make a near prediction about a pattern is to state or show what a pattern will look like just beyond the given representation of that pattern. The prediction can be verified by extending that pattern.

To make a far prediction about a pattern is to state or show what a pattern will look like well beyond the given representation of that pattern. Often calculations are needed to make an informed prediction that can be justified.

Identifying the missing elements in a pattern represented using a table of values may require determining the term number (x) or the term value (y).

Identifying the missing elements in a pattern represented on a graph may require determining the point (x, y) within the given representation or beyond it, in which case the pattern will need to be extended.

The algebraic expression that represents a linear growing pattern is also referred to as the general term or the nth term. It can be used to solve for the term value or the term number.

Note

Determining a point within the graphical representation of a pattern is called interpolating.

Determining a point beyond the graphical representation of a pattern is called extrapolating.

Opportunities for Subject Integration:

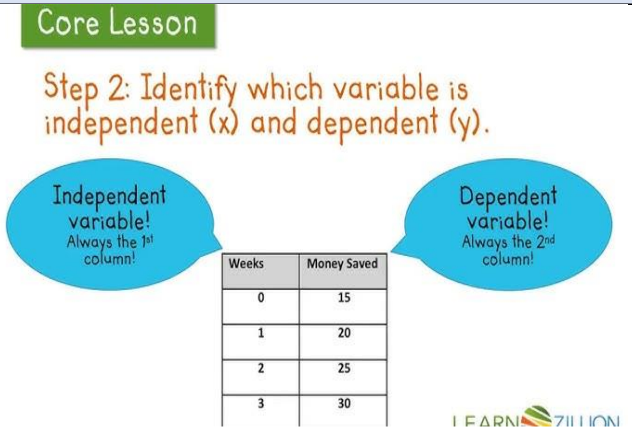
1. **Mathematics and Science:**
    - **Data Collection:** Collect environmental data (e.g., temperature) to create graphs, analysing trends in weather or plant growth.
    - **Graphing Experiments:** Use scientific experiments to create line or bar graphs, illustrating mathematical modelling in science.
2. **Mathematics and Art:**
    - **Artistic Graphs:** Design visually appealing graphs using colours and shapes to represent data accurately.
    - **Patterns in Art:** Explore mathematical patterns (fractals, symmetry) in art, encouraging learners to create projects that illustrate these concepts.
3. **Mathematics and Social Studies:**
    - **Census Data Analysis:** Analyse demographic data, creating graphs to visualize and predict trends.
    - **Economic Trends:** Model economic scenarios with algebraic expressions based on real-world data (e.g., inflation, stock market).
4. **Mathematics and Physical Education:**
    - **Fitness Tracking:** Track physical activities and graph results, helping set fitness goals through data analysis.
    - **Sports Statistics:** Analyse and represent sports statistics in tables and graphs, informing strategies based on mathematical insights.
5. **Mathematics and Language Arts:**
    - **Story Problems:** Write and solve story problems based on real-life scenarios, enhancing comprehension and critical thinking.
    - **Mathematical Journals:** Maintain journals to describe mathematical concepts, reflecting on their relevance to everyday life.

These integrations help learners connect math with various contexts, enhancing understanding and engagement.

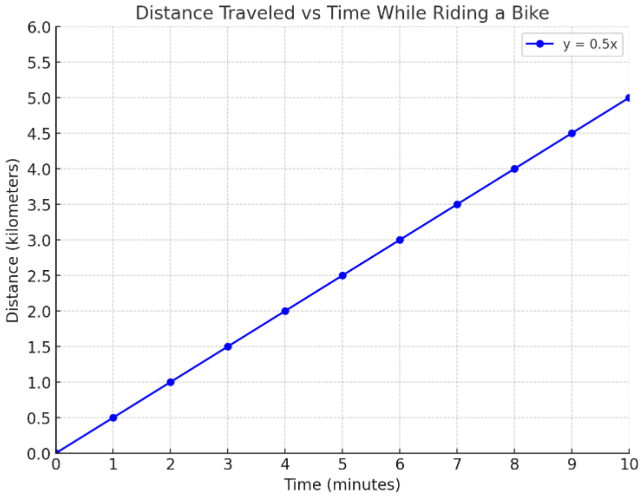
Essential Learning Outcome: P3.3. Modelling Quantitative Relationships and Analysing Change – Solving Problems with Functions and Relationships

Grade Level Expectations and/or Focus Questions:

- Use variables to represent two quantities in a real-world problem that change in relationship to one another; write an equation to express one quantity, thought of as the dependent variable, in terms of the other quantity, thought of as the independent variable.
- Analyse the relationship between the dependent and independent variables using graphs and tables and relate these to the equation.

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
Learners are expected to: **Knowledge** 1. Identify and define independent and dependent variables in real-world problems. 2. Use variables to represent two quantities that change in relation to one another 3. Observe patterns in tables that show how changes in the independent variable affect the dependent variable. **Skills** 4. Plot the values from the table on a coordinate grid to create a graph that shows the relationship between the independent and dependent variables.	**Conversation** **Peer Assessment with Feedback** **Strategy**: Incorporate peer assessment where learners evaluate each other's identification of independent and dependent variables in provided scenarios, using a structured rubric. ***E.g. Hours Worked and Earnings*** ***Scenario***: A learner explains that the independent variable is the number of hours worked and the dependent variable is the amount of money earned. ***Peer Assessment***: Learners swap their explanations and use a rubric with space for comments. The rubric assesses if the relationship between the variables is clearly explained. **Rubric Criteria**: - Does the learner identify hours worked as the independent variable? - Is the amount of money earned identified as the dependent variable? - Does the explanation make it clear how one variable affects the other? ***Guided Feedback***: ***Sentence Frame***: "You did a great job identifying the hours worked as the independent variable. To improve, you could add a sentence explaining how more hours lead to more money earned."	 https://www.youtube.com/watch?v=dsKWcwUgalI **Role Play** ***Strategy***: Engage learners in role-playing activities where they act out real-world scenarios, identifying and explaining the independent and dependent variables ***E.g., Ticket Sales (Price and Number of Tickets Sold)*** ***Description***: Learners set up a role-playing activity where one learner plays the seller, and others are buyers. The seller determines the total revenue based on the number of tickets sold and the price of each ticket. ***Independent Variable***: Number of tickets sold.

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
5. Analyse graphs to determine the nature of the relationship (e.g. increasing or decreasing). **Values** 6. Create stories to explain the patterns in different graphs.	***Constructive Feedback***: "I like how you explained the hours and money. Maybe you can explain how the money changes when the hours change, like by giving an example." **Product** **Multiple Representation of Answers** Invite learners to show their understanding in different ways. They could write an algebraic equation, draw a graph, or explain the relationship in words. This helps accommodate learners who may struggle with formal notation but still grasp the concepts. **Product** **Real-World Problem-Solving** • Provide learners with word problems based on the table. ***For example***: "If you bike for **5** minutes, how far will you have travelled? How about for **7** minutes?" They can use the table as a reference to solve these problems. • Encourage learners to create their own word problems and swap with a partner to solve, supporting creativity and comprehension.	***Dependent Variable:*** Total revenue (price × number of tickets). ***Sample Activity:*** • The "seller" sets a price for tickets (e.g., $5 per ticket). • The "buyers" come to purchase different numbers of tickets (e.g., 2 tickets, 4 tickets, 10 tickets). • After each transaction, the seller calculates the total revenue (e.g., $5 × 4 tickets = $20). • Learners complete a table and graph the number of tickets sold versus the total revenue generated. **Real-World Context** Use relatable, real-life examples. For instance: "As you ride your bike, the distance you travel increases with time. If x represents the time in minutes, and y represents the distance in kilometres, how can you represent this relationship using variables?" ***Example:*** If a bike travels at a constant speed, the relationship between the time and distance can be expressed as: $y=kx$ Where: • Y represents the distance travelled in kilometres. • X represents the time in minutes. • K represents the constant speed of the bike in kilometres per minute (rate). For example, if the bike is traveling at **0.5 kilometres per minute**, the equation would be: $y=0.5x$

<table>
<tr><th>Specific Curriculum Outcomes</th><th>Inclusive Assessment Strategies</th><th>Inclusive Learning Strategies</th></tr>
<tr><td></td><td></td><td>

Invite learners to work in pairs or groups to discuss various scenarios (e.g., savings over time, steps taken over time).

Hands-On Activities
Movement-Based Learning: Create a physical model by having learners physically move to represent time and distance. ***For example***, set up stations or marks on the floor where each step forward represents 1 minute of time and half a kilometre of distance. As learners walk through the "time", they can observe how the distance increases.

Here's the information in table form showing the key points on the graph for ***y=0.5x:***</td></tr>
</table>

<table>
<tr><th>Specific Curriculum Outcomes</th><th>Inclusive Assessment Strategies</th><th>Inclusive Learning Strategies</th></tr>
<tr><td></td><td></td><td>
<table>
<tr><th>Time (x) in minutes</th><th>Distance (y) in kilometres</th></tr>
<tr><td>0</td><td>0</td></tr>
<tr><td>2</td><td>1</td></tr>
<tr><td>4</td><td>2</td></tr>
<tr><td>6</td><td>3</td></tr>
<tr><td>8</td><td>4</td></tr>
<tr><td>10</td><td>5</td></tr>
</table>
This table shows that for every 2 minutes, the distance increases by 1 kilometre, following the equation $y=0.5x$
</td></tr>
</table>

Additional Useful Content Knowledge for the Teacher

Using Variables to Represent Relationships in Grenadian Cuisine

Scenario: A Grenadian street vendor is selling freshly squeezed tamarind juice. The cost of the juice depends on the number of glasses sold.

Problem: How can we represent the relationship between the number of glasses sold and the total cost of the juice?

Solution:

Variables:

x: The number of glasses of juice sold

y: The total cost of the juice

Equation:

Assuming the vendor charges a fixed price per glass, we can represent the relationship using a linear equation:

$$y = mx + b$$

where:

m is the price per glass (slope)

b is the fixed cost (y-intercept)

Example:

If the vendor charges $2 per glass and has a fixed cost of $50 for supplies, the equation would be:

$$y = 2x + 50$$

Analysis:

Graph: Plotting the equation on a graph would show a straight line with a slope of 2 (price per glass) and a y-intercept of 50 (fixed cost).

Table: A table can be used to represent the relationship between x and y for different numbers of glasses sold.

Number of Glasses (x)	Total Cost (y)
0	50
10	70
20	90
30	110

Conclusion:

The equation y = 2x + 50 represents the relationship between the number of glasses sold and the total cost of the juice.
The graph and table provide visual and numerical representations of this relationship.

Opportunities for Subject Integration

Exploring Relationships Between Quantities

Subject Integration: Math, Science, and Art

1. Real-World Problem

Scenario: Learners can explore the relationship between the amount of water a plant receives and its growth.

- **Independent Variable:** Amount of water (in litres) given to the plant.
- **Dependent Variable:** Height of the plant (in centimetres).

2. Write an Equation

Learners will gather data by watering a plant with different amounts of water (e.g., 0, 0.5, 1, 1.5, 2 litres) and measuring the height of the plant after a week.

Example Data:

Water (litres)	Height (cm)
0	10
0.5	15
1	20
1.5	25
2	30

Equation: Learners can express the relationship as a linear equation. For instance, if the relationship appears to be linear, they can write:

$H=5W+10$

Where:

- **H** is the height of the plant (dependent variable).
- **W** is the amount of water (independent variable).
- The slope (5) represents the growth in height per litre of water.

3. Analyse the Relationship

a. Graphing the Relationship

- Learners can create a graph with water on the x-axis and plant height on the y-axis.
- Each point represents a pair of values from their table.
- Encourage learners to draw the line of best fit, which represents the equation.

b. Using Tables

- Learners can extend their table by predicting heights for additional water amounts based on the equation (e.g., 2.5 litres).

Water (litres)	Height (cm)
0	10
0.5	15
1	20
1.5	25
2	30
2.5	35

4. Relating to the Equation

- Discuss how the slope of the line indicates how much the height increases with each additional litre of water.
- Have learners analyse what the y-intercept (10) represents in the context of the problem (the height of the plant when no water is given).

5. Cross-Disciplinary Connections

- **Science:** Explore the biology of plant growth and the role of water in photosynthesis. Discuss factors that might affect growth other than water, such as sunlight and soil quality.
- **Art:** Learners can create a visual representation of their findings through drawings or digital graphics showing the plant's growth stages with varying water amounts.

Geometric Thinking

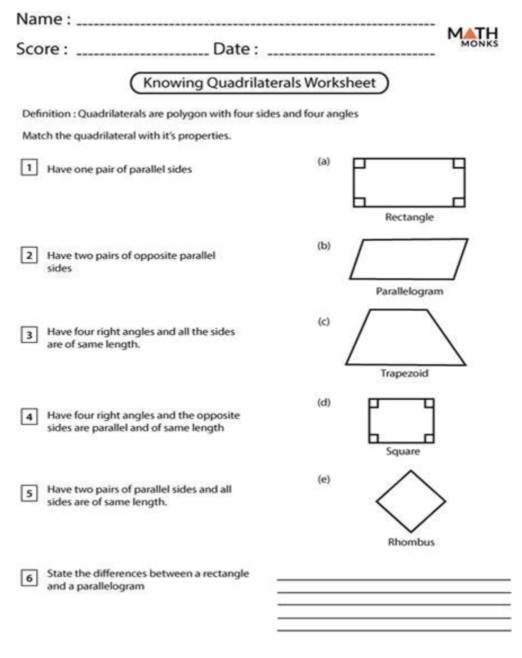
Introduction to Strand: Geometric thinking describes a learner's understanding of the properties of geometric shapes and spatial relationships. Geometric thinking is essential to how learners make sense of shapes and spatial relationships (where an object is in relation to another). This kind of reasoning requires learners to analyse geometric concepts and formulate arguments based on their observations. Learners engage in deductive reasoning, problem solving and critical thinking while enhancing their ability to conceptualise and utilise geometric shapes and relationships in different ways. Geometric thinking is foundational to advancement in science, technology, engineering and mathematics (STEM), in school and also in STEM careers.

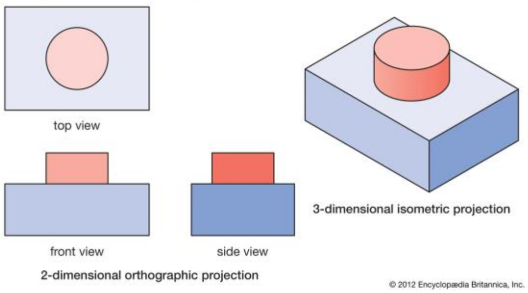
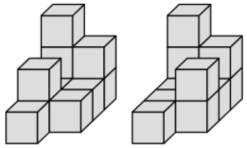
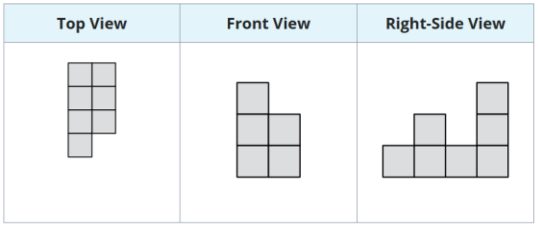
Essential Learning Outcome: G1.1. Explore and Analyse Geometric Shapes and Relationships - Developing Spatial Sense

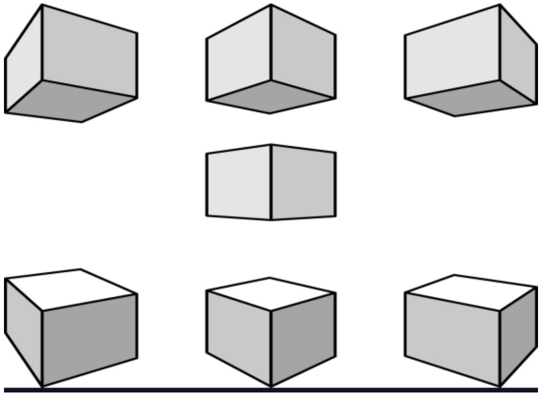
Grade Level Expectations and/or Focus Questions:

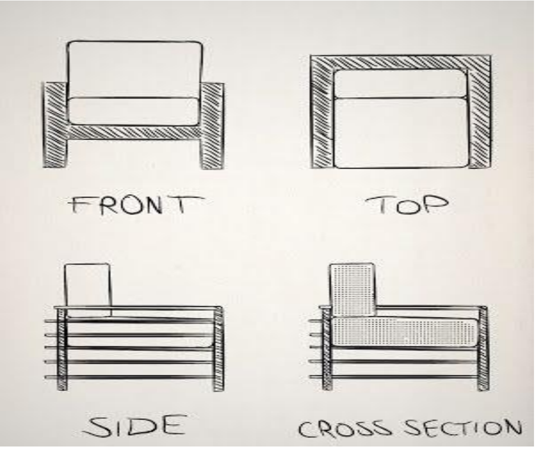
- Use language and gestures that describe shape, objects, and space orally and in writing
- Describe a picture or object in real world contexts or an object undergoing a transformation;
- Draw a picture or build a model from a description and vice versa (orthographic drawing of 3D objects); from a picture or description and vice versa (3D objects from orthographic drawing);
- Make predictions based on spatial reasoning (orthographic drawings of 3D objects, 3D objects from orthographic drawings and result of combining transformations).
- Create lists of the geometric properties of various types of quadrilaterals, including the properties of the diagonals, rotational symmetry, and line symmetry.

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
Learners are expected to: **<u>Knowledge</u>** 1. Identify and categorize various types of quadrilaterals (e.g., squares, rectangles, rhombuses, parallelograms, trapezoids, and	**Entrance Slip/Conversation: To evaluate learners' conceptualisation of geometric properties.(Outcomes 1,2)** Invite learners to match the quadrilateral to the properties that best describe it. Discuss results after completion.	To help learners grasp the distinguishing properties of various quadrilaterals, have them sort and analyse a diverse collection of quadrilaterals, including squares, rectangles, parallelograms, rhombuses, kites, darts, and both concave and convex regular and irregular quadrilaterals. As they categorize these shapes, guide them in recognizing attributes that differentiate one class of shapes from another, such as angles, side lengths, diagonal properties, line symmetry, and rotational symmetry. They

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
quadrilaterals) based on their characteristics. 2. Compile comprehensive lists of geometric properties for each type of quadrilateral, including *the number of sides and angles, Lengths of opposite sides, Measures of interior angles, and Relationships between sides and angles)* *3.* Examine the properties of diagonals in different quadrilaterals, detailing:*(The number of diagonals, Lengths and relationships of diagonals, The intersection properties of diagonals (e.g., whether they bisect each other)* *4.* Investigate the concepts of rotational symmetry and line symmetry in quadrilaterals, noting: *The order of rotational symmetry (if applicable)* 5. State the axes of symmetry for each type of quadrilateral 6. Compare and contrast the geometric properties of various quadrilaterals, highlighting similarities and differences in their properties, particularly in terms of diagonals and symmetry.	 Name : ____________ Score : ________ Date : ________ MATH MONKS Knowing Quadrilaterals Worksheet Definition : Quadrilaterals are polygon with four sides and four angles Match the quadrilateral with it's properties. 1 Have one pair of parallel sides 2 Have two pairs of opposite parallel sides 3 Have four right angles and all the sides are of same length. 4 Have four right angles and the opposite sides are parallel and of same length 5 Have two pairs of parallel sides and all sides are of same length. 6 State the differences between a rectangle and a parallelogram (a) Rectangle (b) Parallelogram (c) Trapezoid (d) Square (e) Rhombus Retrieved from: https://th.bing.com/th/id/OIP.6vNHlm8DLdsQgY6DxZDFUQAAAA?rs=1&pid=ImgDetMain **Checklist** Learners are able to match quadrilaterals to their properties accurately **yes / no**	should document and articulate various defining features, for example, stating, "All of these shapes are squares because they possess four equal sides, four right angles, and four lines of symmetry." To deepen their understanding and create property lists that define categories, provide groups of learners with pre-sorted sets of quadrilaterals—squares, rectangles, parallelograms, rhombuses, kites, darts, and trapezoids. Assign a label to each group (e.g., "These are all parallelograms"), and have them compile detailed property lists that describe the characteristics of each class (e.g., "What defines a parallelogram?"). To enhance their recognition of relationships among different quadrilateral categories, have learners compare their property lists for various shapes and pinpoint common characteristics: For squares and rectangles For squares, rectangles, and parallelograms For squares, rhombuses, parallelograms, and kites Learners should utilize these shared properties to articulate why all squares qualify as rectangles, and all rectangles are parallelograms. They should also differentiate the properties that set squares apart from rectangles, and rectangles apart from parallelograms (e.g., while all squares are rectangles, not all rectangles are squares; similarly, all rectangles are parallelograms, but not all parallelograms are rectangles). Instruct learners to construct a structure using interlocking cubes, guided by its top, front, and side views. Once they have built their models, have them compare their structures with those of their peers who received the same instructions and engage in discussions about any discrepancies. As they examine the different constructions and compare them to the provided drawings, assist them in identifying and resolving potential

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
7. Create visual representations (e.g., drawings, diagrams, or models) of quadrilaterals to illustrate different properties and geometric relationships. 8. Interpret the top, front, and side views of three-dimensional objects. 9. Visualize and explain how a three-dimensional shape corresponds to its two-dimensional views. 10. Compare 3D constructed models to identify similarities and differences in interpretation. **Skills** 11. Construct three-dimensional models using materials such as interlocking cubes or other manipulatives based on provided views. 12. Analyse discrepancies between their models and the provided views to troubleshoot and explain any errors in construction.	**Observation: To evaluate how learners visualize shapes from different perspectives.** Give learners an orthographic shape and various perspectives. Have them draw top, front and side view of the shape. Orthographic and isometric projections of an object  Retrieved by https://cdn.britannica.com/73/131973-050-748BD531/drawing-projections-isometric-projection.jpg **Checklist** Learners are able to accurately represent the side, top and front view of the shape. yes / no **Self-Assessment /Product-to assess learners; ability to draw 3d objects**	mistakes. Encourage them to assess whether all, some, or none of the structures meet the given criteria and articulate their reasoning. - Two possible objects:   To promote multiple valid solutions and enhance the troubleshooting and reasoning process, give learners only the top and front views of a structure. Alternatively, present them with one view at a time, allowing each new perspective to help them progressively refine their construction.

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
Values 13. Communicate the properties of quadrilaterals in creative ways. 14. Articulate the process of constructing the three-dimensional objects, using appropriate geometric vocabulary.	Teacher provides learners with 3D objects e.g. cube) and ask them to draw the front, top, and side views.  Retrieved from https://cdn4.vectorstock.com/i/1000x1000/76/58/cubes-with-shadows-in-perspective-vector-10937658.jpg **Checklist** I can draw a simple 3d object yes/no I can draw the 3D object form at least 2 perspectives yes/no	

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
	Group Work /Product - to design a unique orthographic drawing or create a 3D model from an orthographic drawing (outcomes 6,8,9) In small groups learners will design/draw **or** create a 3D model from interlocking cubes and isometric dot paper. Activity will be done over a week period. If drawn, represent shape from 3 perspectives (front, side, top)  Retrieved from https://i.pinimg.com/originals/7c/cf/33/7ccf332c9ba8fedc34a0f1e064cca277.jpg **Checklist** Learners can design/create shape incorporating 3D principles	

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
	yes/no Learner represents model from at least 3 perspectives yes/no	

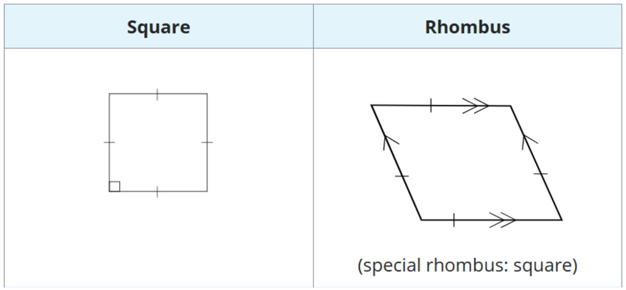
Additional Resources and Materials

Seeing All Sides: Orthographic Drawing :https://www.teachengineering.org/activities/view/cub_spatviz_lesson01_activity2

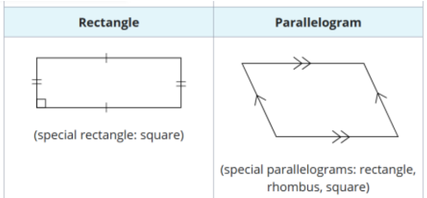
Making Connections Between Orthographic Drawings and 3-D Shapes
https://makinginmath.wordpress.com/2019/06/17/making-connections-between-orthographic-drawings-3d-shapes/

Additional Useful Content Knowledge for the Teacher:

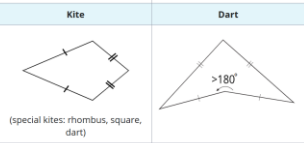
- **types of quadrilaterals:**



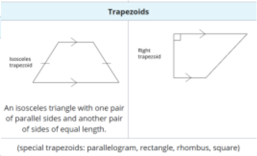
Square	Rhombus
	(special rhombus: square)



Rectangle	Parallelogram
(special rectangle: square)	(special parallelograms: rectangle, rhombus, square)

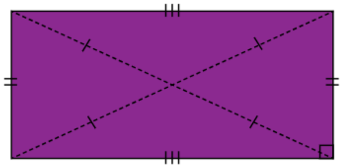
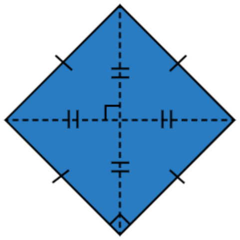


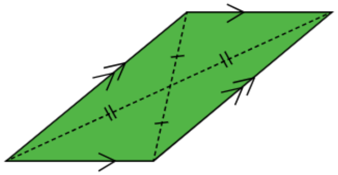
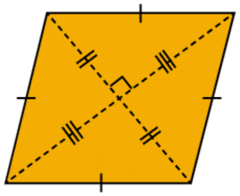
Kite	Dart
(special kites: rhombus, square, dart)	

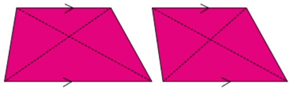
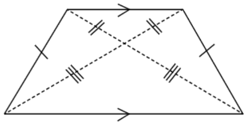
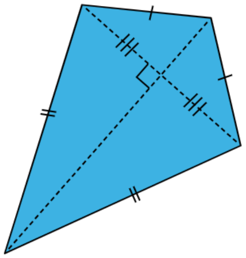


Trapezoids	
An isosceles triangle with one pair of parallel sides and another pair of sides of equal length.	
(special trapezoids: parallelogram, rectangle, rhombus, square)	

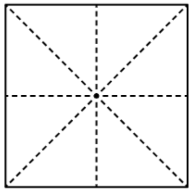
- **using diagonals of a quadrilateral:**

Rectangle	Square
 • A rectangle has two diagonals. • Its diagonals are equal. • Its diagonals bisect each other.	 • A square has two diagonals. • Its diagonals are perpendicular. • Its diagonals bisect each other.

Parallelogram	Rhombus
 • A parallelogram has two diagonals. • Its diagonals bisect each other.	 • A rhombus has two diagonals. • Its diagonals are perpendicular. • Its diagonals bisect each other.

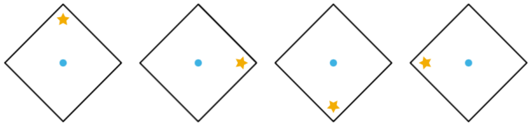
Trapezoid	Kite
 • A trapezoid has two diagonals. • Its diagonals are not equal (exceptions: rectangle, square, parallelogram, and isosceles trapezoid below). 	 • A kite has two diagonals. • Its diagonals are perpendicular. • The longer diagonal bisects the shorter one.

- **using line symmetry:**
  - using paper folding, reflection tools, dot paper, or technology to determine the number of lines of symmetry in a shape; for example:



A square has
4 lines of symmetry.

- When a square is rotated about its centre, its position matches its original position after a $\frac{1}{4}$ rotation, a $\frac{1}{2}$ rotation, and a $\frac{3}{4}$ rotation; therefore, a square has rotational symmetry of order 4 because its position matches the original position four times during a complete rotation:



Shapes and Objects

Polygon: A flat shape with straight sides. Examples include triangles, quadrilaterals, pentagons, hexagons, etc.

Regular Polygon: A polygon with all sides and angles equal.

Irregular Polygon: A polygon with sides and/or angles of different lengths and sizes.

Vertex (Vertices): The point where two or more edges meet.

Edge: The line segment between two vertices.

Face: A flat surface on a 3D shape.

Prism: A solid object with two identical ends and flat sides.

Pyramid: A solid object with a polygonal base and triangular faces that meet at a point (apex).

Opportunities for Subject Integration:

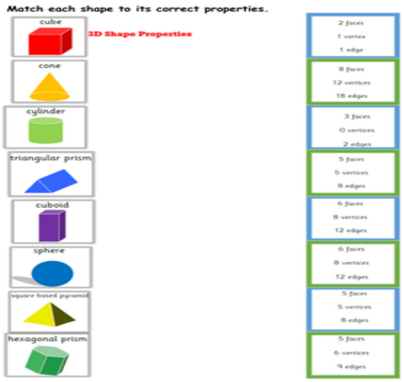
- Mathematics and Art: Use symmetry to create designs like mandalas, exploring cultural patterns and spatial awareness.
- Mathematics and History: Study the role of geometry in ancient architecture and art, appreciating its historical applications.
- Mathematics Engineering: Build models using quadrilateral shapes to learn about structural stability in real-world construction.
- Mathematics and Language Arts: Develop a geometry glossary, practicing technical vocabulary and presentation skills.
- Mathematics and technology: Use 3D modelling tools to visualize and manipulate quadrilaterals, enhancing spatial reasoning.
- Mathematics and Science: Research symmetry in nature (e.g., butterfly wings, honeycombs) to connect geometry with biology.
- Mathematics and Physical Education: Form shapes with body movement to understand symmetry and rotation kinaesthetically.
- Mathematics and Geography: Apply quadrilateral concepts in map reading and grid-based mapping for spatial skills.

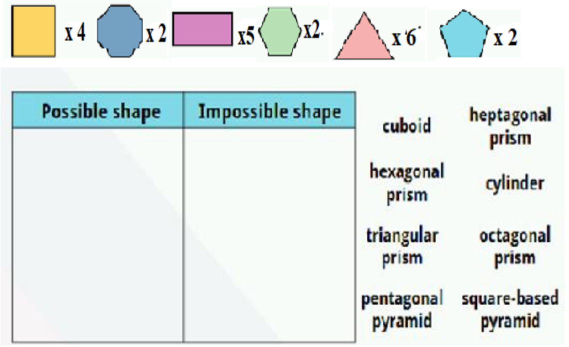
Each approach reinforces geometric concepts through hands-on, interdisciplinary learning.

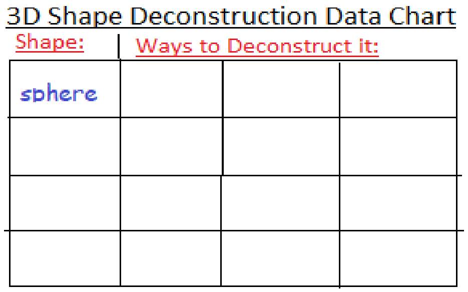
Essential Learning Outcome: 1.2. Explore and Analyse Geometric Shapes and Relationships - Sorting, patterning, and building with 2D & 3D Shapes

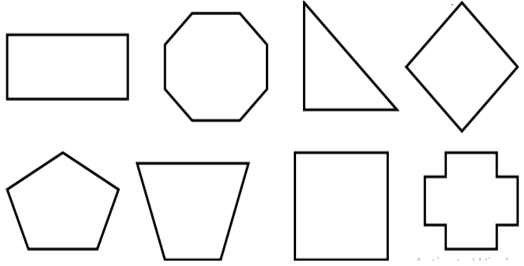
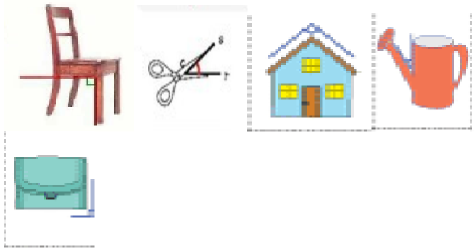
Grade Level Expectations and/or Focus Questions:

- Represent, construct and deconstruct 3D shapes and objects
- Represent and construct right, acute, obtuse, and reflex angles using a straightedge and protractor
- Sort and pattern with Angles.

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
Learners will be expected to: **Knowledge** 1. Identify3d shapes and objects with further accuracy **Skills** 2. Construct 3D shapes with further accuracy 3. Deconstruct 3D shapes with further accuracy 4. Draw angles using straight edges and protractors 5. Classify angles according to their size 6. create patterns using angles	**Entrance Slip /Observation: to determine whether learners can sort objects based on the 3D shapes they look like as well as name the shape they look like. (Outcome 1)** 1. Sort objects according to 3D shapes. 2. Name the shapes  Retrieved from https://encrypted-tbn0.gstatic.com/images?q=tbn:ANd9GcRkVaNuQro5YMltIdM0HtfBnguYwoGG_8G9dfOXZXEyKYOidF4BPEDkQoDsugl_kZ32xJk&usqp=CAU **Checklist** 1. Learners are correctly able to sort objects - Yes	***Discovery/independent learning (Outcome1)*** Provide opportunity for learners to recognize 3D shapes based on their attributes Invites learners to identify and correctly match 3D shapes to their attributes  Retrieved from ***https://d1uvxqwmcz8fl1.cloudfront.net/tes/resources/11445922/ce2f07cb-840b-4da8-***

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
Values 7. Create unique 3D shapes to depict real life examples. 8. Design creative pieces (anchor charts, booklets) to show different angles in objects.	- Somewhat - No **2.** Learners can correctly name the 3D shapes that a group of objects are examples of - Yes - Somewhat - No **Peer Assessment/Product**: To **determine whether learners can create 3D shapes** Learners will be given a cut-out paper to represent faces (triangles, rectangles, circles, squares etc), tape/ glue and be asked to create 3D shapes. Learners will then present their creations to their peers who will identify the shapes. **Checklist**  Retrieved from https://d1uvxqwmcz8fl1.cloudfront.net/tes/resources/11666249/bbf1abd1-1024-4e9d-8402-4a9b118f8ddd/image?width=500&height=500&version=1586379585350 **Conversation: To determine whether learners are able to deconstruct objects and discuss different arrangements for their faces. (outcomes 3 and 4)**	*[9723-cc8f199f3316/image?width=500&height=500&version=1520432278179]()* (note that some property may match more than shape and some properties may not be listed) ***Guided discovery through critical thinking (Outcomes 2 and 4)*** Provide opportunity for exploring the 2D shapes which form the faces of 3D shapes. Invite learners to determine the 3D shapes that can be created using a given set of 2D shapes then complete the given table  Retrieved from [Google Images]() ***Guided Discovery / Deconstructing Objects.(outcomes 3 and 4)***

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
	Learners will be provided with a collection of 3D objects (e.g. shoe boxes, pizza boxes, smarties candy box). Learners will be invited to choose one object. They will then trace around each of the faces then cut them out. Learners will then lay out the shape so they can remake the object if it was folded. They will then compare the nets of the shape. Learners will discuss and answer the following questions 1. Can you open up your object in a different way and still be able to put it back together to make the same object? Is there another way? Is it the same? 2. If not, how is it different? Does it matter that it is different? 3. Is there a number of different ways of putting the faces together so that they could be re-folded to make the box? **Checklist** Learners can correctly deconstruct 3D shapes and discuss various arrangements ● Yes ● Somewhat ● No ***Independent Learning(outcomes 5 and 6)*** Provide opportunities to identify angles in 2D shapes Identify and name the types of angles that can be found in given shapes	Provides learners with an opportunity to deconstruct shapes in different ways. Invite learners to fill in information on ways given objects can be deconstructed (learners may be given manipulatives if necessary)  3D Shape Deconstruction Data Chart Shape: | Ways to Deconstruct it: sphere Retrieved from https://study.com/cimages/multimages/16/3dshapechart.png Provide opportunities to identify and name different types of angles Have learners view the following video [Types of Angles (Acute, Obtuse, Right, Straight, Reflex) | Math with Mr. J]() Present learners with various items that can be found in the school/ classroom environment and be asked to identify angles they can see

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
	What type of angles can you identify in these shapes?  Retrieved from [Google Images](#) **Checklist** Learners are correctly able to identify and name angles correctly ● Yes ● Somewhat ● No **Product/Conversation: To determine whether learners can use a ruler and protractor to draw given angles.** Have learners view the following video [Drawing Angles Using a Protractor](#) Learners will be given a bag from which they will dip the name of a type of angle Learners will be given paper, a ruler and protractor and asked to draw the angle they dipped.	  Retrieved from [Google Images](#) ***Discovery*** Provide opportunities for gamifying the recognition of angles Invite learners in groups to play this game where they are to attempt to draw angles accurately. [**Alien Angles | Math Playground**](#) ***Learning by doing (outcome 8)*** Provide opportunities to Sort angles**.** Give cutout paper with angles and be asked to sort and stick them on matching spaces in the classroom based on the type of angle

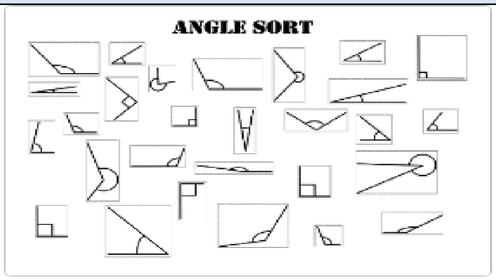
<table>
<tr><th>Specific Curriculum Outcomes</th><th>Inclusive Assessment Strategies</th><th>Inclusive Learning Strategies</th></tr>
<tr>
<td></td>
<td>
Learners will later present their drawn angle to their peers and have them discuss the angle and say what type of angle they think was drawn.

Checklist

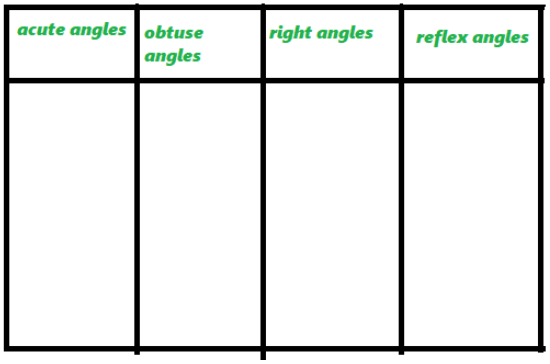
Learners are correctly able to draw and name angles correctly
● Yes
● Somewhat
● No

Think, Pair, Share: To check whether learners are able to sort types of angles based on given measurements.
(outcome 8)

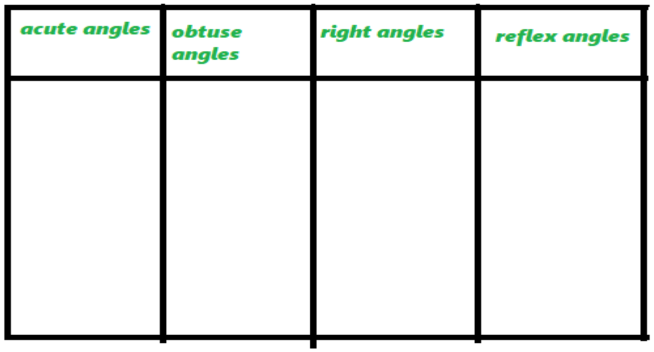
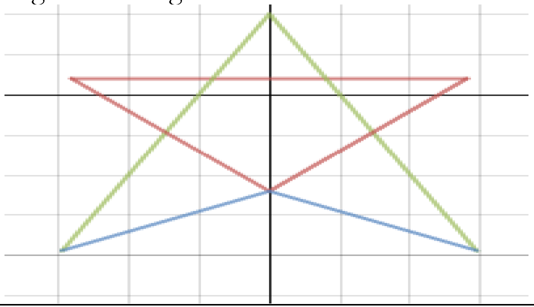
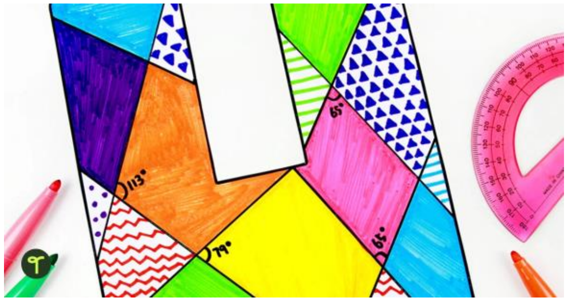
Learners will be given measurements of angles and be asked with a peer to classify each measurement based on the type of angle it would be.


</td>
<td>


Retrieved from <i>Angle sorting worksheet activity | Teaching Resources</i>


<table>
<tr><th>acute angles</th><th>obtuse angles</th><th>right angles</th><th>reflex angles</th></tr>
<tr><td></td><td></td><td></td><td></td></tr>
</table>
Retrieved from Google Images

Video Assisted Learning and Project
<i>(outcome 9)</i>
Provides learners with an opportunity to create a pattern using different angles
</td>
</tr>
</table>

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
	 acute angles obtuse angles right angles reflex angles Retrieved from Google Images **Checklist** Learners are correctly able to sort angles by measurement ● Yes ● Somewhat ● No **Group Work)/Observation :To create patterns using angles** **(outcome 9)** In small groups learners will create a unique pattern using angles on Geogebra. 	Present the video below. Angles and Protractor Art Project (Teacher will use discretion and pause at intervals to complete each step) Give learners a cardstock paper, a ruler, a protractor and crayons. Learners will then be invited to create their project involving drawing angles and creating a pattern by colouring the angles based on their type.  https://cdn.teachstarter.com/fileserver/2021/05/angles-in-letters-activity-1200x628.jpg

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
	Retrieved from https://www.desmos.com/calc_thumbs/production/ch29jvpwgg.png **Checklist** 1.Learners are able to create patterns using angles - Yes - Somewhat - No 2. Learners were able to identify the types of angles in presented pattern - Yes - Somewhat - No	

Additional Resources and Materials

https://www.orchidsinternationalschool.com/maths-concepts/nets-3d-shape

https://wmznlejcfq.s3-ap-southeast-1.amazonaws.com/media/worksheets/classifying-angles-worksheet-1.pdf

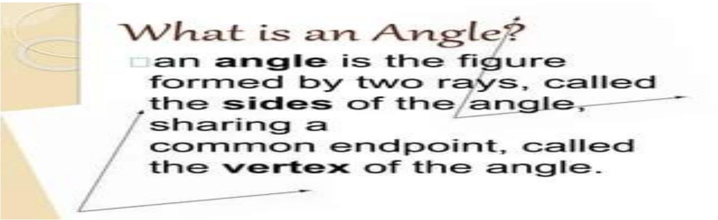
https://corbettmaths.com/wp-content/uploads/2018/09/Types-of-Angle-pdf.pdf

http://www.drysdaleps.vic.edu.au/wp-content/uploads/2020/08/Drawing-Angles-Using-a-180-Degree-Protractor-Worksheet-Adobe-Reader-_352305-1.pdf

https://www.greatschools.org/gk/worksheets/drawing-angles/

https://wordwall.net/resource/14385681/angles

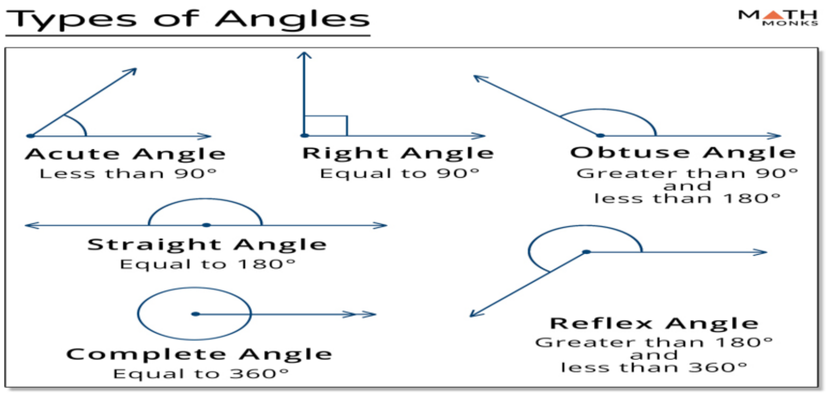
Additional Useful Content Knowledge for the Teacher:



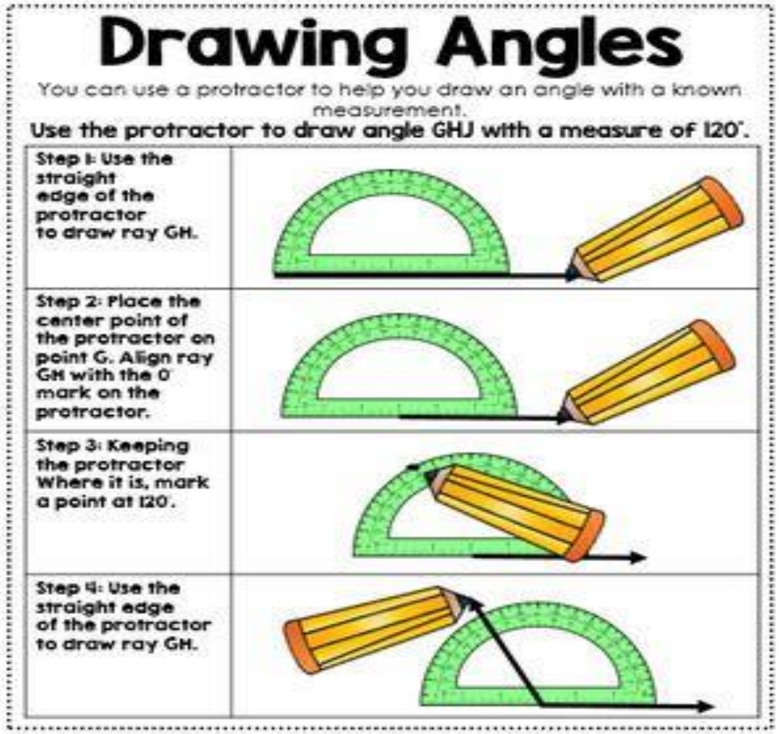
What is an Angle?

- an **angle** is the figure formed by two rays, called the **sides** of the angle, sharing a common endpoint, called the **vertex** of the angle.

https://image.slidesharecdn.com/differenttypesandpartsofanangle-140814043617-phpapp02/85/Different-types-and-parts-of-an-angle-2-320.jpg



https://mathmonks.com/wp-content/uploads/2020/12/Types-of-Angles.jpg



Drawing Angles

You can use a protractor to help you draw an angle with a known measurement.

Use the protractor to draw angle GHJ with a measure of 120°.

Step 1: Use the straight edge of the protractor to draw ray GH.

Step 2: Place the center point of the protractor on point G. Align ray GH with the 0° mark on the protractor.

Step 3: Keeping the protractor where it is, mark a point at 120°.

Step 4: Use the straight edge of the protractor to draw ray GH.

https://i.pinimg.com/474x/48/30/be/4830bef3640ecc18259054b801219193.jpg

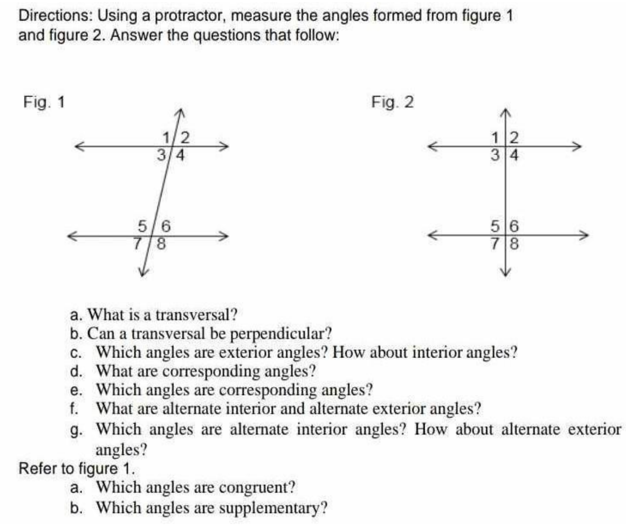
Opportunities for Subject Integration:

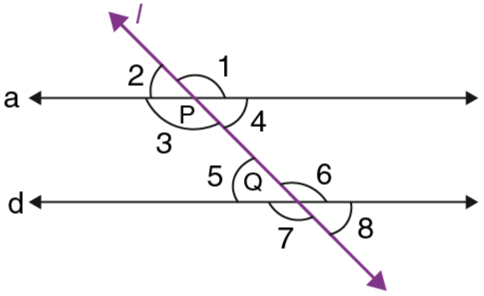
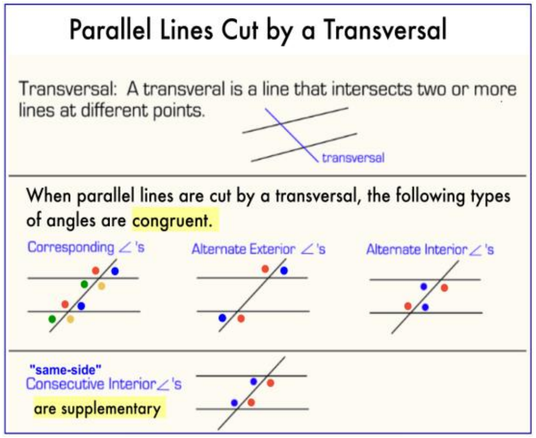
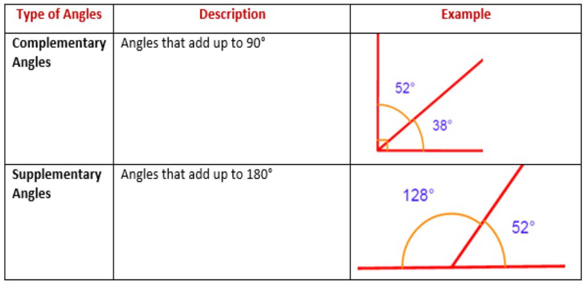
Identifying and drawing angles is important in geometry as these concepts can be effectively used in the description and construction of different shapes such as polyhedrons, and polygons.
Angles can be used in mathematical problems to explain and explore the behaviour of different lines. It is also useful in trigonometry.

Essential Learning Outcome: G2:1. Recognizing, Naming and Describing Shapes - Analysing and Describing Shapes

Grade Level Expectations and/or Focus Questions:

- Recognize and describe angle relationships (complimentary, supplementary, vertical opposite angles, angles created by parallel lines and transversals (through measuring)
- The sum of angles in various polygons

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
Learners will be expected to: **Knowledge** 1. Recognize angle relationships (complementary, supplementary, vertically opposite angles and angles created by parallel lines and transversals). 2. Describe angle relationships (complementary, supplementary, vertically opposite angles and angles created by parallel lines and transversal. 3. Illustrate various types of angle relationships. . 4. Recognize the sum of angles in various polygons. **Skills** 5. Determine the sum of the interior angles of a polygon by calculating the number of non-overlapping triangles it contains.	**Product: To give learners practice on measuring angles on diagrams drawn to scale as well as using the measurements to prove the relationships between pairs of angles. *(Outcomes 1, 2 and 3)***  Directions: Using a protractor, measure the angles formed from figure 1 and figure 2. Answer the questions that follow: a. What is a transversal? b. Can a transversal be perpendicular? c. Which angles are exterior angles? How about interior angles? d. What are corresponding angles? e. Which angles are corresponding angles? f. What are alternate interior and alternate exterior angles? g. Which angles are alternate interior angles? How about alternate exterior angles? Refer to figure 1. a. Which angles are congruent? b. Which angles are supplementary? Retrieved from https://brainly.ph/question/31997112	***Discovery Learning (Outcome 1)*** Give learners an opportunity to measure angles using a protractor. This allows them to prove the relationships between various pairs of angles. For example: Have learners' measure angles on GeoGebra and invite them to compare the measures of pairs of angles to prove the relationships that exist between them. Retrieved from https://www.geogebra.org/m/zngydp5x ***Video-assisted learning (Outcomes 2,3).*** Engage learners' visual and auditory senses to help them gain a deeper understanding of the concept. For example: Show videos that illustrate the relationships between different types of angles and how a transversal creates certain angles when it intersects parallel lines. Complementary Angles & Supplementary Angles | Math with Mr. J Parallel Lines Cut by a Transversal - Finding Angle Measures

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
Values: 6. Create real life situations to compare complementary and supplementary angles	**Checklist:** Learners correctly measure and determine the size of the angles. - All - Some - None **Conversation: To determine whether learners know the different terms describing the relationships between pairs of angles. *(Outcomes 2, 3)*** Draw a diagram similar to this one on the board. Point out various pairs of angles and ask learners to describe the relationship between them, e.g., angles 2 and 4 are vertically opposite; angles P and Q are consecutive interior angles and therefore are supplementary.  Retrieved from https://byjus.com/maths/parallel-lines-transversals-angle/ **Checklist:** Learners are able to correctly recognize and describe the relationships between various pairs of angles from the diagram. - All - Some - None	**Relevant information in this video ends at 2:35** Provide learners with information sheets (like the ones below). Study and review the different types of angles and their relationships with learners, and discuss as a class. Parallel Lines Cut by a Transversal Transversal: A transveral is a line that intersects two or more lines at different points. When parallel lines are cut by a transversal, the following types of angles are congruent. **Retrieved from https://amandapaffrath.weebly.com/2-parallel-lines-and-transversals.html** Type of Angles – Description – Example Complementary Angles – Angles that add up to 90° Supplementary Angles – Angles that add up to 180°

<table>
<tr><th>Specific Curriculum Outcomes</th><th>Inclusive Assessment Strategies</th><th>Inclusive Learning Strategies</th></tr>
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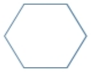
Product: To enable learners to use the fact that the angles in a triangle add up to 180° to find the sum of angles in different polygons. ***(Outcomes 4,5,6)***

Provide learners with a sheet of various polygons and ask them to identify triangles within each polygon. By counting the triangles, they can determine the sum of the polygon's interior angles by multiplying the number of triangles by 180°. Have learners fill out a table, like the one below, with their answers.

<table>
<tr><th>Shape</th><th>Shape broken into triangles</th><th># of sides</th><th>Math Work</th><th>Total Degrees</th></tr>
<tr><td></td><td></td><td>3</td><td>1(180°)</td><td>180°</td></tr>
<tr><td></td><td></td><td>4</td><td>2(180°)</td><td>360°</td></tr>
<tr><td></td><td></td><td>5</td><td>3(180°)</td><td>540°</td></tr>
<tr><td></td><td></td><td>6</td><td>4(180°)</td><td>720°</td></tr>
</table>

Retrieved from https://www.softschools.com/math/geometry/topics/the_sum_of_the_interior_angles_in_a_polygon/

Checklist: Learners are able to correctly determine the sum of angles within each polygon.

- All
- More than half
- Less than half

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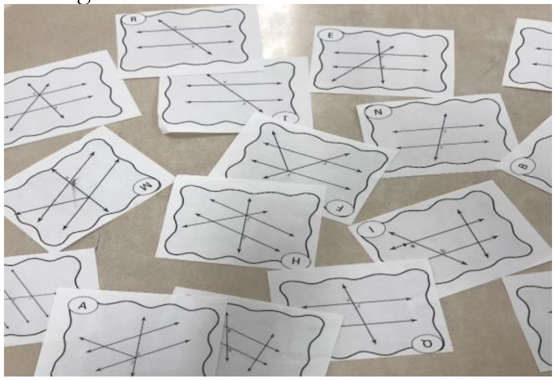
Retrieved from https://www.onlinemathlearning.com/complementary-angle.html

Vocabulary Game (Outcomes 2,3)

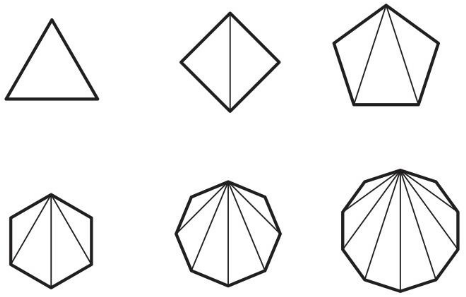
Provide opportunities for learners to familiarize themselves with vocabulary that might be new to them. For example: Invite learners to work in pairs. Spread answer cards face up on top of their desks. The teacher reads a definition for the group of words listed below. The learner who grabs the right answer first gets the point.

Congruent ***Parallel lines***
Transversal ***Complementary***
Supplementary ***Vertically opposite angles***
Alternate angles ***Interior angles***
Exterior angles ***Corresponding angles***
Consecutive angles

Answers on the cards can be in the form of words or images.



</td>
</tr>
</table>

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
		Retrieved from **https://bluemountainmath.com/angle-relationships/** ***Discovery Learning (Outcomes 4, 5)*** Provide learners with the opportunity to break up various polygons into triangles that do not overlap each other. For example: The sum of their interior angles can then be found by multiplying the number of triangles by 180° or by adding. Angles in a triangle add up to 180°. Learners can use this rule to determine the sum of the interior angles in a polygon.  Retrieved from https://www.earthslab.com/mathematics/polygon/ If the polygon contains two triangles, then the sum of the interior angles is 2 x 180° = 360°, or 180° + 180° = 360°

Additional Resources and Materials

- Cardstock
- Markers
- Rulers
- Protractors
- Internet access and devices for GeoGebra

Additional Useful Content Knowledge for the Teacher:

A trick to help learners remember that complementary angles add up to 90° and supplementary angles add up to 180°: The **c** in complementary can start to form the **9 in 90°**, while the **s** in supplementary can start to form the **8 in 180°**.

Angle sum of any polygon - Maths Tutorials

Opportunities for Subject Integration:

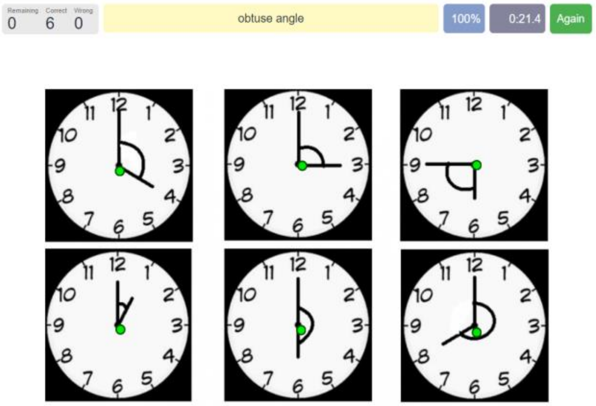
- Mathematics and Art: Create tessellation designs to explore and measure angle relationships.
- Mathematics and Technology: Make digital presentations to compare complementary and supplementary angles.
- Mathematics and Physical Education: Using body movements to form and identify angles enhances kinesthetic learning.
- Mathematics and Science: Observe angles in nature or physics, such as light refraction, to connect angle concepts to real-world phenomena.
- Mathematics and Engineering: Construct polygons and calculate interior angles by dividing shapes into triangles and reinforcing angle sums.
- Mathematics and Language Arts: Write explanations or brochures about angle relationships with real-life examples for clear communication.
- Mathematics and History: Study angles in historical architecture to link geometry to structural design.

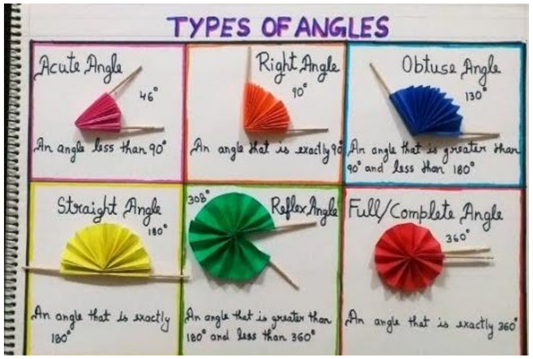
Each activity strengthens angle concepts and connects math to other disciplines.

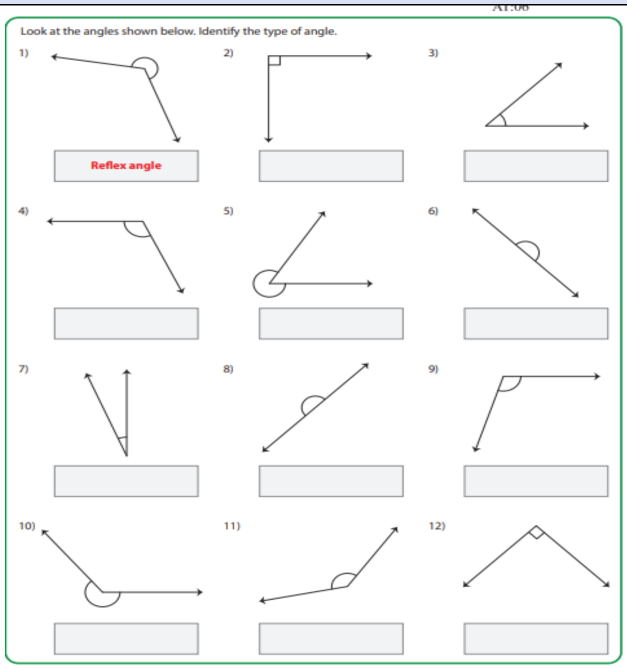
Essential Learning Outcome: G2.2. Recognising, Naming and Describing Shapes - Naming 2D & 3D shapes

Grade Level Expectations and/or Focus Questions:

- Recognize, name and classify angles

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
Learners are expected to: **Knowledge** 1. Recognize angles (acute, obtuse, right, reflex, and straight). 2. Name angles (acute, obtuse, right, reflex, and straight). **Skills** 3. Classify angles according to the type (acute, obtuse, right, reflex, and straight). 4. Create different types of angles through hands-on practice. **Values** 5. Design different creative pieces *(a posters, poems, stories songs*) outlining types of angles in the environment.	**Observation: To assess how much information learners remember about types of angles *(Outcomes 1, 2, and 3)*** Invite learners to play this quick game to review types of angles. Press on the blue dot in the middle of the clock(s) representing the angle named. https://www.purposegames.com/game/603afcb93d  Retrieved from https://www.purposegames.com/game/603afcb93d **Checklist:** Game scores ● Scored 83-100% ● Scored 50-67%	***Interactive Learning - Making a Math Angle Clock (Outcomes 1, 2 and 3)*** Give learners a hands-on opportunity to demonstrate different types of angles. For example: Have learners make a math angle clock as shown in the video. Learners use this clock to show acute, obtuse, right, reflex and straight angles. How to Make Maths Angle Project/ Angle Clock Model/ Types of Angle Model  Retrieved from https://www.youtube.com/watch?app=desktop&v=qdyffTvt3X8

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
	● Scored 0-33% **Observation- To identify types of angles in your environment *(Outcomes 1, 2, and 3)*** Walk around the classroom and the school and have learners identify and classify different angles in their environment, e.g. corners of surfaces, angle at which the door is ajar, etc.  Retrieved from https://tools4schoolsathome.com/how-to-teach-angles-a-fun-way/ **Checklist:** Learners are able to correctly identify different at least 3 types of angles in their environment. ● Yes ● Somewhat ● No **Product- Exit slip -To determine whether learners are able to Name and classify various angles *(Outcomes 1, 2 and 3)***	***Group work (Outcomes 1 , 2, 3,4)*** Provide learners with the opportunity to work together to reinforce their ability to identify types of angles. For Example: Place learners in small groups and have them create a poster on the different types of angles with drawings and descriptions  Retrieved from https://www.youtube.com/watch?app=desktop&v=u51-eqEfMAc ***Game - Angle Hunt (Outcomes 1,3)*** Incorporate fun activities to help learners classify different types of angles. For example: Hide cut-outs of the various types of angles around the class. Place learners in 5 groups based on the names of the angles- ***acute, obtuse, right, reflex and straight***. Groups are timed and hunt around the classroom **only** for the angles after which their group is named. The group that

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
	 Look at the angles shown below. Identify the type of angle. Retrieved from https://www.liveworksheets.com/sites/default/files/styles/worksheet/public/def_files/2022/7/19/207190612093933937/207190612093933937002.jpg?itok=vGzXy9Yl **Checklist:** Learners are correctly able to classify angles as acute, obtuse, right, reflex and straight. ● All ● More than half ● Less than half	accurately finds the most angles within the allotted time wins.

Additional Resources and Materials

- Manila sheet
- Construction paper
- Ruler and protractor
- Markers
- Tooth picks

Additional Useful Content Knowledge for the Teacher:

There are many things in real life that create angles, such as clothes hangers, scissors, crossroads, arrowheads, partially opened doors, to pyramids, Different letters in various alphabets also form examples of angles. What is the angle of the letter V? An acute angle. While practicing yoga and exercising, we make different angles in different postures. Angles are all around us.
Retrieved from https://www.mathnasium.com/math-centers/sherwood/news/angles-real-life-s#:~:text=Real%2Dlife%20Application%20of%20Angles,enhance%20their%20performance%20in%20sports.

Opportunities for Subject Integration:

- Measurement
- Trigonometry

Essential Learning Outcome: G2.3. Recognizing, Naming and Describing Shapes – Comparing and Adding the Angles of 2D & 3D Shapes

Grade Level Expectations and/or Focus Questions:

- Recognize, describe and compare angles based on angle relationships
- Generalize the sum of interior angles in various polygons

<table>
<tr><th>Specific Curriculum Outcomes</th><th>Inclusive Assessment Strategies</th><th>Inclusive Learning Strategies</th></tr>
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Learners are expected to:

Knowledge

1. Use the properties of supplementary angles, complementary angles, opposite angles, and interior and exterior angles to solve for unknown angle measures
2. Explain how the number of sides in a polygon affects the size of its interior angles.

Skills

3. find the sum of interior angles in various polygons
4. Calculate the measure of an interior angle based on the polygon's sides
5. Determine the corresponding exterior angles after calculating the sum of the interior angles.

Values

6. Design a colour-coded chart highlighting the angles formed with parallel lines and a transversal

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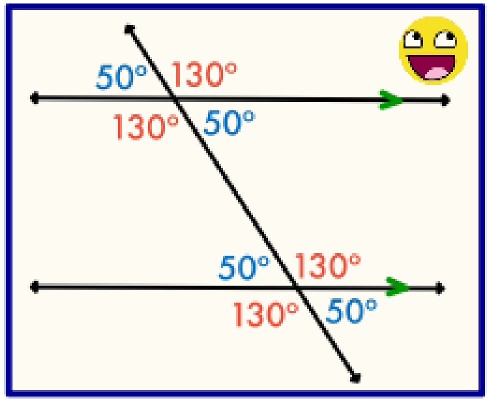
Observation: To determine whether learners can identify the relationship between the angles shown. The teacher places this chart on the board and points at different pairs of angles. Learners state the relationship between them, giving reasons for their answers.



Retrieved from
https://amandapaffrath.weebly.com/2-parallel-lines-and-transversals.html

Checklist: Learners are correctly able to state and describe the relationship between the angles shown.

- All
- Some
- None

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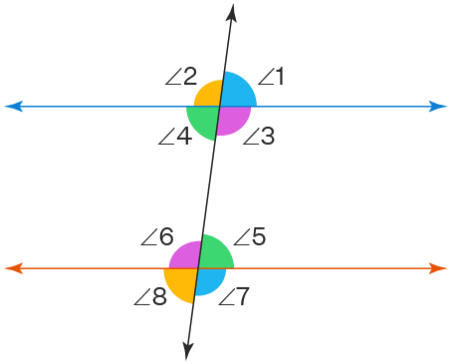
Tactile Learning
Give learners the opportunity to gain a deeper understanding of the different relationships between angles created by transversals.

For example: Draw a large diagram with a transversal on the floor. Have children stand in positions representing the angles and have the class identify the relationships. They could also place objects on the drawings to denote the angles and show the relationships.



Retrieved from
https://www.cuemath.com/geometry/transversal/

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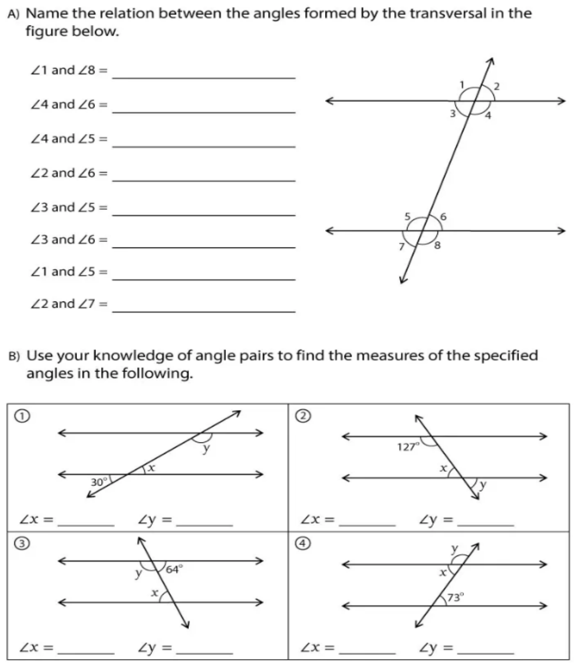
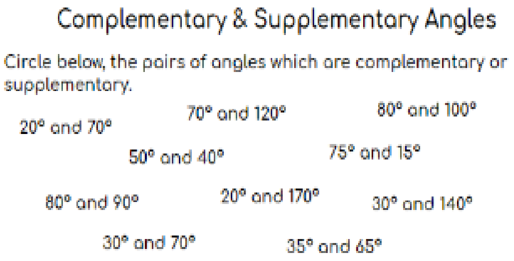
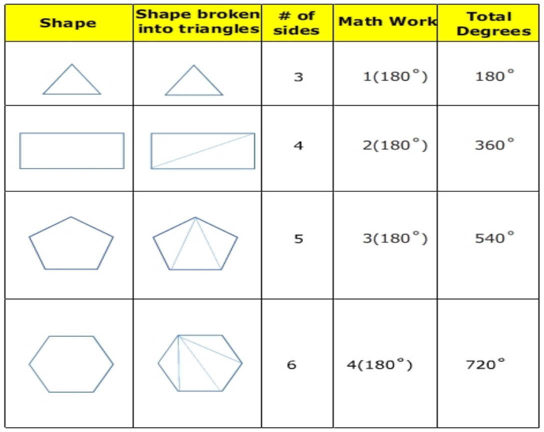
Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
	Product - Group Work: To give learners an opportunity to work together to determine the measure of various angles based on the relationship between them.  A) Name the relation between the angles formed by the transversal in the figure below. ∠1 and ∠8 = ____________ ∠4 and ∠6 = ____________ ∠4 and ∠5 = ____________ ∠2 and ∠6 = ____________ ∠3 and ∠5 = ____________ ∠3 and ∠6 = ____________ ∠1 and ∠5 = ____________ ∠2 and ∠7 = ____________ B) Use your knowledge of angle pairs to find the measures of the specified angles in the following. ① ∠x = ______ ∠y = ______ ② ∠x = ______ ∠y = ______ ③ ∠x = ______ ∠y = ______ ④ ∠x = ______ ∠y = ______ Retrieved from https://mathmonks.com/wp-content/uploads/2023/12/Angle-Pairs-Formed-by-a-Transversal-Worksheet.webp **Checklist:** Learners are correctly able to determine the relationship between pairs of angles and find/calculate the measure of angles. ● All ● Some ● None	***Conceptual understanding (Outcome 1)*** Give learners an opportunity to practice distinguishing between complementary and supplementary angles. For example: Write various pairs of angles on the board and ask learners to identify which pairs are supplementary (add up to 180°) and which pairs are complementary (add up to 90°).  Complementary & Supplementary Angles Circle below, the pairs of angles which are complementary or supplementary. 20° and 70° 70° and 120° 80° and 100° 50° and 40° 75° and 15° 80° and 90° 20° and 170° 30° and 140° 30° and 70° 35° and 65° Retrieved from https://www.tes.com/en-us/teaching-resource/complementary-and-supplementary-angles-12522919 Have learners apply the additivity principle and angle properties to measure angles in pattern blocks and create benchmark angles (30°, 45°, 60°, 90°, 120°, 135°, 180°, 270°, and 360°). For instance, they can identify the orange square as 90°, deduce that 1 square + 3 tan rhombuses = 180° implies each rhombus has a 30° angle, and calculate that 3 blue parallelograms forming 360° means each obtuse angle is 120°. They can also demonstrate that combining the obtuse angles (120° + 120°) with the acute angle (30°) results in a reflex angle of 270°, and verify this by subtracting the square's angle from 360°.

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies

Inclusive Assessment Strategies

Conversation: To determine whether learners are able to identify the general formula for finding the sum of interior angles in a polygon *(Outcome 2)*

Use this activity from E.L.O. 2.1 and ask learners to compare the math work for each polygon with the number of sides in order to identify the relationship or general formula for finding the sum of interior angles in a polygon.



Shape	Shape broken into triangles	# of sides	Math Work	Total Degrees
		3	1(180°)	180°
		4	2(180°)	360°
		5	3(180°)	540°
		6	4(180°)	720°

Retrieved from https://www.softschools.com/math/geometry/topics/the_sum_of_the_interior_angles_in_a_polygon/

To find the interior angle sum of a polygon, we can use a formula: interior angle sum = (n - 2) x 180°, where n is the number of sides. For example, a pentagon has 5 sides, so its interior angle sum is
(5 - 2) x 180° = 3 x 180° = 540°.

Inclusive Learning Strategies

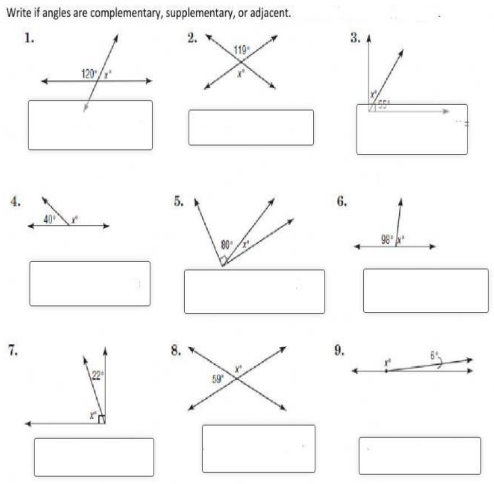
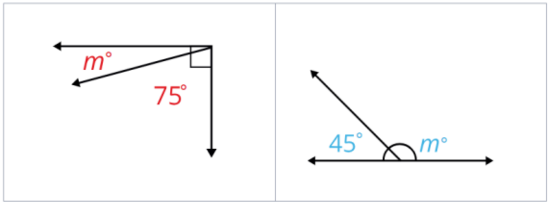
Learners draw a straight line with a point and create another line at an angle, estimating and then confirming the angle measures with a protractor. In groups, they compare their diagrams and determine the sum of the two non-straight angles, identifying them as supplementary angles.

Learners draw a right angle and create two angles from the vertex, estimating and confirming their measures with a protractor, then checking if the angles sum to 90°, identifying them as complementary angles.

Learners draw intersecting lines, estimate the measures of the four resulting angles, and confirm with a protractor. In groups, they discuss angle relationships, noting that opposite angles are equal, adjacent angles form a straight angle (180°), and the total of all angles is 360°.

Introduce the formula for the sum of interior angles: $(n-2)\times 180°$ where n is the number of sides.
Work through examples on the board, starting with a triangle ($n=3$) and quadrilateral ($n=4$). Explain that in a regular polygon, all interior angles are equal. Show how to find the measure of one interior angle by dividing the sum of interior angles by the number of sides:

$$\frac{(n-2)\times 180^{\circ}}{n}$$

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
	Checklist: Learners are able to determine the general formula for finding the sum of interior angles in a polygon. - Most learners - Some learners - No learner  Write if angles are complementary, supplementary, or adjacent. Retrieved from https://www.liveworksheets.com/w/en/math/882878	Learners draw a polygon, calculate the sum of the interior angles, and extend lines from each vertex to determine the corresponding exterior angles. They compare their findings in groups to observe similarities and differences. Provide learners with scaled angle diagrams and a set of measures so they can calculate unknown angles using angle properties, verifying their solutions with a protractor.  Have learners create "angle puzzles" where an angle is missing from a straight line, a full circle, or a right angle, and then exchange their puzzles with a partner. Support learners who may struggle with identifying the angle or understanding the relationship to addition and subtraction.

Additional Resources and Materials

- ruler
- protractor

Additional Useful Content Knowledge for the Teacher:

A trick to help learners remember that complementary angles add up to 90° and supplementary angles add up to 180°: The **c** in complementary can start to form the **9 in 90°**, while the **s** in supplementary can start to form the **8 in 180°**.

Angle sum of any polygon - Maths Tutorials

Angles can be measured indirectly (calculated) by applying angle properties. Measuring angles indirectly is often quicker than measuring them directly and is the only choice if the location of an angle is impossible or impractical to measure.
Smaller angles may be added together to determine a larger angle. This is the additivity principle of measurement.
Angle properties can be used to determine unknown angles.
A straight angle measures 180°: this property is used to determine the measurement of a supplementary angle and is applied when determining the exterior angles of a polygon.
A right angle measures 90°: this property is used to determine the measurement of a complementary angle.
Interior angles of quadrilaterals sum to 360°; this property is used to find an unknown angle in a quadrilateral.
Interior angles of triangles sum to 180°; this property is used to find an unknown angle in a triangle.
Angle properties can also be used to determine other unknown measures (e.g., the exterior angle measures of a polygon) or to explain why opposite angles are equal.

Opportunities for Subject Integration:

- Mathematics and Art: Create geometric artwork using polygons and angles, such as mosaics or mandalas.
- Mathematics and Science: Explore natural examples of polygons and angles, such as honeycomb structures, through research and presentations.
- Mathematics and History: Investigate historical architecture that uses geometric shapes, such as the Parthenon, and present findings.
- Mathematics and Physical Education: Form angles with body movements in activities like yoga or dance to reinforce concepts kinesthetically.
- Mathematics and Technology: Use software like GeoGebra for digital creation and manipulation of polygons to enhance understanding.

- Mathematics and Language Arts: Write reports or presentations explaining interior and exterior angles, fostering communication skills.
- Mathematics and Social Studies: Create maps with polygons, calculating angles for layout and direction.
- Mathematics and Music: Develop a dance involving turns at specific angles, connecting math to rhythm and movement.

Essential Learning Outcome: G3.1: Composing, Decomposing and Transforming Shapes - Combining Shapes

Grade Level Expectations and/or Focus Questions: learners should be able to :

- Calculate missing angle using angle relationship (complementary, supplementary, vertical opposite angles)
- Draw angles using a straightedge and a protractor.
- Plot and read coordinates in all four quadrants of a Cartesian plane
- Describe the translations that move a point from one coordinate to another.

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
Learners are expected to: **Knowledge** 1. Identify and describe the four quadrants of the Cartesian plane. 2. State the relationship between angles that are measured clockwise and those that are measured counter clockwise **Skills** 3. Use a protractor to measure and construct angles up to 360°. 4. Plot given coordinates on a Cartesian plane in all four quadrants, demonstrating an understanding of the x-axis and y-axis 5. Read and interpret the coordinates of plotted points, explaining their positions relative to the axes and quadrants.	Provide a worksheet that requires learners to measure given angles and identify whether they are measured clockwise or counter clockwise. Include questions about the relationships between angles, asking learners to explain their reasoning. ☐ Evaluate learners' worksheets to check for understanding of measuring and constructing angles. ☐ Assess participation during guided practice and the accuracy of angle constructions. 1. Pairs of angles can be ____, _____ or _____. 2. Two angles that sum 90 are called ________. When put together these angles form_________ 3. Two angles that sum 180 are called __________. When put together, these angles form a ________. 4. Two angles that share a _________ and are opposite of one another are called _________. These angles are __________.	***Conceptual Understanding*** ***Playing Games – Bingo*** Provide learners with the opportunity to calculate angles to create complementary, supplementary or vertical angles. Let learners select various angle sizes to fill in their bingo sheets and apply their mental math skills to solve the problems as they are announced. The first learner to completely fill in the angles on their bingo sheet wins.

<table>
<tr><th>Specific Curriculum Outcomes</th><th>Inclusive Assessment Strategies</th><th>Inclusive Learning Strategies</th></tr>
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6. Describe the translation of a point from one coordinate to another using directional language (e.g., "move right," "move left," "move up," "move down") and quantify the movements in terms of units
7. Perform translations on given points, calculating the new coordinates after moving a point a specified number of units in the x or y direction, and represent these translations visually on a Cartesian plane
8. Evaluate the results of translations by comparing the original and new coordinates, confirming that the changes made are consistent with their descriptions of the movements.
Values
8. Use coordinates in creating artistic designs and incorporate angles in making artistic designs
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Think Pair Share/Self-Assessment : to determine whether learners can calculate missing angles using angle relationships
Have learners view the following videos to help learners further understand how to find the missing angle
Complementary Angles & Supplementary Angles | Math with Mr. J
What are Vertical Angles? | Math with Mr. J
Invite learners to work in small groups/ pairs to solve problems related to finding the value of missing angles. Learners will share their answers and explain how they were able to determine the answers
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BINGO
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<tr><td>37°</td><td>175°</td><td>12°</td><td>24°</td><td>109°</td></tr>
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<tr><td>100°</td><td>104°</td><td>FREE</td><td>22°</td><td>16°</td></tr>
<tr><td>78°</td><td>57°</td><td>60°</td><td>140°</td><td>40°</td></tr>
<tr><td>89°</td><td>179°</td><td>91°</td><td>8°</td><td>81°</td></tr>
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Retrieved from https://ecdn.teacherspayteachers.com/thumbitem/Complementary-and-Supplementary-Angles-Bingo-Small-Group-9115954-1676281882/original-9115954-1.jpg
Present learners with both a semi-circle and a full-circle protractor, and encourage them to compare their similarities and differences. Help learners understand the relationship between the term “360” for a full circle and the concept that angles can extend to 360°. Have them explore reading the protractor in both clockwise and counter clockwise directions. Ask them to identify the angle measures for straight and right angles, as well as the range of measures for acute and obtuse angles. Additionally, have them use both types of protractors to measure angles greater than 180° (reflex angles) found in everyday life.
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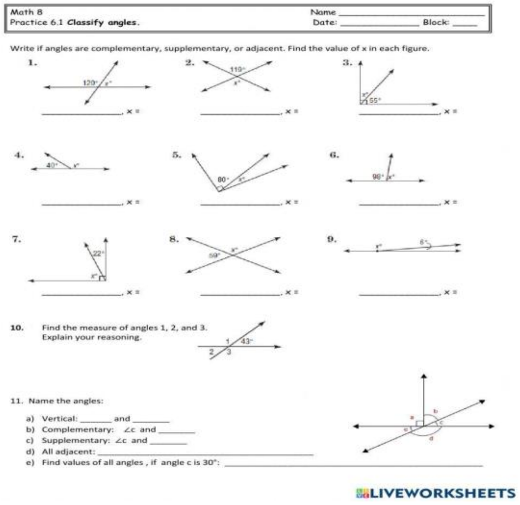
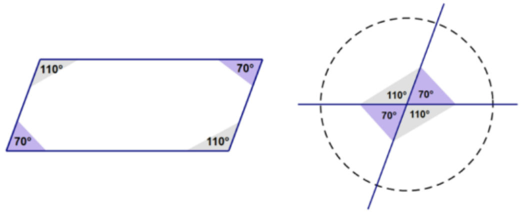
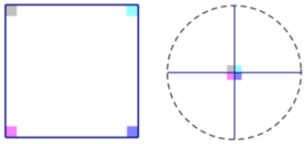
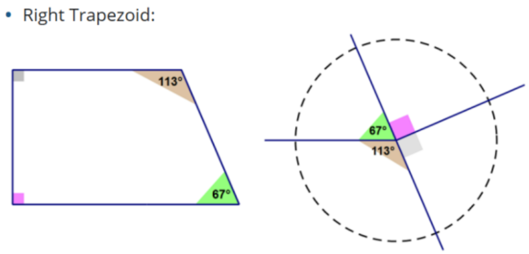
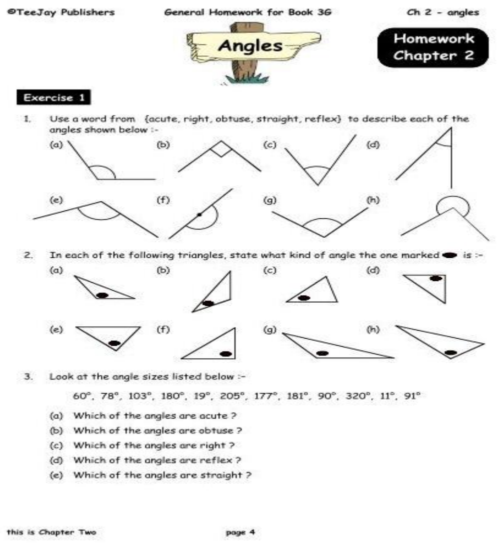
Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
	 Math 8 Practice 6.1 **Classify angles.** Name ______ Date: ______ Block: ____ Write if angles are complementary, supplementary, or adjacent. Find the value of x in each figure. 1. ______, x = 2. ______, x = 3. ______, x = 4. ______, x = 5. ______, x = 6. ______, x = 7. ______, x = 8. ______, x = 9. ______, x = 10. Find the measure of angles 1, 2, and 3. Explain your reasoning. 11. Name the angles: a) Vertical: ______ and ______ b) Complementary: ∠c and ______ c) Supplementary: ∠c and ______ d) All adjacent: ______ e) Find values of all angles , if angle c is 30°: ______ Retrieved from https://www.liveworksheets.com/sites/default/files/styles/worksheet/public/def_files/2021/4/5/104051456131607534/104051456131607534001.jpg?itok=wutC4kIG **Checklist** Learners will carry out self-assessment as to how well they understood the concept and how well they were able to calculate missing angles based on angle relationships .	[Drawing Angles Using a Protractor]() Have learners measure the angles of convex quadrilaterals, such as a dart shape, and calculate the sum of their interior angles. As they measure different quadrilaterals, guide them to observe that the total always equals 360°. This can be further demonstrated by removing the vertices of a quadrilateral and rearranging them into a circle to illustrate the concept visually. - Parallelogram:  - Square: 

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
	 Retrieved from https://i.pinimg.com/originals/ab/38/8a/ab388ae9891c76d2d9897458e7203280.jpg **Product (Naming angles) : to determine learners ability to identify angles and their measurements** Learners will be given a worksheet to complete on identifying the types of angles	 Instruct learners to measure the exterior angles of different quadrilaterals and assist them in recognizing that the sum of an interior angle and its corresponding exterior angle always equals 180°. Have learners measure the angles in a rotation, both clockwise and counter clockwise (see E1.4). As they rotate an object 270° and 90°, either by hand or using technology, discuss why the images end up at the same coordinates. Have learners measure the interior angles of various polygons, including those found in everyday life, and determine the sum of their angles. Discuss any similarities and differences. Have learners create a design featuring a variety of angles, including at least one right angle, one acute angle, one obtuse angle, and one reflex angle. They should measure each angle and record the measurements on a separate sheet of paper before exchanging their designs with a partner. Assist learners in measuring the angles in each other's designs and verifying any measurements that differ. If discrepancies are within a few degrees, emphasize that measurements are often approximate and can be affected by the tools used. For larger

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
	 ©TeeJay Publishers General Homework for Book 3G Ch 2 - angles Angles Homework Chapter 2 Exercise 1 1. Use a word from {acute, right, obtuse, straight, reflex} to describe each of the angles shown below :- (a) (b) (c) (d) (e) (f) (g) (h) 2. In each of the following triangles, state what kind of angle the one marked ● is :- (a) (b) (c) (d) (e) (f) (g) (h) 3. Look at the angle sizes listed below :- 60°, 78°, 103°, 180°, 19°, 205°, 177°, 181°, 90°, 320°, 11°, 91° (a) Which of the angles are acute ? (b) Which of the angles are obtuse ? (c) Which of the angles are right ? (d) Which of the angles are reflex ? (e) Which of the angles are straight ? this is Chapter Two page 4 **Retrieved from** https://img.yumpu.com/38210969/1/500x640/3g-hwork-ch-02pdf-mathsrevisioncom.jpg **Checklist:** Learners are correctly able to identify the various types of angles. - All - Some - None **<u>Guess my Angle</u> Game/Observation - learners will be made to review the video below then teacher**	discrepancies, encourage learners to review the scale they applied or the accuracy of their calculations for determining the reflex angle. 1. Have learners draw the four quadrants of a coordinate plane on a grid or graph paper. Have them use a scale of 1 and place the positive integers to the right of the origin on the x-axis and above the origin on the y-axis and the negative integers to the left of the origin on the x-axis and below the origin on the y-axis. Have them plot various points as a horizontal movement to the right or left of the origin and then a vertical movement up or down. For example, to plot the point (−3, 4), move 3 to the left from the origin and then up 4. Next, have them draw an image on the grid using the point that they have just plotted. Then, have them write down the coordinates for their image and exchange them with a partner to re-draw the image. 2. Have learners play strategic guessing games with a partner. Behind a screen, each should plot secret objects, such as a treasure chest, along points in all four quadrants of a coordinate plane. They will take turns guessing the location of their partner's hidden objects, using positive and negative coordinates to identify locations. Each partner will need a blank coordinate plane to keep track of their guesses. The game ends when one person has found all the objects hidden by their partner.

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<tr><th>Specific Curriculum Outcomes</th><th>Inclusive Assessment Strategies</th><th>Inclusive Learning Strategies</th></tr>
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will demonstrate how to draw angles using a straightedge and protractor

Learners will be given paper, ruler and protractor. A list of angle measurements will be presented to the entire class (projected or written). Learners will select one of the measures and use the steps to draw their chosen angle (angle size must not be written).

Learners will then show their drawing to peers who will then try to guess which angle was constructed. Peers who drew an angle with the same measurement will be asked to also present their drawing. If there appears to be any difference in the appearance of the angles they will be asked to measure each one using their protractor and discussions will be held to determine what the error was.

Checklist

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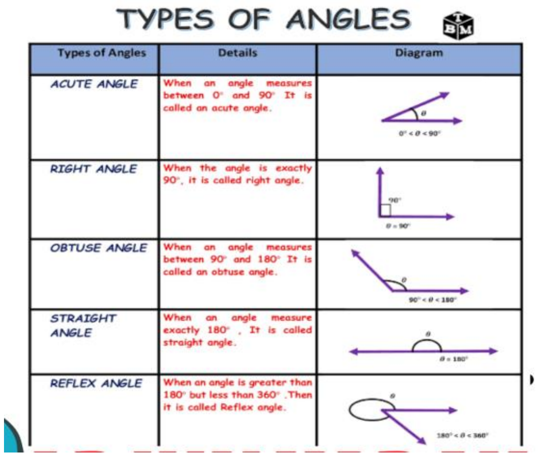
3. Provide learners with the four quadrants of a coordinate plane with points plotted on it. Ask them to describe the movement to get from one point to the next. Guide learners to use appropriate signs to indicate the movements; for example, 3→ or right 3 and -3↑ or up 3.

Discussion (outcome 4)
Provide opportunity for learners to discuss the types of angles and the characteristics of each type of angle



TYPES OF ANGLES

<table>
<tr><th>Types of Angles</th><th>Details</th><th>Diagram</th></tr>
<tr><td>ACUTE ANGLE</td><td>When an angle measures between 0° and 90° It is called an acute angle.</td><td>$0° < \theta < 90°$</td></tr>
<tr><td>RIGHT ANGLE</td><td>When the angle is exactly 90°, it is called right angle.</td><td>90°
$\theta = 90°$</td></tr>
<tr><td>OBTUSE ANGLE</td><td>When an angle measures between 90° and 180° It is called an obtuse angle.</td><td>θ
$90° < \theta < 180°$</td></tr>
<tr><td>STRAIGHT ANGLE</td><td>When an angle measure exactly 180° . It is called straight angle.</td><td>θ
$\theta = 180°$</td></tr>
<tr><td>REFLEX ANGLE</td><td>When an angle is greater than 180° but less than 360° .Then it is called Reflex angle.</td><td>θ
$180° < \theta < 360°$</td></tr>
</table>

Retrieved from https://teachmint.storage.googleapis.com/public/755496959/StudyMaterial/7cbf7bee-12f4-43fb-a737-018172dbbd32.png

</td>
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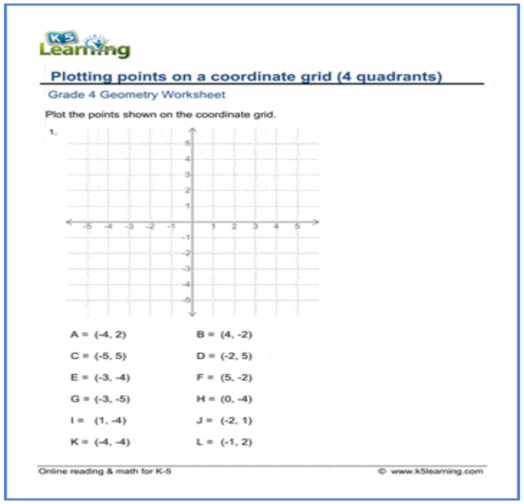
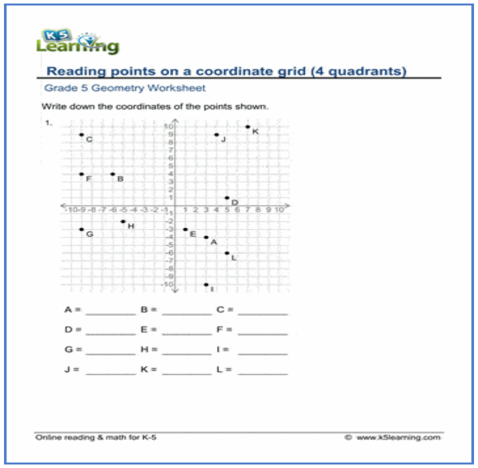
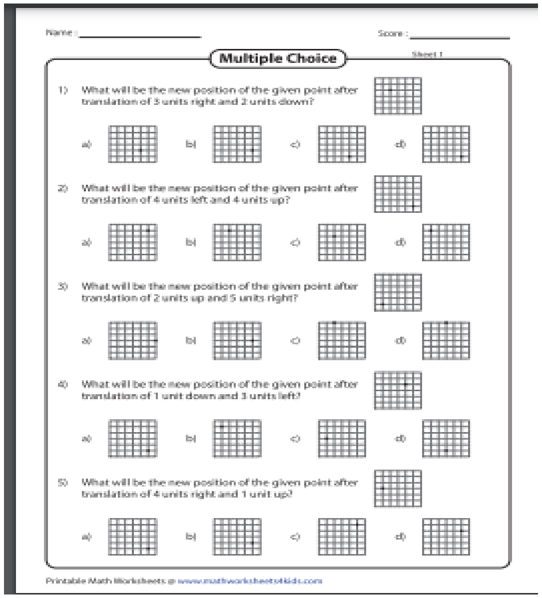
Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
	Observation and Product: to determine whether learners can identify points and plot given points on four quadrants of a Cartesian plane. Plotting Points on a Coordinate Plane | All 4 Quadrants Coordinate Plane Song | The 6th Grade Graphing Video That Spits Actual Fire Have learners recall what axis are and how points are written based on x and y axis. Observe learners as they complete a given worksheet on plotting points on a coordinate plane  K5 Learning Plotting points on a coordinate grid (4 quadrants) Grade 4 Geometry Worksheet Plot the points shown on the coordinate grid. 1. A = (-4, 2) B = (4, -2) C = (-5, 5) D = (-2, 5) E = (-3, -4) F = (5, -2) G = (-3, -5) H = (0, -4) I = (1, -4) J = (-2, 1) K = (-4, -4) L = (-1, 2) Online reading & math for K-5 © www.k5learning.com Retrieved from https://worksheets.clipart-library.com/images/grade-4-geometry-plotting-points-coordinate-grid-4q.gif	***Guided Learning with technology*** Provide opportunities for learners to digitally create different angles. Allows learners to practice drawing different types of angles: 1. Using protractors 2. Using the software ***https://www.geogebra.org/m/crgtvj5s*** ***Video Assisted Learning (outcome 13 ,14)*** Provides learners with the opportunity to review the concept of translating points and to take necessary and relevant notes in their book. Translating points on a coordinate plane Ask learners to explain what translation means in their own words. Use a whiteboard or digital tool to demonstrate how to translate a point. For example, show how the point. (2, 3) translates to (4, 5) by moving it right two units and up two units. Guided Practice: Provide a few examples for learners to practice with you, encouraging them to visualize the movement on the coordinate plane

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
	Checklist learners are able to plot points on a coordinate plane - All - Some - None **Discussion : to determine whether learners can plot points on a plane and read the coordinates (outcomes 9, 10)** A coordinate grid will be presented to learners (printed copies/ projected).  K5 Learning Reading points on a coordinate grid (4 quadrants) Grade 5 Geometry Worksheet Write down the coordinates of the points shown. 1. A = ______ B = ______ C = ______ D = ______ E = ______ F = ______ G = ______ H = ______ I = ______ J = ______ K = ______ L = ______ Online reading & math for K-5 © www.k5learning.com Retrieved from https://www.k5learning.com/worksheets/math/grade-5-geometry-reading-points-coordinate-grid-4q.gif	Learners will be given a worksheet and be asked to select the correct position that would be created based on a given translation.  Name : ______ Score : ______ Multiple Choice Sheet 1 1) What will be the new position of the given point after translation of 3 units right and 2 units down? a) b) c) d) 2) What will be the new position of the given point after translation of 4 units left and 4 units up? a) b) c) d) 3) What will be the new position of the given point after translation of 2 units up and 5 units right? a) b) c) d) 4) What will be the new position of the given point after translation of 1 unit down and 3 units left? a) b) c) d) 5) What will be the new position of the given point after translation of 4 units right and 1 unit up? a) b) c) d) Printable Math Worksheets @ www.mathworksheets4kids.com Retrieved from https://www.mathworksheets4kids.com/transformation/translation/mcq-point1.pdf

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
	learners will be called on randomly and asked to identify a named or numbered point and to then read out the coordinates for the point **Checklist** Learners were able to accurately identify and read points on a Cartesian plane. **yes/ no** **Product -Group Work/ Project - to allow learners to perform translations** **(*outcome 13 and 14*)** Translating Points Each group will be given a sheet of graph paper on which they will draw a Cartesian plane and plot four points on (1 in each quadrant). Learners will name each of their points and state their coordinates They will then create a translation of each point which they will name appropriately. They should be able to provide their coordinates and explain their translation. Learners will be invited to present their plane and explain their plotting and translations with their peers. **Checklist:** 1.Learners are correctly able to correctly plot and name points on Cartesian plane	

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
	- All - Some - None 2. Learners were able to accurately calculate translations - yes - somewhat - no 3. Learners were able to correctly plot and label transformed points - All - Some - None	

Additional Resources and Materials

https://wmznlejcfq.s3-ap-southeast-1.amazonaws.com/media/worksheets/pairs-of-angles-worksheet-1.pdf

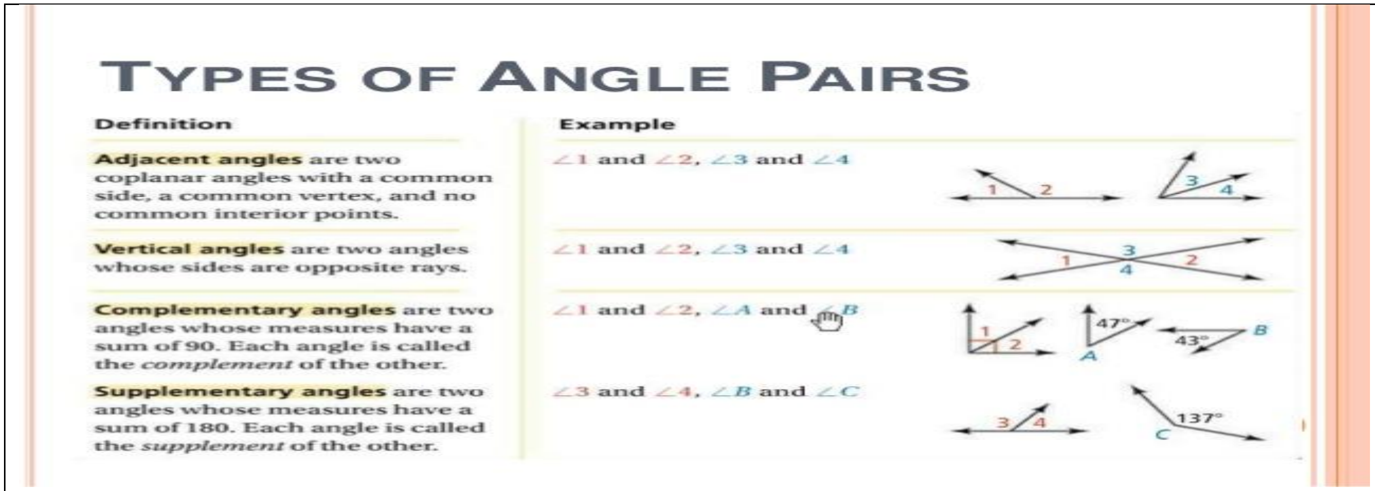
https://www.ufacademy.org/wp-content/uploads/Complementary-and-Supplementary-Angles.pdf

https://www.sac.edu/learnerservices/EOPS/Documents/Math%20Study%20Guide%204%20-%20Geometry.pdf

https://www.mathantics.com/files/pdfs/Worksheets_GraphingOnTheCoordinatePlane.pdf

https://www.fusd.net/site/handlers/filedownload.ashx?moduleinstanceid=12431&dataid=15409&FileName=Graphing%20Points%20and%20Identifying%20Shapes.pdf

Additional Useful Content Knowledge for the Teacher:

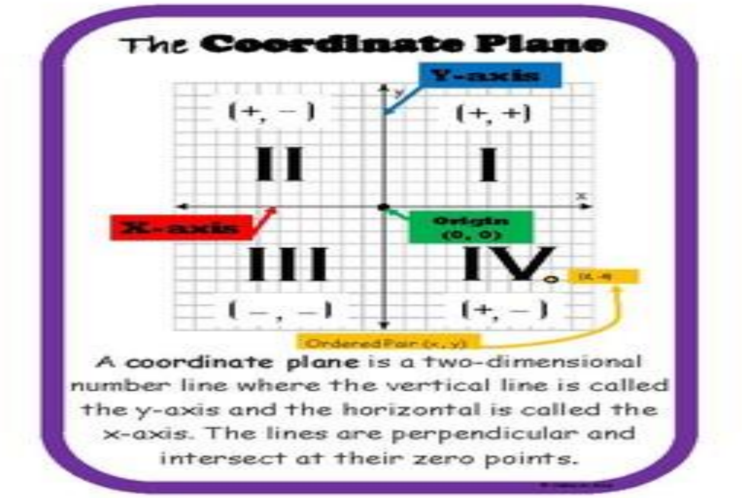


TYPES OF ANGLE PAIRS

Definition	Example
Adjacent angles are two coplanar angles with a common side, a common vertex, and no common interior points.	∠1 and ∠2, ∠3 and ∠4
Vertical angles are two angles whose sides are opposite rays.	∠1 and ∠2, ∠3 and ∠4
Complementary angles are two angles whose measures have a sum of 90. Each angle is called the *complement* of the other.	∠1 and ∠2, ∠A and ∠B
Supplementary angles are two angles whose measures have a sum of 180. Each angle is called the *supplement* of the other.	∠3 and ∠4, ∠B and ∠C

Retrieved from https://msroymaths7.weebly.com/uploads/6/0/1/2/60121593/1084793_orig.jpg

- Complementary angles are formed when the total of two angles equals 90 degrees. These angles don't have to be close to each other, but their sum should equal 90 degrees.
- A linear pair must be supplementary, but a supplementary angle does not have to be. In either case, the sum of the angles should always be 180°.
- If we have an x° angle, we can subtract it from 90° to obtain a complementary angle.
- If we have an x° angle, we can subtract it from 180° to find a supplementary angle.



A coordinate plane is a two-dimensional number line where the vertical line is called the y-axis and the horizontal is called the x-axis. The lines are perpendicular and intersect at their zero points.

https://ecdn.teacherspayteachers.com/thumbitem/Coordinate-Plane-Poster-5910582-1597408107/original-5910582-1.jpg

Translation is the movement of a horizontal, vertical or both movement of a point or shape of a graph or figure. A figure can be translated left, right, up or down. It is a slide and does not change the size or orientation of a shape.

Any translation in the coordinate plane affects the coordinates of any point in the same way. In particular, it will add or subtract constant values from the x- and y-coordinates; these can be thought of as the horizontal and vertical displacement of the translation respectively.

In general, if a translation in the coordinate plane has a horizontal displacement of a units and a vertical displacement of b units, then (x,y) will be mapped to $(x+a,y+b)$.We write this as $(x,y)\rightarrow(x+a,y+b)$.The signs of a and b tell us the direction of the displacement.

Example: If we want to translate D (−3; 2) four units right. We move 4 from −3 and stop at (1; 2). The new position is the image of D. We write D'(1; 2) and we say "D prime".

- Note: The x-coordinate changed because we translated D horizontally (i.e. left or right).

- If we translate a point up or down (vertically) the y-coordinate will change but the x-coordinate will not

Opportunities for Subject Integration:

The calculation of complementary, supplementary and vertical angles is helpful for working with Algebra as well as Trigonometry.

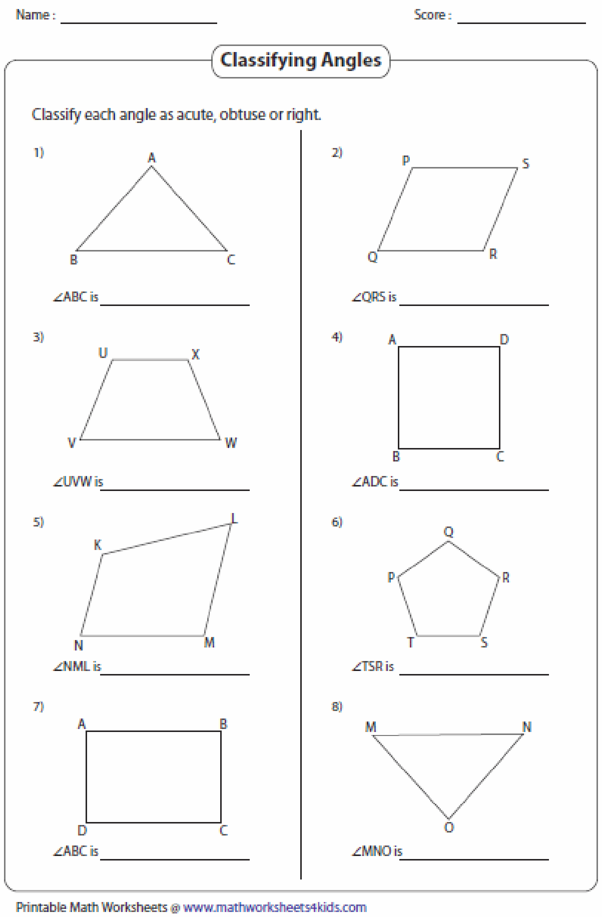
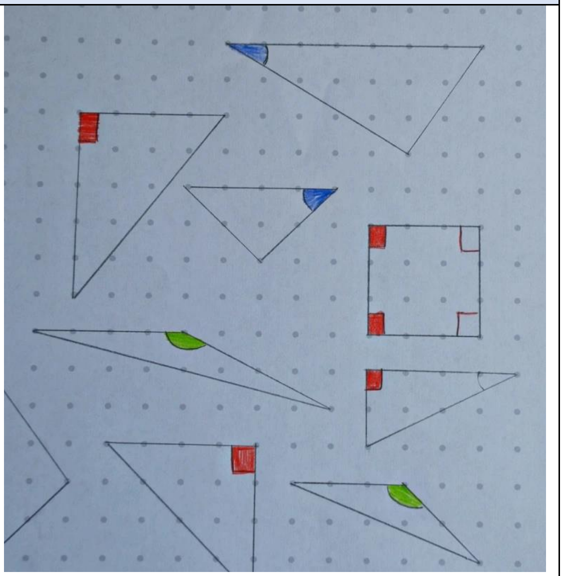
Working with a coordinate system and Cartesian plane can be used to determine the position of any item from its starting point (origin) to its current location. Plotting points on a graph is a valuable skill in coordinate geometry, serving as a gateway to understanding more complex concepts like distance, slope, and equations of lines.

Essential Learning Outcome: G3.2. Composing, Decomposing and Transforming Shapes - Deconstructing Shapes

Grade Level Expectations and/or Focus Questions:

- Learners will be able to deconstruct shapes to identify and describe angles.

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
Learners are expected to: **Knowledge** 1. Identify individual angles from complex shapes 2. Describe the types and properties of angles they identify within shapes. **Skills** 3. Interpret the structure of shapes by deconstructing them into their angle components.	**Entrance Slip - to determine whether learners can represent angles using concrete materials** In pairs learners will use given material e.g. Match sticks and playdough to construct shapes using different types of angles E.g. : Reflex, Obtuse , Acute, Right Learners are able to represent angles accurately **Yes / With Guidance/No** **Product- to determine the ability of learners to identify angles within shapes.**	***Visual learning*** Provide opportunities for learners to identify angles with further accuracy. 1. Have learners view videos on shapes and angles. Review what angles are https://youtu.be/FehnQ_2SgsM?feature=shared 2. Guide learners into reviewing the different types of angles using video- Types of Angles https://youtu.be/UsE1hu-q0Cs?feature=shared 3. Invite learners to colour code like angles within a shapes

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
	 Name : ____________ Score : ____________ Classifying Angles Classify each angle as acute, obtuse or right. 1) ∠ABC is ____________ 2) ∠QRS is ____________ 3) ∠UVW is ____________ 4) ∠ADC is ____________ 5) ∠NML is ____________ 6) ∠TSR is ____________ 7) ∠ABC is ____________ 8) ∠MNO is ____________ Printable Math Worksheets @ www.mathworksheets4kids.com Retrieved from https://i.pinimg.com/originals/56/4a/63/564a63a6407db1a0c91292de1bb0b8a7.png	 **Retrieved from** **https://ofamilyblog.files.wordpress.com/2018/05/colouring-in-different-types-of-angles-different-colours.jpg?w=768** Invite learners to identify angles based on given properties Give learners a stack of old magazines or printed images. Ask them to cut out shapes (both regular and irregular) and glue them onto a large board or flat surface.

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
		Next, have learners identify the angles within each shape by drawing lines to connect the vertices. Then, have learners deconstruct the shapes built and label the angles

Additional Resources and Materials

Classifying Angles: https://www.k5learning.com/worksheets/math/grade-3-geometry-classifying-angles-b.pdf

Angles Worksheet 1: https://www.letsplaymaths.com/Class-6-Angle-Worksheet-1.html

Angles worksheet: https://www.letsplaymaths.com/Class-6-Angle-Worksheet-1.html

Additional Useful Content Knowledge for the Teacher:

Composing And Decomposing *:* https://www.tutoringhour.com/worksheets/2d-shapes/composing-decomposing/
Types of Angles: https://www.cemc.uwaterloo.ca/events/mathcircles/2018-19/Winter/Junior6_Feb12.pdf
Angles an Introduction - https://byjus.com/maths/angles/

Opportunities for Subject Integration:

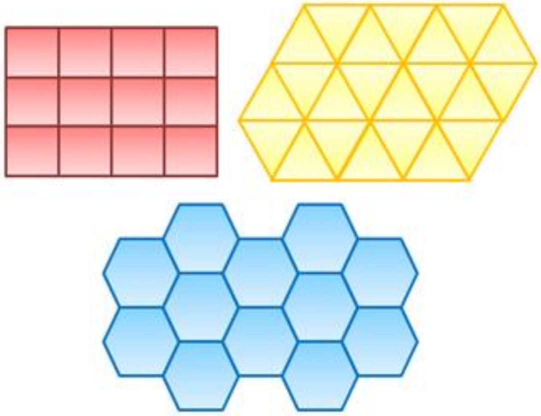
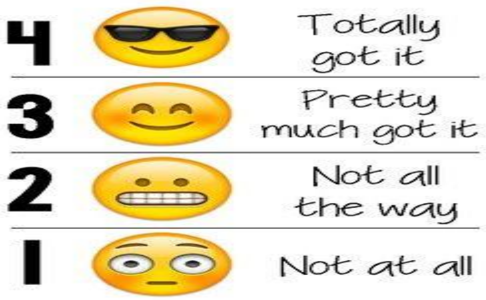
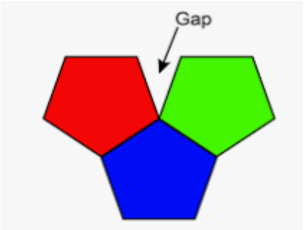
Geometry - Tessellations
Patterns and Relations
Time - Angles formed from hand on clock

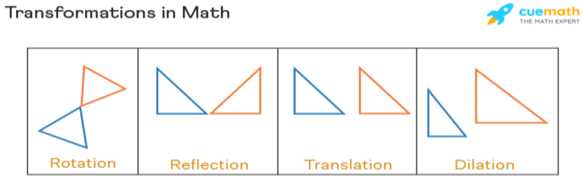
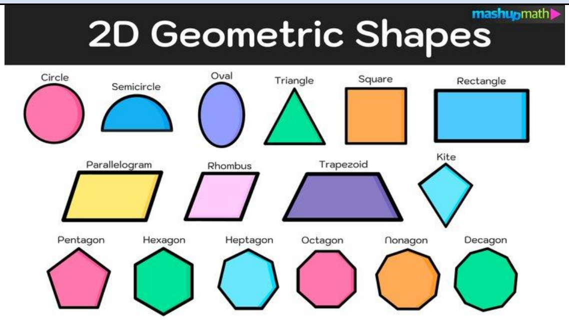
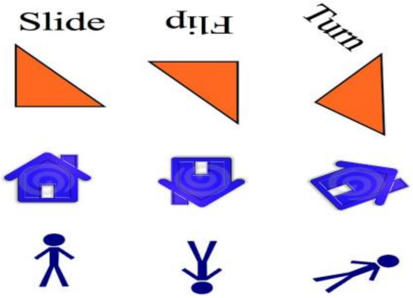
Essential Learning Outcome: G3.3. Composing, Decomposing and Transforming Shapes - Transforming Shapes

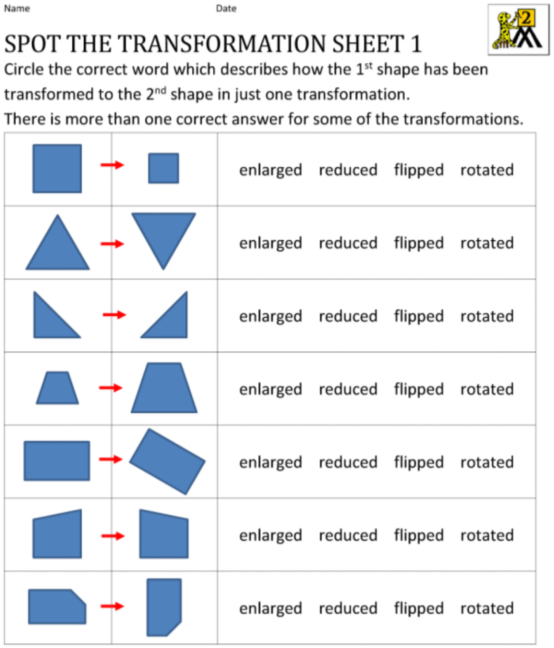
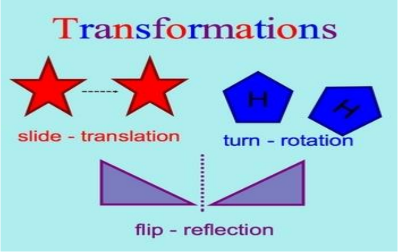
Grade Level Expectations and/or Focus Questions:

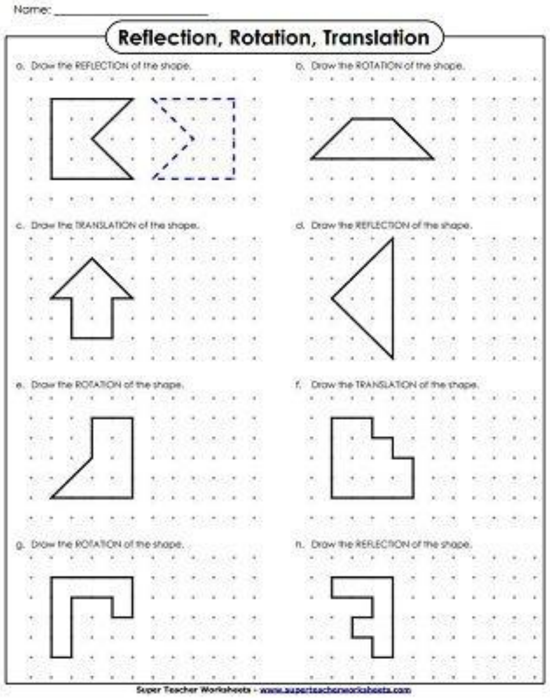
- Recognize, name and create tessellations
- Recognize, name, perform and draw transformations (reflections, rotations, translations and dilations).
- Predict, describe, compare and verify the image of a shape under a given transformation.
- Compare the image to the pre-image for a transformation.
- Justify why an image is (or is not) the result of a particular transformation.
- Determine the composition of two or more transformations.
- Determine the inverse of a given transformation.

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
Learners are expected to: **Knowledge** 1. Recognize shapes that can tessellate 2. Describe the characteristics of translations, reflections, and rotations, 3. Translate shapes on a grid, moving them a specified distance in a given direction while maintaining their orientation. 4. Execute reflections across a specified line (e.g., x-axis, y-axis, or a line of symmetry) and describe the changes in orientation and position of the reflected shape.	**Observation:** Observe group discussions and participation during activities Evaluate learners' tessellation patterns based on creativity, understanding of tessellation, and the use of identified shapes. **Product/Self-Assessment: to determine learners' ability to create a tessellation** 1. Learners are shown the following video to help them to create unique patterns. <u>Tessellation art.</u> 2. Learners are also presented with tessellation patterns and are led to create one	***Discovery/Manipulation.*** Provide opportunities for learners to manipulate shapes in forming tessellations. 1. Show learners images of tessellating patterns found in nature (honeycombs, turtle shells) and art (M.C. Escher). Ask learners what they notice about these patterns. Lead them into a discussion about the characteristics of shapes that tessellate. Explain tessellation and the concept of repeating shapes that cover a plane without gaps or overlaps. Regular polygons: triangles, squares, and hexagons tessellate. Some irregular shapes can tessellate if they fit together without gaps.. Use the projector to display different shapes and demonstrate whether they tessellate or not. Distribute cut-out shapes (triangles, squares, hexagons, and various irregular shapes). In small groups, have learners experiment

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
5. Carry out rotations of shapes around a fixed point on a grid by given angles (90°, 180°, 270°, or 360°) and identify how the rotation affects the shape's position **Skills** 6. Demonstrate the ability to create tessellating patterns using identified shapes 7. Apply combinations of at least two transformations (translations, reflections, and rotations) on shapes and record the final position and orientation of the transformed shapes on a grid. 8. Compare the results of different combinations of transformations on the same shape to analyse how the order of transformations affects the final outcome. 9. Predict a shape's resulting position and orientation after performing a specified combination of transformations and justify their predictions using geometric reasoning. 10. Test predictions by performing the transformations on a grid and evaluate the accuracy of the predictions, discussing any discrepancies.	 Retrieved from http://mathandmultimedia.com/tag/tessellation-patterns/ **Checklist**  4 Totally got it 3 Pretty much got it 2 Not all the way 1 Not at all Retrieved from https://i.pinimg.com/originals/ab/38/8a/ab388ae9891c76d2d9897458e7203280.jpg	with different shapes to see if they can create tessellations on their paper. Learners should trace around the shapes to create a pattern and identify which shapes tessellate. Invite each learner to choose one or two shapes they identified as tessellating. Using grid paper, learners will create a tessellating pattern using their chosen shapes. They can colour in the shapes to enhance their designs. Encourage creativity while ensuring they maintain the tessellation rules. Invite learners to display their tessellating patterns and explain their choices of shapes.  ***Retrieved from*** ***https://mammothmemory.net/maths/geometry/tessellation/what-regular-shapes-can-be-tessellated-and-how-can-you-tell.html***

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
Values 11. Use transform to create different tessellation design .	**Observation: to determine leaner's ability to identify the type of transformation of any shape** Learners will be presented with the video to grasp the concept of the 4 different types of transformations) then complete the exercises. The Four Transformations In Maths  Retrieved from https://www.cuemath.com/geometry/transformations/	 Retrieved from https://www.mashupmath.com/geometric-shapes ***Class Discussion /Practice(Outcome*** Provide learners with the opportunity to draw transformations a shown below 1. Discuss and describe using the terms flip, slide, turn enlarge and reduce (dilations) in discussion.  Retrieved form https://s-media-cache-ak0.pinimg.com/736x/52/a0/18/52a0181df96a4fcb97f1c2c1f35e181d.jpg

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
	1.  Name Date SPOT THE TRANSFORMATION SHEET 1 Circle the correct word which describes how the 1st shape has been transformed to the 2nd shape in just one transformation. There is more than one correct answer for some of the transformations. enlarged reduced flipped rotated enlarged reduced flipped rotated enlarged reduced flipped rotated enlarged reduced flipped rotated enlarged reduced flipped rotated enlarged reduced flipped rotated enlarged reduced flipped rotated Retrieved from https://www.2nd-grade-math-salamanders.com/image-files/geometry-worksheets-printable-spot-the-transformation-1.gif 2. Complete the worksheet below.**(Page 1 Only)** https://www.mayfieldschools.org/Downloads/translation_reflection_rotation_-_homework.pdf	 Retrieved from https://s3-us-west-2.amazonaws.com/quizizz-destination-bkt/80fcc9dd-dcb0-4aa4-ad0d-c393bf6fad2c.jpg?w=90&h=90 2. Present the worksheet below.

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
		 Name: ________________ Reflection, Rotation, Translation a. Draw the REFLECTION of the shape. b. Draw the ROTATION of the shape. c. Draw the TRANSLATION of the shape. d. Draw the REFLECTION of the shape. e. Draw the ROTATION of the shape. f. Draw the TRANSLATION of the shape. g. Draw the ROTATION of the shape. h. Draw the REFLECTION of the shape. Super Teacher Worksheets - www.superteacherworksheets.com Retrieved from https://worksheets.clipart-library.com/worksheet/geometry-transformations-worksheet-answers-31.html Instruct learners to create a triangle on grid paper, labelling the vertices as A, B, and C. Using tracing paper, they should explore various combinations of translations and reflections (e.g., moving right by 10 units and then reflecting horizontally) to produce new triangles. They will label these new triangles with prime notation (A’, B’, C’), double prime (A”, B”, C”), triple prime (A’”, B’”, C’”), etc., to differentiate them from the original triangle.

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
		Learners should confirm that the original and the translated triangles are congruent and investigate whether changing the order of transformations affects the outcome. This process can be repeated with different polygons. Have learners sketch a triangle on grid paper and label its vertices D, E, and F. They will rotate the triangle around one of its vertices by angles of 90°, 180°, 270°, and 360°, both clockwise and counter clockwise, using tracing paper. Learners should label the rotated triangles with prime notation (D', E', F'), double prime (D'', E'', F''), triple prime (D''', E''', F'''), and so on, to identify the variations. They will compare the triangles and discuss the similarities and differences among them. Ask learners to draw a triangle on grid paper and label the vertices J, K, and L. They will perform rotations of 90°, 180°, 270°, and 360° around a point located outside the triangle, using tracing paper as a guide. They should label these rotated triangles with prime notation (J', K', L'), double prime (J'', K'', L''), triple prime (J''', K''', L'''), and so forth. Learners will compare the triangles and discuss what remains the same and what changes. Have learners create a triangle on grid paper, labelling its vertices P, Q, and R. They will rotate the triangle about a point inside the triangle by 90°, 180°, 270°, and 360°, both clockwise and counter clockwise, using tracing paper. They should label the resulting triangles with prime notation (P', Q', R'), double prime (P'', Q'', R''), triple prime (P''', Q''', R'''), etc.

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
		Learners will compare the triangles and describe their similarities and differences. Encourage learners to use a dynamic geometry software to construct a polygon, rotate it by 270°, and measure the angles and distances involved. They can move a vertex or the rotation point and observe the effects of these changes (i.e., what varies and what remains constant). Learners should compare the effects of clockwise and counter clockwise rotations (positive vs. negative angles) and discuss why a 270° clockwise rotation is equivalent to a 90° counter clockwise rotation. They will carry out successive transformations and have classmates identify the transformations that occurred. Ask learners to perform a series of transformations that include a translation, reflection, and rotation (up to 360°) on a grid, making a mental note of each transformation. They will share their original shape and transformed image with a partner, who will identify and explain the transformation process. This procedure can be repeated with two successive transformations, allowing another partner to analyse and explain what occurred. Challenge learners to predict the outcome of two combined transformations that result in a single transformation, and have them test their predictions using dynamic geometry software.

Additional Resources and Materials

https://www.youtube.com/watch?v=ihh3GRI4gAY

https://www.2nd-grade-math-salamanders.com/transformation-geometry.html

https://mathbitsnotebook.com/Geometry/Transformations/TRCompositeTransformations.html

https://study.com/learn/lesson/transformation-math-types-examples.html

Additional Useful Content Knowledge for the Teacher:

https://study.com/learn/lesson/reflections-math-geometry.html
https://mathsux.org/2020/08/12/reflections/

Transformations on a shape result in changes to its position or its size. As a shape transforms, its vertices (points on a grid) move. The transformation describes the results of the movement. This explains how transformations involve location and movement. Transformations can be combined or composed. Sometimes a single transformation can be created by combining multiple transformations. A translation involves distance and direction. Every point on the original shape "slides" the same distance and direction to create a translated image. This combination of distance and direction is called the translation vector. For example, on a grid, a vector could describe that each point moving "5 units right and 2 units up". It is a mathematical convention that the horizontal distance (x) be given first, followed by the vertical distance (y). A reflection involves a line of reflection that acts like a mirror. Every point on the original shape is "flipped" across the line of reflection to create a reflected image. Every point on the original image is the same distance from the line of reflection as the corresponding point on the reflected image. Reflections are symmetrical. A rotation involves a centre of rotation and an angle of rotation. Every point on the original shape turns around the centre of rotation by the same specified angle. Any point on the original is the same distance to the centre of rotation as the corresponding point on the reflected image. Because a rotation is a turn, and 360° produces a full turn, a counter clockwise rotation of 270° produces the same result as a clockwise rotation of 90°. Convention has it that a positive angle describes a counter clockwise turn and a negative angle describes a clockwise turn, based on the numbering system of the Cartesian plane (see E1.3).

Note

At this grade level, learners can express the translation vector using arrows; for example, $\binom{}{}$.Dynamic geometry applications are recommended to support learners to understand how transformations behave, either as a single transformation, or a combination of transformations.

Opportunities for Subject Integration:

- Lines of Symmetry
- Tessellations
- Patterns
- Statistics - Pictographs

Measurement

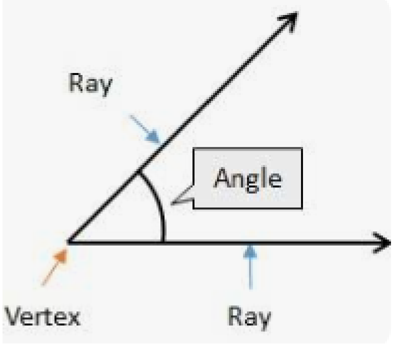
Introduction to Strand: Measurement is basically quantifying something. Measurement can be used to determine the height, weight, capacity, temperature, distance, conversion or the amount of a certain thing, especially in comparison to something else (also known as a standard). In measurement, the numerical value is called a unit and various instruments are used to "measure" any type of quantity. Measurement is extremely essential in everyday transactions and interactions such as:

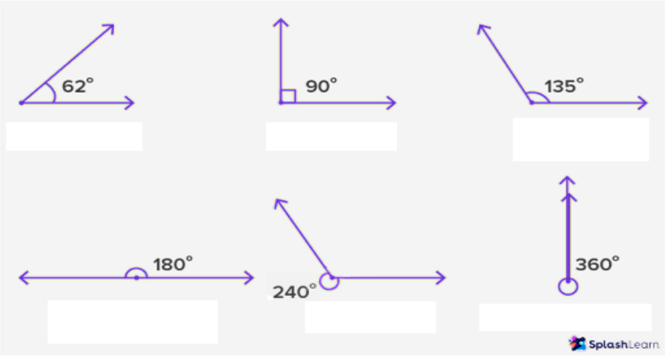
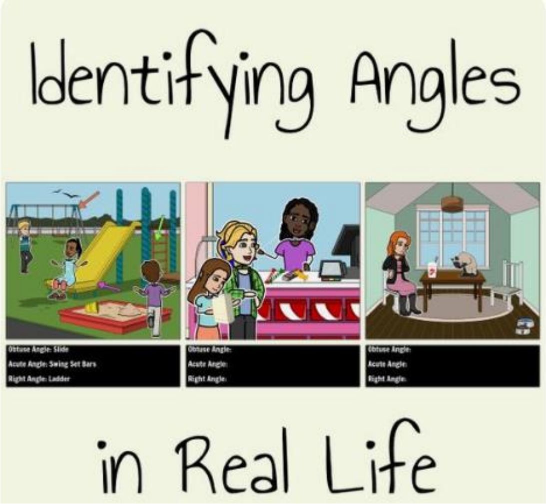
- In the construction of buildings (dimensions)
- In commerce, buying and selling goods
- Preparing food, we measure the ingredients in specific quantities
- Conducting scientific experiments
- Completing tasks, we need to know time
- Getting to places, we need to calculate distance
- For formulating medicines and treating patients

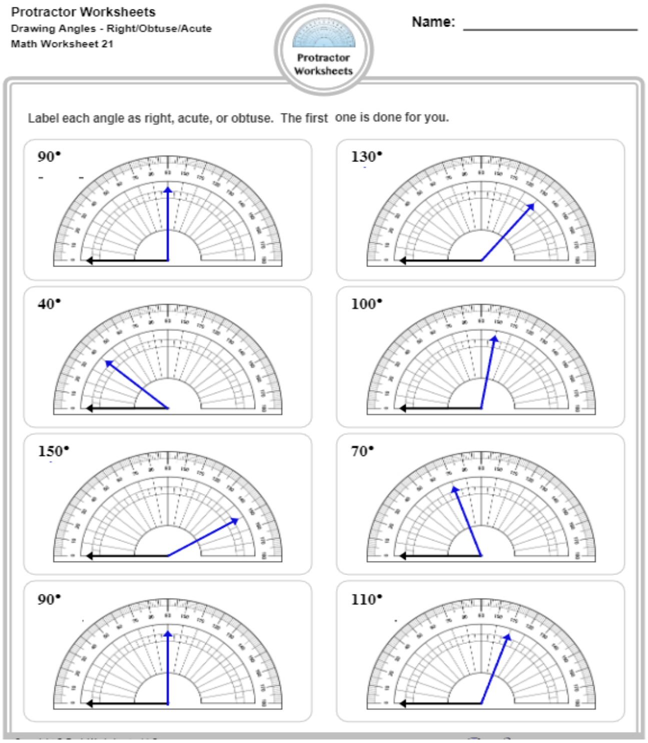
Essential Learning Outcome M1.1 : Understanding What and How We Measure - Developing an Understanding of Measurable Attributes

Grade Level Expectations and/or Focus Questions:

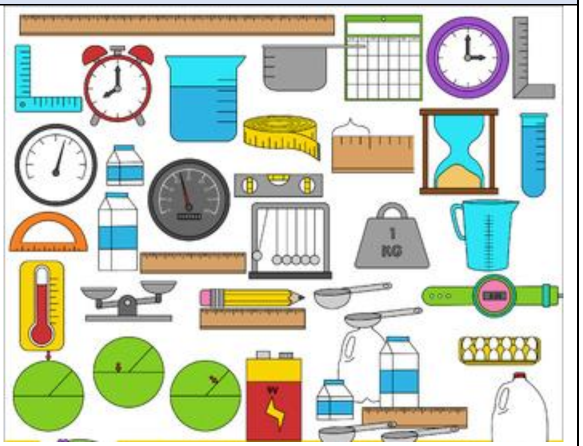
- Develop and apply language relating to measurement terms (surface area, money, time and angles).
- Recognize angles as geometric shapes that are formed wherever two rays share a common endpoint.
- Recognize measurement as the number that indicates a comparison between the attribute of the object being measured and the same attribute of a given unit of measure.
- Use the concept of measuring to fill, cover, or match the attribute being measured with a unit of measure for that attribute.
- Measure length, area, mass, and capacity using the appropriate metric units.
- Solve problems that require converting smaller units to larger ones and vice versa.

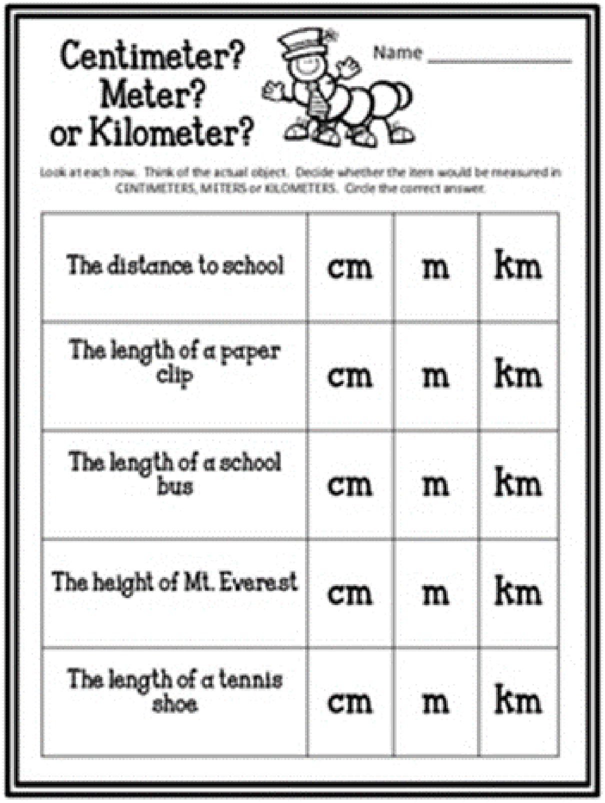
Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
Learners are expected to: **Knowledge** 1. Use and apply language relating to measurement terms (surface area, money, time and angles). 2. Explain how an angle is formed **Skills** 3. Use a protractor to measure and construct angles up to 360°. 4. State the relationship between angles that are measured clockwise and those that are measured counter clockwise 5. Find a comparison between the attributes of the object being measured. 6. Use appropriate metric units to Measure length, area, mass, and capacity. 7. Solve problems that require converting the length, area, mass, and capacity of smaller units to larger ones and vice versa. **Values** 8. Create a simple word problem which incorporates the conversion of two units studied	**Conversation - To determine whether learners are able to develop and define terminology relating to measurement and appropriately apply them to the respective measurement unit.** - Explain how to find the area of a square - Explain what the numbers represent on a these analogue clock - Describe these angles  Protractor Worksheets Measuring Angles - Hands of a Clock Math Worksheet 17 Name: ______________ Measure the angles formed by the hands of the clock using a 180° protractor. The first one is done for you. 90 degrees Copyright © DadsWorksheets, LLC These Math Worksheets are provided for personal, homeschool or classroom use. Retrieved from https://www.dadsworksheets.com/worksheets/protractor/protractor-measuring-angles-hands-of-a-clock-v1.html	***Conceptual Understanding*** Provide opportunities for learners to develop language skills and enhance understanding of measurement terms for example: Invite learners to create a word web for each concept below, with associated words or phrases. e.g. <u>surface area</u> (squared, multiply, length, width, centimetre, meter, kilometre) <u>money</u> (cost/ price, change. profit. loss, hire purchase) <u>time</u> (duration, minutes, seconds, hour, time elapse, o'clock, am, pm) <u>angles</u> (degree, acute, obtuse, right, straight, reflex, rays, ***Conceptual Understanding*** Demonstrate using how an angle is formed using a diagram 

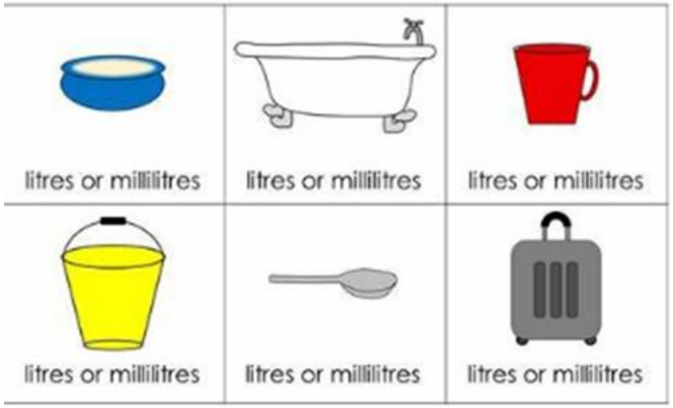
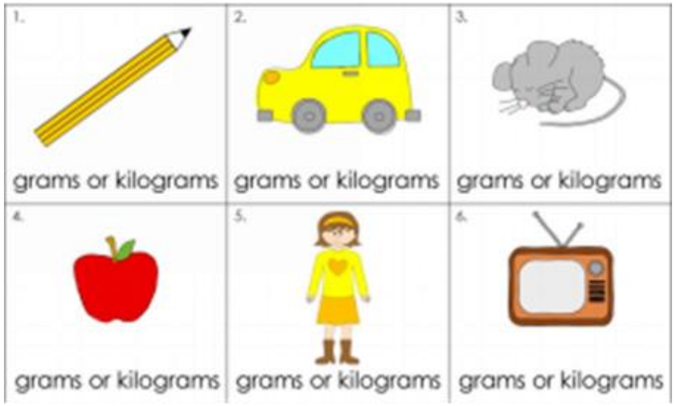
Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
	Checklist Learners are able to describe at least 1 application of measurement **yes/no** Learners can name at least 4/6 angles correctly **yes/no** **Observation: To determine whether learners are able to name and define a specific angle by looking at a picture** Name each angle and state reason for name.  Retrieved form https://www.splashlearn.com/math-vocabulary/geometry/angle **Checklist** Learners can name at least 4/6 angles correctly **yes/no** Learners can state at least 1 valid reason for 4/6 angles correctly named	**Retrieved from https://www.mathematics-monster.com/glossary/angle.html** ***Guided Discovery Learning*** Provide learners with the opportunity to demonstrate their ability to identify angles (as geometric shapes) in their environment (e.g., classroom, outdoors, at home) from different perspectives. For example:  Retrieved from https://www.pinterest.com/pin/120612096261882165/ 1. Present the video: Retrieved from https://youtu.be/9RTM418qfdI

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
	yes/no **Product:** To determine learners' ability to use a protractor to measure angles.  Protractor Worksheets Drawing Angles - Right/Obtuse/Acute Math Worksheet 21 Protractor Worksheets Name: ______________ Label each angle as right, acute, or obtuse. The first one is done for you. Retrieved from https://www.dadsworksheets.com/worksheets/protractor/protractor-drawing-angles-right-obtuse-acute-v1.html **Checklist**	2. Generate a discussion of other places in the classroom and school environment they can locate other angles as well as name the angles identified. 3. Invite learners to work in groups to draw pictures and mark off locations of angles. ***(promote angles from both left and right vertices)*** ***Video Assisted learning*** Provide opportunities to develop learners' skills in comparing attributes of objects being measured For example: Present the videos as shared below that allow learners to use suitable terms to describe and compare everyday objects based on attributes, given a scenario. Retrieved from https://youtu.be/rhBrte0NV0U Retrieved form https://youtu.be/kC_xVobgfw4 **Measurable attributes refer to characteristics of objects that can be measured, which may include length, weight, mass, volume, capacity, or area.**

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
	Learners can name at least ⅝ angles accurately (+/- 2) in each worksheet **yes/no** **Observation/Group work: To determine whether learners can compare attributes of objects being measured.** Invite learners to work in groups to compare various objects and assign attributes to them Learners will be provided with pairs of objects, as well as worksheets. They will use their knowledge of the different measurement attributes to compare them.  Name: Describing Objects Let's test your knowledge about the attributes of an object. Color the box blue if it best describes the picture. 	When comparing two objects with a measurable attribute in common, we can determine which object has "more of" or "less of" the attribute. ***Tactile Learning*** Provide opportunities to develop learners' skills in measuring length mass or capacity For example: Demonstrate use of measurement tools in measuring different things (objects, liquids, etc.) and learners will follow suit using tools provided for them.

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
	Retrieved from https://kidskonnect.com/math/describing-and-comparing-measurable-attributes/ **Checklist** Learners can state at least one (1) comparison between each pair **yes/somewhat/no** **Self - Assessment: To determine whether learners can apply units of length, mass, and capacity**	 Retrieved from https://ecdn.teacherspayteachers.com/thumbitem/Measurement-A-Z-Clip-Art-11116466-1708381098/original-11116466-1.jpg Present demonstration video: Retrieved from https://youtu.be/jNFevCpkRoY Measuring length | Mass | Capacity | Units of measure | Maths with Nile (youtube.com) Learners are placed in groups and given measurement tools.

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
	Learners complete three (3) worksheets such as those below by selecting the most appropriate unit.  **Centimeter? Meter? or Kilometer?** Name ____________ Look at each row. Think of the actual object. Decide whether the item would be measured in CENTIMETERS, METERS or KILOMETERS. Circle the correct answer. The distance to school — cm — m — km The length of a paper clip — cm — m — km The length of a school bus — cm — m — km The height of Mt. Everest — cm — m — km The length of a tennis shoe — cm — m — km Retrieved from https://ecdn.teacherspayteachers.com/thumbitem/Metric-Measurement-Centimeter-Meter-Kilometer-Worksheets-2510284-1500876148/original-2510284-4.jpg	 **MEASURING TOOLS MIX-UP** Circle the tools that are used to measure **length**. Retrieved from https://www.kidsacademy.mobi/printables/measuring-tools-mixup/ Learners use appropriate units on the tools to measure objects. e.g. meter rule and foot rule to measure lengths of yarn or measuring cylinder to measure capacity of various bottles of liquids. Learners will be expected to use appropriate units to measure, be it ml or l as it pertains to the liquid.

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
	 Retrieved from https://th.bing.com/th/id/OIP.PSnMvr-c6IWjQpqm6lXwUgAAAA?rs=1&pid=ImgDetMain  	***Demonstration /Group work*** Demonstrate converting units in length, mass, time and capacity using videos provided. Retrieved from https://www.youtube.com/shorts/dFIFPv7SiFs?feature=share Retrieved from [Weight – Units and their conversion | Mathematics Grade 4 | Periwinkle]() Retrieved from [Converting Units of Time (Hours to Minutes)]() Retrieved from [Converting Lengths (Meters and Kilometres)]() Retrieved from [Capacity Units And Their Conversion | Maths For Kids | Periwinkle]() Place learners in groups to observe their peers convert units of measurement before attempting to do conversions independently. Learners then move from group to group to teach the conversion and learn from the experts of the other conversions from members of the other group. This is done until all members of each group have visited each other's group and grasp the understanding of all the conversions.

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
	Retrieved from https://files.pango.education/resource-thumbnails/medium/dfe51994-3841-4758-b920-5e5ffacb4668. **Checklist** I can determine at least 4/6 appropriate units in EACH worksheet **yes/no** **Peer Assessment: To determine whether learners can correctly convert the different units of measurement (e.g., mm to cm to m to km)** ***(Outcomes 6, 7).*** Learners will complete conversion worksheets and one word problem involving conversion. Invite learners to correct the work of their peers. e.g. Note: 1 kilometre (km) = 1,000 meter (m) 1 m = 100 centimetres (cm) = 1,000 millimetres (mm) Convert to the units shown: 1. 73 m =___ mm 2. 45 m = ____mm 3. 20 m = ____cm 4. 49 m = ____cm 5. 67 m = _____cm 6. 89 m = ___cm 7. 13 m = mm 8. 17 cm = mm	

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
	9. 22 m = cm 10. 31 m = cm Retrieved from https://www.k5learning.com/free-math-worksheets/fifth-grade-5/measurement/metric-units-length-km-m-cm-mm Sara bought 500 ml of mustard oil, 250 ml of coconut oil and 2 l of refined oil. What is the total quantity of the 3 oils together in ml? **Checklist** Learner can accurately convert at least 6/10 units yes/no Learner can solve word problem yes/no	

Additional Resources and Materials

- **Protractor**
- **Computer**
- **Projector**
- https://www.dadsworksheets.com/worksheets/protractor.html

Additional Useful Content Knowledge for the Teacher:

https://www.splashlearn.com/math-vocabulary/geometry/angle-measure

https://thirdspacelearning.com/us/math-resources/topic-guides/measurement-and-data/units-of-measurement/

Opportunities for Subject Integration:
Calculating Area and Perimeter
Converting time hrs to minutes and vice versa
Geometry - Types of angles
Number Concepts - Rounding off, fractions, decimals

Essential Learning Outcome: M1.2. Understanding What and How We Measure - Comparing and Ordering Based on Measurable Attributes

Grade Level Expectations and/or Focus Questions:

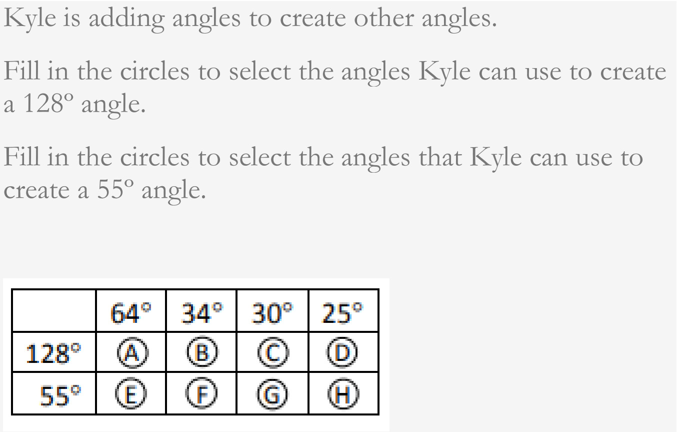
1. Recognize angle measure as additive.
2. Understand the role of estimation including personal referents and benchmarks
3. Choose objects that model the attribute being measured, and the sequence of self, non-standard and standard units in comparing and ordering measurements.

<table>
<tr><th>Specific Curriculum Outcomes</th><th>Inclusive Assessment Strategies</th><th>Inclusive Learning Strategies</th></tr>
<tr>
<td>Learners are expected to:

Skills
1. Solve addition and subtraction problems to find unknown angles on a diagram in real world and mathematical problems, e.g., by using an equation with a symbol for the unknown angle measure.

2. Identifying non-standard measuring unit when measuring angles

3. Identify a referent for a given common non-standard measurement unit</td>
<td>Product: to determine learners’ ability to calculate an unknown part of an angle, given the total degree of the angle. (Outcome 1)

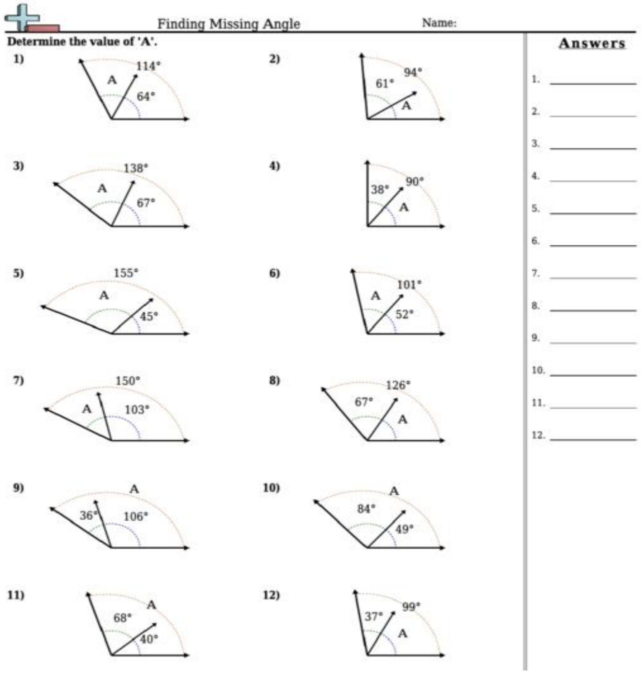
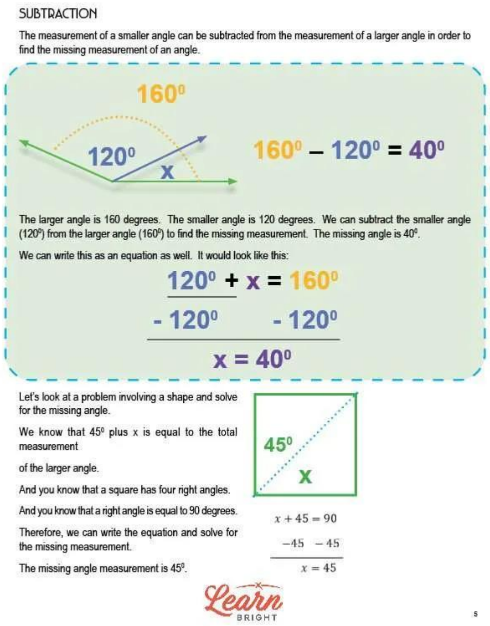

Kyle is adding angles to create other angles.

Fill in the circles to select the angles Kyle can use to create a 128° angle.

Fill in the circles to select the angles that Kyle can use to create a 55° angle.

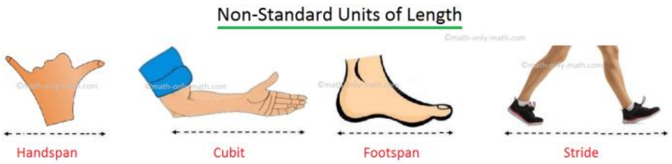
<table>
<tr><th></th><th>64°</th><th>34°</th><th>30°</th><th>25°</th></tr>
<tr><td>128°</td><td>Ⓐ</td><td>Ⓑ</td><td>Ⓒ</td><td>Ⓓ</td></tr>
<tr><td>55°</td><td>Ⓔ</td><td>Ⓕ</td><td>Ⓖ</td><td>Ⓗ</td></tr>
</table>
</td>
<td><i>Discovery Learning (Outcome 1)</i>
Provide opportunity to determine missing angles by deduction (using rules) from examples not drawn to scale.

The teacher draws angles and divides them into two or more parts, not drawn to scale with sizes of each part included. The learners are then asked to calculate the total size of the angle.</td>
</tr>
</table>

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
4. Estimate measures with different attributes using non-standard units and personal referents **Values** 5. Use personal referents to compare and order measurements of objects in the environment	 Finding Missing Angle Name: Determine the value of 'A'. 1) 114° A 64° 2) 94° 61° A 3) 138° A 67° 4) 90° 38° A 5) 155° A 45° 6) 101° A 52° 7) 150° A 103° 8) 126° 67° A 9) A 36° 106° 10) A 84° 49° 11) A 68° 40° 12) 99° 37° A Answers 1. ____ 2. ____ 3. ____ 4. ____ 5. ____ 6. ____ 7. ____ 8. ____ 9. ____ 10. ____ 11. ____ 12. ____ Retrieved from https://th.bing.com/th/id/OIP.G86LR3VTOzEydnBRAHESQgAAAA?rs=1&pid=ImgDetMain **Checklist** Learners can determine at latest 5 /9 missing angles yes/no	 SUBTRACTION The measurement of a smaller angle can be subtracted from the measurement of a larger angle in order to find the missing measurement of an angle. 160^0 120^0 x $160^0 - 120^0 = 40^0$ The larger angle is 160 degrees. The smaller angle is 120 degrees. We can subtract the smaller angle (120^0) from the larger angle (160^0) to find the missing measurement. The missing angle is 40^0. We can write this as an equation as well. It would look like this: $120^0 + x = 160^0$ $- 120^0 \quad - 120^0$ $x = 40^0$ Let's look at a problem involving a shape and solve for the missing angle. We know that 45^0 plus x is equal to the total measurement of the larger angle. And you know that a square has four right angles. And you know that a right angle is equal to 90 degrees. Therefore, we can write the equation and solve for the missing measurement. The missing angle measurement is 45^0. 45^0 x $x + 45 = 90$ $-45 \quad -45$ $x = 45$ Learn BRIGHT 5 Retrieved by https://learnbright.org/lessons/math/angles-and-equations/

<table>
<tr><th>Specific Curriculum Outcomes</th><th>Inclusive Assessment Strategies</th><th>Inclusive Learning Strategies</th></tr>
<tr><td></td><td>

Self-Assessment: Learners will explore the concept of measurements using non-standard units.(Outcome 2)



Retrieved from https://www.math-only-math.com/measurement-of-length.html

Using either hand span or ‘feet’. Each learner will measure a suitable object of your choice for example their desk.

Checklist
I can measure using non-standard measuring units.

- Yes
- No
- Somewhat

Observation : learners will determine what can be measured using these items

1. Learners are given a variety of items, such as paper clips, coins, beans etc.

<table>
<tr><th>Given</th><th>Non-Standard unit</th></tr>
<tr><td>1. bed sheet</td><td></td></tr>
<tr><td>2. needle</td><td></td></tr>
<tr><td>3. human height</td><td></td></tr>
<tr><td>4. iPhone</td><td></td></tr>
</table>

Retrieved from https://brainly.in/question/48547864

</td><td>

Video Assisted Learning (VAL)/ guided discovery/Independent Learning

Provide learners with the opportunity to use real-life situations, and discussions to apply the usage of non-standard measuring units

1. Present video and engage learners in a discussion on non-standard measuring units.
For example, can you think of any other object not mentioned in the video that can be used as a non-standard unit of measurement? What can it be used to measure?

[Non Standard Units of Measuring](#)

2. Invite learners to complete the activity on the site from questions 3 - 12 after there is a review of the content presented on the page as a whole class discussion.

Retrieved from ***https://www.math-only-math.com/measurement-of-length.html***

3. Provide items to measure and they state the best non-standard unit to use and also provide valid reasoning why.

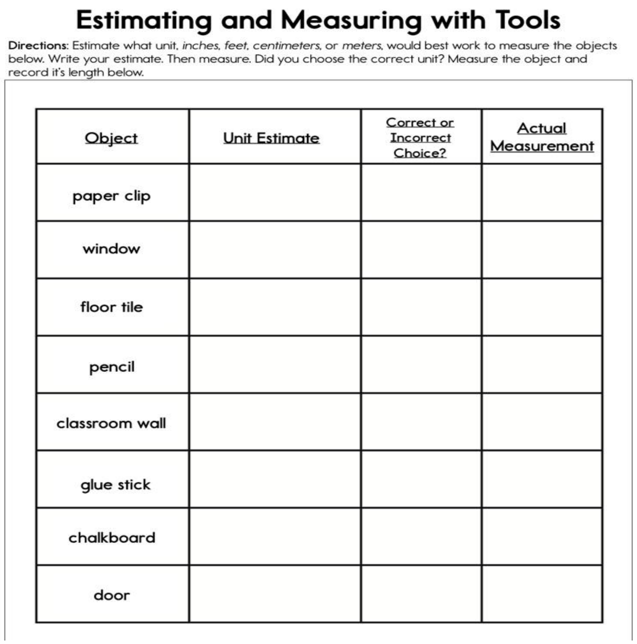
Example. What is the distance around the school building?

</td></tr>
</table>

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
	Checklist Learners can identify at least ¾ non-standard measuring units • Yes • No	Invite learners to demonstrate as in the case of strides, hand spans etc. Lead learners to deduce that strides for example will take a shorter time to measure, as it is a bit more practical than using hand spans or foot spans. ***Guided Discovery using critical thinking*** Provide learners with the opportunity to use various items as non-standard units of measurements. 1. Invite learners to collect items shown below, then identify what each item can be used to measure.  Retrieved from https://physicsgoeasy.com/non-standard-units-of-measurement/ 2. Invite learners to complete the worksheet below.

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies

Product: to determine learners' ability to estimate using non-standard units



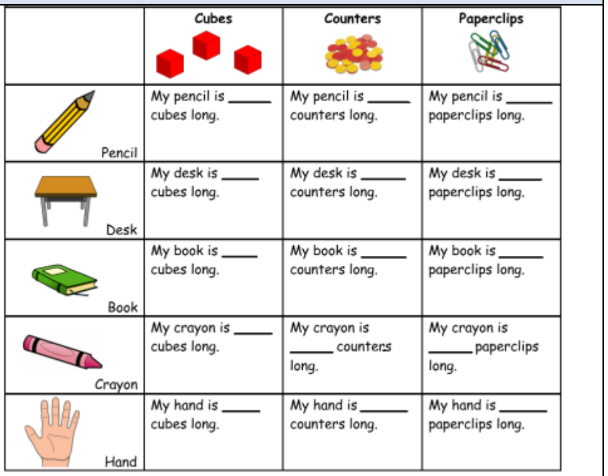
Estimating and Measuring with Tools

Directions: Estimate what unit, *inches, feet, centimeters,* or *meters*, would best work to measure the objects below. Write your estimate. Then measure. Did you choose the correct unit? Measure the object and record it's length below.

Object	Unit Estimate	Correct or Incorrect Choice?	Actual Measurement
paper clip			
window			
floor tile			
pencil			
classroom wall			
glue stick			
chalkboard			
door			

Retrieved from https://www.havefunteaching.com/resource/subject/math/measurement/estimating-and-measuring-with-tools-worksheet/

(Adapt worksheet to allow learners to use centimetres and metres only)



	Cubes	Counters	Paperclips
Pencil	My pencil is ____ cubes long.	My pencil is ____ counters long.	My pencil is ____ paperclips long.
Desk	My desk is ____ cubes long.	My desk is ____ counters long.	My desk is ____ paperclips long.
Book	My book is ____ cubes long.	My book is ____ counters long.	My book is ____ paperclips long.
Crayon	My crayon is ____ cubes long.	My crayon is ____ counters long.	My crayon is ____ paperclips long.
Hand	My hand is ____ cubes long.	My hand is ____ counters long.	My hand is ____ paperclips long.

Retrieved from https://walshysclassroom.wordpress.com/wp-content/uploads/2017/04/nonstandard.png?w=447&h=373

Guided Discovery using critical

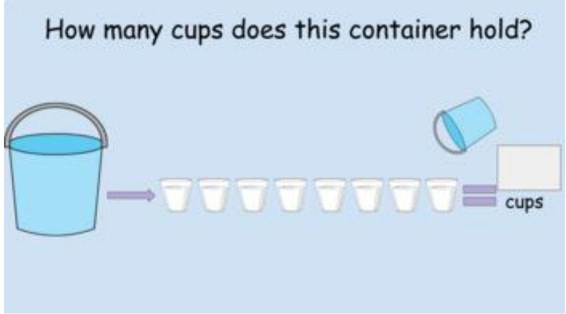
Provide learners with the opportunity to estimate using non-standard units. For example:

Invite learners to work in groups of two or three. Learners will construct a scale using a hanger, two paper cups, and a string.
learners will use simple objects as referents to measure the weight of common items found in the classroom

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
	Conversation- determine learners' ability to discuss relevant content in ordering the measurement of objects Learners are invited to work through the site provided and observe. Retrieved from https://scienceres-edcp-educ.sites.olt.ubc.ca/files/2015/01/elem_math_shape_volume.pdf **Learners will be engaged in discussions with teachers on measurement accuracy when using referents.** ■ Are "hands" or "feet" a good unit of measure? Why or why not? ■ There is a box of cookies that is three hands wide and another box of cookies that is five hands wide. The boxes are exactly the same size. How can this be? ■ Why do you think "inches" and "feet" (the kind of feet you find on a yardstick or tape measure) are better units of measure than "hands" and "feet"? Learners can use appropriate non-standard measuring units to model the attribute being measured ● Yes ● No ● Somewhat	 Retrieved from https://jdaniel4smom.com/2018/05/make-homemade-balance-scale-to-weigh-chickens-activity.html ***Use reflective observation and guided discovery*** Provide opportunity for learners to model attributes being measured for example: Use your hands and feet to measure the classroom furniture.

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
		■ First, have learners measure all the classroom objects (the height of a desk, the width of a door frame) ■ Next, take your turn (teacher), measuring all the same objects using your hands or feet. ■ Together, find the difference of each measurement set by subtracting the number of "hands" or "feet" that the learners measured from the number of "hands" or "feet" that the teacher measured. Since children and adults don't have the same size hands, the measurements will be very different! ***Discovery using Guided/Independent Learning)*** 1. Invite learners to use the manipulatives to find the distance around the desk as well as the area. The lesson should not be time constraint but to develop mastery. Learners use cubes to measure the perimeter of the desk surface in front of them.

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
		  Retrieved from Google Images Invite learners to bring items from home, such as a large and small coke bottle, as well as small and large bottles of water. Learners will determine how much of the small bottle fills the large one and vice versa.   Retrieved from Google Images

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
		 Retrieved from Google Images

Additional Resources and Materials

https://www.varsitytutors.com/common_core_4th_grade_math-help/recognize-angle-measure-as-additive-ccss-math-content-4-md-c-7

https://us.sofatutor.com/math/videos/additive-angles-2

https://www.commoncoresheets.com/angles-worksheets?filter_by_grade=7

Text, worksheets, www.splashlearn.com

Protractor
https://mathsframe.co.uk/en/resources/category/234/year-6-block-d-estimate-angles-and-use-a-protractor-to-measure-and-draw-them-on-their-own-and-in-shapes-calculate-angles-in-a-triangle-or-around-a-point

https://quizizz.com/en/measurement-and-weight-worksheets-class-1

Additional Useful Content Knowledge for the Teacher:

Math Antics - Angle Basics
https://www.splashlearn.com/math-vocabulary/geometry/angle-measure

Additive angles - Part 1

Referents: A referent is an object that can be used to help estimate a measurement. Referents are used to estimate the length of an object in centimetres, meters, and millimetres

Nonstandard units of measurement are units of measurement that are not typically used, such as a pencil, an arm, a toothpick, or a shoe. We can use just about anything as a nonstandard unit of measurement

Opportunities for Subject Integration:
Statistics - Pictographs
Patterns and Relations
Geometry - Types of angles
Number Concepts - Rounding off, fractions, decimals

Essential Learning Outcome: M1.3. Understanding What and How We Measure - Developing and Applying Non-standard Units of Measure

Grade Level Expectations and/or Focus Questions:

- select and use appropriate non-standard measuring units including personal referents and benchmarks that model the attribute being measured

Specific Curriculum Outcomes

Learners are expected to:

Skills

1. Use non-standard to estimate the measure of objects

Knowledge

2. Identify a referent for a given common non-standard measurement unit

3. Estimate a non-standard measuring unit using personal referents

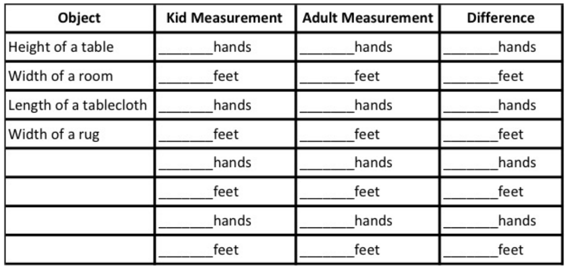
Values

4. Use personal referents to model attributes being measured

5. Use appropriate non-standard units to measure the attribute being modelled

Inclusive Assessment Strategies

Entrance Slip - to determine learners' level in competency using non-standard unit of measurement
Each learner will measure and record **only** the objects listed below using either hand span or 'feet'. Teacher will measure and learner will record difference.



Object	Kid Measurement	Adult Measurement	Difference
Height of a table	_____hands	_____hands	_____hands
Width of a room	_____feet	_____feet	_____feet
Length of a tablecloth	_____hands	_____hands	_____hands
Width of a rug	_____feet	_____feet	_____feet
	_____hands	_____hands	_____hands
	_____feet	_____feet	_____feet
	_____hands	_____hands	_____hands
	_____feet	_____feet	_____feet

Retrieved from Google Image

Checklist
Learner records a difference within 1 or 2 units for all objects

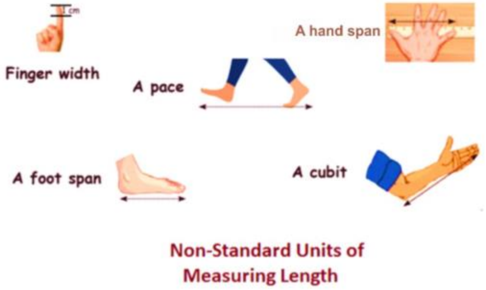
- Yes
- No

Inclusive Learning Strategies

Discovery using Guided/video assisted learning/Independent Learning

Provide opportunities to identify classroom objects best suited to be measured in non-standard units for example:

1. Invite learners to identify two items in the class that can be measured using each of these body parts.



Retrieved from Google Images

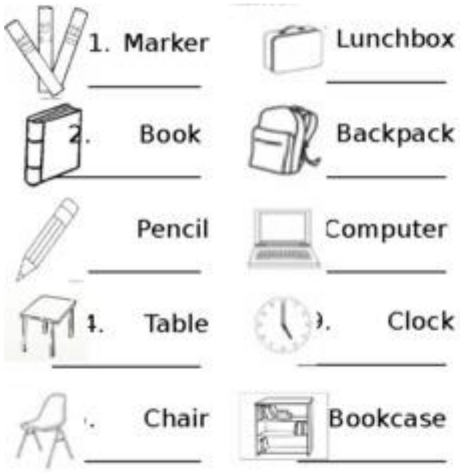
2. Present learners with the video and engage in a discussion with the teacher on non-standard measuring units.

Non-standard Units of Measuring

<table>
<tr><th>Specific Curriculum Outcomes</th><th>Inclusive Assessment Strategies</th><th>Inclusive Learning Strategies</th></tr>
<tr>
<td></td>
<td>

Conversation / Observation : to determine learners' ability to referents to estimate measurement

Learners will be given a variety of items, such as paper clips, coins, beans etc. Learners will determine what can be measured using these items.



Retrieved from [Google Images]

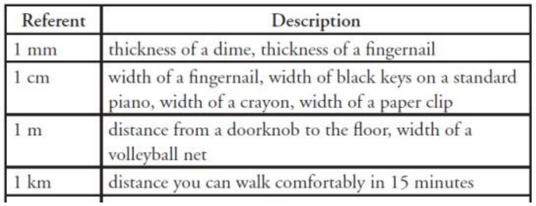
Learners can identify referent for a non-standard unit

- Yes
- No
- Somewhat

</td>
<td>

Use reflective observation and guided discovery

Provide opportunity for learners to use a referent guide to measure objects



<table>
<tr><th>Referent</th><th>Description</th></tr>
<tr><td>1 mm</td><td>thickness of a dime, thickness of a fingernail</td></tr>
<tr><td>1 cm</td><td>width of a fingernail, width of black keys on a standard piano, width of a crayon, width of a paper clip</td></tr>
<tr><td>1 m</td><td>distance from a doorknob to the floor, width of a volleyball net</td></tr>
<tr><td>1 km</td><td>distance you can walk comfortably in 15 minutes</td></tr>
</table>

[1.1B Referents]

For example if crayons are stacked on each other, how many crayons is the length of your pencil. If each crayon is 1cm in diameter, then how long is your pencil in cm,

Retrieved from https://boingboing.net/2017/07/25/this-pack-of-hamilton-cray.html

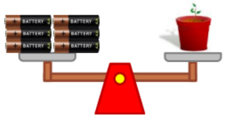
</td>
</tr>
</table>

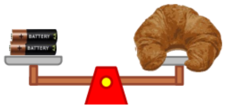
Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies

Observation : to determine learners' ability to compare non-standard units using other objects

1. In the flower shop, the owner does not have any batteries remaining but he has croissants.

Using the information below, how many croissants is equal to two flower pots?





Learners can identify a referent for a given common non-standard measurement unit

- Yes
- No

2. How many shirts can be hung on this wire?

Retrieved from Google Images

Learners can identify a referent for a given common non-standard measurement unit

- Yes
- No

Use reflective observation and guided discovery

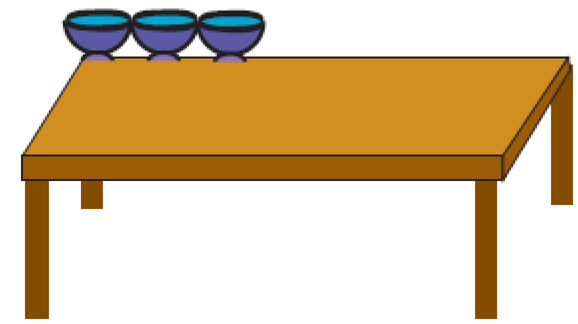
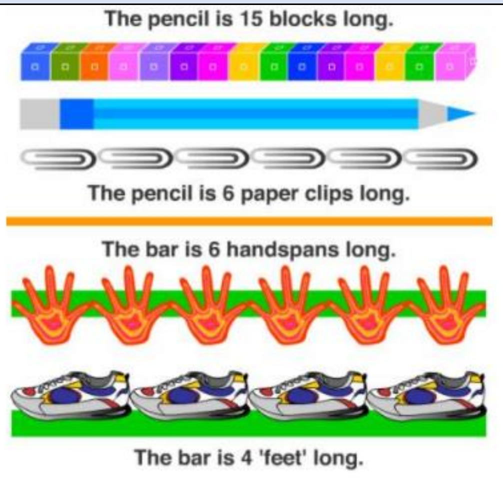
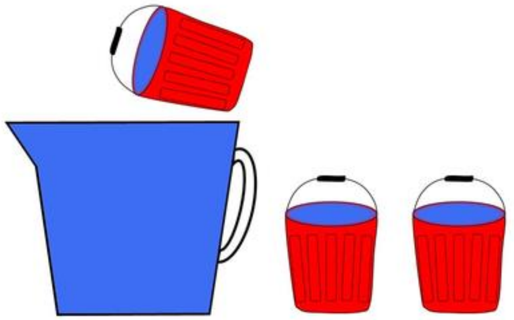
Provide opportunity for interaction with personal referents for example:

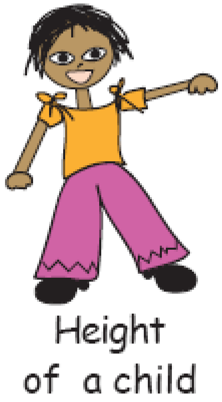
1. Give learners a chopstick of 5cm.

Find something in the classroom that is about*:*

Length (cm)	What is it?
5 centimeters	
10 centimeters	
1 centimeter	
7 centimeters	

2. Using paper clips and/ or blocks, measure the length of your pencil. Use the pencil to measure the distance from one end of the class to the next. The information collected is then converted into a number of blocks or paper clips equivalent to the measurement.

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
	3. How many cups can be placed in a line on this table?  Retrieved from [Google Images]() Learners can identify a referent for a given common non-standard measurement unit - Yes - No	 Retrieved from [Google Images]() 3. Use the small buckets from the class kitchen to fill a jug. How many buckets were needed?  Retrieved from [Google Images]()

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
	Product/Peer Assessment : to allow learners to use referents in a real- life situation Learners will work in pairs to dramatize the following for a week. One learner will pretend to be the patient and the other nurse. Learners will make records and discuss the methods used to arrive at the given answer at the end of the week. (chocolate syrup could be used as the medication The doctor prescribed 5 ml every 8 hrs for 5 days. One spoonful shown measures 5 ml. At the end of the 5 days how many spoons would the child have consumed and what is the remainder in terms of spoonful.  Retrieved from https://qualitymatters.usp.org/sites/default/files/blogs/content-images/Teaspoon-BlogArticle.jpg	***Practical Activity*** Provide opportunity for practical ways to model use of referents for example: Pair learners to measure each other's height using a hand span. Each learner will lean against a wall or an object while the other learners mark their height using chalk. Then, measure the height using a hand span.  Retrieved from [Google Images]() Record your findings and share with the class.

Additional Resources and Materials

Text, worksheets, www.splashlearn.com (teachers can adapt worksheet accordingly)

Additional Useful Content Knowledge for the Teacher:

Nonstandard units of measurement are units of measurement that are not typically used, such as a pencil, an arm, a toothpick, or a shoe. We can use just about anything as a nonstandard unit of measurement

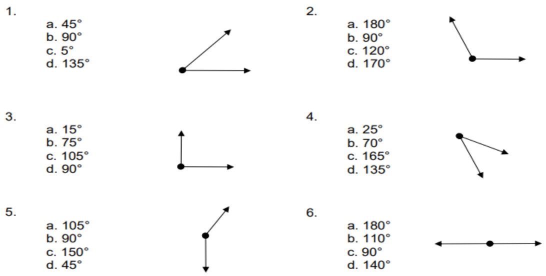
Opportunities for Subject Integration:

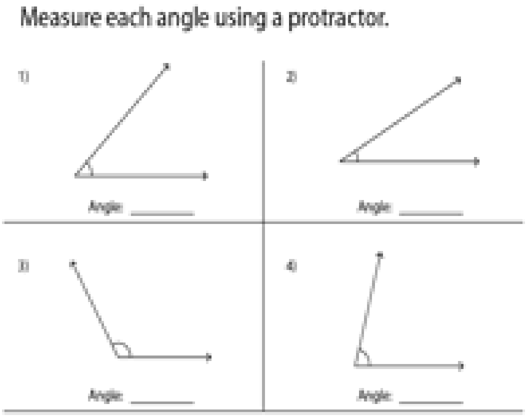
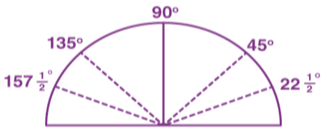
Operations- operations can be used during conversion by apply division and multiplication primarily

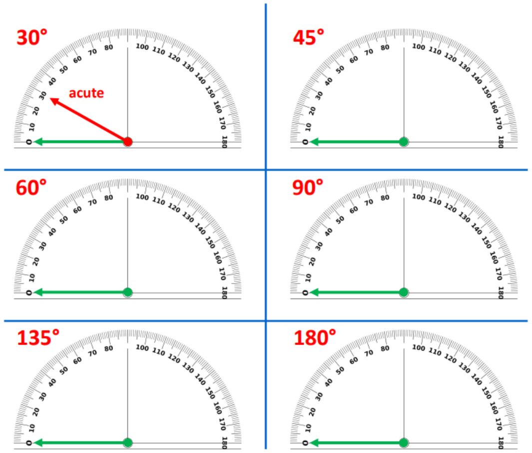
Essential Learning Outcome: M1.4. Understanding What and How We Measure - Developing and Applying Standard Units of Measure

Grade Level Expectations and/or Focus Questions:

- Measure angles in whole-number degrees using a protractor;
- Draw angles of specified measurement
- Convert among different-sized standard measurement units within a given measurement system (e.g., convert 5 cm to 0.05 m), and use these conversions in solving multi-step, real-world problems.

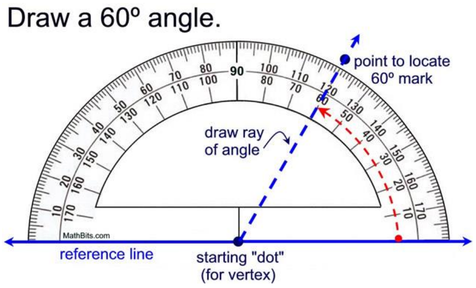
Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
Learners are expected to: **Skills** 1. Estimate the size of an angle 2. Measure angles in whole-number degrees using a protractor 3. Draw angles of specified measure 4. Convert among different-sized standard measurement units within a given measurement system (e.g., convert 5 cm to 0.05 m), 5. Use conversions of different-sized standard measurement units within a given measurement system to solve multi-step problems **Values** 6. Describe a problem/experience/scenario encountered that involves the multiple conversion of units.	**Entrance Slip- to determine learners' ability to estimate and measure angles** 1. Learners will work in groups of four to complete the form  Retrieved from https://www.k5learning.com/worksheets/math/grade-5-geometry-estimate-angles-a.pdf Learners are given a worksheet to complete.	***Revision using Practical Games and Technology)*** Provide opportunity for competition in reviewing measuring angles. The learner who gets the most correct wins. 1. Divide class into teams. Teams of 3 will take turns using their hands to represent angles. The other teams will guess the size of the angle. The team closest to the correct answer gets the points. If they are both correct, they both get the point. 2. Log into the given site independently. Follow the instructions of this interactive game [**Estimate Angles | Turtle Diary Quiz**]() ***Guided Discovery using critical thinking*** Provide alternate methods for estimating angles for example: **Measure Angles by Folding Paper**

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
	 Retrieved from https://encrypted-tbn0.gstatic.com/images?q=tbn:ANd9GcTgoDLd6iCgZcI46LDspqO54wdyhLRttwCNsg&s **Self-Assessment/Product - to determine learners' ability to mark of angles on a protractor** 1. Draw a second ray to create the angles shown. Label each angle as acute, obtuse, right or straight.	**Cut a paper in circular shape using a bangle or compass.** - Fold it once to get the shape of a semicircle. The straight edge of the semicircle formed shows the 180 degree angle. - Again fold it into equal half and mark the folded line. Now, mark 90 degrees in this fold. - Fold the 90 degrees into equal half, then we get an angle equal to 45 degrees. Now if we open the sheet to have the semi-circle shape, then the mark opposite to the 45 degrees, across 90 degrees, can be marked as 135 degrees (45 + 90 = 135). - Fold the 45 degrees mark, then we will get the angle equal to 22 ½ degrees and the angle on the left of 135 degrees will be (135 + 22 ½ = 157 ½ degrees).  Retrieved from https://cdn1.byjus.com/wp-content/uploads/2021/07/how-to-measure-angles-by-folding-paper.png ***Guided Discovery using video assisted learning)***

<table>
<tr><th>Specific Curriculum Outcomes</th><th>Inclusive Assessment Strategies</th><th>Inclusive Learning Strategies</th></tr>
<tr><td></td><td>

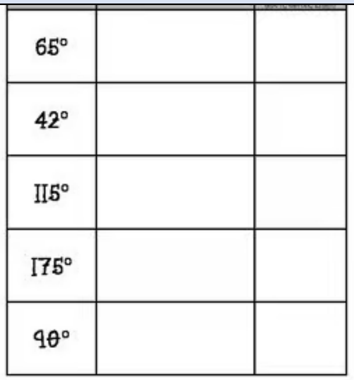
Retrieved from https://media.studyx.ai/us/6bad6d39/3879cc3a81374c7f9f4bfdc58c43b7b0.jpg

Checklist
1. I can mark off at least 4/6 angles correctly yes/no
2. Using a protractor, draw and classify the following angles.</td><td>Provide opportunity for video assisted demonstration of using the protractor to draw angles
Present video on how to use the protractor.
How to Use a Protractor | Math Videos for Kids | Measuring Angles | Geometry for Kids | Twinkl
Complete the worksheet by circling the correct answer.

Use reflective observation and guided discovery (
Provide opportunity for learners to manipulate the protractor to draw angles. For example:
1. Equip learners with small protractors to manipulate. Teacher will then demonstrates the proper use of the protractor (chalkboard appropriate) through illustrations using both scales (left and right vertex)


2. Draw the following angles using the provided ray as a starting point.</td></tr>
</table>

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies



65°		
42°		
115°		
175°		
90°		

Checklist

I can draw at least 3/5 angles correctly
yes/no

Conversation/Product - to determine learners' ability solve simple problems involving conversion of capacity

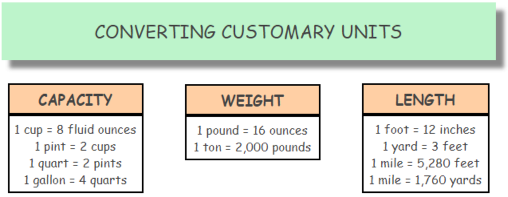
1. The doctor insisted I drink 2 litres of water a day. How many bottles of this water should I drink daily?

1. Draw the following angles
   a. 55°
   b. 125°
   c. 20°
   d. 160°

Guided discovery using real-life application

Provide opportunity for real-life application involving the conversion of units.

1. Using a scale, measuring cups and other measuring units, learners will practice converting measurement. For example, pour 1500 ml of water into a 2-litre bottle. Record the amount of water in the bottle in litres.



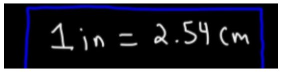
CONVERTING CUSTOMARY UNITS

CAPACITY	WEIGHT	LENGTH
1 cup = 8 fluid ounces 1 pint = 2 cups 1 quart = 2 pints 1 gallon = 4 quarts	1 pound = 16 ounces 1 ton = 2,000 pounds	1 foot = 12 inches 1 yard = 3 feet 1 mile = 5,280 feet 1 mile = 1,760 yards

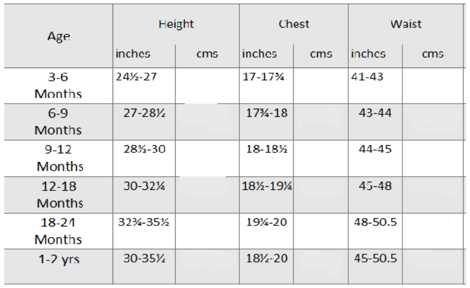
Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies

Retrieved from https://5.imimg.com/data5/NQ/OV/MY-27015760/250-ml-packaged-water-bottle.jpg

2. John wants to order some clothes on Shein for his children. The measurements on the Shein clothing sites are in inches but John only knows his children's measurements in cm. Fill out the table using the conversion below so John can buy the right sizes for his kids.



1 in = 2.54 cm

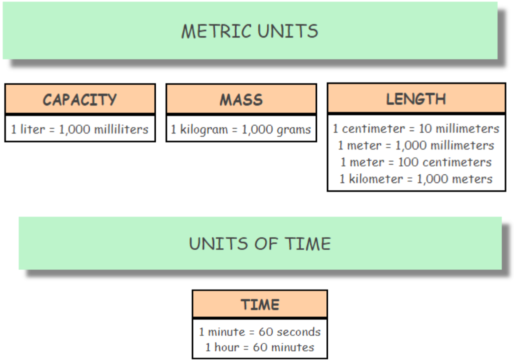


Age	Height		Chest		Waist	
	inches	cms	inches	cms	inches	cms
3-6 Months	24½-27		17-17¾		41-43	
6-9 Months	27-28½		17¾-18		43-44	
9-12 Months	28½-30		18-18½		44-45	
12-18 Months	30-32¼		18½-19¼		45-48	
18-24 Months	32¾-35½		19¼-20		48-50.5	
1-2 yrs	30-35½		18½-20		45-50.5	

Retrieved from Google Images

Checklist

Learner can convert units accurately yes/somewhat/no



Retrieved from https://www.learningfarm.com/web/practicePassThrough.cfm?TopicID=648

Use reflective observation

Provide learners with the given scenario and observe how they arrive at their respective conclusions.

'The local shop has run out of quarters in the cash register. $20 is given to the messenger to go to the nearest bank to buy quarters.'

With how many quarters should the messenger return?

Guided Discovery using critical thinking

Provide learners with opportunity to use details from charts, advertisements, travelling tickets/schedules, work schedules etc. as a guide for conversions in time.

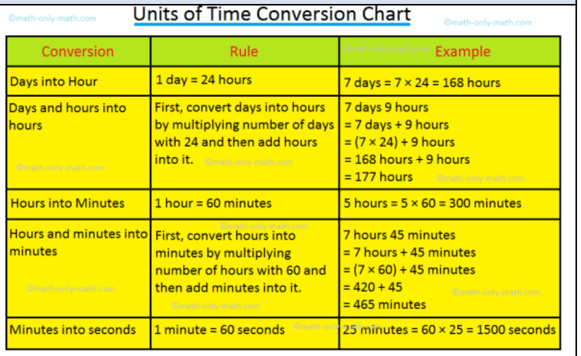
Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies

Conversation/ Observation- to provide opportunity to discuss conversions with money

How many of each these do I need to obtain
- a. $1
- b. $10
- c. $100

How many ten cents will give you $1?
How many $1 will give you $10?
How many 10c will give you $10?

Peer Assessment- to provide opportunity to discuss conversions with time. Peers will assess each other's responses under teacher's supervision.



Units of Time Conversion Chart

Conversion	Rule	Example
Days into Hour	1 day = 24 hours	7 days = 7 × 24 = 168 hours
Days and hours into hours	First, convert days into hours by multiplying number of days with 24 and then add hours into it.	7 days 9 hours = 7 days + 9 hours = (7 × 24) + 9 hours = 168 hours + 9 hours = 177 hours
Hours into Minutes	1 hour = 60 minutes	5 hours = 5 × 60 = 300 minutes
Hours and minutes into minutes	First, convert hours into minutes by multiplying number of hours with 60 and then add minutes into it.	7 hours 45 minutes = 7 hours + 45 minutes = (7 × 60) + 45 minutes = 420 + 45 = 465 minutes
Minutes into seconds	1 minute = 60 seconds	25 minutes = 60 × 25 = 1500 seconds

Retrieved from [Units of Time Conversion Chart]()

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
	Leah loves to cook with fresh herbs. So, she decides to plant 8 different herbs and keep the small pots on her kitchen window sill. She starts with a 2-kilogram bag of soil and puts the same amount of soil in each pot. If she uses all of the soil, how many grams does she add to each pot? Retrieved from Multi-step problems with metric unit conversions | 6th grade math **Fill in the blanks:** (i) 1 day = …………….. hours (ii) 1 week = …………….. hours (iii) 1 fortnight = …………….. hours (iv) Number of days in the month of March = …………….. (v) Number of days in an ordinary year = …………….. (vi) Number of weeks in a year = …………….. (vii) Number of minutes in 2 days = …………….. (viii) …………….. Months have 31 days. **Checklist** **Learner can accurately convert at least ⅝ units yes/no**	

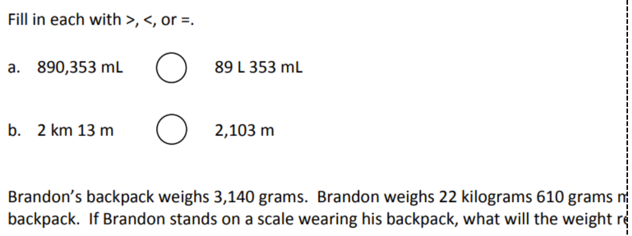
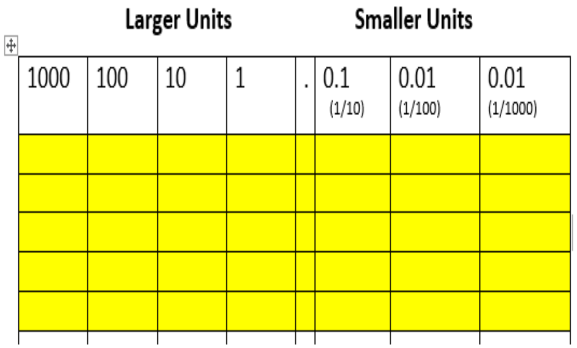
Additional Resources and Materials - Money - Measuring tape - Meter ruler - Measuring cup - Related text book - Printed worksheets - https://www.geogebra.org/m/jvav67sm - https://www.geogebra.org/m/jvav67sm - Angle Unlimited - Angle - Learn Metric Units & Unit Conversions (Meters, Liters, Grams, & more) - [5-8-1] -
Additional Useful Content Knowledge for the Teacher: In the metric system, all units are defined in terms of a basic unit. The basic unit of mass in the metric system is the gram.
Opportunities for Subject Integration: Operations- requires the ability to use all the basic operations Geometry- drawing angles or shapes Number theory- fractions, decimals

Essential Learning Outcome: M2.1. Applying Techniques, Tools and Formulas for Measuring – Developing Personal Referents for Measuring Attributes

Grade Level Expectations and/or Focus Questions:

- **Develop and apply relationships within systems of measurement and relate to place value concepts**

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
Learners are expected to: **Knowledge** 1. Recognize the relationship between the metric system of measurement and place value 2. Explain how to convert between various units of measurement using a place value chart **Skills** 3. Use a place value chart to convert measurements from one unit to another. 4. Solve real-life problems relating to unit conversion **Values** 5. Create real-life problem that involve conversions of units.	***Observation*** *Present groups of learners with objects labelled with varying lengths/masses/ capacities. Have learners work on converting the units to given units of measurement using the place value chart. Observe learners as they use the chart to convert between units.* ***Oral Presentation*** *Have learners work in small groups. Each team will be given work cards on which they will be required to solve real-life problems involving the conversion between units of measurement relating to length/mass/capacity. Have learners solve the problems then explain to the class how to perform the calculations using the place value chart.* ***Product*** *Complete a worksheet involving the conversion of units relating to length/mass/capacity.* *Source: chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://www.k5learning.com/worksheets/math/grade-5-metric-units-length-km-m-cm-mm-a.pdf*	**Video presentation** Provide learners with opportunities to connected place value to metric unit conversions. Invite learners to recognize that larger metric units, like litres, kilograms, and kilometres, are 1,000 times their smaller counterparts, such as millilitres, grams, and meters. Question learners to discover similar patterns in place value, where 1 thousand is 1,000 times 1 one, and 1 hundred thousand is 1,000 times 1 hundred. Have learners to further linked this to smaller relationships, such as 1 meter being 100 times 1 centimetre, just like 1 hundred is 100 times 1 one. Both systems rely on powers of ten, reinforcing learners' understanding of scaling in math. Present a video clip to learners to demonstrate the procedure for converting between units. Discuss real-life situations that require the conversion from one unit to another. Model the procedure for converting from a higher unit to a lower unit and vice versa. Metric Conversion with a Place Value Chart

<table>
<tr><th>Specific Curriculum Outcomes</th><th>Inclusive Assessment Strategies</th><th>Inclusive Learning Strategies</th></tr>
<tr>
<td>6. Ask questions involving the connections between place value and metric conversions of units</td>
<td>

Fill in each with >, <, or =.
a. 890,353 mL ○ 89 L 353 mL
b. 2 km 13 m ○ 2,103 m
Brandon's backpack weighs 3,140 grams. Brandon weighs 22 kilograms 610 grams m
backpack. If Brandon stands on a scale wearing his backpack, what will the weight r
</td>
<td>
Group work
Divide learners into groups of 4. Present each group with two (3) worded problems involving the conversion from one unit to another. Provide place value charts for each group and guide learners as they work on solving the first problem. Give each group the opportunity to solve the other two (2) problems then present their answers to the rest of the class.

<table>
<tr><th colspan="4">Larger Units</th><th></th><th colspan="3">Smaller Units</th></tr>
<tr><td>1000</td><td>100</td><td>10</td><td>1</td><td>.</td><td>0.1 (1/10)</td><td>0.01 (1/100)</td><td>0.01 (1/1000)</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
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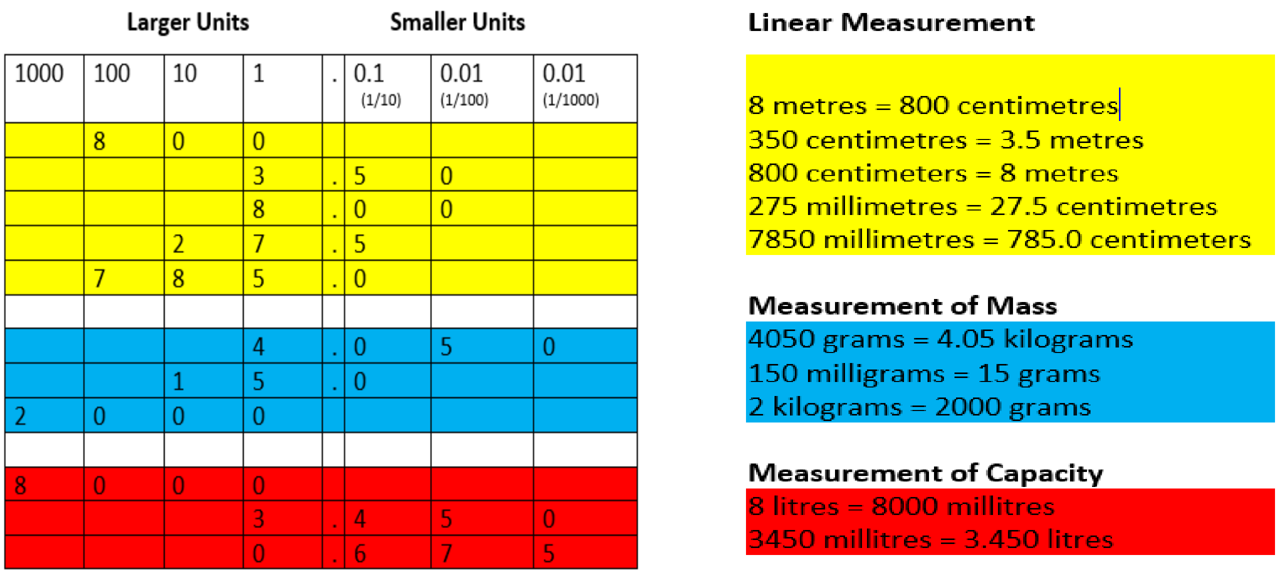
Useful Content Knowledge for the Teacher about the Outcome:
When converting from one unit of measurement to another, it is necessary to make the connection to place value units. For example: (For linear measurement) 10 millimetres = 1 centimetre 100 centimetres = 1 metre 1000 metres = 1 kilometre
The units are emphasized in multiples of 10.
Examples: Harry travelled a distance of 80 kilometres. Calculate the distance he travelled in metres
80km = ______m (To convert km to m, you multiply 80 by 1000) 80 x 1000 = 80,000 m
A place value chart can also be used to convert between units.



Larger Units					Smaller Units		
1000	100	10	1	.	0.1 (1/10)	0.01 (1/100)	0.01 (1/1000)
	8	0	0				
			3	.	5	0	
			8	.	0	0	
		2	7	.	5		
	7	8	5	.	0		
			4	.	0	5	0
		1	5	.	0		
2	0	0	0				
8	0	0	0				
			3	.	4	5	0
			0	.	6	7	5

Linear Measurement

8 metres = 800 centimetres
350 centimetres = 3.5 metres
800 centimeters = 8 metres
275 millimetres = 27.5 centimetres
7850 millimetres = 785.0 centimeters

Measurement of Mass

4050 grams = 4.05 kilograms
150 milligrams = 15 grams
2 kilograms = 2000 grams

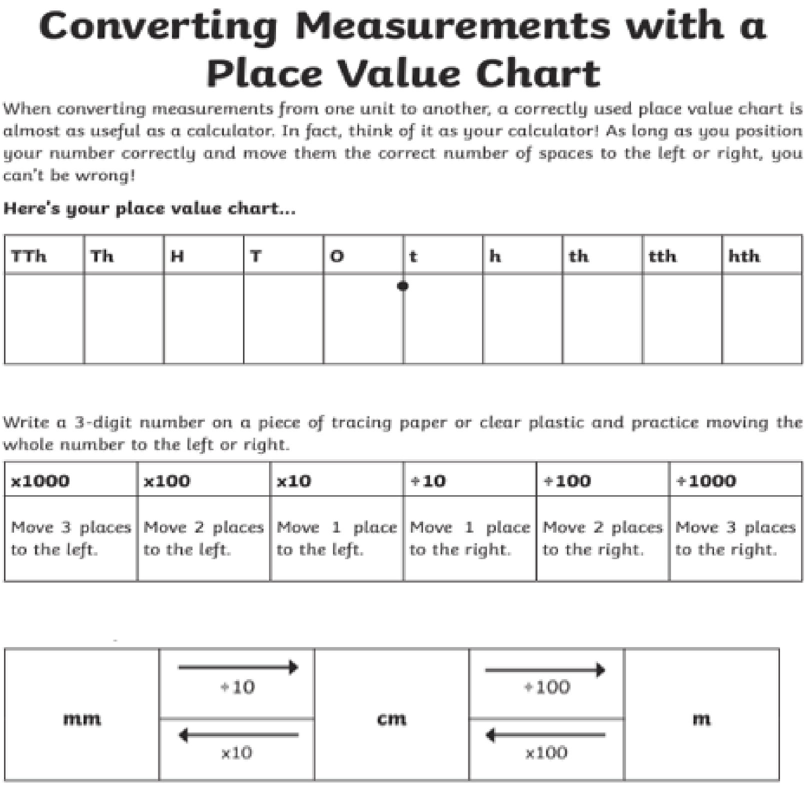
Measurement of Capacity

8 litres = 8000 millitres
3450 millitres = 3.450 litres

The same principle applies to mass and capacity.

Additional Resources and Materials

Add meters and centimetres pattern Sheets
Personal white boards
Unlabelled hundred thousand place value chart (Template) and Unlabelled hundred thousands place value chart



Converting Measurements with a Place Value Chart

When converting measurements from one unit to another, a correctly used place value chart is almost as useful as a calculator. In fact, think of it as your calculator! As long as you position your number correctly and move them the correct number of spaces to the left or right, you can't be wrong!

Here's your place value chart...

TTh	Th	H	T	O	t	h	th	tth	hth
					•				

Write a 3-digit number on a piece of tracing paper or clear plastic and practice moving the whole number to the left or right.

x1000	x100	x10	÷10	÷100	÷1000
Move 3 places to the left.	Move 2 places to the left.	Move 1 place to the left.	Move 1 place to the right.	Move 2 places to the right.	Move 3 places to the right.

mm	→ ÷10 ← x10	cm	→ ÷100 ← x100	m

Source: *chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://orchardsjunior.school/wp-content/uploads/2021/03/Converting-Measures-guide.pdf*

Opportunities for Subject Integration:
Maths: Converting between units
Language Arts: Writing a poem/jingle about unit conversion
Social Studies: Calculating the
Health:
Science: Converting between units - e.g. Calculating the distance travelled by an object (6 kilometres to metres) / Calculating the capacity of containers in selected units etc.
Art: Creating a place chart to demonstrate how to convert between units

Essential Learning Outcome: M2.2. Applying Techniques, Tools and Formulas for Measuring – Using Tools to Measure Attributes

Grade Level Expectations and/or Focus Questions:

- Measure, classify, compare, and create angles using standard units of degrees, using a protractor
- Estimate angles using benchmarks
- Understand and demonstrate the selection and use of appropriate measuring tools that model the attribute being measured.

<table>
<tr><th>Specific Curriculum Outcomes</th><th>Inclusive Assessment Strategies</th><th>Inclusive Learning Strategies</th></tr>
<tr>
<td>Learners are expected to:

Knowledge

1. Identity the different types of angles
2. Write the measurement of angles in degrees

Skills

3. Use a protractor to measure angles
4. Draw angles using a protractor
5. Classify angles according to their measurement</td>
<td><i>Self-assessment</i>
<i>Have learners work independently to measure the size of various types of angles using a protractor. Present a self-assessment checklist for them to use to assess their ability to use a protractor correctly.</i>
Self-assessment Checklist – Using a protractor
<table>
<tr><th>Instructions</th><th>Yes</th><th>No</th></tr>
<tr><td>I lined up the vertex of the angle with the dot at the center of the protractor.</td><td></td><td></td></tr>
<tr><td>I lined up one side of the angle with 0 degrees on the protractor.</td><td></td><td></td></tr>
<tr><td>I read the protractor to see where the other side of the angle crosses the number scale.</td><td></td><td></td></tr>
<tr><td>I wrote the size of the angle in degrees.</td><td></td><td></td></tr>
</table>
<i>Observation</i>
Activity #1: Have learners work in pairs to use protractors to determine the size of various angles. Learners measure the angles and classify them according to their sizes/types.

Activity # 2: Present various sizes of angles to the learners. Have them use their protractors to draw angles</td>
<td>Ask learners to brainstorm how angles are used in the world around us. Create a list from the brainstorming session.
Discuss the following questions:
How do people in various professions use angles to complete their work?
How do all people use angles in their everyday lives?
How do you (as a child/learner) use angles?

Review the concept of angles and how they are formed.
Present learners with the following scenario:
AJ and Kayla are working at the Bookshop. They are setting up a new sales display that includes several different math tools which includes rulers and protractors. AJ and Kayla are not familiar with a protractor.

AJ asked, “What is a protractor?"

Can you help AJ and Kayla solve some problems using a protractor?

Present a video to demonstrate how to use a protractor to measure angles. Present various types</td>
</tr>
</table>

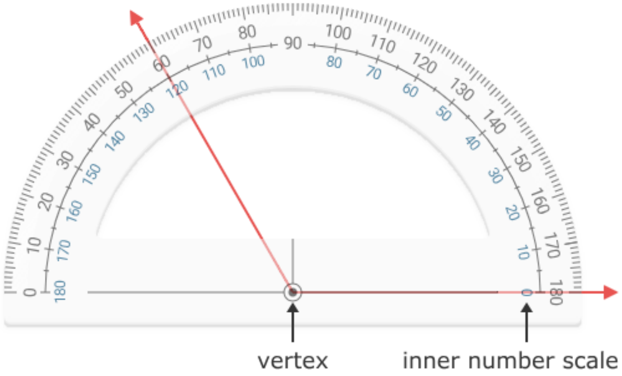
<table>
<tr><th>Specific Curriculum Outcomes</th><th>Inclusive Assessment Strategies</th><th>Inclusive Learning Strategies</th></tr>
<tr><td></td><td>to match the given measurements. They will then classify the angles by labelling the type of angle each. After completing this activity, have learners display their work for their classmates to check for accuracy.
<table>
<tr><td>The students correctly drew the angles.</td><td>The students incorrectly drew two or three angles.</td><td>The students correctly drew one angle.</td><td>The students correctly drew all angles.</td></tr>
<tr><td>The students did not correctly classify any of the angles.</td><td>The students did not correctly classify two or three of the angles.</td><td>The students did not correctly classify one of the angles.</td><td>The students correctly classified all of the angles.</td></tr>
<tr><td>**1 mark**</td><td>**2 marks**</td><td>**3 marks**</td><td>**4 marks**</td></tr>
</table>
Worksheet
Have learners complete a worksheet on which they use a protractor to measure given angles and classify them by type.
Source: https://www.k5learning.com/worksheets/math/grade-5-geometry-classify-measure-angles-a.pdf</td><td>of angles to learners and have them practise using the protractor to measure the angles.

Have learners create angles out of toothpicks. Angles can be created out of simple toothpicks and glued to construction paper creating a sheet of angles. Learners can exchange angle sheets and then measure each angle with a protractor, record the measurement in degrees, and identify the angle.

Using the toothpick models, ask learners to identify some objects that might resemble or contain each of the angles created. For example, a rectangle end table contains right angles at the corners, a recliner set back might resemble an obtuse angle, and the beak of bird may look acute.

Provide learners with crayons or coloured pencils to turn the toothpick models into images and drawings. Display the creative work of your learners.</td></tr>
</table>

Useful Content Knowledge for the Teacher about the Outcome:
Angles are measured in degrees. To find the size of an angle, we use a geometric tool called the protractor. A protractor looks like a semicircle and has measurements marled in degrees from zero (0) to one hundred and eight (180). There are 360 degrees in a full rotation.
The midpoint of the protractor is called the centre marker. The numbering on a protractor often runs clockwise and anticlockwise. It is very important to follow the steps when using a protractor to draw or measure angles.



Source: https://www.ixl.com/math/lessons/measuring-angles-with-a-protractor

How to use a protractor

To measure an angle using a protractor, follow the steps below.

1. Ensure that you align the vertex of the angle with the dot at the centre of the protractor.
1. Line up one side of the angle with 0 degrees on the protractor.
2. Read the scale on the protractor to identify where the other side of the angle crosses the number scale.

Most protractors have two number scales. It is important to use the same number scale for both sides of the angle.

Additional Resources and Materials

Construction Paper
Crayons or Coloured Pencils
Glue
Index Cards
Pencils
Protractor
Toothpicks

Opportunities for Subject Integration:

Maths:

Language Arts: write a descriptive paragraph on how to use a protractor.

Social Studies: use a protractor to find out the distance of one country from another.

Health:

Science:

Art: use a ruler and protractor to create an art piece.

Essential Learning Outcome: M2.3: Applying Techniques, Tools and Formulas for Measuring – Developing and Applying Formulae for Measuring

Grade Level Expectations and/or Focus Questions:

- Apply the area, perimeter, volume formulae for rectangles, triangles, parallelograms, composite shapes and prisms in real world and mathematical problems.

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
Learners are expected to: **Knowledge** 1. Identify appropriate formulae to find the perimeter of rectangles, triangles, parallelograms and composite shapes. 2. Identify appropriate formulae to find the area of rectangles, triangles, parallelograms and composite shapes. 3. State how to use the formula to calculate the volume of prisms. **Skills** 4. Calculate the area, perimeter, and volume of rectangles, triangles, parallelograms, composite shapes and prisms. 5. Solve real world problems involving the calculation of area, perimeter, and volume of selected shapes. **Values** 6. Discuss the importance of being able to find the area, perimeter and volume of selected 2D shapes, composite shapes and prisms.	*Observation* Teacher observes learners as they use given formulae to calculate the area and perimeter of selected 2D shapes and composite shapes. Teacher observes learners actions in forming the shapes on the geoboard. Conversation Pupils work in pairs using given lengths of sides and perimeter and or area and generalise Formulas Each pair will present to the entire class their method of generating the formula. For example: Perimeter for square: (4 x L.) (L + L + L + L.) (L +L × 2) etc.  *Product* *Complete a worksheet by using the formula for calculating the volume of prisms.* Pupils use given perimeters and areas to create 2 D shapes.	Give each learner a geo board and a pack of rubber bands. Begin by inviting learners free exploration for five minutes. Then ask them to create a shape and calculate the perimeter and area. Have learners taking turns giving measurements to the class of the shape they made, like, “Make a triangle with a perimeter of 16,” or “Make a rectangle with an area of 8.” Everyone tries it on their geo boards and holds them up to show their answers. Learners are given tools and instruments to measure the sides of different shapes. They will find the perimeter of each shape by adding the sides. Have learners find the perimeter and area of polygons by counting the sides of a rectangle and find the area by counting the square units and then by using the formula of length time’s width. Learners find the perimeter and area by using the formula and adding the sides together. These shapes and their perimeter will be recorded on the board. Learners will observe the shapes and the perimeter and formulate formulas to find perimeter. Learners then draw shapes with given perimeters with and without grid paper. Have learners find

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
7. Appreciate the use of area, perimeter and volume in real life situations.		the missing side of a rectangle when the perimeter is given. Teacher will also present the perimeter to learners create a shape with that perimeter.

Additional Resources and Materials
Geoboard
Rubber bands

Opportunities for Subject Integration:
Maths: calculate the perimeter of the classrooms and arrange the seats given a specific distance apart.
Language Arts: penned a poem on how to find perimeter.
Social Studies:
Health:
Science: Measure a plot of land to cultivate crops and the distance from each seedling calculate how many of the seedlings can be planted on the plot of land.
Art: Create models of different shapes using given perimeters.

Data Handling and Probability

Introduction:

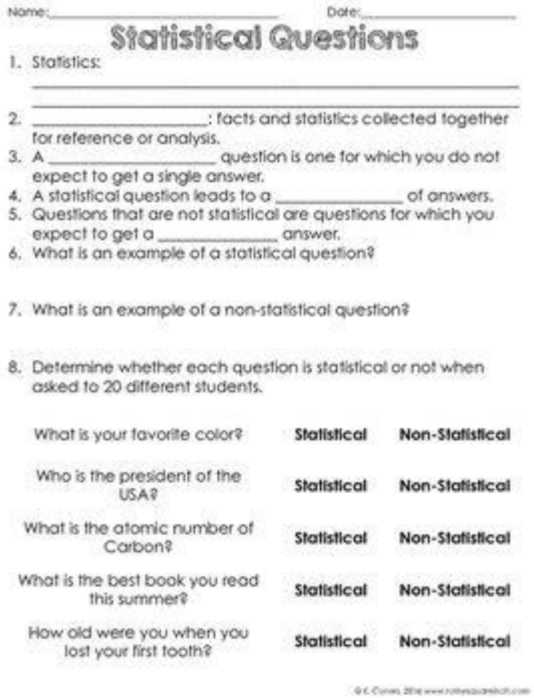
In our increasingly data-driven world, the ability to collect, organise, and interpret data is essential. Whether you're looking to understand patterns in learner performance, make informed decisions in business, or simply make sense of the world around you, data plays a crucial role.
Understanding how to formulate questions and work with data equips you with powerful skills that apply in countless real-world scenarios. From assessing the effectiveness of teaching strategies and improving learner outcomes to making strategic business decisions or contributing to scientific research, the ability to handle data is invaluable.

Essential Learning Outcome: D1.1. Collecting, Organizing, and Displaying Data – Formulating Questions That Can be Answered with Data

Grade Level Expectations and/or Focus Questions:

- Recognize a statistical question as one that anticipates variability in the data related to the question and accounts for it in the answers

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
Learners are expected to: **Knowledge** 1. Identify and explain the role of variability in formulating and interpreting statistical questions. 2. Explain that different factors (e.g., time period, location, population) can influence variability in data and affect the formulation of statistical questions. 3. Interpret findings from statistical analyses in a way that acknowledges and explains variability.	***Observation*** Learners are given a list of questions and are told to identify which ones are statistical by considering variability.	Provide opportunities for learners to identify and pose questions that can be answered by data that varies. This task helps them distinguish between statistical and non-statistical questions. For example, a statistical question involves data collection with expected variation, like "How many minutes do 6th graders spend on homework each week?" In contrast, a non-statistical question, such as "How much time did Juana spend on homework last night?" has a single, fixed answer without variation. Teacher will discuss the definition of a statistical question and provide examples. Teacher will

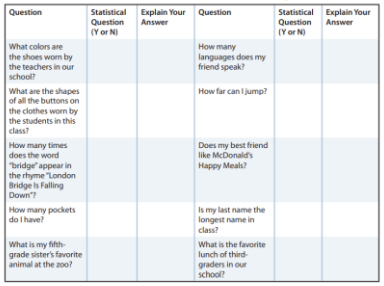
Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
Skills 4. Recognize what constitutes a statistical question. 5. Differentiate between statistical and non-statistical questions. 6. Apply the concept of variability in answers to statistical questions **Values** 7. Create real life situation involving the influence of variability in data.	 Name:________ Date:________ Statistical Questions 1. Statistics: ________ 2. ________: facts and statistics collected together for reference or analysis. 3. A ________ question is one for which you do not expect to get a single answer. 4. A statistical question leads to a ________ of answers. 5. Questions that are not statistical are questions for which you expect to get a ________ answer. 6. What is an example of a statistical question? 7. What is an example of a non-statistical question? 8. Determine whether each question is statistical or not when asked to 20 different students. What is your favorite color? Statistical Non-Statistical Who is the president of the USA? Statistical Non-Statistical What is the atomic number of Carbon? Statistical Non-Statistical What is the best book you read this summer? Statistical Non-Statistical How old were you when you lost your first tooth? Statistical Non-Statistical Source:https://cdn.education.com/worksheet-image/3535052/statistical-questions-card-sort-2023-01-25.gif Learners will analyse a real-world data set and write their own statistical questions that anticipate variability.	provide hypothetical objects or scenarios to learners to illustrate the concept of statistical question: *For example:* *Ask learners whether "How old is my pet dog?" is a statistical question. Explain that it's not, since there's only one subject, so no variability exists. Then, discuss how to rewrite it into a statistical question, such as "How old are the pets of the learners in our class?" This question involves a population (learners' pets) and a measurement (pets' ages), where variability in the ages is expected.* *Ask learners why "What is my favourite pizza topping?" is not a statistical question. Then, have them rewrite it as one, such as "What is the favourite pizza topping of learners in this class?" The population is the learners, the measurement is their favourite topping, and we would expect varied responses like cheese, sausage, or pepperoni.* ***Survey Responses from Learners:*** ***Object**: Charts or graphs showing survey responses from learners on different topics.* ***Scenario**: Teacher presents survey data on topics that interest learners (like favourite sports, TV shows, or hobbies). Teacher discusses with learners how questions about preferences can anticipate variability in responses.* ***Example of a statistical question:** "What is the most popular sport among learners in our grade?"* ***Explanation:** This question anticipates variability because it recognizes that different learners may have different favourite sports, and the answer (most popular sport) takes this variability into account.*

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
	Conversation  Source:https://images.squarespace-cdn.com/content/v1/6282ec55d5f3c229291fcb47/1674437692155-M76N7FPBYPLS0T7J5SXQ/image-asset.jpeg **<u>Think Pair Share Activities</u>** Pairs of learners will be given a list of questions and they will have to identify which ones are statistical questions based on the concept of variability. They would present their explanations orally to the rest of the class. Learners will go on a scavenger hunt around their school to find examples of statistical questions and explain the variability they account for.	Teacher will clarify the concept of variability in data and how it impacts the answers to statistical questions. Provide scenarios where learners can generalized that a well-written statistical question refers to a **population of interest**, a **measurement of interest**, and **anticipates answers that vary**.

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
	Product Learners find examples of statistical questions in the news or online and highlight the presence of variability in the data. Learners will write a short story that incorporates a statistical question and describes how the answer accounts for variability.	

Additional Resources and Materials

Statistical Questions Worksheet Level A and Level B: For example, retrieved from https://www.statisticsteacher.org/files/2019/02/Section1.pdf

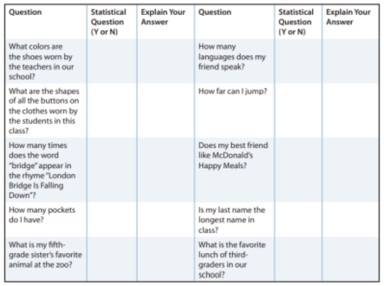


Question	Statistical Question (Y or N)	Explain Your Answer	Question	Statistical Question (Y or N)	Explain Your Answer
What colors are the shoes worn by the teachers in our school?			How many languages does my friend speak?		
What are the shapes of all the buttons on the clothes worn by the students in this class?			How far can I jump?		
How many times does the word "bridge" appear in the rhyme "London Bridge Is Falling Down"?			Does my best friend like McDonald's Happy Meals?		
How many pockets do I have?			Is my last name the longest name in class?		
What is my fifth-grade sister's favorite animal at the zoo?			What is the favorite lunch of third-graders in our school?		

Link teaching about statistics: Conduct statistical investigations : Year 6: Planning tool (mathematicshub.edu.au)

Additional Resources and Materials

Statistical Questions Worksheet Level A and Level B: For example, retrieved from https://www.statisticsteacher.org/files/2019/02/Section1.pdf



Question	Statistical Question (Y or N)	Explain Your Answer	Question	Statistical Question (Y or N)	Explain Your Answer
What colors are the shoes worn by the teachers in our school?			How many languages does my friend speak?		
What are the shapes of all the buttons on the clothes worn by the students in this class?			How far can I jump?		
How many times does the word "bridge" appear in the rhyme "London Bridge Is Falling Down"?			Does my best friend like McDonald's Happy Meals?		
How many pockets do I have?			Is my last name the longest name in class?		
What is my fifth-grade sister's favorite animal at the zoo?			What is the favorite lunch of third-graders in our school?		

Link teaching about statistics: [Conduct statistical investigations : Year 6: Planning tool (mathematicshub.edu.au)]()

Opportunities for Subject Integration:

Maths: Learners answer questions based on graphs presented to them.

Language Arts: Learners know how to form questions to get answers they are looking for.

Social Studies: Learners use statistics to get the population of the school.

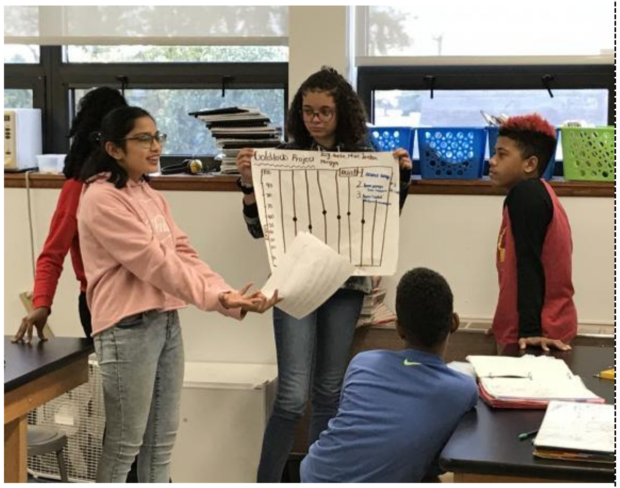
Health: Learners will track their daily physical activities and analyse the data to understand their activity levels.

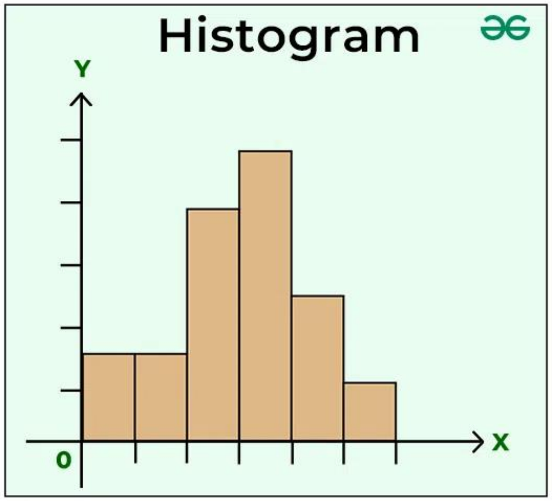
Science: Learners identify weather patterns and can make judgement based on the weather patterns observed.

Essential Learning Outcome: D1.2. Collecting, Organizing, and Displaying Data – Collecting, Organizing, Displaying and Communicating Data

Grade Level Expectations and/or Focus Questions:

- Collect qualitative data and discrete and continuous quantitative data to answer questions of interest about a population, and organize the sets of data as appropriate, including using intervals

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
Learners are expected to: **Knowledge** 1. Explain the difference between qualitative and quantitative data. **Skills** 2. Identify discrete and continuous quantitative data. 3. Use tally charts and compute facility (spreadsheets, Microsoft excel) to organize collected data. 4. Organise data sets using intervals. 5. Use grid paper and computer software (Excel program) to create tables, simple vertical and horizontal bar graphs and simple line graphs. 6. Analyse data to answer questions of interest **Values** 7. Show how data collection and analysis are used in various fields (e.g., health	***Observation*** Learners will create a survey to collect qualitative and quantitative data from their classmates. Then, organise the data in appropriate intervals and answer questions based on the data collected. Peer Assessment Learners will exchange data sets with their classmate and provide feedback on how they organised and analysed the information ***Conversation*** 	Teacher and learners will distinguish between qualitative data (descriptions and characteristics) and quantitative data (numerical measurements) and identify examples of discrete (countable) and continuous (measurable) quantitative data. *For example:* *The teacher and learners will discuss examples of qualitative data (e.g., favourite colours, types of pets) and quantitative data (e.g., number of siblings, temperature). Sort examples into discrete and continuous categories.* Give learners scenarios involving qualitative data, as well as discrete and continuous quantitative data. Ask them to sort the scenarios into these three categories and explain their reasoning. Continuously reinforce the differences between these data types as learners identify which kind is needed to answer their questions of interest. Teacher teaches learners how to construct frequency tables, histograms (for continuous data), and bar charts (for discrete and qualitative data). The teacher emphasises the importance of choosing appropriate intervals for grouping data (e.g., ages grouped in 5-year intervals).

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
surveys, market research, environmental studies).	Source:https://www.csionline.org/files/assets/images/medium/1583527988_Learners.Presenting.Data.jpg Learners create a poster, slideshow, or video to present their data collection and analysis to the class. Learners compare and contrast qualitative and quantitative data they collected. They explain how the data provided different information about the population. ***Product*** Learners will observe their surroundings and identify examples of qualitative and quantitative data. They record their observations in a journal and categorise the data they collect. Learners will create presentations or reports that summarise their data collection process, findings, and conclusions. They will use graphs, charts, and tables to support their explanations and interpretations.	 Source:https://media.geeksforgeeks.org/wp-content/uploads/20231004173705/Histogram.webp Use the data from learners' heights in the class to make a histogram. After learners complete their histograms, have them compare with partners who used larger and smaller intervals. Help them see how different interval sizes change the histogram's appearance, with smaller bins showing more detail and larger bins showing less. Provide learners with a bar graph or histogram that presents information in a misleading way. For example, the histogram below does not start at zero on the vertical axis, nor does it have a consistent scale for the age of guests. Have learners describe what makes this graph misleading. Ask them to recreate the graph so that it presents the information accurately

Useful Content Knowledge for the Teacher about the Outcome:

Quantitative data is either discrete or continuous.
Discrete data includes variables that can be counted using whole numbers, such as the number of learners in a class, the number of pencils in a pencil case, or the number of words in a sentence.
Continuous data can have an infinite number of possible values for a given range of a variable (e.g., height, length, distance, mass, time, perimeter, and area).
Continuous data can take on any numerical value, including decimals and fractions.

Understanding the features and purposes of different kinds of graphs is important when selecting appropriate displays for a set of data.
Pictographs, line plots, bar graphs, multiple-bar graphs, and stacked-bar graphs are used to display qualitative data and discrete quantitative data.
Histograms display continuous quantitative data using intervals. The bars on a histogram do not have gaps between them due to the continuous nature of the data. This contrasts with bar graphs, which do have gaps between the bars to show the discrete categories.
Broken-line graphs are used to show change over time and are helpful for identifying trends. To create a broken-line graph, learners apply their understanding of scales and estimation.
The source, titles, labels, and scales provide important information about data in a graph or table:
The source indicates where the data was collected.
The title introduces the data contained in the graph.
Labels provide additional information, such as the intervals that have been used in a histogram.
Scales identify the possible values of a variable along an axis of a graph.
Introduce learners to tools like spreadsheets (Excel, Google Sheets) for organising and analysing data. Teach them to use graphing tools or software (e.g., online graph makers, statistical software) to create charts and plots.

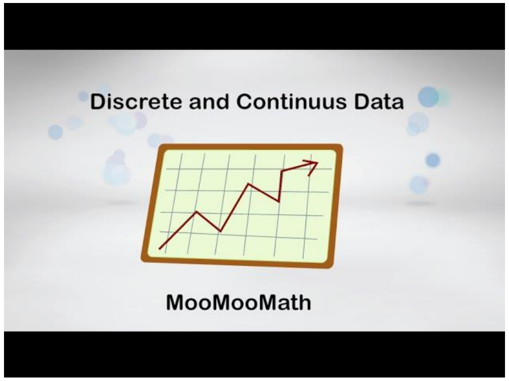
Additional Resources and Materials
Video on teaching about frequency: https://study.com/learn/lesson/frequency-distribution-table.html
Video on making a histogram: How To Make a Histogram Using a Frequency Distribution Table
Online Game on frequency tables: https://ca.ixl.com/math/grade-6/create-frequency-tables

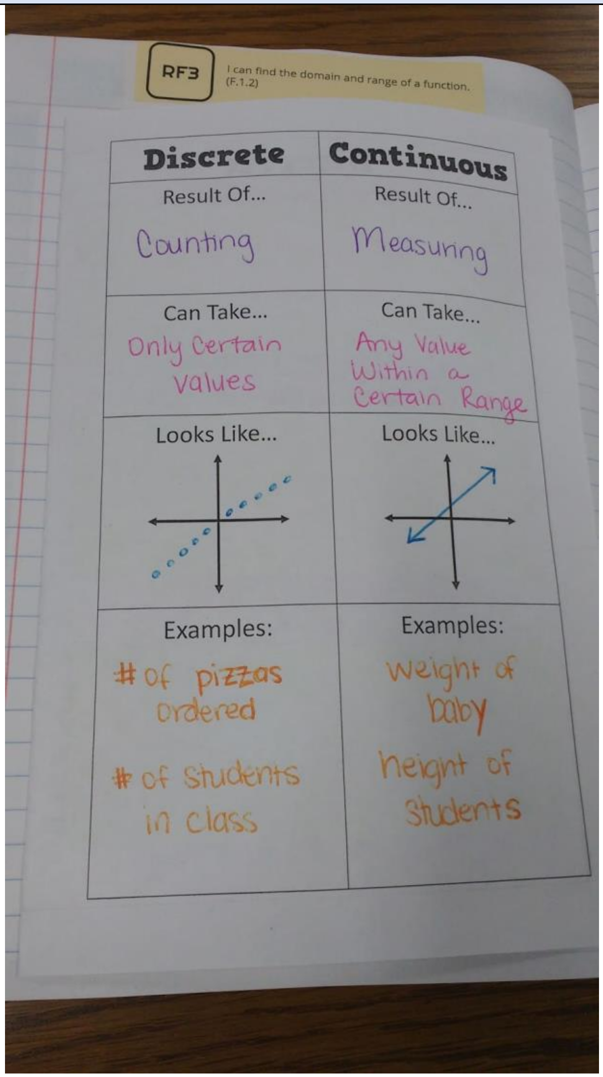
Opportunities for Subject Integration:
Maths: Learners see how data collection and analysis are used in market research.
Language Arts: Learners learn how to answer and form ‘w’ questions words correctly.
Social Studies: Learners see how data collection and analysis are used in environmental surveys.
Health: Learners see how data collection and analysis are used in health surveys.
Science: Learners look at the frequency of weather patterns. There is a frequency of weather patterns during certain seasons of the year.
Art: Draw weather patterns to display in the classroom.

Essential Learning Outcome: D2.1. Using Statistical Methods to Analyse Data – Describing Data Sets

Grade Level Expectations and/or Focus Questions:

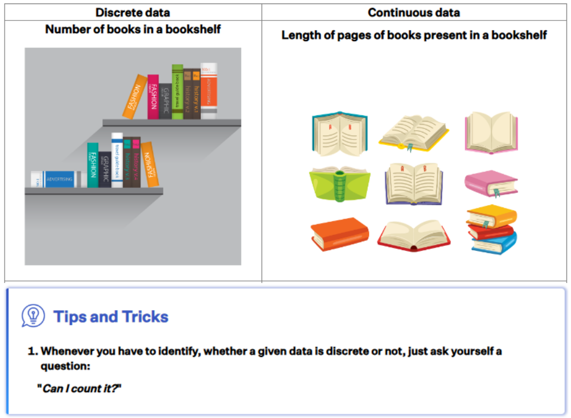
- Determine whether a given set of data can be represented by a line graph (continuous data) or a series of points (discrete data) and explain why
- Understand that a set of data collected to answer a statistical question has a distribution that can be described by its centre, spread, and overall shape.

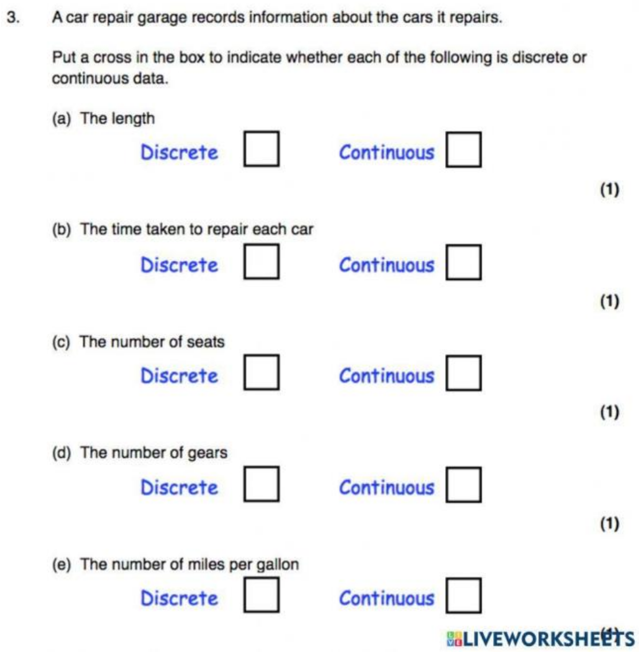
Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
Learners are expected to: **Knowledge** 1. Identify a given set of data as continuous or discrete 2. Discuss whether a given data set is continuous or discrete. 3. Explain the difference between continuous and discrete data **Skills** 4. Select the most suitable graph, such as histograms or broken-line graphs, to represent different data sets. 5. Display the data with accurate sources, titles, labels, and scales, and justify the choice of graph. 6. Decide between using a line graph and a scatter plot (series of points) based on information given. 7. Describe a data set by its centre, spread, and shape.	**Observation** Learners complete a table highlighting the differences between discrete and continuous data.	Present learners with a set of numerical data and discuss if the data is continuous or discrete. Learners look at a video on continuous and discrete data. Video link: [Discrete and Continuous Data]  Present different types of data sets on the board: Categorical data (e.g., favourite colours) Continuous data over time (e.g., temperature changes over a week) Data showing correlation (e.g., height vs. weight) Guide learners to decide the best graph type for each data set, highlighting: Histogram: Useful for showing distributions and frequency of data within ranges.

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
Values 8. Create real life stories/situations to depict the correct graph to represent continuous and discrete data.		Line Graph: Best for showing changes over time. Scatter Plot: Ideal for showing relationships or correlations between two variables. Explain the importance of accurate titles, labels, scales, and sources: Show a sample graph with errors (e.g., no title, unclear scale, or missing labels) and have learners identify and correct them. Display two sample data sets: Data showing changes over time (for line graph). Data showing correlation without time sequence (for scatter plot). Ask learners to work in pairs to determine which graph type to use for each data set. Discuss answers as a class. **Have learners describe data sets:** Introduce the terms centre, spread, and shape: Center: The middle value or typical value of a data set (mean or median). Spread: The range or how spread out the values are (variance or standard deviation). Shape: The overall pattern of the data distribution (e.g., symmetrical, skewed, or bimodal). Use an example data set to demonstrate these concepts on a histogram or box plot. Prompt learners to describe the centre, spread, and shape. Provide learners with a data set and have them:

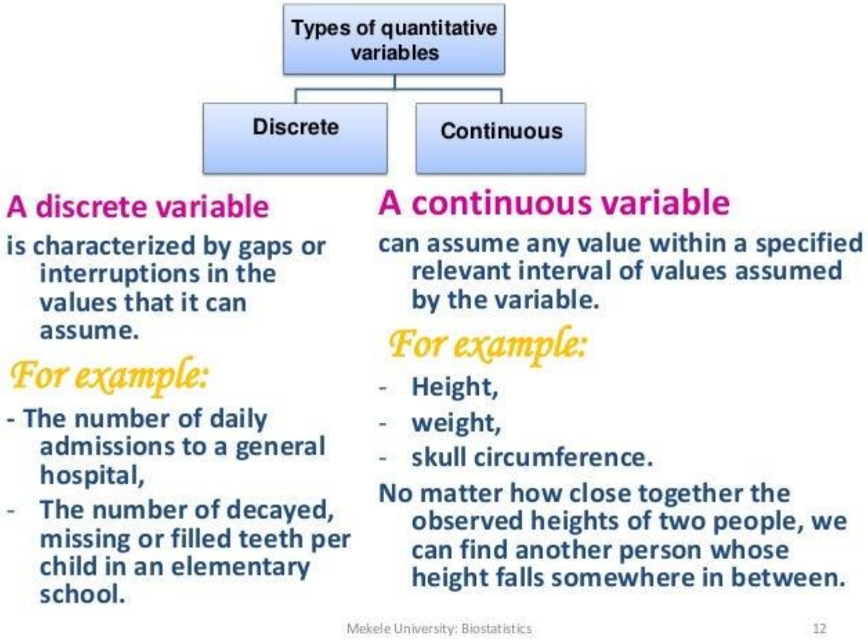
RF3 I can find the domain and range of a function. (F.1.2)

Discrete	Continuous
Result Of... Counting	Result Of... Measuring
Can Take... Only Certain Values	Can Take... Any Value Within a Certain Range
Looks Like...	Looks Like...
Examples: # of pizzas ordered # of students in class	Examples: weight of baby height of students

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
	Source:https://mathequalslove.net/wp-content/uploads/2017/12/Discrete-vs-Continuous-Functions-Foldable-3.jpg Learners generate scenarios to fall under the heading continuous and discrete.  Discrete Situation: The price of a hotel stay depends on the number of nights. Variables: Dependent: Price of Hotel Stay; Independent: Number of Nights. Sketch of Graph: price of hotel stay / # of nights Situation: The cost of traveling on the turnpike depends on the number of axels a vehicle has. Variables: Dependent: cost of toll; Independent: number of axels. Sketch of Graph: cost of toll / number of axels Situation: Student Council earns a profit of $5 for each Homecoming Shirt sold. Variables: Dependent: Profit; Independent: # of Shirts Sold. Sketch of Graph: Profit / # of Shirts Continuous Situation: Walmart sells bananas by the pound. Variables: Dependent: Total Price; Independent: # of pounds of bananas. Sketch of Graph: total price / lbs. of bananas Situation: Bob empties his swimming pool at a rate of 10 gallons per minute. Variables: Dependent: amt of water in pool; Independent: amt of time. Sketch of Graph: water in pool / time Situation: The height of a tree changes over time. Variables: Dependent: Height of Tree; Independent: Age of Tree. Sketch of Graph: height of tree / age of tree Source:https://mathequalslove.net/wp-content/uploads/2017/12/Discrete-vs-Continuous-Functions-Foldable-1.jpg **Conversation** Group work Learners analyse real-life data sets and decide on the appropriate graph. Learners will discuss the centre, spread, and shape of these data sets and how they help answer statistical questions. **Product** Learners complete a worksheet identifying discrete and continuous data.	Choose an appropriate graph type to represent the data. Create a graph with accurate titles, labels, and scales. Write a short paragraph justifying their graph choice. Describe the data's centre, spread, and shape.  Discrete data: Number of books in a bookshelf Continuous data: Length of pages of books present in a bookshelf Tips and Tricks 1. Whenever you have to identify, whether a given data is discrete or not, just ask yourself a question: *"Can I count it?"* Source: https://www.cuemath.com/data/discrete-data/ Provide examples of data sets and have learners decide which type of graph is appropriate. For instance, plot the temperature over a week (continuous data, line graph) versus the number of learners arriving at different times (discrete data, scatter plot). Use real data sets (like test scores or heights) and guide learners through calculating and interpreting the centre, spread, and shape. Visual aids like

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
	 3. A car repair garage records information about the cars it repairs. Put a cross in the box to indicate whether each of the following is discrete or continuous data. (a) The length Discrete ☐ Continuous ☐ (1) (b) The time taken to repair each car Discrete ☐ Continuous ☐ (1) (c) The number of seats Discrete ☐ Continuous ☐ (1) (d) The number of gears Discrete ☐ Continuous ☐ (1) (e) The number of miles per gallon Discrete ☐ Continuous ☐ (1) LIVEWORKSHEETS Source: [Continuous & Discrete Data | NMK | Live Worksheets]() Learners collect their own data (e.g., daily temperatures, number of books read in a month) and create graphs and descriptive statistics. Exit Ticket: Ask learners to answer one of the following questions: Why would you choose a histogram over a scatter plot? When is it best to use a line graph? Define "spread" and provide an example.	histograms or box plots can help illustrate these concepts. Instruct groups to create a visual representation of their data (histogram). As a class, discuss how to interpret the graphs and what the centre, spread, and shape indicate about the data. Class Discussion: Explore how different data sets can have similar centres but different spreads and shapes. Discuss how the context of the data influences interpretation.

Useful Content Knowledge for the Teacher about the Outcome:



Types of quantitative variables

Discrete

Continuous

A discrete variable

is characterized by gaps or interruptions in the values that it can assume.

For example:

- The number of daily admissions to a general hospital,
- The number of decayed, missing or filled teeth per child in an elementary school.

A continuous variable

can assume any value within a specified relevant interval of values assumed by the variable.

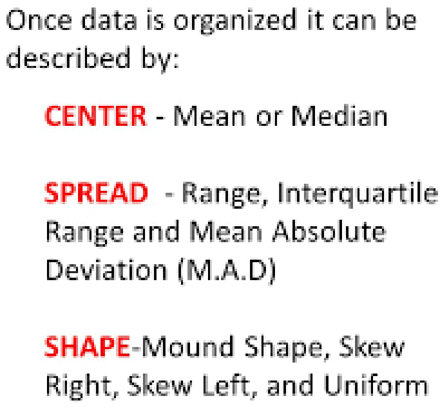
For example:

- Height,
- weight,
- skull circumference.

No matter how close together the observed heights of two people, we can find another person whose height falls somewhere in between.

Mekele University: Biostatistics 12

Source:https://medium.com/hackernoon/continuous-vs-discrete-variables-in-the-context-of-machine-learning-15d9005e2525



Once data is organized it can be described by:

CENTER - Mean or Median

SPREAD - Range, Interquartile Range and Mean Absolute Deviation (M.A.D)

SHAPE-Mound Shape, Skew Right, Skew Left, and Uniform

Source:https://mcdowellmatheog.weebly.com/uploads/2/6/7/6/26765014/7479784_orig.png

Line Graphs: Use these for continuous data to show trends over time or a range. Emphasise that the line represents a continuous change.
Scatter Plots: Use these for discrete data to show individual data points. They are ideal for showing relationships between two variables that are not necessarily continuous.

Understanding the features and purposes of different graphs is essential for selecting the appropriate display for a data set.

Pictographs, line plots, bar graphs, multiple-bar graphs, and stacked-bar graphs are used for qualitative data and discrete quantitative data.
Histograms display continuous quantitative data in intervals, with no gaps between bars, unlike bar graphs, which have gaps to indicate discrete categories.
Broken-line graphs illustrate changes over time and help identify trends, requiring an understanding of scales and estimation.
Key elements for effective graphs include:

Title: Clearly describe what the graph shows.
Labels: Identify what each axis represents.
Scale: Ensure consistent intervals and that the data fits well within the graph.
Source: Acknowledge where the data originated from.

Additional Resources and Materials
Link teaching discrete data: Discrete Data - Cuemath
Link on discrete and continuous data:4-4 Continuous vs. Discrete Data Notes

Whiteboard and markers
Projector/smartboard
Graph paper and rulers
Printed or digital copies of example data sets
Computers or tablets with access to graphing tools (e.g., Excel, Google Sheets, or graphing calculators)

Opportunities for Subject Integration

Social Studies: Learners list examples of discrete and continuous data collected in their country.

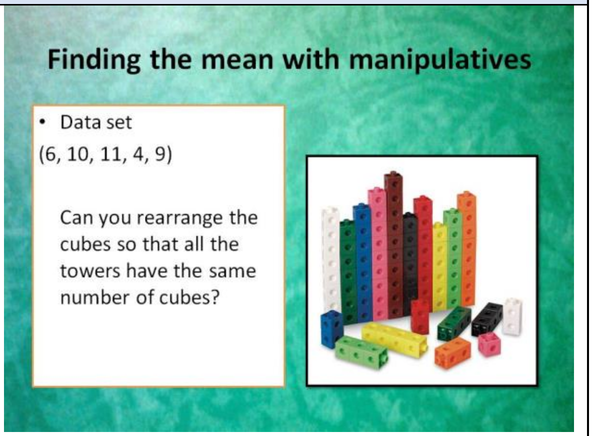
Science: Learners identify whether the data collected on the weather is continuous or discrete.
Art: Learners design a chart showing discrete and continuous data.

Essential Learning Outcome D2.2: Using Statistical Methods to Analyse Data – Developing and Applying Methods to Analyse Data Sets

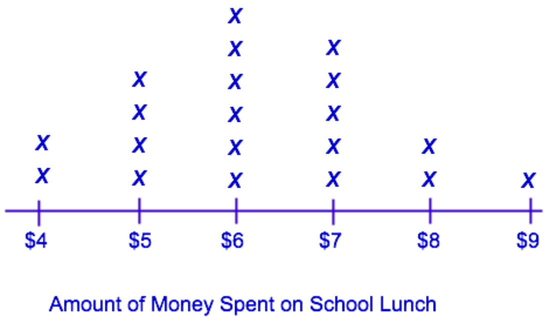
Grade Level Expectations and/or Focus Questions:

- **Recognize that a measure of centre for a numerical data set summarizes all of its values with a single number, while a measure of variation describes how its values vary with a single number**

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
Learners are expected to: **Knowledge** 1. Describe a given set of numerical data using a measure of centre (mean) 2. Describe a given set of numerical data using a measure of variation (range) 3. Determine suitable centres and variation for given data sets 4. Compare different data sets to understand how measures of centre and variation vary. 5. Summarize a given data set in the context of centre and or variation **Values** 6. Share examples of data sets to model the difference between measures of centre and measures of variation	<u>Conversation</u> After discussing with their partner in pairs on a measure of centre or measure of variation to a statistical question given, learners will present their responses to the class orally. This is done by deciding if a measure of centre or measure of variation is preferred in answering the question and why.	Have learners describe data using mean: Define mean as the average of a data set. Please explain how to calculate it (sum of values divided by the number of values). Work through a sample data set as a class (e.g., learner ages and weekly test scores). Calculate the mean together, highlighting how the mean represents the centre. Using manipulative to find the mean Learners are presented with counters or building blocks to help them calculate the mean of a given data set. First, learners make the height of the building block according to each data value then they are asked to use the building blocks to help the make each stock of building blocks the same height For examples:

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
		 **Finding the mean with manipulatives** - Data set (6, 10, 11, 4, 9) Can you rearrange the cubes so that all the towers have the same number of cubes? https://1.bp.blogspot.com/-8tkRZ7-NhxI/VqtdKFrFz9I/AAAAAAAAGc8/ZTo7KyuApEM/s1600/Slide3.JPG [Ms Rashid: Find the mean of a data set (kiciaabdurrashid.blogspot.com)](kiciaabdurrashid.blogspot.com) Understanding how the mean works Learners are then questioned as to what it means to have a mean of 5(from the example above). This is to elicit the fact that if each data set value were created equally each would be 5. Learners are then asked to formulate a number sentence that can be used to calculate the obtained mean. measure of variation Have learners describe data using the range: Define range as a measure of variation, calculated as the difference between a data set's highest and lowest values.

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
		Demonstrate this with the same data set used for meaning, emphasizing that range shows how spread out the data values are. Discuss why some data sets might have a larger or smaller range and how this reflects variation. Have learners determine suitable measures for different data sets: Present two or three different data sets: Example 1: A set of quiz scores with values close together. Example 2: A set of class heights with a wider spread of values. Guide learners in calculating the mean and range for each data set, discussing which measure (mean or range) gives more insight into the data's characteristics. Have learners compare different data Sets: Show two data sets with similar means but different ranges (e.g., scores from two different quizzes). Ask learners to compare them based on the mean and range, discussing how the difference in range affects our understanding of the data. Lead learners in a whole class discussion on how these differences in range suggest varying levels of consistency or variability. Provide learners with a set of data and have them: Calculate the mean to find the centre. Calculate the range to understand the variation.

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
		Write a short paragraph summarizing the data, focusing on the centre (mean) and variation (range). Provide learners with a set of data on a dot plot  https://vt-vtwa-assets.varsitytutors.com/vt-vtwa/uploads/problem_question_image/image/36075/1.png Ask learners a series of questions: What is the typical amount of money spent on school lunch? How is the data set spread out in comparison to the centre? Learners are questioned to elicit the idea that some data sets are best described using the measures of centre while some are using the measure of variation.

Useful Content Knowledge for the Teacher about the Outcome:

Measures of central tendency

Mode - this is the most frequently occurring value in a data set. It is the least used of all the measures of centre because a data set may not have a mode or may have more than one.

Median - this is the value that occurs in the middle of a set of arranged (ascending order or descending order) data. Also, half of the values in the data set lie above the median and half lie below. Furthermore, the value of the median is easier to understand when compared to the mean because its value is not affected by any extreme value (small or large)

Mean - this is calculated by finding the sum of the values in the data set and then dividing the sum by the number of data values in the set.

Measure of variation

Range - this the value obtained by finding the difference between the maximum (largest) and minimum (smallest) values in the data set.

Additional Resources and Materials

Linking cubes, Whiteboard, and markers
Projector or smartboard
Printed or digital copies of sample data sets
Calculators (if allowed)
Graph paper or digital graphing tools

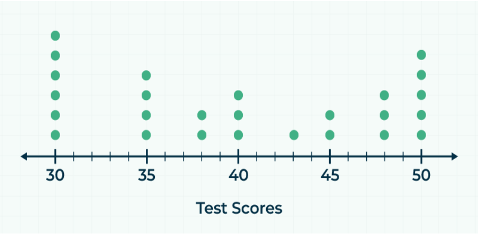
Opportunities for Subject Integration:

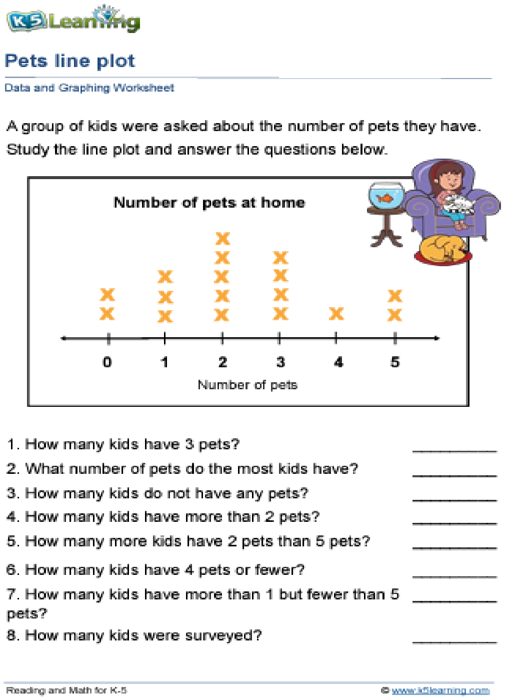
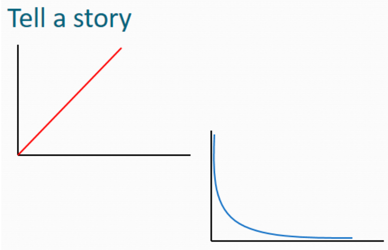
Mathematics and Science: Analyse experiment data (e.g., plant growth) using mean and range to observe trends.
Mathematics and Social Studies: Calculate the mean and range of historical data (e.g., population growth) to understand trends.
Mathematics and Physical Education: Use class performance data (e.g., running times) to compare measures of centre and variation.
Mathematics and Technology: Use spreadsheet software to calculate and graph data, enhancing tech and data skills.
Mathematics and Art: Create visual representations of data, using art to illustrate measures of centre and variation.
Mathematics and Language Arts: Write summaries explaining data findings and building communication skills.
.

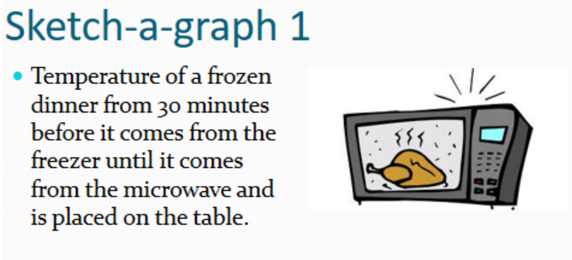
Essential Learning Outcome: D3.1. Evaluating Inferences and Making Predictions Based on Data – Making Inferences with Data Sets

Grade Level Expectations and/or Focus Questions:

- Read, explain patterns, and make predictions from data represented in line plots or graphs.

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
Learners are expected to: **Knowledge** 1. Read data in a line plot 2. Identify patterns presented in a line plot **Skills** 3. Interpret data presented in a line plot 4. Make predictions based on data presented in a line plot **Values** 5. Work collaboratively to create and solve real life questions about given line plots 6. Discuss the importance of using line plots to represent data.	**Observation** Observe learners as they work in groups to discuss and make predictions about data presented in a line plot.  *Source: https://www.shutterstock.com/search/learner-talking-teacher?image_type=illustration* **Product** Learners complete a worksheet which will require them to use the information presented to answer related questions.	*Have learners look at a video clip about line plots. Hold a discussion with them to reinforce their understanding of the features of line plots and their usefulness in the real world.* [Introduction to line plots | Measurement and data | Early Math | Khan Academy]() Provide opportunities for learners to read and interpret line plots. For example, present a diagram of a line plot to the class. Have learners observe the data to identify patterns and make predictions. Use probing questions to guide learners into exploring concepts such as range, mode etc. - Which number occurs most often in the data set? - Which number lies in the middle of the data set?  *Source: https://www.geeksforgeeks.org/what-is-line-plot/*

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
	 K5 Learning **Pets line plot** Data and Graphing Worksheet A group of kids were asked about the number of pets they have. Study the line plot and answer the questions below. Number of pets at home 0 1 2 3 4 5 Number of pets 1. How many kids have 3 pets? ________ 2. What number of pets do the most kids have? ________ 3. How many kids do not have any pets? ________ 4. How many kids have more than 2 pets? ________ 5. How many more kids have 2 pets than 5 pets? ________ 6. How many kids have 4 pets or fewer? ________ 7. How many kids have more than 1 but fewer than 5 pets? ________ 8. How many kids were surveyed? ________ Reading and Math for K-5 © www.k5learning.com *Source:/ https://www.k5learning.com/worksheets/math/data-graphing/grade-3-interpreting-line-plots-a.pdf* ***Group work*** Place learners into groups. Provide each group with diagrams of line plots representing the same data set. Ask learners to examine the data to identify patterns and make predictions. Ask learners to share their observations.	Place learners in groups of four. Present each group with diagrams of line plots to observe. Ask learners to make a list of at least 5 things they observe from the line plot. Have them paste their responses on post-it notes around the classroom.  Source: *https://www.classcover.com.au/3-ways-to-use-post-it-notes-classroom/* **Think Pair Share** Learners write a story of the different line graphs below, share with another learner to decide the most appropriate story that the graph depicts and share results with the class. 

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
		Learners also create graphs given different real-life situations. For example:  Sketch-a-graph 1 - Temperature of a frozen dinner from 30 minutes before it comes from the freezer until it comes from the microwave and is placed on the table.

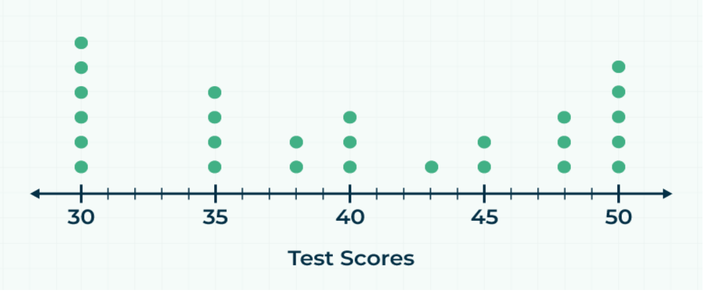
Useful Content Knowledge for the Teacher about the Outcome:

Collected data can be displayed using various types of graphs - e.g. Line plot, pictograph, bar graph, line graph etc.

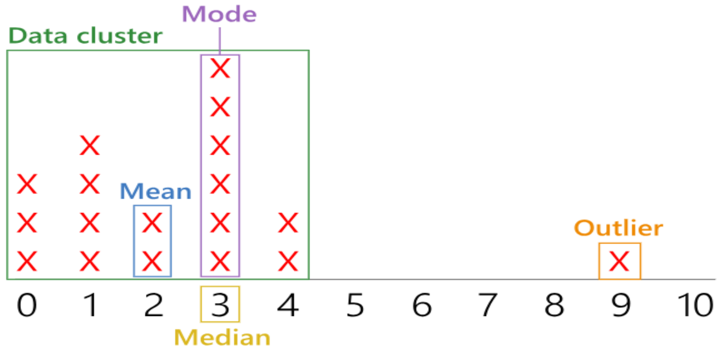
Line plot - This is a graph that displays data using a number line. To create a line plot, you first draw a number line that includes all the values in the data set. Next, you place an X (or dot) above each data value on the number line. If a value occurs more than once in a data set, you place an X over that number for each time it occurs. The Xs or dots represent the number of occurrences.

Line plots are often used in various fields, including statistics, science, and business, to represent data and highlight patterns over time or across categories. It is useful to provide a clear and concise representation of trends, patterns, and changes that occur over time.

Examples of line plots



Source: https://www.geeksforgeeks.org/what-is-line-plot/



Source: https://www.mometrix.com/academy/line-plot/

Additional Resources and Materials

- ☐ Whiteboard and markers
- ☐ Sample line plots on printed worksheets or a digital display
- ☐ Graph paper and pencils
- ☐ Sticky notes or index cards
- ☐ Optional: digital tools for creating line plots (e.g., Excel, Google Sheets)

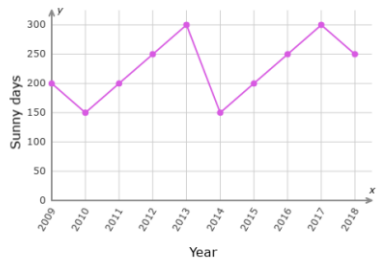
Opportunities for Subject Integration:

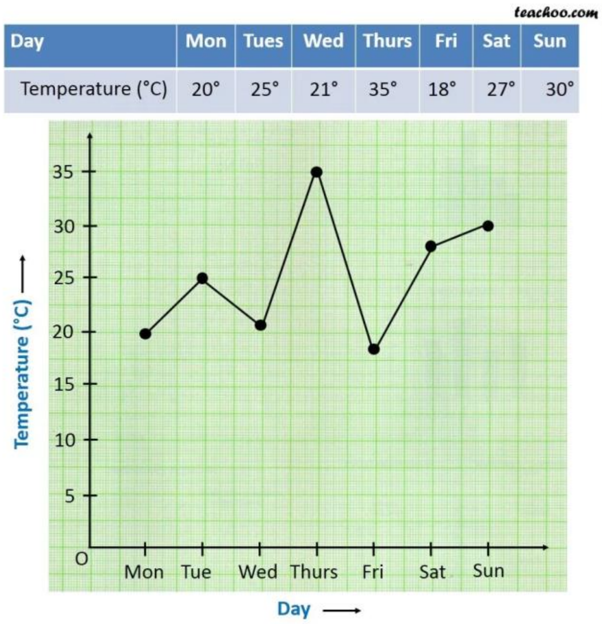
Maths: Answering questions about line plots
Language Arts: Completing a cloze passage using words relating to line plots
Social Studies: Using line plots to identify migration patterns of a population
HFLE:
Science: Drawing line plots to represent data
Art: Drawing diagrams of line plots to be displayed in the classroom.

Essential Learning Outcome: D3.2. Evaluating Inferences and Making Predictions Based on Data – Making and Testing Conjectures Based on Data Sets

Grade Level Expectations and/or Focus Questions:

- Interpret a given line graph to draw conclusions; Analyse the effect of different issues on data

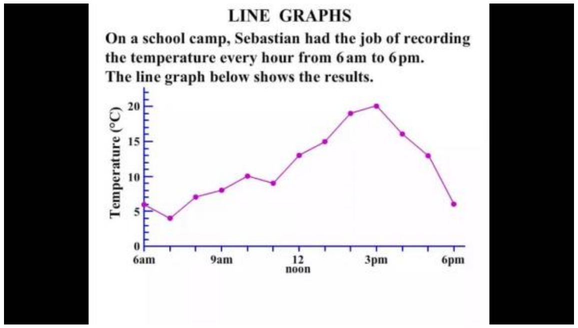
Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
Learners are expected to: **Knowledge** 1. Describe the key components of a line graph including title, axes, scale, data points, and legend. 2. Read specific data points for a line graph and describe what the data represents **Skills** 3. Analyse trends and patterns in a line graph 4. Analyse patterns in a line graph to draw logical conclusions and/or predictions about the data presented. **Values** 5. Communicate effectively their reasoning for deriving at their conclusion/prediction for a line graph	**Conversation** Teacher observes learners as they deliberate/discuss their opinions in support of or against a conclusion made on a line graph. E.g. Assume the line graph below shows the temperature reading for your community and this conclusion was made: “the temperature is very consistent”. Discuss your reason(s) “for” or “against” this conclusion.	Teacher will brainstorm with learners on the usefulness (shows the attainment for every variable being studied/tested) and key components of a line graph (title, axes, scale, data points, and legend). Then the teacher presents learners with various examples of line graphs, and through oral questioning, assesses learners ability to identify key components on the graph as well as the attainment for specific data variables on the graph. Examples For a study on local weather, the Lexington City Council tallied the total number of sunny days each year. Sunny days in Lexington  How many sunny days did Lexington have in all in 2010 and 2011? ☐ days

<table>
<tr><th>Specific Curriculum Outcomes</th><th>Inclusive Assessment Strategies</th><th>Inclusive Learning Strategies</th></tr>
<tr><td></td><td>


<table>
<tr><th>Day</th><th>Mon</th><th>Tues</th><th>Wed</th><th>Thurs</th><th>Fri</th><th>Sat</th><th>Sun</th></tr>
<tr><td>Temperature (°C)</td><td>20°</td><td>25°</td><td>21°</td><td>35°</td><td>18°</td><td>27°</td><td>30°</td></tr>
</table>

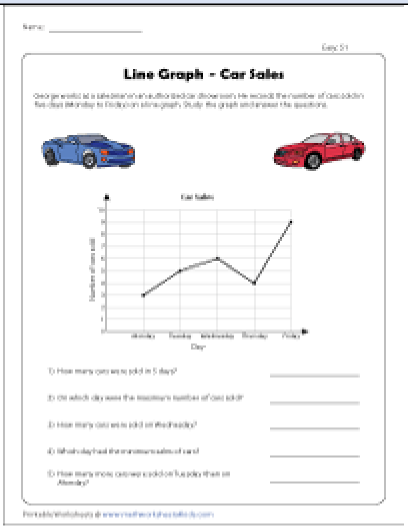
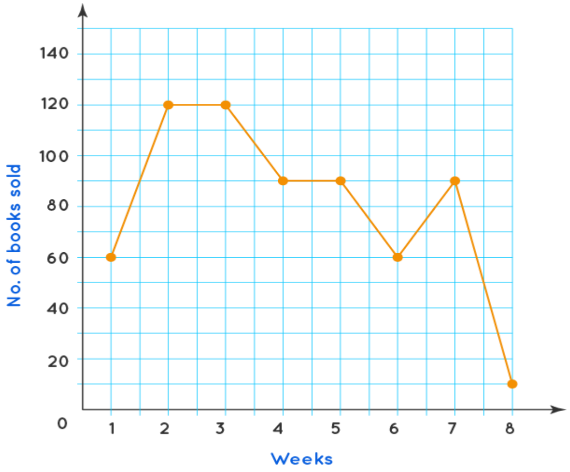
Source: https://tamelia-stickdesign.de/line+graph+for+temperature#gallery-6

Group work
Place learners in groups and assign one line graph to each group. Each group will be instructed to use a line graph to answer basic questions and to make a prediction on future occurrences. Note, some groups could be given the same line graph to strengthen the presentation and discussion phase of the lesson.
E.g.
</td><td>
Source: https://www.ixl.com/screenshot/da87f5b4bbc6865c3788a43bd88260627b5da8be.png


LINE GRAPHS
On a school camp, Sebastian had the job of recording the temperature every hour from 6am to 6pm. The line graph below shows the results.

https://i.ytimg.com/vi/qfs1ksnwAJA/maxresdefault.jpg

After this oral discussion, the teacher can mention that these answers given were exact/accurate for learners to recognise that no prediction was made from the data set.
Teachers will continue to guide learners to develop an awareness of the possible approaches to make a conclusion on a data set: by calculation (mean, mode, median, range…) or by Prediction through the study of the patterns and trends in the graph.
When studying the trends and patterns in a graph, learners need to focus on what things are changing and what remains the same. Further, see if there is a reasonable consistency in the attainment for every consecutive x-variable or for every other set of x-variables.
After this level of “reasonable consistency” is determined then the teacher can train his/her
</td></tr>
</table>

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
	 Name: Line Graph - Car Sales Car Sales Day https://www.mathworksheets4kids.com/line-graph/interpret-easy1.pdf  https://d138zd1ktt9iqe.cloudfront.net/media/seo_landing_files/line-graph-solved-example-1-1-1624257560.png	learners to use this evaluation to make a prediction on the data set. Note: learners must be made aware that the idea of the prediction supported by the data is very important. Also, emphasize that it is normal for learner's predictions on a data set to differ. However, there is a level of reasonableness that must be applied to the accuracy of the prediction made.

Useful Content Knowledge for the Teacher about the Outcome:
Prediction in statistics involves using a model to estimate future values or outcomes based on existing data. It is a forward-looking process where the goal is to make informed guesses about what will happen based on the patterns observed in the data.
A conclusion in statistics is a judgment or decision reached after analysing data.

Opportunities for Subject Integration:
Language Arts: Writing a composition on the topic: Line Graphs
Social Studies: Studying and predicting population and migration trends
Health: Studying health trends
Science: Analysing temperature changes and their effects on plant growth

Essential Learning Outcome: D3.3. Evaluating Inferences and Making Predictions Based on Data – Evaluating Data Descriptions and Reports Analyse Misinterpreted Data

Grade Level Expectations and/or Focus Questions:

- Determine the range as a measure of spread and the measures of central tendency for various data sets, and use this information to compare two or more data set

<table>
<tr><th>Specific Curriculum Outcomes</th><th>Inclusive Assessment Strategies</th><th>Inclusive Learning Strategies</th></tr>
<tr>
<td>**Learners are expected to:**

Knowledge

1. Explain the meaning of each of the measures of central tendency (mean, median, mode, range).
2. Explain how to calculate the mean, median, mode, and range.

Skills

3. Calculate the mean, mode, median and range of a set of numbers.
4. Compare data sets using the measures of central tendency.

Values

5. Discuss the importance of being able to calculate and apply the measures of central tendency in real life situations</td>
<td>***Observation***
Present similar data sets to groups of learners. Have learners work together to calculate the mean, median, mode and range. A checklist will be used to assess learners as they perform calculations.

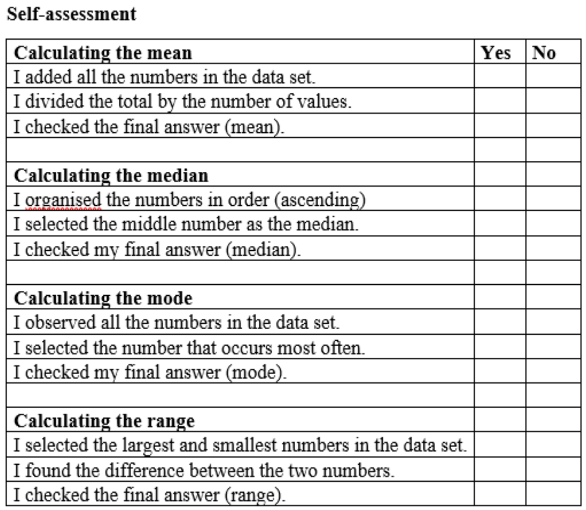
<table>
<tr><th>Calculating the mean, median, mode and range</th><th>Yes</th><th>No</th></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td>The mean was calculated correctly.</td><td></td><td></td></tr>
<tr><td>The median is correct.</td><td></td><td></td></tr>
<tr><td>The mode is correct.</td><td></td><td></td></tr>
<tr><td>The range was calculated correctly</td><td></td><td></td></tr>
</table>

Self - assessment
Present each learner with a worksheet to calculate the mean, median, mode and range. After calculating each, learners will complete a self-assessment sheet.</td>
<td>Video clip
Present a video clip to the learners to review the measures of central tendency - mean, median, mode and range. After watching the clip, have a discussion with learners about the procedure for calculating each measure of central tendency.
Mean Mode Median and Range | Year 6 Maths lesson

Help learners understand the range, mode, median, and mean, provide them with a set of data, such as T-shirt prices:

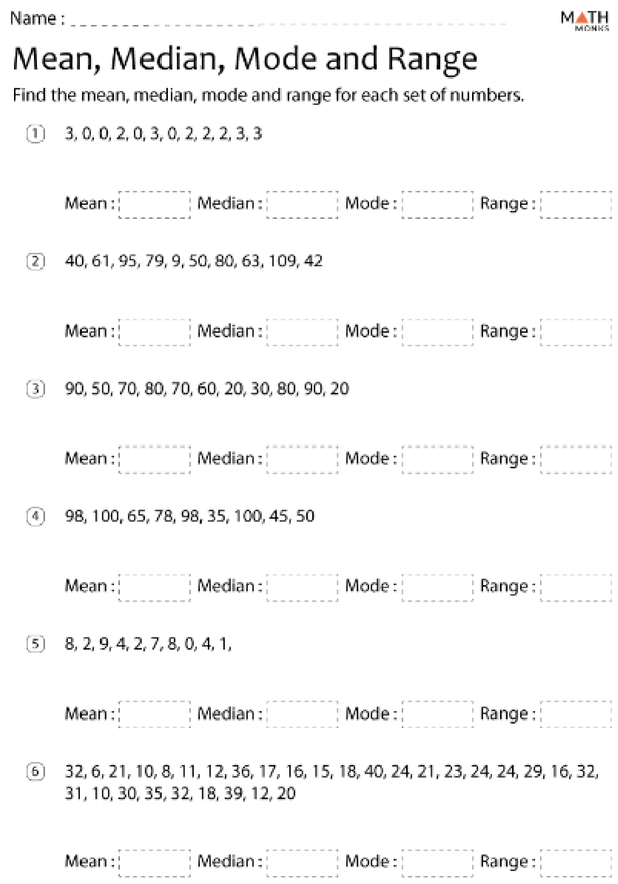
$15.50, $12.25, $15.50, $35.00, $44.50, $28.75, $15.50, $35.00, $20.00, $17.25, $31.50, $8.75, $22.25, $10.75, $46.00.
Range: $46.00 − $8.75 = $37.25
Mode: $15.50 (appears most frequently)
Mean: $358.50 ÷ 15 = $23.90 (average)
Median: $20.00 (middle value)
Ask learners questions like:

What is the range (difference between the highest and lowest values)?
What is the mode (most frequent value)?
What is the median and what does it indicate?
How do you calculate the mean, and what does it represent?</td>
</tr>
</table>

<table>
<tr><th>Specific Curriculum Outcomes</th><th>Inclusive Assessment Strategies</th><th>Inclusive Learning Strategies</th></tr>
<tr><td></td><td>

Self-assessment
<table>
<tr><th>Calculating the mean</th><th>Yes</th><th>No</th></tr>
<tr><td>I added all the numbers in the data set.</td><td></td><td></td></tr>
<tr><td>I divided the total by the number of values.</td><td></td><td></td></tr>
<tr><td>I checked the final answer (mean).</td><td></td><td></td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td>Calculating the median</td><td></td><td></td></tr>
<tr><td>I organised the numbers in order (ascending)</td><td></td><td></td></tr>
<tr><td>I selected the middle number as the median.</td><td></td><td></td></tr>
<tr><td>I checked my final answer (median).</td><td></td><td></td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td>Calculating the mode</td><td></td><td></td></tr>
<tr><td>I observed all the numbers in the data set.</td><td></td><td></td></tr>
<tr><td>I selected the number that occurs most often.</td><td></td><td></td></tr>
<tr><td>I checked my final answer (mode).</td><td></td><td></td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td>Calculating the range</td><td></td><td></td></tr>
<tr><td>I selected the largest and smallest numbers in the data set.</td><td></td><td></td></tr>
<tr><td>I found the difference between the two numbers.</td><td></td><td></td></tr>
<tr><td>I checked the final answer (range).</td><td></td><td></td></tr>
</table>

<i>Product</i>
<i>Present learners with worksheets requiring them to calculate the measures of central tendency (mean, mode, median, range).</i>
</td><td>
Explore how removing the highest or lowest values or increasing all prices by 50% would impact these measures.

Online game
Have learners practice calculating the mean, median, mode and range of a data set.
https://www.turtlediary.com/game/mean-median-mode-range.html
</td></tr>
</table>

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
	 Name : **Mean, Median, Mode and Range** Find the mean, median, mode and range for each set of numbers. ① 3, 0, 0, 2, 0, 3, 0, 2, 2, 2, 3, 3 Mean : Median : Mode : Range : ② 40, 61, 95, 79, 9, 50, 80, 63, 109, 42 Mean : Median : Mode : Range : ③ 90, 50, 70, 80, 70, 60, 20, 30, 80, 90, 20 Mean : Median : Mode : Range : ④ 98, 100, 65, 78, 98, 35, 100, 45, 50 Mean : Median : Mode : Range : ⑤ 8, 2, 9, 4, 2, 7, 8, 0, 4, 1, Mean : Median : Mode : Range : ⑥ 32, 6, 21, 10, 8, 11, 12, 36, 17, 16, 15, 18, 40, 24, 21, 23, 24, 24, 29, 16, 32, 31, 10, 30, 35, 32, 18, 39, 12, 20 Mean : Median : Mode : Range : *Source:* *https://mathmonks.com/wp-content/uploads/2021/06/7th-Grade-Mean-Median-Mode-Range-Worksheets.jpg*	

Useful Content Knowledge for the Teacher about the Outcome:

The mean, mode, and medium are different types of averages from a data set. They are referred to as measures of central tendency.

- The mean is the average of a data set. It can be calculated by adding up all of the numbers in the data set and then dividing by the total number of values in the set.
- The median is the middle value (or midpoint) when a data set is ordered from least to greatest. So list the numbers in your dataset from the lowest value to the highest value. The median is the number that is in the middle of the list of numbers.
- The mode is the value that appears the most number of times in a set of data.
- The range is the difference between the largest value and the smallest value. To calculate the range, subtract the smallest value in data set from the largest. The difference is called the range.

Additional Resources and Materials

Online worksheet: ***Mean, Median, Mode and Range worksheet***

Worksheet: *https://www.math-salamanders.com/image-files/5th-grade-statistics-worksheets-mean-median-mode-range-1.gif*

Opportunities for Subject Integration:

Maths: Solving problems involving the calculation of the mean, median, mode and range of data sets

Language Arts: Writing a composition to explain how to calculate each measure of central tendency

Social Studies: Calculating the mean age of a selected population/group

Science: Calculating the mean (average) height of plants/learners etc.

Art: Creating a poster for the classroom with the definitions for mean, median, mode and range

Essential Learning Outcome: D4.1. Understanding and Applying Concepts of Probability – Predicting and Describing the Likelihood of Events

Grade Level Expectations and/or Focus Questions: Explore events involving two or more steps; represent data using charts and diagrams

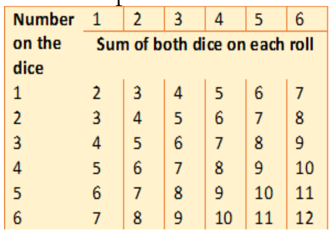
<table>
<tr><th>Specific Curriculum Outcomes</th><th>Inclusive Assessment Strategies</th><th>Inclusive Learning Strategies</th></tr>
<tr>
<td>Learners are expected to:

Skills
1. Predict possible outcomes of events

Knowledge
2. Describe the likelihood of an event occurring

Values

3. Discuss the importance of determining the likelihood of an event occurring.</td>
<td><i>Have learners supply their predictions about the popularity of the usage of the vowels in the names of children in the class. Learners will make predictions by supplying their percentages of each letter up front then the teacher will show the actual results. (This can be reflected using a table or a graph; learners given a choice)</i>

<table>
<tr><th><i>Vowel</i></th><th><i>Prediction</i></th><th><i>Actual probability</i></th></tr>
<tr><td><i>E -</i></td><td></td><td></td></tr>
<tr><td><i>A-</i></td><td></td><td></td></tr>
<tr><td><i>O-</i></td><td></td><td></td></tr>
<tr><td><i>I-</i></td><td></td><td></td></tr>
<tr><td><i>U-</i></td><td></td><td></td></tr>
</table>
<i>Josh has 4 green ties and three blue ties. He selects one of the ties at random for himself and them another tie at random for his friend.</i>
<i>1. What is the probability of choosing a green tie?</i>
<i>2. If Josh has already chosen his tie, what is the probability of choosing a blue tie for his friend?</i></td>
<td>Experiment 1
Five learners can be given five chances to score a ball in a basket. Learners will predict the likelihood of learners scoring in the basket. They will check their predictions at the end.
Experiment 2
This is a table of a player rolling two dice and looking at the sum of all the rolls. Learners will create a chart with all the possible outcomes of rolling both dice at the same time. Teacher make sure to explain the table well to learners.

<table>
<tr><th>Number on the dice</th><th>1</th><th>2</th><th>3</th><th>4</th><th>5</th><th>6</th></tr>
<tr><td></td><td>Sum of both dice on each roll</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td></tr>
<tr><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td></tr>
<tr><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td></tr>
<tr><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td></tr>
<tr><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td><td>11</td></tr>
<tr><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td><td>11</td><td>12</td></tr>
</table>
1. What is the probability of getting a sum of 10?
2. What is the probability of getting a total of 6?
3. What is the probability of getting a sum that is the result of a double?</td>
</tr>
</table>

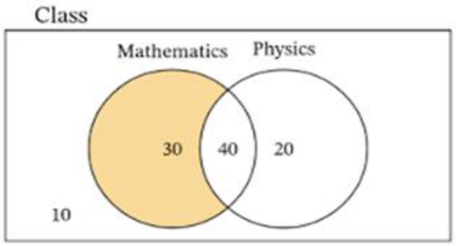
Useful Content Knowledge for the Teacher about the Outcome: Two-step experiments are those that incorporate two simple experiments. For example tossing a coin and rolling a die, or tossing a coin twice. Finding probabilities of two-step experiments is easier if we use a list, table or tree diagram to show all possible outcomes.

Reminder: P = <u>Number of favourable outcomes</u>

Total number of outcomes

Learners can describe what is taking place in the diagram as to the probability of
Learners who like math only
Learners who like physics only
Learners who do not like math nor physics

https://encrypted-tbn0.gstatic.com/images?q=tbn:ANd9GcRKPkE5aN_hOwrVO10trWBNPDgQLmRpw3f0AQ&s



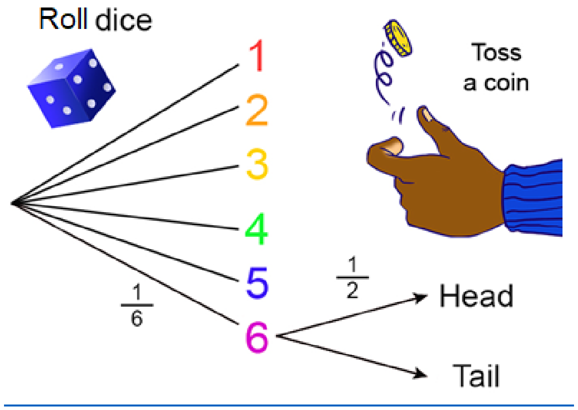
Additional Resources and Materials:
https://www.google.com/search?q=bk8_10.pdf&sca_esv=5fbf67e4323cad9e&sca_upv=1&udm=2&biw=1366&bih=607&sxsrf=ADLYWIIxwXTx0JwaWpZ9HRYYpxu1TSUlKA%3A1726076168053&ei=CNXhZtH4AoOq5NoPhuqTkQM&ved=0ahUKEwjRnOjmtruIAxUDFVkFHQb1JDIQ4dUDCBA&uact=5&oq=bk8_10.pdf&gs_lp=Egxnd3Mtd2l6LXNlcnAiCmJrOF8xMC5wZGZI14IBUMoGWMN9cAF4AJABAJgBhASgAcIUqgEMMC4xMC4yLjAuMS4xuAEDyAEA-AEBmAIDoAKaBsICChAAGIAEGEMYigXCAgUQABiABMICBhAAGAcYHpgDAOIDBRIBMSBAiAYBkgcHMC4yLjQtMaAH7iU&sclient=gws-wiz-serp#vhid=aEH-pO3nDLJ2sM&vssid=mosaic

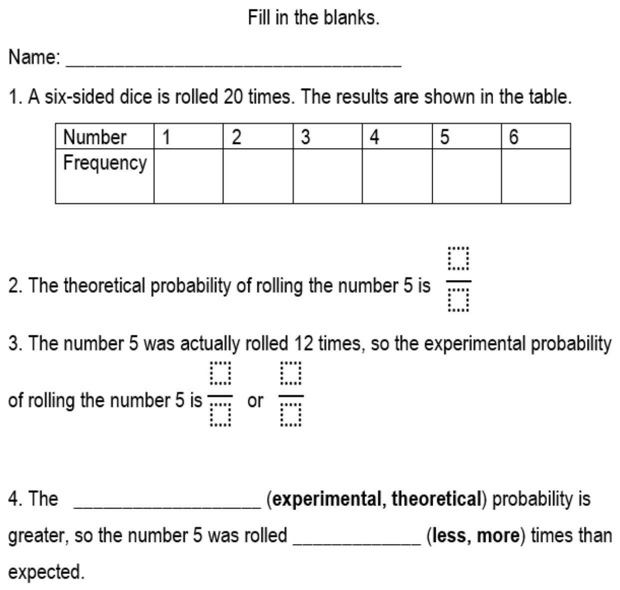
Opportunities for Subject Integration:
Maths: Predicting and describing sales from a small business operated by learners over a period of time.
Language Arts: Based on a story, what is the likelihood of a character successfully completing a task based on the obstacles present?
Social Studies: What is the likelihood of population increase or decrease in the country over a particular period?
Health: Predicting and describing weight loss or gain over a period of time.
Science: Explore the use of probability in weather forecasts. What is meant by ‘a 20% chance of rain’? Where in the world would the probability of rain be close to zero? Or close to 1? What does it mean?

Essential Learning Outcome: D4.2. Understanding and Applying Concepts of Probability – Calculating Probabilities

Grade Level Expectations and/or Focus Questions:

- Compare experimental results and theoretical probabilities of an experiment; explain that as the number of trials in a probability experiment increases the experimental probability approaches the theoretical probability of a particular outcome.

Specific Curriculum Outcomes	Inclusive Assessment Strategies	Inclusive Learning Strategies
Learners are expected to: **Knowledge** 1. Explain the difference in experimental and theoretical probability **Skills** 2. Compare the results of experimental probability versus theoretical probability **Values** 3. Discover that as the number of trials in a probability experiment increases the experimental probability approaches the theoretical probability of a particular outcome.	Conversation Based on prior knowledge, learners are invited to discuss the theoretical probability of the outcomes of flipping a coin or rolling a dice. Teacher probes learners to state why their predicted (theoretical) outcomes did not match the results of the experiments. Observation Teacher observes learners as they carry out each activity of flipping the coin and rolling the dice a specific number of times. Product 	Group Work Activity The learners are placed into groups of 3-4. Each group is given a coin, a dice and an activity sheet. They will conduct a number of events and record the outcomes. The learners will flip a coin twenty times, and roll the dice twenty times. **Record Outcomes:** **Activity 1: Flipping Coin**

<table>
<tr><th>Specific Curriculum Outcomes</th><th>Inclusive Assessment Strategies</th><th>Inclusive Learning Strategies</th></tr>
<tr>
<td></td>
<td>


Fill in the blanks.

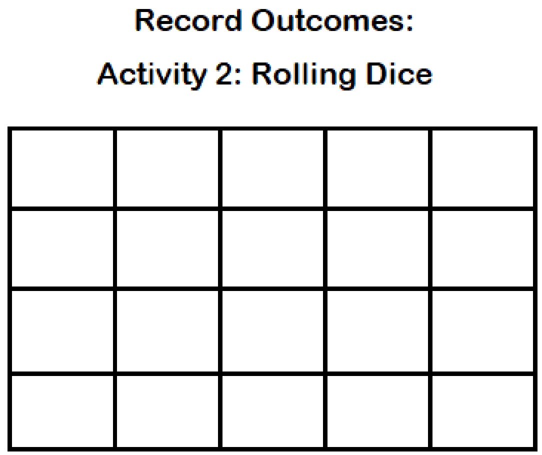
Name: ______________________________

1. A six-sided dice is rolled 20 times. The results are shown in the table.

<table>
<tr><td>Number</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td></tr>
<tr><td>Frequency</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>

2. The theoretical probability of rolling the number 5 is $\frac{\square}{\square}$

3. The number 5 was actually rolled 12 times, so the experimental probability of rolling the number 5 is $\frac{\square}{\square}$ or $\frac{\square}{\square}$

4. The ________________ (**experimental, theoretical**) probability is greater, so the number 5 was rolled ___________ (**less, more**) times than expected.
</td>
<td>


Record Outcomes:

Activity 2: Rolling Dice

<table>
<tr><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td></td></tr>
</table>

After conducting the experiment, the learners state how many outcomes they received for each event.
</td>
</tr>
</table>

Useful Content Knowledge for the Teacher about the Outcome:

Experimental probability: the likelihood of an event occurring based on trials that were performed. This is often considered what *actually* happened.

Experimental probability formula:

$$\frac{\text{number of times event occurs}}{\text{number of trials}}$$

Theoretical probability: the likelihood of an event occurring based on knowledge of the situation. This is often considered what *should* happen.

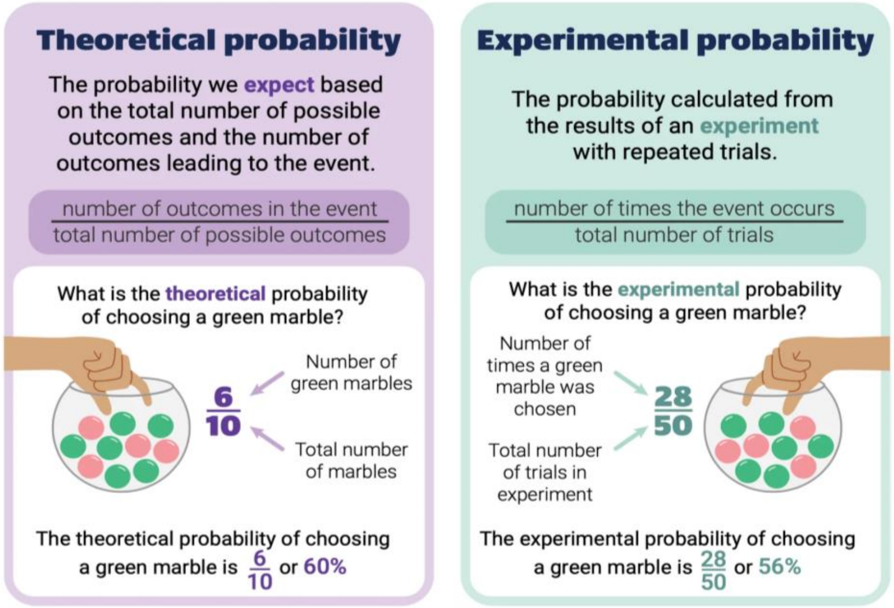
Theoretical probability formula:

$$\frac{\text{number of favourable outcomes}}{\text{number of possible outcomes}}$$

Steps for Comparing Experimental and Theoretical Probability

Step 1: Find the experimental probability of the event as a percentage.
Step 2: Find the theoretical probability of the event as a percentage.
Step 3: Compare the experimental and theoretical probabilities based on the problem.

Additional Resources and Materials
Grade 7 Theoretical and Experimental Probability
Comparing theoretical to experimental probabilities | 7th grade | Khan Academy



Theoretical probability

The probability we **expect** based on the total number of possible outcomes and the number of outcomes leading to the event.

$$\frac{\text{number of outcomes in the event}}{\text{total number of possible outcomes}}$$

What is the **theoretical** probability of choosing a green marble?

The theoretical probability of choosing a green marble is $\frac{6}{10}$ or **60%**

Experimental probability

The probability calculated from the results of an **experiment** with repeated trials.

$$\frac{\text{number of times the event occurs}}{\text{total number of trials}}$$

What is the **experimental** probability of choosing a green marble?

The experimental probability of choosing a green marble is $\frac{28}{50}$ or **56%**

Opportunities for Subject Integration:
Maths:

- **Fraction, decimals and percentages**
- **Consumer Maths:** A learner selling popsicles as a small business will want to know what fraction of her sales will be her new soursop flavour. She tallies the products sold on the first day of the week (12 vanilla and 8 soursop) and finds that 8/20 = 4/10 = 2/5 of her weekly sales will probably be soursop popsicle.

Language Arts: Make predictions when reading stories
Social Studies:

- **Government and Election** - use historical data to understand how a constituency voted previously to understand who they will vote for this time.

- **Population -** Estimate human and animal populations in an area.

Health: Diseases. - produce more accurate information relating to rates of disease and other health conditions.
Science: Weather Forecast: e.g. It rained 15 days in January (a probability of 12/31). Using this information, learners can predict that the probability of the number of rainy days next January is 15/31.
Art: Create or construct game boards or charts e.g. number spinners, colour wheels
P.E.: Predicting Games outcome e.g. A learner playing cricket wants to know the probability he has of scoring a goal in his first match in a football competition. Historically, the player scored 9 goals in 20 games. The probability he will score a goal in his first match is 9/20 = 0.45 = 45%