YEAR 7 MATHEMATICS SCHEME OF WORK 2021

PROCESS STRAND - PROBLEM SOLVING	
Formulating	• Identify the information needed to solve a problem, classifying and sorting it where necessary.
	• Represent problems mathematically, making appropriate use of diagrams, words, symbols, tables and graphs.
	• Use and apply mathematical knowledge, methods and techniques across different mathematical domains, including solving problems in unfamiliar contexts.
	• **Break a complex calculation into simpler steps, choosing and using appropriate and efficient operations, methods and resources**.
Analysing & reasoning	• Use appropriate mathematical techniques and notation to explain how to solve a problem.
	• Check calculations, methods and mathematical arguments.
	• **Extend the answer to a problem to a wider context by generalising**. Extend problems by asking 'What if...?' and altering some of the original variables or constraints.
Interpreting & justifying	• **Decide whether an answer is reasonable**.
	• Interpret answers referring to the context of the original problem.
	• Justify answers and conclusions, orally and in writing.
	• Explore whether statements are always true, sometimes true or never true.
	• Recognise that some statements or conclusions maybe misleading or uncertain. Understand the importance of a counter-example in disproving something is always true.

1. NUMBERS, OPERATIONS & ALGEBRA (21 WEEKS)

SUB-TOPICS	LEARNING OBJECTIVES	LEARNING EXPERIENCE/EXEMPLIFICATION	INSTRUCTION TIME
1.1 PROPERTIES OF NUMBERS	Students should be able to:		2
1.1.1 Multiples, Factors, Common Factors, LCM, HCF, Primes, Test of Divisibility, Index Notation, Prime Factors, Squares & Square Root, Cubes & Cube Root	a) **Recognise and use multiples, factors, common factors, lowest common multiples, highest common factors, primes (less than 100) and tests of divisibility when solving problems**. [SPN21 MATHEMATICS Y7 Pages 2-11]	• Find factors and multiples of a given number. • **Understand the relationship between multiples and factors.** *Examples :* a) What are the factors of 12? 1 x12 = 12 2 x 6 = 12 3 x 4 = 12 **1, 2, 3, 4, 6 and 12 are the factors of 12.** Correspondingly, **12 is a multiple of 1, 2, 3, 4, 6 and 12.** b) List down the first three multiples of 6? 1 x 6 = 6 2 x 6 =12 3 x 6 = 18 **The first three multiples of 6 are 6, 12 and 18.** Correspondingly, **1 and 6 are factors of 6;** **2 and 6 are factors of 12;** **3 and 6 are factors of 18.** c) List down the first four multiples of 7. d) What are the common factors of 20 and 30? e) List down the first two common multiples of 2 and 3. • Find lowest common multiples (LCM) and highest common factors (HCF) of a given number. • Solve word problems involving LCM and HCF. *Examples:*	

		a) Rafa has 45 cookies. She wants to pack an equal number of cookies into different bags. In how many ways can she pack the cookies if she must use at least two bags? b) Three bus services (A, B and C) leave the bus station together at 9.00 a.m. Service A leaves the station every 10 minutes, Service B leaves the station every 15 minutes and Service C every 25 minutes. At what time will the 3 services next leave the station together? c) A choir at your school wants to divide the choir into smaller groups. There are 24 sopranos, 60 altos and 36 tenors. Each group will have the same number of each type of voice. (a) What is the greatest number of groups that can be formed? (b) How many sopranos, altos and tenors will be in each group? d) Three bus services (A, B and C) leave the bus station together at 9.00 a.m. Service A leaves the station every 10 minutes, Service B leaves the station every 15 minutes and Service C every 25 minutes. At what time will the 3 services next leave the station together? e) The LCM of two numbers is 60. One of the numbers is 12. Find the other number. Find as many answers as you can. • Recall prime numbers (less than 100). *Examples:* 1. Is 5 a prime number? Explain your answer. 2. Is 80 a prime or composite? Explain your answer. 3. Find all the prime numbers between 40 and 60. 4. How many prime numbers, less than 50, are odd numbers? 5. List down all the prime numbers which are factors of a) 30 b) 36 • Solve problems involving divisibility rules. *Examples:* 1. Is 72 divisible by 2? 2. Is 53 divisible by 3?	

		3. Is 180 is divisible by 2, 3, 4, 5, 9 and 10?	
	b) Understand, read and write index (exponent, power) notation for a^n where n is a positive integer. Understand, read and write index notation for positive integer powers of 10. [SPN21 MATHEMATICS Y8 Pages 79-80]	• Read and write index notation for a^n where n is a positive integer and for positive integer powers of 10. base ⟶ a^n ⟵ index • Emphasize **index = exponent = power.** *Examples:* 1. Write down the expression in index form. 5x5x5 2. Find the missing base. $\_\_\_\_^3 = 27$ 3. Write down the expression in index form. $41 \cdot 41 \cdot 70 \cdot 70 \cdot 70$ $= 41^{\_\_} \cdot 70^{\_\_}$ 4. Fill in the missing exponent (power/index). $10^{\_\_} = 10{,}000$ 5. Write 4x4 in index form using a) 4 as the base b) 2 as the base 6. Write each of the following in index form using 3 as the base. a) 9 b) 81	
	c) Express 2-digit whole numbers as prime factors. [SPN21 MATHEMATICS Y7 Pages 5-7]	• Express 2-digit whole numbers as prime factors. *Example:* List down 5 numbers which has only two prime factors 3 and 5. • Write the prime factorisation of a given number in terms of index notation. *Example:*	

		Express 72 as prime factors. Leave your answer in index notation.	
	d) Understand square numbers and positive square roots of <u>positive integers</u> and recognise patterns in their sequence. [SPN21 MATHEMATICS Y7 Pages 12-14, 86]	• Review squares and square roots. *Examples:* Calculate mentally: a) $4^2 + 9$ b) $(4+3)^2$ c) $5^2 - 7$ d) $\sqrt{9+7)}$ e) $\sqrt{(40-2^2)}$ f) What is the fourth square number? • Relate squares and square roots with Area and Perimeter of Square problems. *Examples:* 1. Find the length of the side of a square with an area of 36 cm^2 2. The area of a square is 25 m^2. Find its perimeter. • Recognise the sequence patterns in squares and square roots. *Examples:* Complete the number sequence: 1. $1 , 4 , 9 , \_\_ , \_\_$ 2. $144 , \_\_\_ , \_\_\_ , 81 , 64$	
	e) Understand cube numbers and cube roots of <u>positive integers</u> and recognise patterns in their sequence. [SPN21 MATHEMATICS Y7 Pages 15-16, 86]	• Review cubes and cube roots. *Examples:* 1. $1^3 + 3^3$ 2. $\sqrt[3]{9 \times 3}$ • Recognise the sequence patterns in cube and cube root. Examples: Complete the number sequence: 1. $1 , 8 , 27 , \_\_ , \_\_$ 2. $343 , \_\_\_ , \_\_\_ , 64 , 27$ • Relate cubes and cube root with Volume of Cube problems.	

		Examples: 1. Find the length of the side of a cube with volume of 27 cm^3. 2. Find the area of each face of a cube whose volume is 125 cm^3.	

SUB-TOPICS	LEARNING OBJECTIVES	LEARNING EXPERIENCE/EXEMPLIFICATION	INSTRUCTION TIME
1.2 OPERATIONS WITH INTEGERS	Students should be able to:		4
1.2.1 Whole Number Bonds, Multiplication and Division of Whole Numbers, Doubles and Corresponding Halves of Whole Numbers.	a) Consolidate the rapid recall of number facts including: • complements (number bonds) for whole numbers to 100; • multiplication and associated division facts up to 12 × 12; • doubles of whole numbers up to 100 and corresponding halves. Consolidate mental methods for calculating with whole numbers, including multiplication and division by 10, 100 and 1000. [SPN21 MATHEMATICS Y7 Chapter titles involved: Whole numbers and operations; Integers and operations]	• **Addition and subtraction facts** Know with rapid recall addition and subtraction facts to 20. • **Complements (number bonds)** Derive quickly: whole-number complements in 100 and 50, *Example*: 100 = 63 + 37, 50 = -17 + 67 33 and what number makes 100? **33 + 67 = 100** or **100 – 33 = 67** What numbers make 100? • **Multiplication and division facts** Know with rapid recall multiplication facts up to 12x12 (and squares to at least 12x12). Derive quickly the associated division facts, e.g. 56÷7, $\sqrt{81}$. • **Doubles and halves** Derive quickly: doubles of two digit whole numbers up to 100, and all the corresponding halves. *Example:* Double of 25 25 + 25 = 50 or 2 x 25 = 50 Correspondingly, half of 50? $\mathbf{50 \div 2 = 25}$	

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- **Use knowledge of place value** to multiply and divide mentally whole numbers by 10, 100 and 1000. E.g. 2 x 10 = 20 , 35 ÷ 100 = 0.35

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<td>1.2.2 Estimation & Approximation</td>
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b) Make and justify estimates of calculations involving whole numbers.

[SPN21 MATHEMATICS Y7 Pages 79-81]

c) Understand and use place value to solve problems involving whole numbers, including problems that require numbers to be rounded to the nearest 10, 100, 1000, etc.

[SPN21 MATHEMATICS Y7 Pages 72-74, 78]

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- Understand there are many ways to find an approximate answer.

Example: Approximate $192 \div 39$

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<tr><td></td><td>Metod 1</td><td>Method 2</td></tr>
<tr><td>Estimated answer</td><td>$190 \div 40 = 4.75$</td><td>$200 \div 40 = 5$</td></tr>
<tr><td>Exact answer</td><td colspan="2">$192 \div 39 = 4.92$</td></tr>
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Which approximation is closer to the exact answer?

- What makes a good approximation?
  Which is the best approximation for 41 – 28?
  a. 40 – 20
  b. 40 – 30
  c. 4 – 2
  d. 4 - 3

Examples:

1. A total of $29 987 was collected from a walkathon. Express this value to the nearest thousand dollars.
2. An integer number is rounded off to the nearest 1000 and its value is given as 345 000. What are the possible smallest and largest numbers?
   344 449 ≈ 344 000
   344 500 ≈ 345 000
   345 449 ≈ 345 000
   345 500 ≈ 346 000

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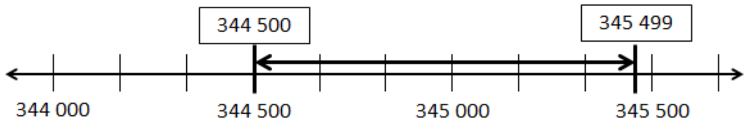


The possible numbers are from 344 500 to 345 499.
Therefore,
Largest possible number is 345 499 and
The smallest possible number is 344 500.

- Understand that there are situations when there is no need to calculate an exact answer and an estimate is good enough.

- Estimation method depends on the context of the situation.

1. Shopping: If I have $100 in my wallet, I need to overestimate the price of each item to make sure the total amount does not exceed my pocket money.

Item	Price	Overestimate price
Earrings	$4.80	$5
Shirt	$17.50	$20
Jeans	$22	$25
Dress	$36	$40
Total	$80.30	$90

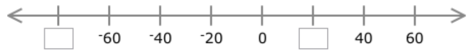
2. A birthday planner wants to prepare 30 goody bags. Each goody bag must contain 1 pack of *Milo* drink, 1 bag of *Twisties*, 2 *Dairy Milk* chocolate bars and 2 sticks of *Chupa Chups*.
   Each food item is available in bigger, economy family packs.

Food item	Contents of each Economy pack
Milo drink	1 pack of 4
Twisties	1 pack of 10
Dairy Milk chocolate bars	1 pack of 20
Chupa Chups	1 pack of 15

	d) Check answers to calculations involving whole numbers by using: • approximations, to verify whether the answer is the right order of magnitude; • inverse operations and working the problem backwards; • a different method. [Calculator can be used to check calculations]	How many of those bigger packs of each snack does the planner need to buy? 3. There are 19 buttons in a bag. Estimate the number of buttons in 29 bags. Give your answer to the nearest hundred. • Check answers to calculations involving whole numbers by a) Approximation by rounding to check whether the answer is the right order of magnitude. *Example:* A tv costs \$798. \$798 is estimated to \$800. It can't be \$700 or \$70 or \$80. b) Check answers by doing inverse operations. *Examples:* By using a calculator to check i. 34 x 32 = 1088 with 1088 ÷ 34 ii. 6 ÷ 7 = 0.85714286 with 0.85714286 x 7 Check answers by doing an equivalent calculation. *Examples:* i. Check 794 x 9 = 7146 with (800 – 6) x 9 = 7200 – 54 = 7146 Or 794 x (10 – 1) = 7940 – 794 = 7146 ii. Check 33 x 99 = 3267 with 33 x (100 – 1) = 3300 – 33 = 3267 Or (30 + 3) x 99 = 2970 + 297 = 3267 c) A different method *Example:* Find the approximate answer for 602 + 237 <u>Estimation method 1</u> 600 + 200 = 800 <u>Estimation method 2</u> 600 + 240 = 840 Which is the better estimate? Use a calculator to check which the closer estimate is. The estimated answer is close to the exact answer, therefore the calculation is likely correct.	

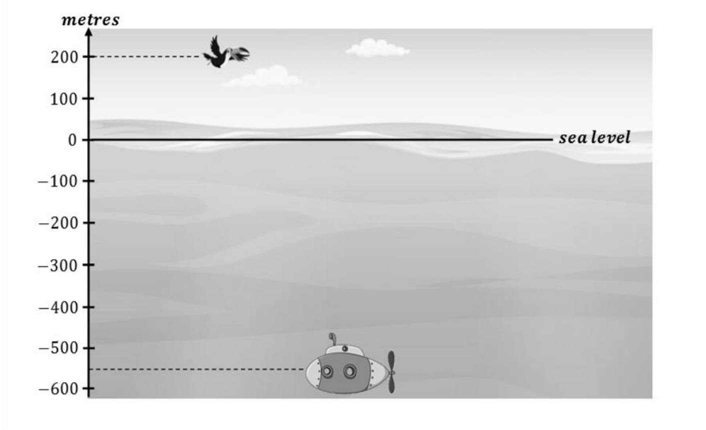
	e) **Choose when it is appropriate and when it is not appropriate to use a calculator to carry out calculations**. Use a calculator efficiently, checking answers appropriately. Remark: Method to use calculator is covered for topics which require its use. A calculator logo is placed next to the question number to indicate the use of calculator. [SPN21 MATHEMATICS Y7 Pages 51-55, 62]	• Decide when it is appropriate and when it is not appropriate to use a calculator to carry out calculations. • The calculator is a **tool** to do calculations. The human brain and pencil and paper are also tools. Students should be taught **when** to use a calculator and when mental computing (or even paper & pencil) are more effective or appropriate. Choosing the right 'tool' is part of an effective problem-solving process. • It is very important that students **learn how to estimate** the result before doing the calculation. A student must not learn to rely on the calculator without checking that the answer is reasonable. • A calculator should not be used to try out randomly all possible operations and to check which one produces the right answer. It is crucial that students learn and understand the different mathematical operations so they know WHEN to use which one — and this is true whether the actual calculation is done mentally, on paper, or with a calculator.	
1.2.3 Word Problems	f) Solve one- and two-step word problems involving calculations with whole numbers choosing appropriately: • the operation(s) to use; • whether to use mental, written or calculator method(s); • whether the answer needs to be rounded due to the context of the problem. [SPN21 MATHEMATICS Y7 Chapter titles involved: Whole numbers and operations; Integers and operations;	• Solve one- and two-step word problems involving calculations with whole numbers. *Examples:* 1. How many books costing $6 each can be bought for $56? What operation (s) do we use? Solve mentally, written or use a calculator? Does the answer need to be rounded off? 3. A cinema sold 125 712 tickets in a year. The price of a ticket is $6. a) Write down 125 712 correct to the nearest thousand. b) Use your answer to (a) and the information above to estimate the total amount earned by the cinema from tickets sales in a year. 4. A company has 897 boxes to move by van. The van can carry 23 boxes at a time. How many trips must the van make to move all the boxes?	

	Approximation (pages 73-74); Percentage]		
1.2.4 Order of Operations	**Know and use the order of operations, including brackets, to carry out more calculations involving the four operations**. [SPN21 MATHEMATICS Y7 Pages 17-25]	• Know and use the order of operations to evaluate expressions: 1. Brackets 2. Powers or indices 3. Multiplication & Division (from left to right) 4. Addition & Subtraction (from left to right) • *Examples:* 1. Find mentally or use jottings to find the value of: a) $20 \div 5 + 10 = 14$ b) $5 + 20 \div 10 = 7$ c) $\frac{200}{4 \times 5} = 10$ d) $(3^3 - 5^2)^2$ 2. Evaluate: a. $289 \div 3 + 98 - 7 \times 11$ b. $\sqrt{289} + 15 \div 3 - \sqrt[3]{729} \times 5$ c. $98 - (132 + 84) \div 12$ 3. Evaluate $\frac{1116}{(65-34)\times 12}$ using a calculator. 4. Insert operation signs (i.e. $+ , - , \times , \div$) and brackets i.e. ( ), whenever necessary to make the following sentence correct. 3 5 2 = 21 • **Number Sense Quizzes (No calculators!)** 1. A number N is multiplied by 30 and divided by 5. The result is 6. Find the value of N. 2. True or false? a) 6^3 is smaller than 3^6. (T/F) b) $12^2 + 3^2 = 15^2$. (T/F) c) 3(52 + 3 x 3) = 3 x 52 + 3 x 3 (T/F)	

1.2.5 Positive & Negative Integers	g) Consolidate understanding of positive and negative integers in context. [SPN21 MATHEMATICS Y7 Pages 27-33]	• **Use the number line to introduce the idea of positive and negative integers.** • Negative integers are integers LESS than zero. • Positive integers are integers GREATER than zero. • ZERO is neither negative nor positive integer. We call it the **origin**. *Examples:* 1. Find the missing numbers:  2.  • **Use integers in daily life**. • Explain the significance of negative numbers by providing daily examples: Ground Floor (0), Basement Floor (–1), 0^0 C, $–6^0$ C, 4 meters below sea-level, etc. Examples: Write an integer to describe each situation: 1. A temperature of 10 degrees below zero. 2. 20 feet below sea level. 3. A $100 withdrawal. 4. Lost 10 points. 5. $50 deposit. 6. A loss of $30. 7. $60 price increase. 8. $10 off the original price. 9. 12 centimeters longer. 10. Ascend 100 meters. 11. Descend 200 meters. 12. 7 students move away to a different school.	

1.2.6 Addition, Subtraction & Multiplication of Integers	h) **Add and subtract positive and negative integers, including through using number lines and other models**. Multiply positive and negative integers by a positive integer. Remark: Multiplying two negative integers is not included. [SPN21 MATHEMATICS Y7 Pages 34-41, 44] **(Link to 1.6, 1.7 and 1.8)**	• Explain how the sum of two integers is obtained on the number line. • Explain how the difference of two integers (especially one positive and the other negative) is obtained on the number line. Apply the idea to finding, e.g., the difference between two temperatures, 4^0 C and –6^0 C. • Demonstrate addition, subtraction, multiplication positive and (or) negative integer by a positive integer on the number line and other models. • Explore the rules for addition & subtraction and involving 2 integers using the calculator or other manipulative. • Multiply positive and negative integers by a positive integer. , e.g., –3 x 2, 2 x (–6) • Establish and use the basic rules for computing a pair of integers with a single operation (+, –, x), e.g., 4 x (–3) = –12, without the use of the calculator. *Examples:* 1. Evaluate $-23 + (-8) - (-10)$, 2. Find the difference between two temperatures, 4^0 C and –6^0 C. 3. Write down the missing values. a) ____ + 3 = −1 b) 8 − ____ = 6 c) ____ × −2 = −10 d) 4 × ____ = −12 4. What are the two integers, when added together, will give -4 as the answer? Are there any other possible pairs of integers which when added, will give the same answer? 5. Mt. Everest, the highest elevation in the world, is 8 850 meters above sea level. The Dead Sea, the lowest elevation, is 413 meters below sea level. What is the difference between these two elevations? 6. A submarine hovers at 340 meters below sea level. If it descends 120 meters and then ascends 290 meters, what is its new position? 7. Chen has overdrawn his checking account by $27. His bank charged him $15 for an overdraft fee. Then he quickly deposited $100. What is his current balance?	

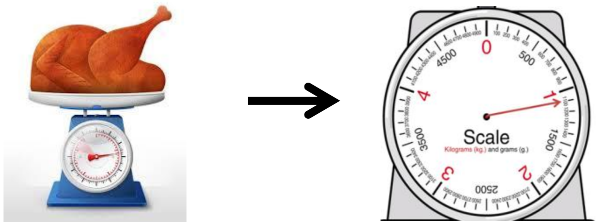
		8. The price of a share of stock started the day at $37. During the day it went down $3, up $1, down $7, and up $4. What was the price of a share at the end of the day? 9. Arief is planning to go on a holiday. He searched the Internet to find out the average temperature of different cities in December. The table below shows his findings. City \| Singapore \| Moscow \| Paris \| Melbourne \| Seoul Average temperature (^{0}C) | 28 | -5 | 6 | 24 | -1 a) Where can he go if he plans to go to the city where the temperature is i. Below $0℃$ ii. Between $-10℃$ and $0℃$ iii. Above $20℃$ b) What is the difference in average temperature between Singapore and Moscow? c) Where is it colder, Moscow or Seoul? d) The average temperature in Taipei is exactly midway between the temperatures in Singapore and Moscow. What is the average temperature in Taipei? 10. The diagram below shows the position of a bird and a submarine from either above or below sea level. The submarine is at 550 metres below sea level.	

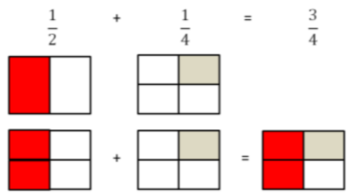
		 (a) What is the distance between the bird and the submarine? (b) A radar system can detect submarines down to 250 metres below sea level. How many metres can the submarine climb if the submarine is to be 50 metres below the level of detection?	

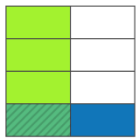
SUB-TOPICS	LEARNING OBJECTIVES	LEARNING EXPERIENCE/EXEMPLIFICATION	INSTRUCTION TIME
1.3 OPERATIONS WITH FRACTIONS AND DECIMALS	Students should be able to:		2
1.3.1 Decimal Number Bonds, Double & Corresponding Halves, Multiplication & Division of Decimals	a) Consolidate the rapid recall of number facts including: – complements (number bonds) for decimals with one and two decimal places to 1; – doubles of 2-digit decimal numbers and corresponding halves. Consolidate mental methods for calculating with decimals, including multiplication and division by 10, 100 and 1000. [SPN21 MATHEMATICS Y7 56-65]	• **Complements (number bonds)** Derive quickly: decimal complements in 1 (one and two decimal places), *Examples:* 1 = 0.8 + 0.2, 1 = 0.41 + 0.59 0.3 and what number makes 1? **0.3 + 0.7 = 1 or 1 – 0.3 = 0.7** • **Doubles and halves** Derive quickly: doubles of two digit decimal numbers, *Examples:* 3.8 x 2, 0.76 x 2 and all the corresponding halves. *Example:* What is double of 2.2? **2.2 + 2.2 = 4.4 or 2x2.2 = 4.4** Correspondingly, half of 4.4? $\mathbf{4.4 \div 2 = 2.2}$ • **Use knowledge of place value** to multiply and divide mentally decimal numbers by 10, 100 and 1000, or by a small multiple of 10, e.g. 4.3 x 100, 1.6 x 20 = 1.6 x 10 x 2 =16 x 2 = 32, _____ ÷ 100 = 4.7 • **Use knowledge of multiplication facts and place value** to multiply mentally. *Examples:* a) 0.2 x 8 = 10 x 0.2 x 8 = 2 x 8 = 16 ÷10 = 1.6 b) 0.04 x 9 c) 8 x 0.5 d) 7 x 0.03	

1.3.2 Estimation & Approximation	b) Make and justify estimates of calculations involving decimals. Remark: The concept of significant figures and rounding off to a specified number of significant figures are introduced in Year 8. [SPN21 MATHEMATICS Y7 Pages 79-81] c) Understand and use place value to solve problems involving decimals, including problems that require numbers to be rounded to the nearest 0.01, 0.1, etc. Understand the concept of 'decimal places' and use it to round decimals to up to three decimal places when solving	e) ____ x 0.2=10 f) 80 x ____ =8 g) The decimal point is missing. Put it in. i. 15.25 x 4.6 = 7 0 1 5 ii. 234.5 x 0.52 = 1 2 1 9 4 • Examples: 1. Find an estimate of: a) 2.13 x 5.71 b) 6641 ÷ 21.3 c) (42.4 x √51) ÷ 21.3 2. One kilogram of fish was sold for $4.95. Estimate how many kilograms of fish you could buy with $20. • **Number Sense Quizzes (No calculators!)** Without working out the exact answers, tell True or False: a) (230 x 0.996) > 230 b) 2.6 – ½ > 2 c) ¾ x 62 ÷ 0.89 is less than 45 d) 0.125 x 8200 < 1000 e) √2500 < 15 Examples: 1. Express the following decimals correct to 2 decimal places. a) 14.055 b) 2.887 c) 0.27642 3. Round off 1.2468 to: a) the nearest tenth, b) the nearest hundredth,	

	problems. [SPN21 MATHEMATICS Y7 Pages 74-75, 78]	c) 3 decimal places. • Understand that there are situations when there is no need to calculate an exact answer and an estimate is good enough (underestimate/overestimate). Example: Safwan wants to make a small doll house using planks of woods. The house requires 2.3 m of wooden planks. Each wooden plank is one meter long. How many pieces of wooden planks does Safwan need to make the doll house?	
	d) **Choose when it is appropriate and when it is not appropriate to use a calculator to carry out calculations**. Use a calculator efficiently, checking answers appropriately. Remark: Method to use calculator is covered for topics which require its use. A calculator logo is placed next to the question number to indicate the use of calculator.	• Use a calculator appropriately. • The calculator is a **tool** to do calculations. The human brain and pencil and paper are also tools. Students should be taught **when** to use a calculator and when mental computing (or even paper & pencil) are more effective or appropriate. Choosing the right 'tool' is part of an effective problem-solving process. • It is very important that students **learn how to estimate** the result before doing the calculation. A student must not learn to rely on the calculator without checking that the answer is reasonable. • A calculator should not be used to try out randomly all possible operations and to check which one produces the right answer. It is crucial that students learn and understand the different mathematical operations so they know WHEN to use which one - and this is true whether the actual calculation is done mentally, on paper, or with a calculator.	
1.3.3 Word Problems	e) Solve one- and two-step word problems involving calculations with decimals choosing appropriately: • the operation(s) to use; • whether to use mental,	• Solve one- and two-step word problems involving calculations with decimals *Example:* A pear costs $1.20 each. What is the maximum number of pears I could get if I only have $10 inside my wallet? What operation (s) do we use?	

	written or calculator method(s); • whether the answer needs to be rounded due to the context of the problem. [SPN21 MATHEMATICS Y7 Pages 63-65]	Solve mentally, written or use a calculator? Does the answer need to be rounded off? *Examples:* 1. A cook bought 224.5 kilograms of almonds and 1.6 kilograms of pecans. How many kilograms of nuts did the cook buy in all? 2. A supermarket sells 1 kg of whole chicken for $3.50. Khadijah bought a whole chicken weighting as shown below. How much did she pay for the chicken?  3. A donut store uses 1.6 kg of sugar each hour. How many kilograms of sugar will the store use in 17 hours? 4. A drink and a box of chocolate together cost $4. Two drinks and a box of chocolate together cost $5.50. How much is a box of chocolate? 5. Five friends went to a restaurant for lunch. The total cost for the set menu was $66. Two more friends came to join the lunch. How much did the set menu cost altogether? 6. A piece of ribbon 3.6 m long is cut into 12 shorter pieces of equal length. What is the length of each short piece?	

	f) Check answers to calculations involving decimals by using: • approximations, to verify whether the answer is the right order of magnitude; • inverse operations and working the problem backwards; • a different method. [Calculator can be used to check calculations]	• Check answers by a) Approximation by rounding to check whether the answer is the right order of magnitude. *Example:* A book costing $26.40 is estimated to $27. It can't be $25 or $2. b) Check answers by doing inverse operations. *Examples:* i. Check 15.9 x 3.2 = 50.88 with 50.88 ÷ 15.9 ii. Check 99.78 ÷ 5.3 = 18.8264151 with 18.8264151 x 5.3 c) A different method *Example*: 25.2 ÷ 4.9 Estimated answer 25 ÷ 5 = 5 or 25.5 ÷ 5 = 5.1, Which one is the better estimate? Exact answer 25.2 ÷ 4.9 = 5.14 The estimated answer is close to the exact answer, therefore the calculation is likely correct. • Mental arithmetic 1. What is the sum of 30 tens and 4 tenths? 2. What is the value of 5 tenths less than twenty and sixteen hundredths?	
1.3.4 Addition & Subtraction of Fractions	g) **Add and subtract fractions and mixed numbers, mentally or with jottings when appropriate**. [SPN21 MATHEMATICS Y7 Pages 48-55]	• Add and subtract simple fractions and mixed numbers, mentally or with jottings when appropriate. *Examples:* 1. 	

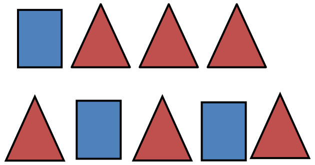
1.3.5 Multiplication & Division of Fractions	h) Multiply and divide fractions, interpreting division as a multiplicative inverse. [SPN21 MATHEMATICS Y7 Pages 48-55]	2. At a pie-eating contest, Ayden got through $\frac{2}{3}$ of a pie before time was called. Malek finished just $\frac{7}{12}$ of a pie. How much more pie did Ayden eat than Malek? 3. My mother made 6 bowls of pasta. She puts extra cheese on 3 of them. What fraction of the bowls did not have extra cheese? 4. Find the fraction which is mid-way between 3/8 and ½. 5. In $\frac{4}{5} = \frac{4+9}{5+?\_}$, what is the missing number? • Multiply and divide simple fractions Multiplicative inverse: Two numbers whose product is 1 are multiplicative inverses of one another. For example, $\frac{3}{5}$ and $\frac{5}{3}$ are multiplicative inverses of one another because $\frac{3}{5} \times \frac{5}{3} = \frac{5}{3} \times \frac{3}{5} = 1$. • Examples: 1. Use the model to find the product.  $\frac{1}{2} \times \frac{1}{4} =$ ____ 2. Calculate five-eighths of fourteen dollars. 3. Ahmad has 2 pieces of papers. He wants to split them into $\frac{1}{4}$ pieces. How many pieces will he get in total? 4. Aqil has 15 shirts in his closet. If 2 out of every 3 of these shirts are striped, how many unstriped shirts does he have in his closet? 5. Khairi and Zul sold candies to raise money for their debate team. Zul sold 3 times as much candies as Khairi did. If Khairi sold $\frac{1}{2}$ of a box of candies, how many boxes of candies did Zul sell? 6. $\frac{1}{3}$ of a number is 4. What is the number?	

1.3.6 Ordering of Integers, Decimals & Fractions	i) Solve problems involving comparisons and ordering of integers, decimals and fractions in a range of different contexts including those involving different units of measurement, using the symbols =, ≠, <, ≤, >, ≥. [SPN21 MATHEMATICS Y7 Pages 27-33, 57-62]	7. Which would you rather have, $\frac{5}{8}$ of 160g chocolate bar or $\frac{3}{4}$ of 120g chocolate bar? • Examples: 1. Without working out the answers, tell True or False: (a) 0.3 – 0.125 > 1/5 (b) ¾ + ½ > 1 (c) 62 ÷ 0.89 is less than 62. (d) 19/8 – 8/19 < 2 2. Rewrite the following numbers in ascending order: 6.1 , 5.444 , $6\frac{4}{5}$, - 6.1 , 5.4 , $\frac{39}{8}$, -2 3. A supermarket found that $\frac{5}{9}$ of the customers bought vegetables and $\frac{5}{8}$ of the customers bought fruits. Which purchase was made by a greater fraction of customers? 4. Fill in the missing values in decimal form.  5. Which sign makes the statement true? 5.9 ______ 5.90×10^1 < > = 6. Select $<, >$ or $=$ to make the statement true. $1\ 000\ centimeters$ _____ $10\ meters$ 7. What is the missing fraction in the box? 2.07 = 2 + ☐ 8. Circle the fraction that represents the largest amount: $\frac{15}{16}, \frac{16}{17}, \frac{19}{20}, \frac{18}{19}$	

		9. Julie and Sharil each bought a bag of grapes. The bag of grapes Julie bought weighed $\frac{4}{10}$ kg while Sharil's bag of grapes was 0.5 kg. Whose bags of grapes weigh more?	

<table>
<tr><th>SUB-TOPICS</th><th>LEARNING OBJECTIVES</th><th>LEARNING EXPERIENCE/EXEMPLIFICATION</th><th>INSTRUCTION TIME</th></tr>
<tr><td>1.4 RATIO & PROPORTION</td><td>Students should be able to:</td><td></td><td>2</td></tr>
<tr><td>1.4.1 Ratio & Proportion</td><td>a) Understand and recognise proportionality and the relationship between ratio and proportion.
[SPN21 MATHEMATICS Y7 Pages 119-120 and Y8 Pages 62-65]</td><td>

- **Ratio is a comparison of two things or more**. Ratios can be written in several different ways: as a fraction, using the word "to", or with a colon.



Ways to write ratio of squares to triangles:

<table>
<tr><td>As a fraction</td><td>Ratio of squares to triangles is $\frac{3}{6}$</td></tr>
<tr><td>Using "to"</td><td>Ratio of squares to triangles is 3 to 6</td></tr>
<tr><td>Using a colon</td><td>Ratio of squares to triangles is 3 : 6</td></tr>
</table>

Example: What is the ratio of lollipops to cookies?

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

	b) Determine whether or not two ratios are in proportion. [SPN21 MATHEMATICS Y7 Pages 119-123]	• To find an equivalent or equal ratio, you can either multiply or divide each term in the ratio by the same number (but not zero). $3:6=6:12=30:60=1:2$ • Two equivalent or equal ratios can be written in 2 ways: **As two equal fractions**: $\frac{3}{6}=\frac{6}{12}$ **Using a colon**: $3:6=6:12$ (Read as three is to six as six is to twelve) • **Proportion is two equivalent/ equal ratios** The ratios $3:6=6:12$ (or $\frac{3}{6}=\frac{6}{12}$) are equivalent or equal. Therefore, $3:6=6:12$ (or $\frac{3}{6}=\frac{6}{12}$) are in proportion or proportional. • Ratio compares part to part whereas proportion compares part to whole. • Proportion can be expressed in each of the following forms: **Frequency**: 9 out of 10 **Ratio**: 9 : 10 **Fraction**: $\frac{9}{10}$ **Rate**: 0.9 **Percentage**: 90%	

As two equal fractions	$\frac{3}{6}=\frac{6}{12}$
Using a colon	$3:6=6:12$ (Read as three is to six as six is to twelve)

Frequency	9 out of 10
Ratio	9 : 10
Fraction	$\frac{9}{10}$
Rate	0.9
Percentage	90%

- *Examples:*
  1) Ingredients to make *Milo* drinks:

1 cup of *Milo*	**5 cups of *Milo***
2 teaspoons *Milo* powder	10 teaspoons *Milo* powder
1 teaspoon creamer	5 teaspoons creamer
1 cup of water	5 cups of water

The ratio of *Milo* powder

1 cup : 5 cups

2 teaspoons : 10 teaspoons

= **2 : 10**

= **1 : 5**

The ratio of creamer

1 cup : 5 cups

1 teaspoons : 5 teaspoons

= **1 : 5**

2:10 and 1:5 are **equivalent ratios**.

We say that **the ratio of *Milo* powder is proportional to the ratio of creamer.**

  2) Complete the ratio table

3	5
6	10
____	25
30	_____
_____	60

  3) Are the ratios 1 : 2 and 3 : 6 equivalent?

		4) Are these ratios equivalent? 4 bags to 8 purses 5 bags to 10 purses 5) Are 1 : 2 and 5 : 10 in proportion? Use cross multiplication, $\frac{1}{2} = \frac{5}{10}$ $\frac{1}{2} \times 2 \times 10 = \frac{5}{10} \times 2 \times 10$ $10 = 10$ Hence **1 : 2 is proportional to 5 : 10** since their cross multiplication is equal. 6) Are 4 : 3 and 16 : 13 in proportion? Use cross multiplication, $\frac{4}{3} = \frac{16}{13}$ $\frac{4}{3} \times 3 \times 13 = \frac{16}{13} \times 3 \times 13$ $52 \neq 48$ Hence **4 : 3 is not proportional to 6 : 13** since their cross multiplication is not equal. 7) Do the ratios $\frac{3}{2}$ and $\frac{9}{6}$ form a proportion? 8) 3:5 and 12:20 are equal ratios?	
1.4.2 Ratios in their simplest forms.	c) Express ratios of two or three quantities in their simplest form. [SPN21 MATHEMATICS Y7 Pages 119-126]	• To **simplify** a ratio means to reduce it to its smallest, simplest, terms. Examples: 1) Simplify the ratio 25 : 40	

		2) Simplify the ratio 12 : 6 : 60 3) Write each of the following ratios in the simplest form a) 5 minutes to 10 minutes b) 21 days to 1 week c) 8 months to 2 years d) 20g to 2kg	
1.4.3 Divide a quantity into parts of a given ratio.	d) Divide a quantity into two or three parts in a given ratio. [SPN21 MATHEMATICS Y7 Pages 119-126]	• Divide a quantity into two or three parts in a given ratio. *Examples:* 1) Divide 60 into two parts in the ratio 2 : 3 2) Divide $50 in the ratio 3 : 2 3) Divide 81 m in the ratio 2 : 7 4) Divide 200 sweets into 3 parts in the ratio 3 : 6 : 1 5) Divide $ 120 between Morgan and Jack in the ratio 3 : 5. 6) Salmah gave $100 to her daughter Ain and asked her to spend three parts and save two parts of the total amount. How much did Ain spend and how much did she save? 7) Divide $260 among Aishah, Buzz and Charlie in the ratio 1/2 : 1/3 : 1/4. 8) Two numbers are in the ratio 5 : 7. If the difference between the numbers is 24, find the numbers.	
1.4.4 Solve ratio & proportion problems	e) **Solve <u>simple</u> ratio and proportion problems using <u>informal methods</u>, including those involving scales on maps or diagrams**. [SPN21 MATHEMATICS Y7 Pages 126-129]	• Examples: 1) A football team played a total of 27 matches and the ratio of wins to losses was 7 : 2. How many games did the team win and how many did it lose? 2) A survey was conducted to find out about students' favourite colours. In 7J, 10 students said their favourite colour was blue while 5 students preferred red. Meanwhile, in 7C, 12 students said their favourite colour was blue while 10 students preferred red. Which class has a higher ratio of students who preferred blue to students who preferred red? 3) 2 apples cost $2.20. Find the cost of 5 apples.	

2 apples --------------------- $2.20
4 apples --------------------- $2.20 x 2 (double) = $4.40

2 apples --------------------- $2.20
1 apple --------------------- $2.20 ÷ 2 (half) = $1.10

Cost of 5 apples = Cost of 4 apples + Cost of 1 apple
= $4.40 + $1.10
= $5.50

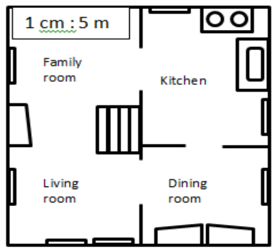
4) Is 6 hair clips for $0.85 better than 8 hair clips for $1.00?
5) Brunei Dollars can be exchanged for Malaysian Ringgit.
B$30 = RM90. How much RM can be exchanged for B$100?

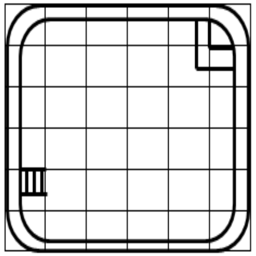
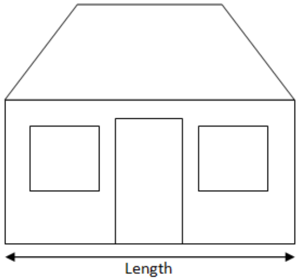
- A **SCALE DRAWING** is a diagram/map/model of an object that is too large or too small to draw. The dimensions are proportional to the actual dimensions (distances) of the real-life example. **Maps, blue prints, floor models are some examples.*

The **SCALE** on a **scale drawing is the ratio of the drawing lengths or model to its corresponding actual lengths.**

"1 cm : 5 m" means that 1 cm in the model represents an actual distance of 5 m.

"Scale" dimensions in the scale drawing.



		• Examples: 1) On the blueprint of the pool, each square has a side length of 0.2cm. What is the actual width of the pool?  Scale 0.2 cm = 2 m • It is not always possible to draw the actual size of real-life objects such as the real size of a car, an airplane or a house on paper. That is why we need scale drawings.  In real-life, the length of this house may measure 900 centimeters. The length of an A4 paper is about 30 centimeters. $\frac{900}{30} = 30$, therefore we will need about 30 sheets of A4 papers to draw the length of the actual size of the house. In order to use just 1 sheet of A4 paper, we could use 1 centimeter on our drawing to represent 30 centimeters on the real-life object.	

We can write this situation as 1 : 30 or $\frac{1}{30}$ or 1 to 30.

Note: **The first number always refers to the length of the drawing on paper and the second number refers to the length of the real-life object.**

- Examples:
  1) The length of a car is drawn to scale of 1 : 40. The length of the car on paper is 12 cm long. Calculate the actual length of the car.

     1 cm on paper = 40 cm in real life
     2 cm on paper = 2 x 40 = 80 cm in real life (double of 1 cm)
     12 cm on paper = 6 x 80 cm = 480 cm in real life (6 times 2 cm)
  2) On a certain map, 5 cm represents 20 km. What is the scale of the map?
  3) Copy and complete the table below for a scale drawing in which the scale is 4 cm to 1 m

Actual length	Length on scale drawing
4 m	
50 cm	
	10 cm
	4.8 cm

1.4.5 Rate

f) Understand rate as a comparison, or ratio, of two measurements with different units.

[SPN21 MATHEMATICS Y7 Pages 130-133]

- Rate is how much of something **per 1 unit of something else**.

  Examples:
  a. 1000 cars pass by in 4 hours.

     1000 cars = 4 hours

     $\frac{1000}{4}$ = 1 hour

     The unit rate is 250 cars per hour.
  b. 100 packets of *Nasi Katok* were eaten by 50 people. The unit rate is 2 packets of *Nasi Katok* per person.
  c. The car can go 1000 km on 50 liters of fuel. The unit rate is 20

km per liter.

d. There are 120 students and 4 teachers. The unit rate is 30 students per teacher.

e. In the last 4 weeks Sam earned $4000. The unit rate is $1000 per week.

- Examples:

1. The table shows the parking rates at a car park.

Parking rates	
First 10 km	$1.20
Every additional km or part thereof	80 cents

(a) Calculate the total fare, in dollars, for the journey of

(i) 8 km,

(ii) 24 km.

(b) Find the length of the journey for which the fare was $16.

2. Last week I paid $5.30 for 2 kg of durians.

This week I paid $11.10 for 3 kg of durians.

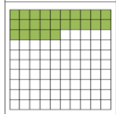
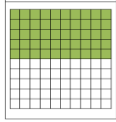
What was the difference in the price per kg?

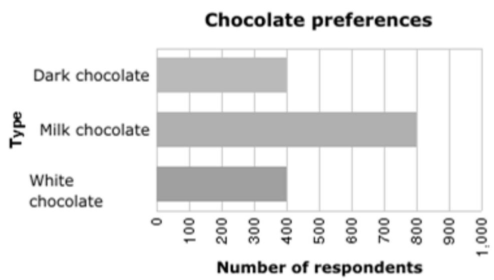
3. Hajah Salmah wants to buy a bottle of cooking oil.

Cooking Oil Brand Y	
1 kg at $4.35	500 g at $2.60

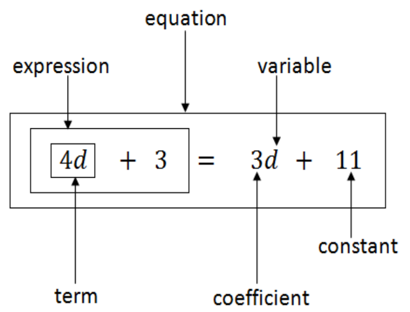
Which cooking oil is of better value, the 1 kg bottle or 500 g bottle? Explain.

SUB-TOPICS	LEARNING OBJECTIVES	LEARNING EXPERIENCE/EXEMPLIFICATION	INSTRUCTION TIME
1.5 PERCENTAGES	Students should be able to:		2
1.5.1 Percentages & their equivalent fractions & decimals	a) Understand percentage and recognise the equivalence of percentages, fractions and decimals. Express percentages as decimals or fractions. [SPN21 MATHEMATICS Y7 Pages 98-105]	• **Recall percentages, fractions and decimals facts** such as: $\frac{1}{4} = 25\%\ or\ 0.25$ $\frac{1}{2} = 50\%\ or\ 0.5$ $\frac{3}{4} = 75\%\ or\ 0.75$ $1 = 100\%\ or\ 1.0$ $\frac{9}{10} = 90\%\ or\ 0.9$ $0.37 = 37\%\ or\ \frac{37}{100}$ $67\% = 0.67\ or\ \frac{67}{100}$ • **Find the equivalence of percentages, fractions and decimals** **Examples:** 1) Express 37% as a fraction and a decimal 37% is equivalent to $\frac{37}{100} = 0.37$ 2) Express 70% as a fraction in its lowest terms. 70% is equivalent to $\frac{70}{100} = \frac{7}{10}$ 3) Express $\frac{2}{5}$ as a percentage $\frac{2}{5} = \frac{4}{10} = \frac{40}{100} = 40\%$ 4) Convert $\frac{1}{8}$ into a decimal $\frac{1}{4} = 0.25$ so $\frac{1}{8} = 0.25\ \div 2 = 0.125$ 5) Fill in the equivalent decimal, fraction & percentage in each of the following	

	Decimal	Fraction	Percentage
			
			

1.5.2 Expressing one quantity as a percentage of another.	b) Express one quantity as a percentage of another and use this in problems to <u>compare simple proportions.</u> [SPN21 MATHEMATICS Y7 Pages 98-105]	• **Find simple equivalent fractions:** *Example:* What are the two fractions equivalent to $\frac{4}{5}$ $\frac{8}{10}, \frac{12}{15}$ • *Examples:* 1. There are 100 flowers in the basket. 40 of them are yellow. (i) What fraction of the flowers is yellow? (ii) What percentage of the flowers is yellow? 2. There are 400 students in a school. 240 of them are boys. Express the number of boys as a percentage of all students in the school? 3. Express 500 g as a percentage of 2.5 kg. 4. A survey was conducted to learn people's chocolate preferences:  a) What fraction of the respondents preferred dark chocolate? b) What percentage of the respondents preferred milk chocolate? 5. A serving of ice cream contains 5000 calories. 200 calories come from fat. What percent of the total calories come from fat? 6. In a box of 8 doughnuts, two have red sprinkles. How many percent of the doughnuts have red sprinkles? 7. What percent of 1 hour is 15 minutes?	

1.5.3 Calculating percentages of quantities	c) **Calculate percentages of quantities, mentally and through jottings**. [SPN21 MATHEMATICS Y7 Pages 98-105]	• Examples: 1. Calculate 40% of 35 kg 10% of 35 = 3.5 20% of 35 = 3.5 x 2 = 7 40% of 35 = 3.5 x 4 or 7 x 2 = 14 kg 2. 20% of a number is 40. What is the number? 20% of the number = 40 40% of the number = 40 x 2 = 80 100% of the number = 40 x 5 = 200 3. The monthly budget for the front of the house is $5000. My mother spent 10% of the budget on fresh flowers. How much did she spend on fresh flowers? 100% of $5000 = $5000 10% of $5000 = $5000÷10 = $500 4. Out of 1200 students in a school, only 85% passed. Find how many students failed. % of students who failed = 100% - 85% = 25% 100% of 1200 students = 1200 students 50% of 1200 students = 1200 ÷ 2 = 600 students 25% of 1200 students = 600 ÷ 2 = 300 students failed	

SUB-TOPICS	LEARNING OBJECTIVES	LEARNING EXPERIENCE/EXEMPLIFICATION	INSTRUCTION TIME
1.6 SEEING, EXPRESSING & RECORDING ALGEBRAIC RELATIONSHIPS **(Link to 1.2.6)**	Students should be able to:		2
1.6.1 Unknowns & variables.	a) **Understand the concepts of an unknown and a variable**. Understand the vocabulary of algebra: expression; equation; formula; term; constant; linear; evaluate; simplify; substitute; solve; factorise; expand. **Recognise and use algebraic conventions when representing unknown numbers or variables in expressions and equations (e.g. 3*n*, *a* – 7, 2*n* + 4, $^{a}/_{2}$, 3 (*n* + 4), 4*x* – 1 = 7, 2 (*a* + 3) = 14)**. [SPN21 MATHEMATICS Y7 Pages 145-173, 177-178]	Algebra is based on the concept of unknown values called variable. A variable is a letter representing some unknown; an unknown quantity or expression whose value can change. A constant is a value or number that never changes in an expression it's constantly the same. A term is a part of an expression separated by + or - signs. A coefficient is a numerical or constant quantity placed before and multiplying the variable in an algebraic expression. An expression is a combination of variables, numbers, and/or operations that represents a mathematical relationship. It does NOT have an equal sign. An equation is a mathematical statement that two or more expressions are equal. It must have an equal sign.  	

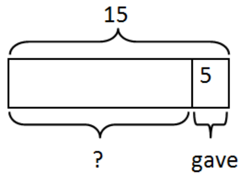
1.6.2 Algebraic expressions & arithmetic Operations

b) Understand that algebraic expressions follow the same conventions and order as arithmetic operations, including the use of brackets. [SPN21 MATHEMATICS Y7 Pages 145-163]

- *Examples:*

1. Fauzan had 15 cookies at first. How many cookies had Fauzan left if he gave Nani

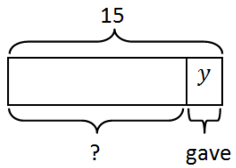
   a. 5 cookies?



$15 - 5$

Fauzan had 15 cookies left.

   b. y cookies?



$15 - y$

Fauzan had $(15 - y)$ cookies left.

2. Each shirt has 7 buttons. How many buttons are there on different numbers of shirts?

Number of shirts	Number of buttons
$\mathbf{1}$	$\mathbf{1 \times 7 = 7}$
$\mathbf{2}$	$\mathbf{2 \times 7 = 14}$
$\mathbf{5}$	$\mathbf{5 \times 7 = 35}$
$\boldsymbol{p}$	$\boldsymbol{p \times 7 = 7p}$

3. A pizza cost \$18. A cake costs $\$x$ more than a pizza. How much does the cake cost?

1.6.3 Constructing algebraic expressions

c) **Generalise rules from simple practical situations and construct algebraic expressions using symbols to represent these**.

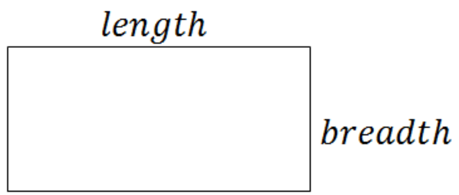
Express previously learned simple mathematics formulae algebraically (e.g. $P = 2l + 2w$).

[SPN21 MATHEMATICS Y7 Pages 145-158, 171-173]

- *Examples:*

Practical Activity

1. The figure below shows a rectangle. Find its Perimeter & Area.



$length$	$breadth$	$Perimeter$	$Area$
$7\ cm$	$8\ cm$		
$9\ cm$	$6\ cm$		
$12\ cm$	$5\ cm$		
$l\ cm$	$b\ cm$		

2. Rayyan save $230 from Hari Raya and birthday gifts. She wants to buy some shirts using her savings. How much money will she have left?

Number of shirt/s	Total cost of shirt/s	Money left
1		
4		
9		
$\boldsymbol{t}$		

3. Misha had $30. She bought food items which cost $4.50 each. Write an expression which represents the money she had left.

1.6.4 Constructing simple linear equations	d) Express ‘Think of a number’ type problems as mappings, using symbols to represent the unknown number. **Construct simple linear equations (integer coefficients and constants, unknown on one side only) to express unknown number problems arising from practical situations**. [SPN21 MATHEMATICS Y7 Pages 164-173]	4. Alex saves the same amount of money every month for 7 months. At the moment, he has $100 in his savings account. Write down an expression for the total amount of money in his account after 7 months. • *Example:* I think of a number, multiply by 2 and then add 3 and I have 11. What is the number? I can write down this problem as a function machine: ? → [× 2] → [+ 3] → 11 The inverse would be: **4** ← [÷ 2] ← [− 3] ← 11 The Inverse helps us solve the problem. $__ \times 2 + 3 = 11$ Let the unknown be a $a \times 2 + 3 = 11$ $2a + 3 = 11$ (Linear equation)	

SUB-TOPICS	LEARNING OBJECTIVES	LEARNING EXPERIENCE/EXEMPLIFICATION	INSTRUCTION TIME
1.7 SIMPLIFYING & TRANSFORMING ALGEBRAIC RELATIONSHIPS **(Link to 1.2.6)**	Students should be able to:		2
1.7.1 Equivalence of algebraic expressions by collecting like terms 1.7.2 Equivalence of algebraic expressions by	a) **Show equivalence (or not) of algebraic expressions by collecting like terms (integer coefficients).** [SPN21 MATHEMATICS Y7 Pages 154-163] b) **Show equivalence (or not) of algebraic expressions by multiplying <u>a constant</u> over**	• *Examples:* 1) <u>Group/pair work</u> Use cubes, algebra discs or draw diagrams to represent the algebraic expressions. Then simplify the expressions. a) $3g + 3g$ b) $4g - 2g$ c) $2g + g + 2$ d) $4g - 4g$ e) $6g - 3 - 2g$ f) $5g - 3g + 5 - 2$ 2) Identify an equivalent expression. i. 5c a) c + c + c b) c + c + c + c c) c + c + c + c + c d) c + c + c + c + c + c ii. p + p + 0 a) 0 b) p c) 2p d) 3p iii. 2t + t a) t + t b) t + 2t c) 2t + 2t d) t + t + 2 iv. 2f + 3z a) f + z b) f + f + z + z + z c) 2 (f + g) d) 3 (f + g) • Examples: 1) Identify an equivalent expression of 4(j + 1)	

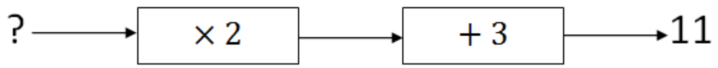
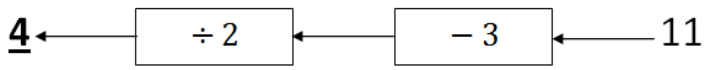
<table>
<tr><td></td><td></td><td></td><td></td></tr>
<tr><td>multiplying over a bracket

1.7.3 Equivalence of algebraic expressions by factorising</td><td>a bracket (integer coefficients), using models and diagrams.
[SPN21 MATHEMATICS Y7 Pages 159-161]

c) Show equivalence (or not) of algebraic expressions by factorising: <u>single-term common factors</u> (e.g. $^{3n}/_{3} = n$; $^{2a}/_{a} = 2$).
[SPN21 MATHEMATICS Y7 Pages 154-158]</td><td>a) j+ 1
b) 4j + 1
c) j + 4
d) 4j + 4

2) Expand 4 (n + 1)
<table><tr><td>x</td><td>n</td><td>1</td></tr><tr><td>4</td><td></td><td></td></tr></table>
• Examples:
Factorise:
1. $\frac{5a}{5}$ 2. $\frac{yz}{y}$ 3. $\frac{-10gh}{2j}$</td><td></td></tr>
</table>

SUB-TOPICS	LEARNING OBJECTIVES	LEARNING EXPERIENCE/EXEMPLIFICATION	INSTRUCTION TIME
1.8 SOLVING LINEAR EQUATIONS **(Link to 1.2.6)**	Students should be able to:		2
1.8.1 Evaluating simple algebraic linear expressions	a) **Evaluate simple algebraic linear expressions arising from practical contexts, including mathematical and scientific formulae, by substitution (positive integers)**. [SPN21 MATHEMATICS Y7 Pages	• *Examples:* 1. Given that $P = 2l + 2w$, where P is the Perimeter of a rectangle, l is its length and w is its width. Find the Perimeter of a rectangle when $l = 9\ cm$ and $w = 5\ cm$. 2. Given the formula $m = v \times d$, where m is mass, v is volume and d is density. Find the volume in g, given m = 60 g and d = 2 g/cm^3. 3. Mrs Zariah spent \$$C$ to buy x calculators and y pencils. A calculator	

	164-173]	costs \$18 and a book costs \$10. a) Find an algebraic expression for calculating $\$C$. b) Find C if $x = 5$ and $y = 10$	
1.8.2 Solving simple linear equations	b) Solve 'Think of a number' type problems, using an appropriate method (e.g. 'seeing', doing the inverse). **Solve simple linear equations (integer coefficients and constants, unknown on one side only) arising from practical situations using an appropriate method (e.g.'seeing', inverse operations, trial and improvement)**. Check solutions to equations by substitution. [SPN21 MATHEMATICS Y7 Pages 164-173]	• *Example:* I think of a number, multiply by 2 and then add 3 and I have 11. What is the number? I can write down this problem as a function machine:  The inverse would be:  The Inverse helps us solve the problem. $x \times 2 + 3 = 11$ $x = (11 - 3) \div 2$ $x = 8 \div 2$ $x = 4$ d) Check solutions to equations by substitution. When $x = 4$, $x \times 2 + 3 = 4 \times 2 + 3 = 8 + 3 = 11 =$ RHS Therefore, the solution $x = 4$ is correct.	
1.8.3 Solving word problems	c) Solve word problems that involve constructing and solving simple linear algebraic expressions and equations. [SPN21 MATHEMATICS Y7 Pages 171-173]	• Solve word problems that involve constructing and solving simple linear algebraic expressions and equations. *Examples:* 1. I think of a number. When I add 3 to that number, the result is 10. What is that number? 2. I think of two numbers. The product of the two numbers is 60. What are my numbers? 3. The perimeter of a rectangle is 24 cm. Its length and width are given	

		in whole units (such as 2 cm, 5 cm, etc.) Draw all the possible rectangles. 4. Ahmad has \$x. Abu has \$5 more than Ahmad. Razak has twice as much as Abu. Together they have \$175. What is the value of x? 5. Ahmad had 40 kg of rice. He gave some rice to his uncle. He had 27 kg of rice left. How many kilograms of rice did he give to his uncle? 6. Sofian has some money. Siti has \$20 more than two times Sofian's money. If Siti has \$68, how much money does Sofian have? 7. My weight is x kg. Hassan's weight is 30 kg. If our total weight is 55 kg, what is my weight? 8. The cost of a fan is \$8t. A lamp costs $\frac{1}{2}$ more than that of a fan. What is the total cost of the fan and the lamp? • **Number Sense Quizzes (No calculators!)** 1) Consecutive whole numbers are numbers next to one another. For example, 34 and 35 are consecutive numbers, and their sum is 69. Using your mental computation methods, find the two consecutive numbers that have a sum of: a) 71 (b) 201 (c) 567 2) Using your mental computation methods, find the three consecutive numbers that have a sum of: a) 6 (b) 24 (c) 117	

SUB-TOPICS	LEARNING OBJECTIVES	LEARNING EXPERIENCE/EXEMPLIFICATION	INSTRUCTION TIME
1.9 PROPERTIES OF NUMBERS & SEQUENCES	Students should be able to:		1
1.9.1 Triangle numbers	a) Understand and recognise the sequence of triangle numbers. [SPN21 MATHEMATICS Y7 Page 91]	• The sequence of triangle numbers: This sequence comes from a pattern of dots that form a triangle.	

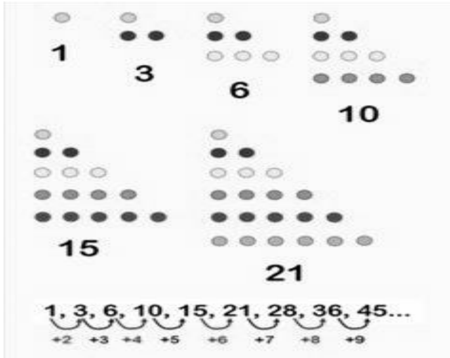


Diagram (n)	No. of dots	Sequence rule (n-1)+n
1	1	1
2	3	1+2
3	6	1+2+3
4	10	1+2+3+4
5	15	1+2+3+4+5
6	21	1+2+3+4+5+6

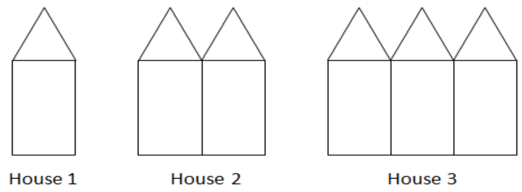
1.9.2 Linear patterns & integers sequence.

b) Describe and continue linear growing patterns and sequences of integers.

[SPN21 MATHEMATICS Y7 Pages 85-96]

- A linear growing pattern/sequence is a pattern/a series of numbers that increases or decreases by a constant difference.
- *Examples:*

1. State the rule of each of the following number patterns and write down the next two terms.
   a) 2 , 4 , 6 , ____ , ____
   b) 1 , 4 , 9 , 16 , ____ , ____
   c) 0 , 1 , 1 , 2 , 3 , 5 , ____ , ____
2. Fill in the missing numbers.
   - 8 , ____ , ____ , -4 , -8 , -12
   - 16 , 48 , 24 , ____ , ____ , 108 , 54
3. Write down the 7th and 10th terms of the number patterns. Use a calculator to check your answers.

		a) 13 , 18 , 23 , 28 , ... b) 200 , 140 , 80 , 20 , ...	
1.9.3 Generating terms of a sequence	c) Generate terms of a sequence given a simple rule (term-to-term and general term). [SPN21 MATHEMATICS Y7 Pages 85-96]	• *Examples:* 1. Generate a number sequence using the rule "Add 3". Start at zero. 2. The numbers in the sequence 7, 11, 15, 19, 23, ... increase by four. The numbers in the sequence 1, 10, 19, 28, 37, ... increase by nine. The number 19 is in both sequences. If the two sequences are continued, what is the next number that is in BOTH the first and the second sequences?	
1.9.4Generating sequences from practical context	d) Generate sequences from practical contexts and describe the general term using words, mapping diagrams and symbols. [SPN21 MATHEMATICS Y7 Pages 85-96]	• Examples: 1) Look at the growing pattern below:  a) What do you notice about these houses? b) What do you think the fourth house will look like? Show how it looks like. c) Describe House 5. Write the rule pattern and the fifth terms for i. Number of triangles ii. Number of rectangles iii. Total number of all the shapes d) How will House 20 look like? e) Describe House 100.	

<table>
<tr><td></td><td></td><td>f) Which house has 12 triangles and 12 rectangles?

2) Study the pattern below.

Pattern 1 Pattern 2 Pattern 3

a) Draw Pattern 5.
b) Pattern 2 has 9 corners, how many corners will there be in Pattern 8?
c) Pattern X has a total of 36 corners. Find X.</td><td></td></tr>
</table>

<table>
<tr><th>SUB-TOPICS</th><th>LEARNING OBJECTIVES</th><th>LEARNING EXPERIENCE/EXEMPLIFICATION</th><th>INSTRUCTION TIME</th></tr>
<tr><td>1.10 RELATIONSHIPS & GRAPHS</td><td>Students should be able to:</td><td></td><td>2</td></tr>
<tr><td>1.10.1 Expressing linear relationships algebraically, in tables & graphically</td><td>a) Understand that linear relationships can be expressed in different ways: algebraically; in tables; graphically.
[SPN21 MATHEMATICS Y7 Pages 246-252]</td><td>Examples:
1. Draw the next three diagram patterns.

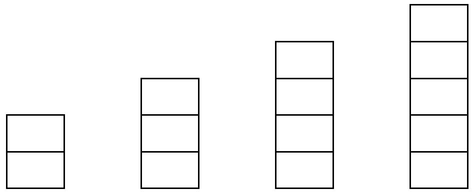
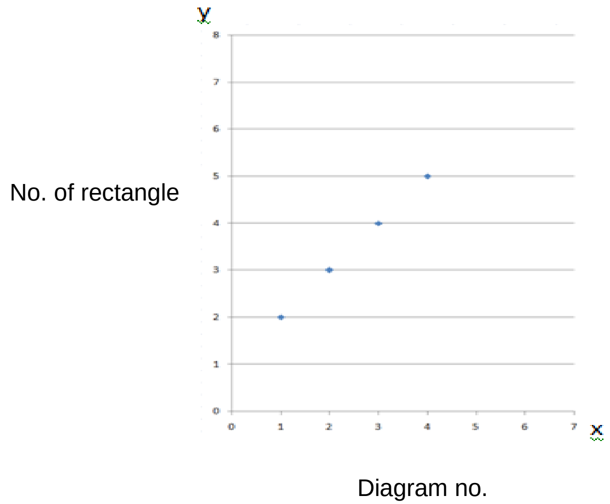



Diagram 1 Diagram 2 Diagram 3 Diagram 4
Describe the diagram pattern in words : The number of rectangle increase by 1 or add 1 more rectangle.
Complete the table by filling in the blanks.
<table>
<tr><td>Diagram no.</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td></tr>
<tr><td>No. of rectangle</td><td>2</td><td>3</td><td>4</td><td>5</td><td></td><td></td><td></td></tr>
</table></td><td></td></tr>
</table>

<table>
<tr>
<td>1.10.2 Plotting simple linear functions graphs</td>
<td></td>
<td>
<table>
<tr><td>Diagram no.</td><td>No. of rectangle</td></tr>
<tr><td>Term (x)</td><td>Value (y)</td></tr>
<tr><td>1
2
3
4
5
6
7</td><td>2
3
4
5</td></tr>
</table>

Plot the next three points in the graph below.



This shows how linear relationships can be expressed algebraically; in tables; and graphically.

Guide students to calculate coordinates of points (coordinate pairs) based on given equations of straight lines. Provide a table to record the ordered pairs. Guide them to plot and draw the graphs, using 1 cm scale on both axes.

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<td></td>
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</table>

<table>
<tr>
<td>1.10.3 Plotting & interpreting simple linear real-life situations graphs</td>
<td>b) Generate coordinate pairs that satisfy a simple linear rule using function machines, function tables and algebraic expressions.
[SPN21 MATHEMATICS Y7 Pages 246-252]

c) Use conventions and notation for 2D coordinates in all four quadrants to solve problems.
[SPN21 MATHEMATICS Y7 Pages 236-245]

d) Plot the graphs of simple linear functions (<u>first quadrant), where y is given explicitly in terms of x</u>.
[SPN21 MATHEMATICS Y7 Pages 246-252]</td>
<td>• Examples:

1) Generate coordinate pairs by completing the following table of values for the equation y = x + 4.

<table>
<tr><td>x</td><td>0</td><td>2</td><td>3</td><td>5</td></tr>
<tr><td>y</td><td></td><td></td><td></td><td></td></tr>
</table>
a) Plot the points in a grid and obtain the straight line graph of y = x + 4.
b) From your graph, find the value of
(i) y if x = 4
(ii) x if y = 5
Guide students to:
• calculate the values of y based on given values of x
• prepare a coordinate plane on graph paper using the scale of 1 cm to represent 1 unit on both axes (or suitable scales)
• plot the points
• draw the straight line graph

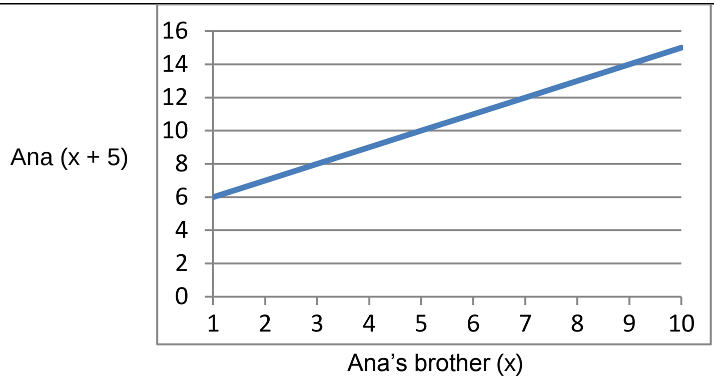
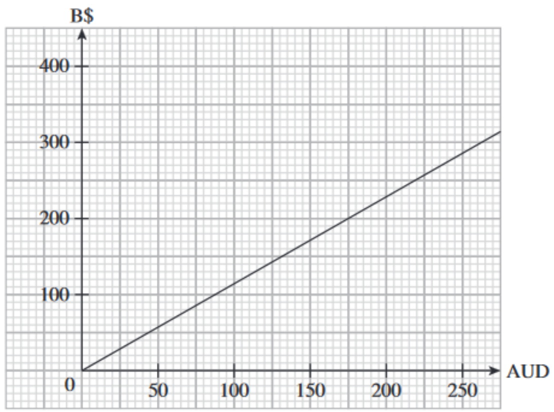
2) Ana is 5 years older than her brother. Her brother is x years old. Write an expression for Ana’s age.

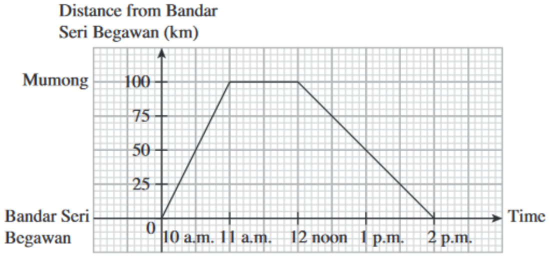
Let Ana’s brother be x
Algebraically, therefore Ana is (x + 5) years old.
If x = 3, then Ana is (3 + 5) = 8, (by substitution).
If Ana’s brother is 10 years old, then Ana is 15 years old.

In tables,

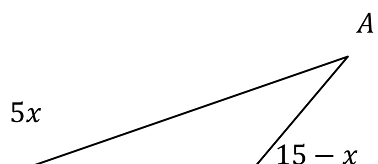
<table>
<tr><td>Ana’s brother</td><td>x</td><td>2</td><td>3</td><td>10</td></tr>
<tr><td>Ana</td><td>x + 5</td><td>7</td><td>8</td><td>15</td></tr>
</table>

Graphically,</td>
<td></td>
</tr>
</table>

	e) Plot and interpret the graphs of simple linear functions arising from real-life situations. [SPN21 MATHEMATICS Y8 Pages 248-254] ***Related to 3.1.3 Line graphs (Data Analysis)***	 Then, introducing the above linear line as having the equation **y = x + 5**. • Instruct students to interpret ready graphs and find answers to questions. Examples: 1. The graph shows the conversion between Brunei dollars (B$) and Australian dollars (AUD) on a certain day.  (a) Find the amount in Australian dollars which is equivalent to B$100. (b) Find the amount in Brunei dollars which is equivalent to AUD 160. (c) A British tourist paid B$150 for an item. Find the amount paid in Australian dollars. (d) A hotel in England charged AUD 200 for a standard room per day. Find this amount in Brunei dollars.	

		2. A family left Bandar Seri Begawan at 10 a.m. and travelled to Mumong before returning to Bandar Seri Begawan. The distance-time graph shows the family's journey.  (a) At what time did the family arrive at Mumong? (b) How long did the family rest at Mumong? (c) Find the total distance travelled. • Plot and interpret simple linear functions graphs from real-life situations. Example: The following table shows the amount of Malaysian ringgit (MYR) a person can exchange for an amount of Brunei dollars (B$) on a particular day. **B$** | 0 | 20 | 60 | 100 **MYR** | 0 | 50 | 150 | 250 (a) Construct a currency conversion graph using the values provided in the table above. (b) Find the amount a person needed to pay in Brunei dollars to buy MYR 200. (c) Arina converted MYR 230 into Brunei dollars. How much did she get? (d) Find the amount in ringgit equivalent to B$64.	

2. MEASUREMENT & GEOMETRY (6 WEEKS)			
SUB-TOPICS	LEARNING OBJECTIVES	LEARNING EXPERIENCE/EXEMPLIFICATION	INSTRUCTION TIME
2.1 TIME, PERIMETER, AREA, & VOLUME	Students should be able to:		2
2.1.1 Time	a) Read the time on analogue and digital clocks and solve problems involving units of time, including start times, end times and duration of events. Understand and use 12-hour clock and 24-hour clock notation. Solve problems involving timetables.	*Examples:* 1) Convert 1.3 hours to minutes. 2) Convert 150 minutes to hour. 3) Convert 3.30 pm into 24-hour clock notation. 4) A movie starts at 6.45 pm. It lasts 2 hours and 35 minutes. What time will the movie finish? 5) It takes 1 h 5 min for Bob to travel from home to his office. If he wants to reach the office by 8.30 a.m. what time should he leave his house? 6) These are the start and finish times of a DVD recorder: START 14:45 FINISH 17:25 For how long was the DVD recording? 7) An aeroplane takes off on Tuesday at 22:47. It lands on Wednesday at 07:05. How long in hours and minutes is the flight? 8) These are the times letters are collected from a post box. <table><tr><td>Monday to Friday</td><td>Saturday</td><td>Sunday</td></tr><tr><td>8 am 2 pm 6:30 pm</td><td>11:30 am</td><td>No collection</td></tr></table>a) What is the latest time letters are collected on Wednesday? b) Anna posts a letter at 9 am on Monday. How long will it be before it is collected? c) Shafi posts a letter on Saturday at 3 pm. When is it collected from the post box? Day: _______ Time: ________	



9) Hu Yen is comparing the duration she spends at dance practice each day. She thinks she spends the greatest duration dancing on Tuesday and the least duration dancing on Wednesday. Do you agree with Hu Yen’s thinking? Explain.

Day 	Time Spent Dancing
Monday	4 hours
Tuesday	156 minutes
Wednesday	2.5 hours
Thursday	3 hours
Friday	120 minutes

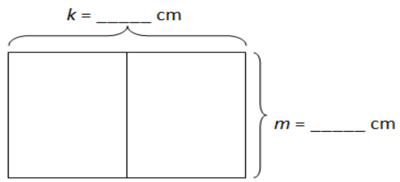
10) Rahman, Mateen and Hanan run a 50m race.
Mateen’s time is 13 seconds.
Rahman finishes 5 seconds before Mateen.
Hanan finishes 3 seconds after Rahman.
What is Hanan’s time in seconds?

11) One of these watches is 3 minutes fast. The other watch is 4 minutes slow. What is the correct time?

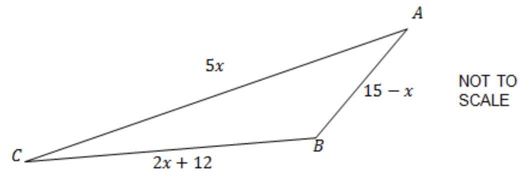
2.1.2 Perimeter & Area of plane figures	b) Solve problems that involve calculating the perimeter and area of plane figures: rectangles (including squares), triangles, parallelograms (including rhombuses) and trapeziums.	• *Examples:* 1. The perimeter of a square is 20 cm. Find the length of each of its sides. 2. The perimeter of a rectangle is 36 cm. If each length is 12 cm, what is the size of each of its width?	

Remark: Perimeter and area of kite is not included.
[SPN21 MATHEMATICS Y7 Pages 286-300]

3. The figure below is made up of 2 identical squares. The total area of the figure is 50 cm^2. Find the value of k and m.

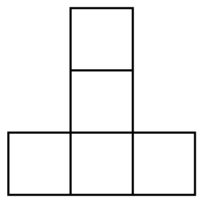


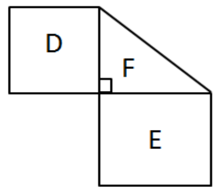
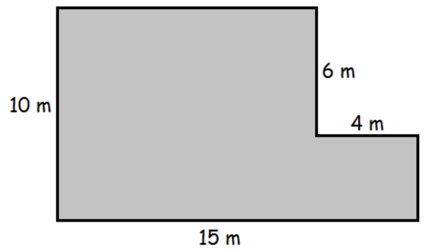
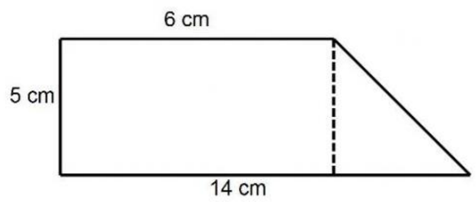
4. Do triangles with the same base and height have the same area?
5. What happens to the area of a triangle when its height is increased?
6. The lengths of the sides of triangle ABC are $5x$, $(15 - x)$ and $(2x + 12)$.



Given that the perimeter of the triangle is 60 cm.
Calculate the value of x.

7. The figure consists of 5 squares of equal area. The area of the whole figure is $180\ \text{cm}^2$. Find the perimeter of the figure.



		8. In the figure, D and E are squares and F is a right-angled triangle. The areas of D and E are 9 cm^2 and 16 cm^2 respectively. What is the area of F? 	
2.1.3 Perimeter & Area of polygons	c) Solve problems that involve calculating the perimeter and area of polygons that can be split into rectangles and triangles. Remark: Perimeter and area of composite figures made up of rectangles and triangles only. [SPN21 MATHEMATICS Y7 Pages 286-300]	• Examples: 1. Find the perimeter and area of the figure:  2. Find the area of the figure: 	
2.1.4 Circumference of a circle	d) Understand and use correctly the vocabulary for parts of a circle: centre, radius, diameter, circumference, arc, chord, sector. [SPN21 MATHEMATICS Y7 Pages 301-302]	• Give clear instructions on the use of the compasses, especially with regards to measuring the radius, and fixing the centre before drawing the circle. Guide students to draw a few circles as practice. • Label on the 1st circle: circumference, centre, radius and diameter. • Label on the 2nd circle: arcs (major arc and minor arc), sectors (major sector and minor sector). Shade the sectors in different shadings. • Label on the 3rd circle: chord, angle subtended at the centre by the	

<table>
<tr>
<td></td>
<td>e) Construct a circle given: its centre and radius; its centre and a point on the circumference. [SPN21 MATHEMATICS Y7 Page 303]

f) **Understand π as the ratio of circumference to diameter of a circle**.

Understand and use the formulae $C = \pi d$ or $C = 2\pi r$ to solve problems involving circumference, diameter and radii of circles.
Remark: Area of circle is not included.
[SPN21 MATHEMATICS Y7 Pages 304-305]</td>
<td>chord, major segment and minor segment.

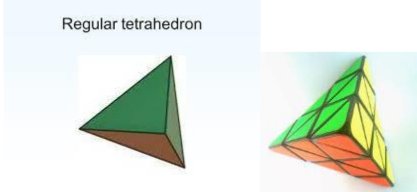
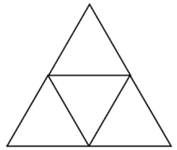
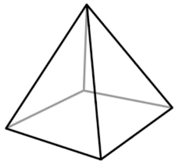
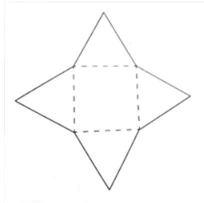
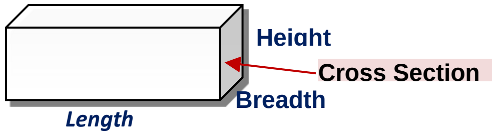
• Construct a circle using a pair of compasses and a ruler.
• Examples:
1. Construct a circle with radius 2 cm and center O.
2. Construct a circle with diameter 6 cm and center O.

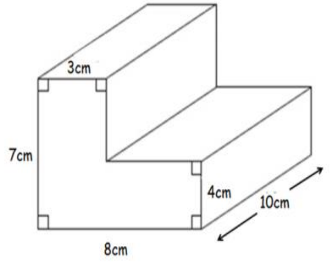
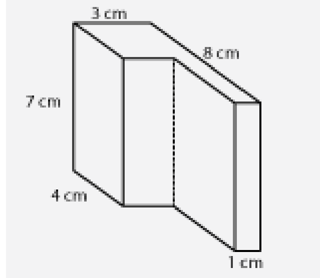
• Establish the formula for circumference of a circle through an investigative activity. Calculators should be used.

Step 1: Preparation
• Prepare cardboard cut-outs of circular discs of varying radii, e.g., 4cm, 5cm, 8cm, etc. Mark centers of discs with small dots.
• Provide thin strings to 'run around' the edges of the discs and read off the lengths of circumference on a ruler.
• Provide a format for recording circumferences (C) and diameters (d) and to guide investigation into the ratio C/d.

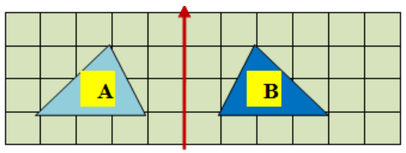
<table><tr><th>Circle</th><th>Radius (r)</th><th>Circumference (C)</th><th>Diameter (d)</th><th>C/r</th></tr><tr><td>1</td><td></td><td></td><td></td><td></td></tr><tr><td>2</td><td></td><td></td><td></td><td></td></tr></table>
Step 2: Investigation by students</td>
<td></td>
</tr>
</table>

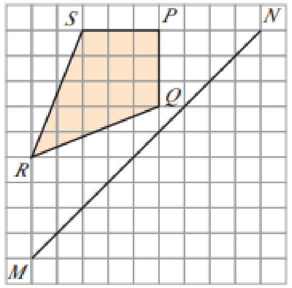
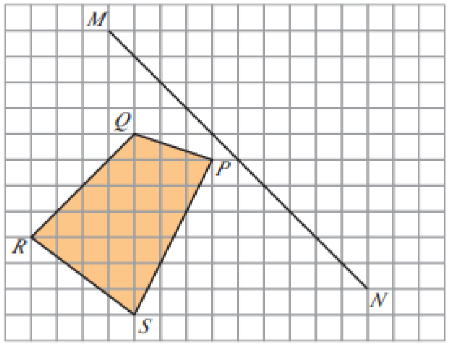
		• Randomly provide 2 – 4 circular discs to each pair of students. • Give instructions to guide investigation: - Measure the radius of each circle. Record your measurement. - Wind the string around the disc and measure the length of string which goes one full circle around the disc. Record your measurement in the column called circumference. - Complete the column diameter. - Use your calculator to compute the ratio C/d and record it in the table. - What do you observe in the results under the column? How are C and d related? a) Consolidate all students' findings and introduce this ratio as π (pi). Guide students to derive the formula: C = π x d, where d = diameter. b) Explain that C = 2πr, where r = radius, since d = 2r. c) Apply the relationship to find the circumferences of two more circles. • Solve problems involving circumference, diameter and radii of circles. *Examples:* 1. The diameter of a circle is 14 cm. What is the length of its radius? 2. Calculate the perimeter of a circle with radius 5 cm. Give your answers in terms of π. 3. The circumference of a circle is 44 cm. What is the length of its radius? [Take π as 3.142]. Give your answer to the nearest whole number.	
2.1.5 Nets of cuboids, triangular prisms, regular tetrahedra, square-based.	g) Identify and draw nets of cuboids, triangular prisms, regular tetrahedra, square-based pyramids. [SPN21 MATHEMATICS Y8 Pages 281-286]	• Review nets of cuboids. • Use concrete models of cuboids, triangular prisms, regular tetrahedra, square-based pyramids and to help students visualise 3-dimensional figures and draw nets of these solids.	

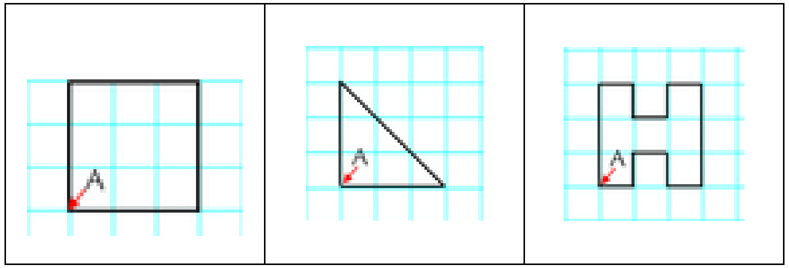
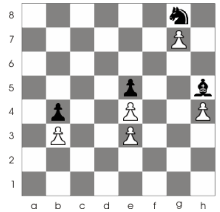
		  Nets of regular tetrahedron Square-based pyramid    Nets of square-based pyramid	
2.1.6 Volume of cuboids and simple composite solids.	h) Solve problems that involve calculating the volume of cuboids (including cubes) and simple composite solids made from cuboids. Remark: Triangular prism and trapezoidal prism are not included. [SPN21 MATHEMATICS Y8 Pages 287-292]	• Guide students to identify the length, the breadth and the height of a cuboid in 3-dimensional figures.  • Guide students to derive the formula of volume of a cuboid: **Volume of cuboid =** ***l*** x ***b*** x ***h*** **=** ***b*** x ***h*** x ***l*** **=** ***area of cross section*** x ***length*** *Examples:* 1. Find the volume of a cube whose side is 4 cm. 2. The volume of a cube is 27 cm^3. What is the length of each of its sides? 3. The volume of a cube is 8 cm^3. What is the area of each of its	

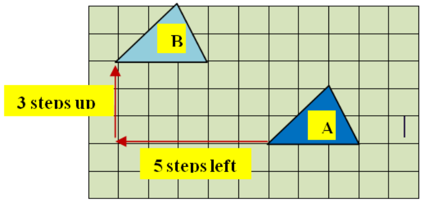
		faces? 4. Find the volume of the solids:   	

SUB-TOPICS	LEARNING OBJECTIVES	LEARNING EXPERIENCE/EXEMPLIFICATION	INSTRUCTION TIME
2.2 SYMMETRY & TRANSFORMATIONS	Students should be able to:		2
2.2.1 Lines of symmetry & Reflection	a) Understand and use the language and notation associated with reflections, rotations and translations. [SPN21 MATHEMATICS Y7 Pages 256-277 and Y8 Pages 258-267] b) Recognise, visualise and identify lines of symmetry. [SPN21 MATHEMATICS Y7 Pages 224-225 and Y8 Pages 184-191] Reflect plane shapes in horizontal, vertical and diagonal mirror lines, including on a coordinate	• Give general ideas about the topic 'TRANSFORMATION' by showing examples of reflection, rotation and translation. • Discuss the significance of using transformations in designing works (Escher patterns and Islamic geometrical patterns). • Review the idea of line symmetry through paper folding of cut-outs of any shapes and using a plane mirror to show the mirror image of an object. • Explain line symmetry of figures and introduce the term 'axis of symmetry' or 'line of symmetry'. • Line symmetry, mirror symmetry, mirror-image symmetry, reflection symmetry, is symmetry with respect to reflection. • Guide students to draw the line of symmetry of a given figure and to complete a symmetrical figure drawing.	

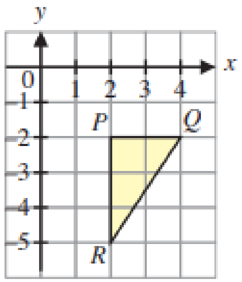
	grid (all four quadrants). Remark: Determining the axis of reflection is not included. [SPN21 MATHEMATICS Y7 Pages 266-275]	<u>Examples of practical activity</u>: • Stand a plane mirror in front of an object to introduce the idea of reflection. Position the mirror behind a picture lying on a table top and ask students to observe the image of the picture in it. • Show pictures which illustrate objects and images and their mirror lines. ✓ Explain the terms 'object' and 'image' with reference to the pictures and the mirror demonstrations. ✓ Emphasise that in any reflection, there is a 'mirror line' which separate the object from the image. Guide students to identify the mirror lines in such pictures and drawings. ✓ Guide students to recognise that the *perpendicular distance* of the image point from the mirror line (or axis of reflection) is equal to the *perpendicular distance* of the object point from the mirror line. ✓ Guide students to perform reflection on given figures in given (i) vertical mirror lines, (ii) horizontal mirror lines and (iii) diagonal lines (45^0 to the horizontal). • Provide practices on drawing the reflection images of given figures on a coordinate grid (all four quadrants). • Guide students to note the invariant properties (angles and sides) of an object and its image under a reflection. Such properties will be used to check accuracy of images and will not be applied in problems. ***Examples***: 1) Reflect the figure A in the given mirror line and label the image as figure B. [Discuss the technique to draw the image.] 	

		2) The diagram shows quadrilateral *PQRS* on a grid. *MN* is the axis of reflection. Draw its image $P_1Q_1R_1S_1$.  3) The diagram shows quadrilateral *PQRS*. It is reflected in the line *MN*. Draw its image $P_1Q_1R_1S_1$. 	
2.2.2 Rotational symmetry & Rotation	c) Recognise, visualise and identify 2D rotational symmetry and identify centres of rotation.	• Introduce the idea of rotational symmetry using different figures. • Show a cut out figure with a pin and rotate it about the pin. • Emphasise that there must be a centre of rotation in a figure with rotational symmetry.	

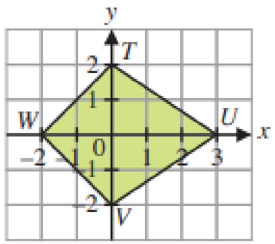
	[SPN21 MATHEMATICS Y7 Pages 226-227] Rotate polygons on a coordinate grid (all four quadrants) after a rotation of 90° or 180° clockwise and anti-clockwise **around one of its vertices.** Remark: Describe a rotation fully in statement form is not included. [SPN21 MATHEMATICS Y8 Pages 258-267]	• ***Examples:*** Rotate the shapes 90° and 180° clockwise/anti-clockwise about the point A. 	
2.2.3 Translation	d) Recognise and visualise 2D translations. Translate a polygon on a coordinate grid (all four quadrants). [SPN21 MATHEMATICS Y7 Pages 256-265]	• Introduce the first idea of translation by shifting a piece on a chess board in a specified direction.  ***Examples***: 1) Shifting a queen 2 steps to the right 2) Shifting a pawn 1 step forward 3) Shifting a knight 3 steps to the left and 2 steps forward • Demonstrate the translation of a given figure drawn in a coordinate plane point (***object*** point) by a specified number of steps horizontally and vertically in the coordinate plane. Label the image (image point) ***Examples***: 1) Translate the Figure A by a shift of "***5 steps to the left and 2 steps up***". Label the image as Figure B.	



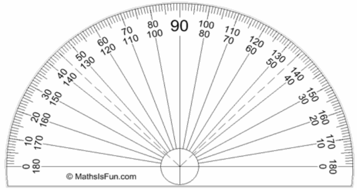
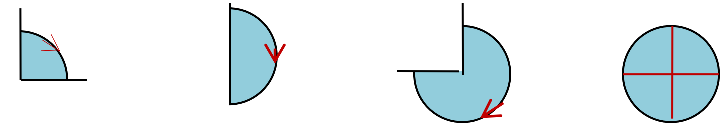
2) Translate triangle *PQR* 6 units to the left and 4 units up. Draw and label the image $P_1Q_1R_1$.



3) Translate kite *TUVW* 5 units down and 8 units to the left. Draw and label the image $T_1U_1V_1W_1$.

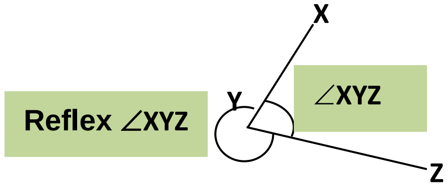


- Guide students to note the invariant properties (angles and sides) of an object and its image under a translation. Such properties will be used to check accuracy of images and will not be applied in problems.

SUB-TOPICS	LEARNING OBJECTIVES	LEARNING EXPERIENCE/EXEMPLIFICATION	INSTRUCTION TIME
2.3 PLANE & SOLID SHAPES	Students should be able to:		2
2.3.1 Lines, angles, plane & solid shapes.	a) Understand and use correctly the vocabulary, notation and labelling conventions for lines, angles, plane and solid shapes. [SPN21 MATHEMATICS Y7 Pages 204-223] b) Use a protractor to measure and draw angles, including reflex angles, to the nearest degree. [SPN21 MATHEMATICS Y7 Pages 204-211]	• Demonstrate rotation using a hand-held fan and discuss the need to use special units to measure the amount of turn of the edge of the fan about a fixed center (pivot).  **Hand-held fan**  **Protractor** • Show a protractor to illustrate that a half turn is measured as 180 degrees (denoted as 180^0). Hence one complete rotation is measured as 360 degrees. • Discuss the sizes of angles associated with quarter-turn (90^0), half-turn (180^0), three quarter-turn (270^0), and complete turn (360^0).  quarter-turn turn (90^0) half-turn (180^0) three quarter-turn (270^0) complete (360^0). • Use the proper symbols in naming angles, e.g., $\angle ABC$, $\angle x$ and $A\hat{B}C$ and  for right angle. • Review different types of angles: acute (less than 90^0), right (90^0), obtuse (more than 90^0 but less than 180^0) and reflex (more than 180^0).	

<table>
<tr>
<td>2.3.2 Properties of angles: angles on a straight line, angles around a point & vertically opposite angles.</td>
<td>c) Solve problems involving angles on a straight line, angles around a point and vertically opposite angles.
[SPN21 MATHEMATICS Y7 Pages 211-217]</td>
<td>Show relationship between an acute angle and its corresponding reflex angle (see diagram below).

Emphasise that the naming of a reflex angle must be preceded with the word ‘reflex’ as shown in the diagram below.



Explain the use of inner scale and the outer scale in reading an angle. Show how the protractor should be positioned so that accurate reading can be obtained.
Guide students to use the protractor to measure ready angles in degrees and to draw angles of specified magnitudes. Give sufficient practice to ensure all students are able to read the size of any angle.
Use the protractor or a corner of a rectangle (or the set-square) to determine if an angle is acute or obtuse. Use the straight edge to determine if an angle is a straight angle (180^0), an obtuse or a reflex angle.
Introduce the meaning of two angles being complementary to one another if their sum = 90^0. Use this property to find the other complementary angle of a given angle.
Similarly introduce the meaning of supplementary angles. Use this property to find the supplementary angle of a given angle.
Show a line with several angles meeting at a point and with a sum of 180 degrees. Introduce the term ‘adjacent angles on a straight line’. Emphasise that a few angles which sum up 180^0 will meet at a point on a straight line. Use this property to find unknown angles on a

</td>
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</table>

straight line.

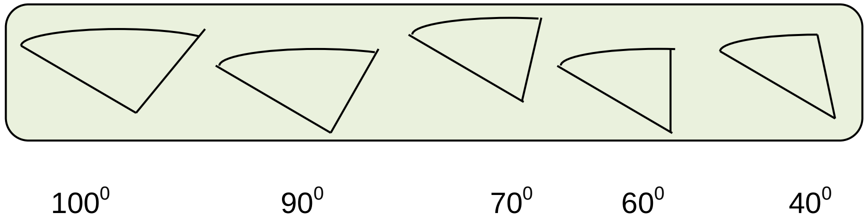
- Guide students to draw two intersecting lines and identify the pairs of vertically opposite angles. Guide them to discover that vertically opposite angles are equal by measuring these angles with a protractor.

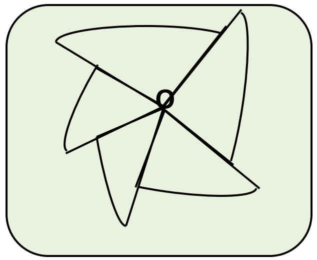
- Give further practice on problems related to the above properties of angles.

- <u>Investigation:</u>

Provide each group with a set of cut-outs of angles with **preset sizes** totaling 360^0, e.g. (150^0, 120^0, 90^0), (100^0, 90^0, 70^0, 60^0, 40^0) [Please see the sample set shown below.]

Sample set: (100^0, 90^0, 70^0, 60^0, 40^0)



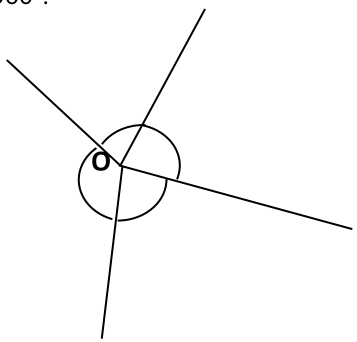


Instruct students to:

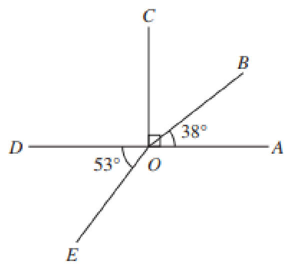
- measure and label the size of each angle

- paste the angles (with vertices pointing to a fixed point)
- take note that all the given angles meet at one point and,
- conclude that angles at a point sum up to 360^0.

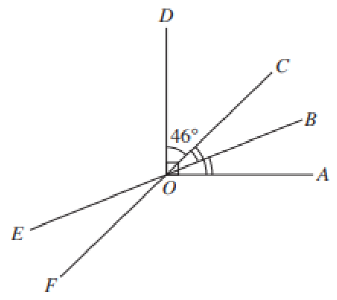
- Guide students to mark a point on a plain paper and draw a few lines radiating from this point to verify this property.
  Measure all angles and then add them up to show that sum of angles at a point = 360^0.



- Examples:
  1) In the figure *AOD* is a straight line and angle *AOC* is a right angle. Find
     d) angle *BOC,*
     e) angle *AOE.*



  2) In the figure, *BOE* and *COF* are straight lines, and angle *AOB* = angle *BOC*. Find a) angle *EOF*, b) angle *AOF*.

2.3.3 Triangles.	d) **Solve geometrical problems involving line, angle and symmetry properties of equilateral, isosceles and right-angled triangles, including finding unknown angles**. Explain geometrical reasoning using diagrams and words. [SPN21 MATHEMATICS Y7 Pages 218-227]	 • Explain the types of triangles: scalene, right-angled, isosceles and equilateral triangles. Guide students to identify types of triangles: • **Oral quizzes:** • 'I have 3 sides. I have two equal sides. What's my name?' • 'I have 3 sides. All my 3 angles are equal. What am I?' • Review that the sum of interior angles of a triangle and the angle property of exterior angles through a demonstration as follows: • Construct a random triangle PQR on a plain paper. Extend the side along RP at corner P (Diagram 1). • Duplicate the triangle PQR on a colour paper and cut up the three angles.(Diagram 2) • Arrange and paste cutout angles Q and R next to the corner P so that the three angles are adjacent angles on a straight line. (Diagram 3)	

This shows that:

- ***Sum of interior angles of a triangle = 180^0, and***
- ***Exterior angle = sum of interior opposite angles***

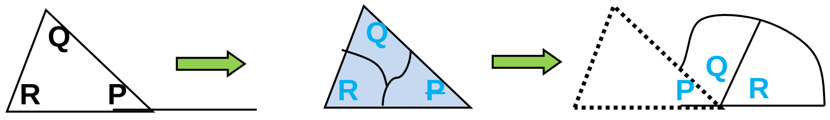
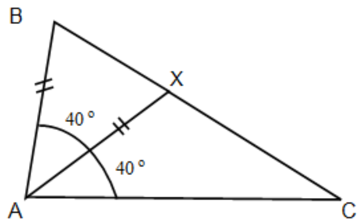


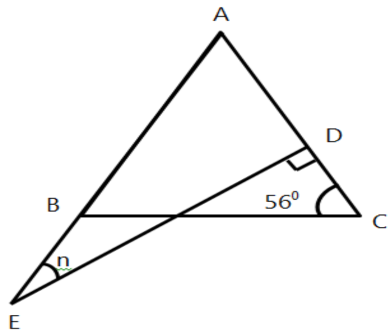
Diagram 1 Diagram 2 Diagram 3

- Apply these properties in finding unknown angles in triangles.

- Examples:
  1) In the triangle ABC, X is a point on BC such that AB = AX.
     Given that ∠BAX = ∠XAC = 40^O. Calculate ∠ACX.



  2) In the figure, AB = AC and ABE is a straight line. Find angle n



	e) Use a ruler and protractor to construct a triangle given two sides and the included angle (SAS) or two angles and the included side (ASA). Remark: Construction of a triangle given its 3 sides. [SPN21 MATHEMATICS Y7 Pages 229-232]	• Guide students to construct different types of triangles given: • Two sides and the included angle (SAS) • Two angles and the included side (ASA) Examples: • Construct triangle ABC where AB = 7 cm, AC = 6 cm and ∠A = 40^{O} • Length of BC = ______________ cm • ∠ACB = ________________^{O} • Construct triangle XYZ where XY = 6 cm, YZ = 7.5 cm and ∠XYZ = 76^{O} • Construct triangle DEF where DE = 5.5 cm, DF = 6 cm and ∠D = 107^{O} • Construct triangle DEF where DE = 7 cm, ∠D = 59^{O} and ∠E = 35^{O} • Construct triangle KLM where KL = 5 cm, ∠KLM = 33^{O} and ∠LKM = 127^{O}	

3. DATA ANALYSIS & PROBABILITY (5 WEEKS)

SUB-TOPICS	LEARNING OBJECTIVES	LEARNING EXPERIENCE/EXEMPLIFICATION	INSTRUCTION TIME
3.1 DATA ANALYSIS	Students should be able to:		3
3.1.1 Types of data	a) Understand and use the vocabulary to describe different types of data: quantitative; categorical (qualitative); discrete; ungrouped and grouped; continuous.	see tables below	

Quantitative data	Qualitative data (categorical)
Information about quantities; information that can be measured and written down with numbers	Information about qualities; information that can't actually be measured
Examples: The amount of money in your wallet, your age, the age of your father's car etc.	Examples: The colour of the sky, the softness of the cat etc.

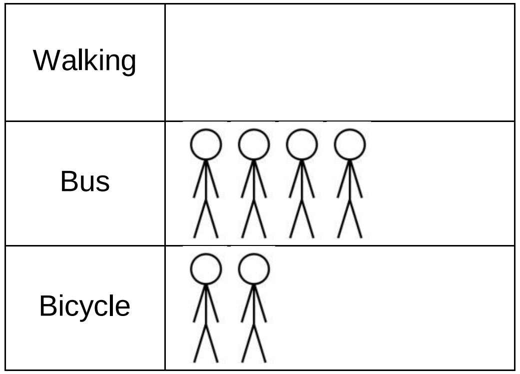
Type of data	**Discrete data**	**Continuous data**	
Meaning	Has clear spaces between values	Falls on a continuous sequence	
Nature	Countable	Measurable	
Values	Can take only distinct or separate values (counted in whole numbers or integers)	Can take any value in some interval	

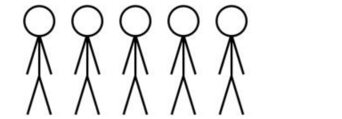
Graphical representation	Bar graph	Histogram	
Tabulation is known as	Ungrouped frequency distribution	Grouped frequency distribution	
Classification	Mutually inclusive	Mutually exclusive	
Examples	Number of students in the classroom, the number of durians on its tree etc.	Your mass. Your mass is not a specific fixed number. Time in a race. A race can be timed to a millisecond. It's not set to a specific fixed number.	

- Give examples of 'data' and invite students to give more examples of data. Examples of data: height, age, shoe size, weight, colour, volume, number of cars, favourite food items, duration, prices, etc.

- Discuss how some types of data can be collected by using various instruments such as ruler, weighing machine, stop-watch, etc. However, some data cannot be measured by any physical instruments but by direct observation or interviews (e.g. colour, favourite food).

- Discuss briefly the use of the various methods of data collection and examples of data that can be collected.

3.1.2 Pictograms, Bar charts, Pie charts, Frequency tables	b) **Collect and organise data and construct**: • frequency tables for ungrouped and grouped discrete data. • pictograms; • bar charts/graphs for discrete data; • **pie charts for categorical data**; Read, analyse and interpret these diagrams and charts and draw simple conclusions from them. [SPN21 MATHEMATICS Y7 Pages 180-200, Y8 Pages 131-138]	**<u>Frequency Tables</u>** <u>Practical Activity:</u> • Collect a few sets of real data (e.g. height, age, favourite colour, etc.) using tally sheets and guide students to prepare frequency tables. • Interpret the frequency tables to find answers to the set of data. Examples: Which is the most popular food item? How many more choose satay than choose laksa? **<u>Pictograms</u>** • A pictogram is a frequency table represented in repeated symbols or pictures. Each symbol/picture represents a number of the same item. • Show a ready-made pictogram to explain the important features of pictograms: key to a picture, uniform picture size, horizontal axis for data and vertical axis for implied frequency (by the number of pictures) or either way, title of pictogram, etc. • Interpret the pictogram and find answers to questions related to the data. Example: The following pictograph shows how a group of students travelled to school one morning 	

Car	

Key:  represents 4 students

a) How many students travelled to school by car?
b) If the total number of students involved in the survey is 56, how many symbols must be drawn in the pictogram for the students walking to school?

- Guide students to construct a pictogram from a set of given data.
- Data represented by a pictogram is easy to understand but half/fraction of a symbol/picture cannot usually be drawn accurately and so the frequency is represented approximately.

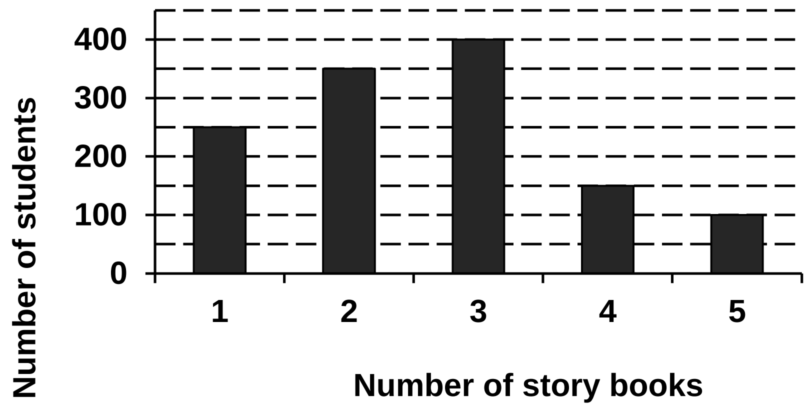
Bar Charts/Graphs (Horizontal and Vertical bar charts/graphs)

- A bar chart/graph is a statistical representation which uses bars to represent the number of units (frequencies) of the various items.
- Show a ready-made bar chart to explain the important features of bar charts: uniform column width, horizontal axis for data and vertical axis for frequency or either way, title of bar chart, etc.

- Interpret the bar chart and find answers to questions related to the data.

Example: The bar graph shows the number of storybooks read by students in a school.

Express the number of students who read only 3 storybooks as a fraction of the total number of students in the school. (Give your answer in its simplest form).



- Guide students to construct a bar chart from a set of given data.

- <u>Group activity:</u>
  Carry out a group activity to investigate students' favourite snack during the recess (or other preferences) on a particular day. The following steps are recommended.

- Describe the purpose of this survey and how it can be carried out.
- Instruct the groups to discuss among them and plan out their steps (role of each member, preparing an observation form, time of survey, etc.)
- Check the group plans and help students to improve their plans.
- Make arrangements to carry out the activity.
- The group constructs the frequency table.
- The group constructs a bar chart.
- The group explains and interprets bar charts to the class.

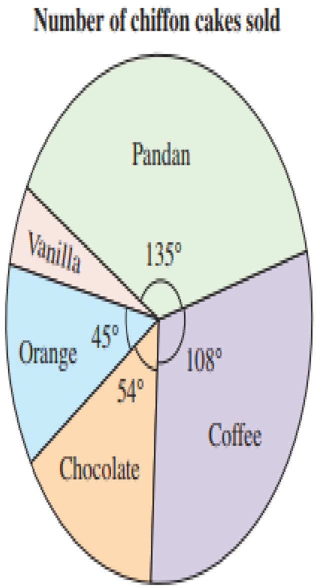
<u>Pie charts</u>

- A pie chart represents data and information in a circle. The circle is divided into various sectors to show the parts of a set of data. The angle of each sector is proportional to the frequency of the category it represents. Pie chart can be used to compare proportions between the various sectors and between a sector and the whole.

- A pie chart is more convenient to represent/illustrate data when there is a big difference between the frequencies or there are only a few categories.

Examples:

1) The pie chart shows the number of chiffon cakes of each flavour sold on a particular day. Copy and complete the corresponding table.



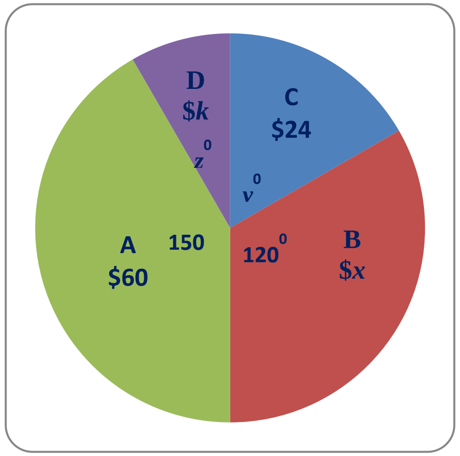
Flavour	Angle of sector	Corresponding fraction
Pandan		
Coffee		
Chocolate		
Orange		
Vanilla		

2) Most of the students in a class kept pets. Of the 160 pets they had, there were 72 fishes, 40 hamsters, 28 cats, 12 terrapins and 8 rabbits. Draw a pie chart to illustrate the above information.
Solution: **Angle of sector for each type of pet is needed to draw the pie chart.**

Type of pet	Frequency	Angle of sector
Fish	72	$\frac{72}{160} \times 360° = 162°$
Hamster	40	$\frac{40}{160} \times 360° = 90°$
Cat	28	$\frac{28}{160} \times 360° = 63°$
Terrapin	12	$\frac{12}{160} \times 360° = 27°$
Rabbit	8	$\frac{8}{160} \times 360° = 18°$

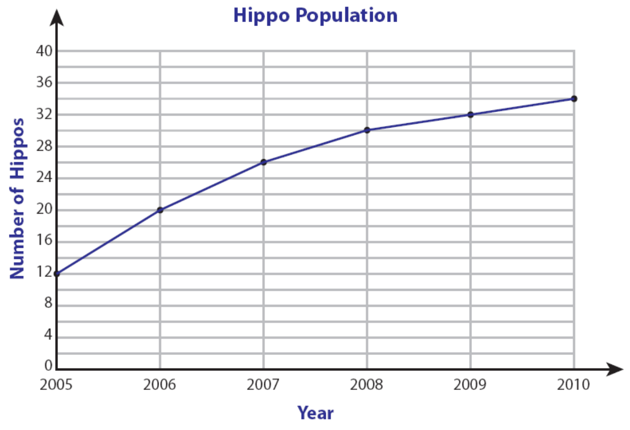
- Show a pie chart with given sector angles and corresponding quantities. Guide students to interpret the pie chart. Use the idea of proportion to establish the relationship between the size of angle and the amount represented by a sector.

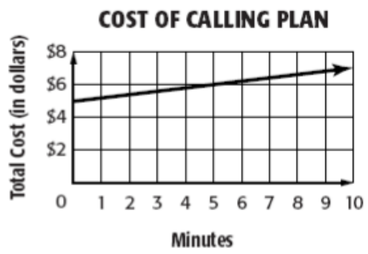
  Example: The pie chart shows the amount of money shared among four siblings: Ashley (A), Bella (B), Camille (C) and Daniel (D).
  Ashley received $60. The angle of the sector representing Ashley's share is 150^0.



Calculate (i) the total amount of money shared between the siblings, (ii) the amount of money received by Bella, (iii) the angle (y^0) of the sector

		C, and (iv) the angle of the sector D and the amount of money received by Daniel. ***Solution:*** **The angle of a sector is proportional to the amount represented by the sector.** (i) Let the total amount of money be *T*. It is represented by the whole circle with angle at centre = 360^0. For A, \$60 is represented by a sector of 150^0. Therefore, $\frac{60}{T} = \frac{150^0}{360^0}$. Hence, T = 144. The total amount of money is \$144. (ii) For B, the amount of money received, x is represented by a sector of 120^0. Therefore, $\frac{x}{144} = \frac{120^0}{360^0}$. [or alternatively, $\frac{x}{60} = \frac{120^0}{150^0}$] Hence, x = 48. The amount of money received by Bella is \$48. (iii) For C, the amount of money received, \$24 is represented by a sector of y^0. Therefore, $\frac{24}{144} = \frac{y^0}{360^0}$. [or alternatively, $\frac{24}{60} = \frac{y^0}{150^0}$] Hence, y = 60. The angle of the sector C is 60^0. (iv) For D, the amount of money received, *k* is represented by a sector of z^0. *k* can be found by adding up the money received by the siblings, $k + 60 + 48 + 24 = 144$	

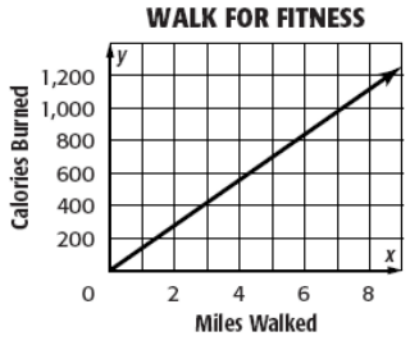
		$k = 12$ Hence, Daniel received $12. Also, $z + 150 + 120 + 60 = 360$. Hence, $z = 30$. The angle of the sector D is 30^0.	
3.1.3 Line graphs	c) **Read information in a line graph and understand the relationship between the two given variables (e.g. distance/time, conversion graphs)**. ***Related to 1.10.3 graphs of simple linear functions arising from real-life situations (Relationships & graphs)*** [SPN21 MATHEMATICS Y8 Pages 248-255]	**Line graphs** • A line graph is a graph that shows the 'trends' of something over a period of time, such as the height of a boy over the 10 years, sales of books over a year etc. • Examples: 1) A wildlife biologist made a study on the population growth of hippopotamus and recorded the information on a graph. Answer the questions based on the graph.  a) How many hippos were there in 2007? b) How many more hippos were recorded in the year 2008 than in 2006? 2) The graph below shows the monthly cost of a long-distance calling plan.	



What does the slope of the graph represent?

a) The cost of zero minutes of calls
b) The cost per additional minutes of long-distance calls
c) The total cost of long-distance calls
d) The number of minutes $1 can buy

3) Linda saw the following graph in a fitness magazine.



Which does the slope of the graph represent?

a) Total calories burned
b) Total distance walked
c) Calories burned per mile walked
d) Miles walked per hour

3.1.4 Mean, mode, median & Range	d) Calculate the mean, mode, median and range for a set of data, including from an ungrouped frequency table. Find the modal class for grouped discrete data. Remark: Grouped data is not included. [SPN21 MATHEMATICS Y8 Pages 139-155]	**Mean** • Revise the concept of average of a set of values through examples. (Average – year 6). Explain that 'average' is a representative value of a given set of values through everyday examples: average weight, average income, etc. • Introduce the term 'mean' to replace the term 'average'. • Compare data (e.g., boys' heights versus girls' heights) by comparing means from given sets of data. • Guide students to apply the concept of mean to solve simple problems related to means. **Mean** = $\frac{\textit{sum of values}}{\textit{number of values}}$ *Examples*: 1) Find the mean of the data: 123, 112, 135, 158, 144 Mean = $\frac{123+112+135+158+144}{5}=\frac{672}{5}=134.4$ 2) Calculate the mean of the set of values given in the frequency table.	

Number, x	**0**	**1**	**2**	**3**	**4**
Frequency, f	3	4	2	5	1
Sum of each number, fx					

Mean = $\frac{\textit{sum of fx}}{\textit{sum of f}}$

3) Shooting at a target board, a man can score 10, 20, 30, 40, 50 or 60 points. After 100 shots, his scores were as shown in the following table.

Score	No. of times
10	26
20	15
30	14
40	15
50	18
60	12

Calculate his mean score.

4) The mean of 5 numbers is 14. Four of the numbers are 20, 16, 11 and 10. Find the 5^{th} number.

5) The mean of 4 numbers is 31. The mean of another 8 numbers is 37. Calculate the mean of the 12 numbers.

Mode

- Introduce the idea of mode as the **most frequent** value or measure (or occurrence) in a set of data. It is used as a representative value or measure (or occurrence) of the set data.
- The **modal class** is the class interval that has the **highest frequency**.

Examples:

1) Identify the mode of the following set of sizes of shoes sold in a sale:

23, 24, 24, 25, 26, 26, 26, 26, 27, 29, 30, 32.

Mode = size 26

2) A shop manager collected the following data regarding the shoe sizes sold over a month. Find the modal value of the shoe sizes in the frequency distribution.

Value, x (size)	4	5	6	7	8
Frequency, f	31	40	22	13	8

Modal value = size 5

- Find the modal class for grouped discrete data.
  Example: Find the modal class for the following data.

Class Interval (Marks)	Number of Students
1-20	4
21-40	8 ← Highest frequency
41-60	6
61-80	7
81-100	5

Modal class = 21 - 40

Median

- Introduce the idea of median as the **middle value** of a set of values **arranged in order of size**. Emphasise that if there are even number of values in a set, the median is the average of the two middle values.

Examples:

1) Find the median of the set of values: 4, 0, 1, 2, 1, 3, 4, 1, 2, 0.

   Rearranged in ascending order: 0, 0, 1, 1, 1, 2, 2, 3, 4, 4.

   There are two values in the middle of the sequence.

   Median $= \frac{1+2}{2} = 1.5$

[Guide students to interpret the data and use a strategy to locate the **position** of the median, e.g. median position = $\frac{n+1}{2}$ th , where n is the number of values in the data.]

2) Find the median of the set of values given in the frequency table.

X	0	1	2	3	4
f	2	3	2	1	2

- Solve simple problems involving mean, mode and median.

<u>Range</u>

- The **range** for a set of data is the highest value of the set minus the lowest value.

  Range = highest value – lowest value

- The range is **not an average**. It shows the **spread of the data**.

  It is used to **compare** two or more sets of similar data and also to comment on the **consistency** of two or more sets of data.

e) Compare two simple distributions using the range and one measure of average (mode, median or mean).

Examples:

1) Rachel's marks in 10 MCT tests were 4, 4, 7, 6, 6, 5, 7, 6, 9 and 6.
Therefore, her mean mark is 60 ÷ 10 = 6 and the range is 9 – 4 = 5.
Adil's marks in the same tests were 6, 7, 6, 8, 5, 6, 5, 6, 5 and 6.
Therefore, his mean mark is 60 ÷ 10 = 6 and the range is 8 – 5 = 3.
Although both means are the same, **Adil has a smaller range. This shows that Adil's results are more consistent.**

2) Find the range for each set of data:

a) 3, 8, 7, 4, 5, 9, 10, 6, 7, 4.

b) 3.5, 4.2, 5.5, 3.7, 3.2, 4.8, 5.6, 3.9, 5.5, 3.8

3) Ali took 7 science tests. His scores were:
68, 69, 69, 67, 65, 68, 67
What was the range of Ali's test scores?

		4) In a golf tournament, the club chairperson had to choose either Maria or Fay to play in the first round. In the previous eight rounds, their scores were as follows: Maria's scores: 75, 92, 80, 73, 72, 88, 86, 90 Fay's scores: 80, 87, 85, 76, 85, 79, 84, 88 a) Calculate the mean score for each golfer. b) Find the range for each golfer. c) Which golfer would you choose to play in the tournament? Explain why. 6) Dani has a choice of two buses to get to school: Number 50 or Number 63. Over a month, he kept a record of the number of minutes each bus was late when it set off from his home bus stop. Bus No. 50: 4, 2, 0, 6, 4, 8, 8, 6, 3, 9 Bus No. 63: 3, 4, 0, 10, 3, 5, 13, 1, 0, 1 a) For each bus, calculate the mean number of minutes late. b) Find the range for each bus. Which bus would you advise Dani to catch? Give a reason for your answer. • <u>Group Project:</u> Only the framework is suggested below. Teachers will provide more details and further instructions to their students so as to enable them to carry out the projects successfully. <u>Project Theme</u>: Statistics in real life. <u>Group Size</u>: 4-5 students. <u>Duration</u>: 3 weeks <u>General Instruction</u>: Each group will be given a theme for investigation.	

		Suggested themes: "Favourite TV programmes", "My favourite subjects-Boys versus Girls", "How students spend the recess time", etc. They will follow three stages in their investigation: 1) Planning ✓ What data will be required in the investigation? ✓ What is the most suitable method(s) for data collection? ✓ Design the survey questionnaire or interview guide. ✓ What statistical representation will be used? (bar charts, pie charts, histograms, mean, etc.) 2) Data collection and processing ✓ Carry out data collection. ✓ Analyse the data. 3) Prepare statistical representation. ✓ Report and presentation ✓ Provide support to each group in terms of materials.	

SUB-TOPICS	LEARNING OBJECTIVES	LEARNING EXPERIENCE/EXEMPLIFICATION	INSTRUCTION TIME
3.2 PROBABILITY	Students should be able to:		2
3.2.1 Introduction to Probability	a) Recognise real-life examples of probability. Understand the concept of probability and use the vocabulary of probability when describing events: certain, more likely, equally likely, less likely, or impossible.	Probability is the chance or possibility that an event (something) will happen. **Vocabulary of probability** / **Event**: **Certain**: will definitely happen. — The Sun will rise and set every day. People will breathe air. **Impossible**: will not happen. — Growing wings, going to the Sun, or breathing underwater. **Possible**: could happen. may or may not actually happen — Visiting another country or getting a new pet.	

Likely: will probably happen.	Read from a book next week.
Unlikely : will probably not happen. Not impossible.	Getting a pet tiger. Some people do have pet tigers, but it is uncommon.
More likely	It is more likely that they will eat at break time than do their homework.
Less likely	It is less likely that they will leave school early to go to Jerudong Park Playground.
Equally likely	It is equally likely for a coin to land on heads or tails.

Activity 1:

1. Introduce Probability and the words: **always, sometimes, never**.

   Probability means how likely it is that something will happen.

   We are learning to say or write a sentence with Probability words.

   - ✓ I can make a sentence with always, sometimes, never, possible, impossible, certain, likely or unlikely.

   <u>Example:</u>

Things we see or do in SCHOOL		
always	**sometimes**	**never**
Have a break period	Go to the library	Bring a pet
See a teacher	See a cat	See a dolphin

2. Introduce the words **"possible"** and **"impossible"**.

- ✓ Sorting possible and impossible sentences on a chart. Teacher gives the sentences.

  Example:

  a) Rain today
  b) Flying cat
  c) Eat at Jolibee
  d) I grow purple hair

possible	impossible

Then, students write their own sentences.

3. **Certain, likely, unlikely, impossible**.
   Sorting on chart (do in separate days). Teacher gives examples. Then students write their own sentences.

Day 1

likely	unlikely
We have dinner tonight at home	We have dinner tonight on a cruise ship

Day 2

certain	impossible
Raining and thunderstorm	Raining gumball

4. Gumball machine:

Look at the gumball machine and fill in the blanks:

a) It is **certain** that we will get a ______________.
b) It is **likely** that we will get a __________ gumball.
c) It is **unlikely** that we will get a __________ gumball.
d) It is **impossible** to get a _________ gumball.
e) It is **impossible** to get a _________.

Provide a new worksheet (gumball machine without colour) and ask the students to colour their own gumballs. Then, answer the questions.

Activity 2:

Show a clear bag of two different colours of counters, such as blue and red connecting cubes.

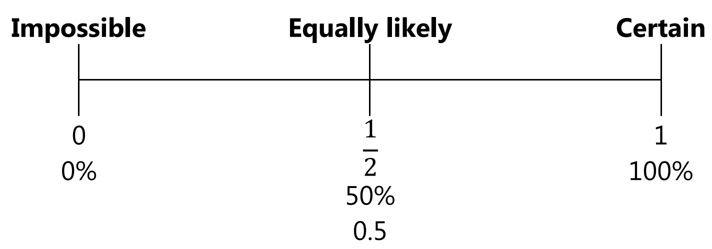
Make sure there are more blue cubes than red. If they chose one cube from the bag, what colour would it be?

Since there are more blue cubes than red, it is more likely they would pick a blue cube.

It is less likely they would pick a red cube.

It is impossible they would pick a pink cube.

<table>
<tr><td></td><td></td><td>Repeat the activity again except have <u>equal numbers</u> of red and blue cubes. Since there are equal numbers of red and blue cubes, it is <u>equally likely</u> to pick a red or a blue cube.</td><td></td></tr>
<tr><td>3.2.2 Probability scale</td><td>b) Understand and use the probability scale: a certain outcome is 1 or 100%, an impossible outcome is 0 or 0%, and an equally likely outcome is 0.5, $^{1}/_{2}$ or 50%.</td><td>



Equally likely events are <u>events</u> that have the same <u>theoretical probability</u> (or likelihood) of occurring.
</td><td></td></tr>
<tr><td>3.2.3 Mutually exclusive outcomes</td><td>c) Identify all the possible mutually exclusive outcomes of a single event.</td><td>
Mutually exclusive: cannot happen at the same time. It is impossible for them to happen together.
The probability of both events happening together is ZERO.
Examples:
Turning both right and left at the same time.
Tossing a coin: showing a head and a tail at the same time.
Today is Monday. Today is also Tuesday.
<u>Activity 1</u>
The table below shows the outcomes of a single event. Could the two events A and B in the following situations happen at the same time?
<table>
<tr><th>Outcomes of a single event</th><th>YES / NO</th></tr>
<tr><td>a) Event A: roll a die and get a “1”.
Event B: roll a die and get a “6”.</td><td></td></tr>
</table>
</td><td></td></tr>
</table>

3.2.4 Theoretical probability & Experimental probability	d) Understand that the theoretical probability of a single event is the ratio of the number of favourable outcomes to the total number of possible outcomes where all outcomes are equally likely. **Identify and justify probabilities of a single event based on equally likely outcomes in simple contexts**.	(see below)	

b) Event A: toss a coin and get a "head". Event B: toss a coin and get a "tail"	
c) A bag contains 2 yellow balls and 3 blue balls. A ball is drawn from it. Event A: You get a yellow ball. Event B: You get a blue ball.	
d) Event A: roll a die and get a "2". Event B: roll a die and get an even number.	
e) One student is selected as the class monitor. Event A: Jamal is selected as the monitor. Event B: Peter is selected as the monitor.	

In everyday life, there are **events that cannot happen at the same time**. We called these **Mutually Exclusive Events**.

2. Can you write down two examples of mutually exclusive events?
3. Since mutually exclusive events cannot happen together, the probability that both events will happen together is equal to ______________.
4. How about the probability that **either** one event will happen?

Probability of any event A occurring, P(A) = $\frac{Number\ of\ outcomes\ favourable\ to\ A}{Total\ number\ of\ possible\ outcomes}$

Examples:

1) A bag contains 2 yellow balls and 3 blue balls. A ball is drawn from it. Find the probability of getting a blue ball.
   P(blue ball) = $\frac{number\ of\ blue\ balls}{total\ number\ of\ balls} = \frac{3}{5}$
2) A fair die is rolled. Find the probability of getting an even number.
   P(even number) = $\frac{3}{6} = \frac{1}{2}$

Activity 2

Complete the following.

1) **Roll a die**:

Event A: Roll a die and get a "1".

Event B: Roll a die, and get a "4".

The probability that you get a "1", P(A), is ____________________.

The probability that you get a "4" , P(B) , is ____________________.

The probability of getting a "1" or a "4", P(A or B), is ________________.

2) **Draw a ball from a bag**:

There are five balls of different colours (orange, yellow, red, blue and white) inside a bag.

Event A: Draw a white ball.

Event B: Draw an orange ball.

P(A) = ____________________.

P(B) = ____________________.

The probability of getting a white or an orange ball, P(A or B), is ________.

Discussion:

In the above cases, events A and B are ______________________________. State the relationship between P(A), P(B) and P(A or B).

P (A or B) = ____________ + ____________.

Why?

Examples:

1. Year 7G is looking for a new form captain. The probability of Zara being a form captain is 0.2 while the probability of Aiman being a form captain is 0.4. What is the probability of either Zara or Aiman becoming a form captain?
2. A bag contains 3 yellow balls, 2 green balls, 5 red balls and 6 black balls. What is the probability of either a yellow ball or a red ball being drawn if only one ball is drawn?

		• The theoretical probability is what you expect to happen, but it isn't always what actually happens. *Examples:* 1. What is the probability of a coin landing on tails? P(getting a tail) = $\frac{1}{2}$ or 50%. You would probably answer that the chance is ½ or 50%. 2. Imagine that you toss a coin 10 times. How many times would you expect it to land on tails? You would expect it to land on tails 5 times. P(getting a tail) = $\frac{5}{10}$ = $\frac{1}{2}$ or 50% You might say, 50% of the time, or half of the 10 times. 3. What is the probability of getting a 2 when you toss a die? There are 6 faces on a die (1, 2, 3, 4, 5 & 6). P(getting a 2) = $\frac{1}{6}$ or 17% 4. A die is rolled, what is the probability of getting a prime number? Out of the 6 possible outcomes, 2, 3 and 5 are prime numbers. P(getting a prime number) = $\frac{3}{6}$ = $\frac{1}{2}$ or 50%. 5. From a group of 20 players, a keeper is chosen. If 5 of the players are keepers, what is the probability that the player chosen will be a keeper? P(keeper chosen) = $\frac{5}{20}$ = $\frac{1}{4}$ or 25%	
	e) Understand that the experimental probability of a single event is the ratio of the number of favourable outcomes to the total number trials. Estimate probabilities based on data collected from simple experiments. Make and justify predictions about the population size when given a probability and experimental data in simple contexts.	• Experimental probability refers to the probability of an event occurring when an experiment was conducted. • Experimental probability is the ratio of the number of favourable outcomes to the total number of trials carried out. Experimental probability $= \frac{number\ of\ events\ in\ trials}{total\ number\ of\ trials\ carried\ out}$ The table below shows the results after Aini tossed a coin 10 times. Outcomes | Frequency Heads | 3 Tails | 7 Total | 10	

		The table shows the experimental probability. It is the probability obtained from the result of an experiment. It is what actually happens instead of what is expected to obtain. Experimental probability of obtaining tails is $\frac{7}{10} = \frac{70}{100} = 70\%$ Now, Aini continues to toss the same coin for 50 total tosses. The results are shown below. Outcomes / Frequency: Heads 27; Tails 23; Total 50 Now, the experimental probability of obtaining tails is $\frac{23}{50} = \frac{46}{100} = 46\%$ The probability is still a bit lower than expected, but as more experiments are conducted; the experimental probability becomes closer to the theoretical probability (i.e. 50%). • Examples: 1) The probability of students bringing calculators during a Mathematics exam is higher than normal school days. 2) The probability of people staying indoor on a rainy day is greater than the probability of people going out. 3) In a lucky draw event where for every purchase of $100 you will entitle one lucky draw cupon. The more lucky draw cupons you get the higher the chances you will get a prize in the lucky draw. 4) The probability of full attendance girls in a class is $\frac{1}{2}$. This means that the number of girls in the class is equal to the number of boys. 5) The probability of full attendance girls in a class is $\frac{3}{10}$. This means that the number of girls in the class is less than the number of boys. In other words, 30% of the students in the class are girls, that is 70% of them are boys.	

Outcomes	Frequency
Heads	27
Tails	23
Total	50

	f) Understand the difference between theoretical and experimental probabilities and compare in simple contexts.	• Compare theoretical and experimental probabilities using tossing a fair coin examples above to understand the difference between both probabilities.	