Aims of Syllabus

The Primary Mathematics Syllabus aims to enable all students to:

- acquire mathematical concepts and skills for everyday use and continuous learning in mathematics;
- develop thinking, reasoning, communication, application and metacognitive skills through a mathematical approach to problem-solving; and
- build confidence and foster interest in mathematics.

Syllabus Organisation

The syllabus is organised along 3 content strands with a listing of mathematical processes that cut across the 3 strands.

3 Content Strands + 1 Process Strand		
Number and Algebra	Measurement and Geometry	Statistics
Mathematical Processes		

Strand: Mathematical Processes

Mathematical processes refer to the process skills involved in the process of acquiring and applying mathematical knowledge. This includes *reasoning, communication and connections, applications*, and *thinking skills and heuristics* that are important in mathematical problem solving and beyond.

At the primary level, students develop these process skills through problem solving. They learn to lay out their working logically; communicate their thoughts clearly both in written and oral forms; and reason inductively by observing patterns, similarities and differences. They make connections among mathematical ideas, and between mathematics and everyday life. Through solving problems in real-world context, students see the relevance of mathematics in everyday situations. They formulate methods and strategies to solve problems, and develop the habit of checking the reasonableness of their answers against the real-world context. Most importantly, they develop reasoning and problem solving skills that are essential to lifelong learning.

The teaching of process skills should be deliberate and yet integrated with the learning of concepts and skills. Students should be exposed to heuristics and use problem-solving approaches such as the Polya's model in class. Teachers could "think aloud" to give attention to these processes and make them visible to students. Through practice, students will develop habits and strategies that will help them be better and more independent learners.

No.	Processes	Indicators
MATHEMATICAL PROCESSES		
MP1	**Reasoning, Communication and Connections**	• Use appropriate notations, symbols and conventions to present and communicate mathematical ideas • Reason inductively and deductively by: ∗ Observing patterns, similarities and differences ∗ Drawing logical conclusions and making inferences ∗ Explaining or justifying solutions, writing out the solutions mathematically • Make connections within mathematics and between mathematics and everyday life
MP2	**Applications**	• Apply mathematics concepts and skills to solve problems in a variety of contexts within or outside mathematics, including: ∗ Identifying the appropriate mathematical representations for a problem ∗ Using appropriate mathematical concepts, skills (including tools and algorithm) to solve a problem ∗ Interpreting the mathematical solution in the context of the problem and making sense of the solution
MP3	**Thinking Skills and Heuristics**	• Use thinking skills such as: ∗ Classifying ∗ Comparing ∗ Sequencing ∗ Generalising ∗ Induction ∗ Deduction ∗ Analyzing (from whole to parts) ∗ Synthesizing (from parts to whole) • Use a problem-solving model such as Polya's model • Use heuristics such as: ∗ Drawing a diagram ∗ Tabulating ∗ Guess and check ∗ Working backwards ∗ Simplifying a problem ∗ Considering special cases

Content & Learning Experiences by Level

In this section, the content is listed by levels and learning experiences statements are included.

The learning experiences for the Primary Mathematics syllabus should provide opportunities for students to:
- enhance conceptual understanding through use of the Concrete-Pictorial-Abstract approach and various mathematical tools including ICT tools;
- apply concepts and skills learnt in real-world context;
- communicate their reasoning and connections through various mathematical tasks and activities;
- build confidence and foster interest in mathematics.

Content	Learning Experiences

PRIMARY ONE

NUMBER AND ALGEBRA

SUB-STRAND: WHOLE NUMBERS

1. Numbers up to 100	Students should have opportunities to:
1.1 counting to tell the number of objects in a given set 1.2 number notation, representations and place values (tens, ones) 1.3 reading and writing numbers in numerals and in words 1.4 comparing the number of objects in two or more sets 1.5 comparing and ordering numbers 1.6 patterns in number sequences 1.7 ordinal numbers (first, second, up to tenth) and symbols (1st, 2nd, 3rd, etc) 1.8 number bonds for numbers up to 10	(a) use number-bond posters and make number stories to build and consolidate number bonds for numbers up to 10. (b) work in groups using concrete objects to - make a group of ten and count on from 10 to tell the number (less than 20). - make groups of ten and count tens and ones to tell the number (more than 20). - estimate the number of objects in a set before counting. - make sense of the size of 100. (c) use concrete objects and the base-ten set to represent and compare numbers in terms of tens and ones, and use language such as 'more than', 'fewer than', 'the same as' and 'as many as' to describe the comparison. (d) play games using dot cards, picture cards, numeral cards and number-word cards etc. for number recognition and comparison. (e) describe a given number pattern using language such as '1 more/less' or '10 more/less' before continuing the pattern or finding the missing number(s).
2. Addition and Subtraction	**Students should have opportunities to:**

2.1 concepts of addition and subtraction
2.2 use of +, – and =
2.3 relationship between addition and subtraction
2.4 adding more than two 1-digit numbers
2.5 adding and subtracting within 100
2.6 adding and subtracting using algorithms
2.7 solving 1-step word problems involving addition and subtraction within 20
2.8 mental calculation involving addition and subtraction
   • within 20
   • of a 2-digit number and ones without renaming
   • of a 2-digit number and tens
	(a) work in groups to make addition and subtraction stories using concrete objects/pictures and write an addition or subtraction equation for each story.
	(b) write two addition facts and two subtraction facts for a given number bond within 10.
	(c) use strategies such as 'count on', 'count back', 'make ten' and 'subtract from 10' for addition and subtraction within 20 (before committing the number facts to memory) and thereafter, within 100.
	(d) compare two numbers within 20 to tell how much one number is greater (or smaller) than the other by subtraction.
	(e) achieve mastery of basic addition and subtraction facts within 20 through playing a wide range of games.
	
	(f) use the base-ten set to illustrate the standard algorithms for addition and subtraction of 2-digit numbers.

Primary Mathematics

Content	Learning Experiences
3. Multiplication and Division	**Students should have opportunities to:**
3.1 concepts of multiplication and division 3.2 use of x 3.3 multiplying within 40 3.4 dividing within 20 3.5 solving 1-step word problems involving multiplication and division with pictorial representation	(a) make equal groups using concrete objects and count the total number of objects in the groups by repeated addition using language such as '2 groups of 5' and '2 fives'. (b) share a given number of concrete objects/picture cutouts and explain how the sharing is done and whether the objects can be shared equally. (c) divide a set of concrete objects into equal groups, and discuss the grouping and sharing concepts of division.
SUB-STRAND: MONEY	
1. Money	**Students should have opportunities to:**

1.1 counting amount of money
   • in cents up to $1
   • in dollars up to $100
1.2 solving 1-step word problems involving addition and subtraction of money in dollars only (or in cents only)
	(a) communicate and share their shopping experiences.
	(b) recognise coins and notes of different denominations, count money from the highest to the lowest denomination and represent money using $ and ¢ symbols.
	(c) match a coin/note of one denomination to an equivalent set of coins/notes of another denomination using play money, and realise that a greater number of coins/notes is not necessarily a greater amount of money.
	(d) compare amounts of money using play money, and realise that when comparing two sets of notes (or coins), it is their values that are being compared and not the number of notes (or coins).
	(e) work in groups using play money to add, subtract and make change during shopping activities.

MEASUREMENT AND GEOMETRY

SUB-STRAND: MEASUREMENT	
1. Length	**Students should have opportunities to:**
1.1 measuring and comparing the length of objects in non-standard units	(a) work in groups to measure length using a variety of non-standard units such as body parts, paper clips and common objects in their environment and explain their choices of units and how the measurement is done. (b) estimate the length of an object before measuring it and use the word 'about' to describe the measurement.

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Content	Learning Experiences
2. Time	**Students should have opportunities to:**
2.1 telling time to the hour/half hour	(a) tell time from a clock face and relate time to the events of a day using 'o'clock' and 'half past'. (b) sequence events according to time and explain the appropriateness of events at different times of the day, e.g. lunch at 3 o'clock in the afternoon.
SUB-STRAND: GEOMETRY	
1. 2D Shapes	**Students should have opportunities to:**
1.1 identifying, naming, describing and classifying 2D shapes • rectangle • square • circle • triangle 1.2 making/completing patterns with 2D shapes according to one or two of the following attributes • size • shape • colour • orientation	(a) recognise, name and describe the 4 basic 2D shapes (rectangle, square, circle and triangle) from real objects and pictures (drawings and photographs). (b) trace the outline of 2D shapes from 3D objects. (c) identify and describe 2D shapes in different sizes and orientations. (d) form a 2D shape from cut-out pieces of the shape. (e) guess a 2D shape from a description of the shape. (f) recognise and describe the differences/similarities between two 2D shapes according to attributes such as sides, corners, sizes and colours. (g) work in groups to sort 2D shapes in different ways and explain how the shapes are sorted. (h) use 2D shapes or applets to create patterns according to one or two attributes (size, shape, colour and orientation) and describe the patterns. (i) work in groups to create a pattern and invite other groups to guess the missing shape(s) in the pattern and explain the pattern.

STATISTICS

SUB-STRAND: DATA REPRESENTATION AND INTERPRETATION	
1. Picture Graphs	**Students should have opportunities to:**
1.1 reading and interpreting data from picture graphs	(a) work in groups to collect data from the class to answer questions such as "What kind of fruits do we like?" and use the data to make a picture graph for display. (b) discuss and describe the data presented in a picture graph using language such as 'most', 'least', 'greatest', 'smallest', 'as much as' and 'as many as'. (c) represent picture graphs in both vertical and horizontal forms, and make a story using information from a graph.

Content	Learning Experiences
PRIMARY TWO	
SUB-STRAND: WHOLE NUMBERS	
1. Numbers up to 1000	**Students should have opportunities to:**

1.1 counting in tens/hundreds
1.2 number notation, representations and place values (hundreds, tens, ones)
1.3 reading and writing numbers in numerals and in words
1.4 comparing and ordering numbers
1.5 patterns in number sequences
1.6 odd and even numbers
	(a) give examples of numbers in everyday situations, and talk about how and why the numbers are used.
	(b) work in groups using concrete objects/the base-ten set/play money to
	  - count in tens/hundreds to establish 10 tens make 1 hundred and 10 hundreds make 1 thousand.
	  - represent and compare numbers.
	(c) make sense of the size of 100 and use it to estimate the number of objects in the size of hundreds.
	(d) use the base-ten set/play money to represent a number that is 1, 10 or 100 more than/less than a 3-digit number.
	(e) use place-value cards to illustrate and explain place values, e.g. the digit 3 stands for 300, 30 or 3 depending on where it appears in a number.
	(f) use place-value cards to compare numbers digit by digit from left to right, and use language such as 'greater than', 'greatest', 'smaller than', 'smallest' and 'the same as' to describe the comparison.
	(g) describe a given number pattern before continuing the pattern or finding the missing number(s).

2. Addition and Subtraction	**Students should have opportunities to:**

2.1 addition and subtraction algorithms (up to 3 digits)
2.2 solving up to 2-step word problems involving addition and subtraction
2.3 mental calculation involving addition and subtraction of a 3-digit number and ones/tens/hundreds
	(a) write addition and subtraction equations for number stories and explain the meaning of the equal sign.
	(b) achieve mastery of basic addition and subtraction facts within 20 by
	  - writing a family of 4 basic facts within 20 given any one of the basic facts (e.g. 9 + 7 = 16, 7 + 9 = 16, 16 – 9 = 7 and 16 – 7 = 9 are a family of addition and subtraction facts).
	  - playing games, including applets and digital games.
	(c) work in groups using the base-ten set/play money to illustrate the standard algorithms for addition and subtraction up to 3 digits.
	(d) use the part-whole and comparison models to illustrate the concepts of addition and subtraction and use the models to determine which operation (addition or subtraction) to use when solving 1-step word problems.
	(e) use the comparison model to reinforce the language of comparison such as "Ali has 30 more stickers than Siti."

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Content	Learning Experiences
	(f) solve 2-part word problems (1 step for each part) before solving 2-step word problems. (g) achieve mastery of addition and subtraction algorithms up to 3 digits by playing games, including applets and digital games. (h) work in groups to create word problems involving addition and subtraction for other groups to solve.
3. Multiplication and Division	**Students should have opportunities to:**

3.1 multiplication tables of 2, 3, 4, 5 and 10
3.2 use of ÷
3.3 relationship between multiplication and division
3.4 multiplying and dividing within the multiplication tables
3.5 solving 1-step word problems involving multiplication and division within the multiplication tables
3.6 mental calculation involving multiplication and division within the multiplication tables of 2, 3, 4, 5 and 10
	(a) work in groups to make multiplication and division stories, write a multiplication or division equation for each story and explain the meaning of the equal sign.
	(b) use concrete objects and pictorial representations to illustrate the concepts of multiplication and division such as 'multiplying 3 by 5' and 'dividing 12 by 4'.
	(c) explore number patterns in the multiplication tables of 2, 3, 4, 5 and 10 through activities such as colouring the hundred chart.
	(d) achieve mastery of multiplication and division facts by
	   - using multiplication-fact cards and division-fact cards.
	   - playing games, including applets and digital games.
	   - writing a family of 4 basic facts within the multiplication tables given any one of the basic facts (e.g. $3 \times 4 = 12$, $4 \times 3 = 12$, $12 \div 4 = 3$ and $12 \div 3 = 4$ are a family of multiplication and division facts).
	(e) work in groups to create word problems (with pictorial representation if necessary) involving multiplication and division for other groups to solve.
	(f) solve non-routine problems using heuristics such as 'act it out' and 'draw a diagram' and share their ideas.

SUB-STRAND: FRACTIONS	
1. Fraction of a Whole	**Students should have opportunities to:**
1.1 fraction as part of a whole 1.2 notation and representations of fractions 1.3 comparing and ordering fractions with denominators of given fractions not exceeding 12 • unit fractions • like fractions	(a) give examples of fractions in everyday situations and use language such as '2 out of 3' to describe fractions. (b) use concrete objects, fraction discs and pictorial representations to represent and interpret fractions in terms of unit fractions, e.g. $\frac{3}{5}$ is 3 units of $\frac{1}{5}$, $\frac{1}{5} + \frac{1}{5} + \frac{1}{5}$, or 3 fifths, and to compare the sizes of fractions referring to the same whole.

Content	Learning Experiences
	(c) use fraction discs to represent and compare two unit fractions and explain why the greater the denominator, the smaller the unit fraction, e.g. $\frac{1}{6}$ is smaller than $\frac{1}{3}$.
	(d) use fraction discs to represent and compare two like fractions (i.e. fractions with the same denominator) and explain why the greater the numerator, the greater the like fraction, e.g. $\frac{6}{7}$ is greater than $\frac{4}{7}$.
	(e) achieve mastery of fraction recognition and comparison by playing games using fraction cards (pictures and symbols), including applets and digital games.
2. Addition and Subtraction	**Students should have opportunities to:**
2.1 adding and subtracting like fractions within one whole with denominators of given fractions not exceeding 12	(a) work in groups to write addition and subtraction stories involving like fractions. (b) use fraction discs to illustrate addition and subtraction of like fractions within one whole, e.g. $\frac{3}{5} + \frac{1}{5} = \frac{4}{5}$ (3 fifths + 1 fifth = 4 fifths)
SUB-STRAND: MONEY	
1. Money	**Students should have opportunities to:**
1.1 counting amount of money in dollars and cents 1.2 reading and writing money in decimal notation 1.3 comparing two or three amounts of money 1.4 converting an amount of money in decimal notation to cents only, and vice versa 1.5 solving word problems involving money in dollars only (or in cents only)	(a) read the prices of items from a supermarket advertisement or a grocery shopping list, write the prices in dollars and cents and in decimal notation, e.g. $3.45 is 3 dollars and 45 cents, and use play money to make up an amount of money to pay for a selected item. (b) use play money to make up a given amount of money in different ways (e.g. $1 is made up of 2 fifty-cent coins or 5 twenty-cent coins), and write the amount in different ways (e.g. $1, $1.00 and 100 cents). (c) use play money to make different amounts of money and to add, subtract and make change during shopping activities. (d) work in groups to create word problems involving shopping using data from supermarket advertisements etc. for other groups to solve.

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Content	Learning Experiences
MEASUREMENT AND GEOMETRY	
SUB-STRAND: MEASUREMENT	
1. Length, Mass and Volume	**Students should have opportunities to:**

1.1 measuring
  • length in metres/centimetres
  • mass in kilograms/grams
  • volume of liquid in litres
1.2 measuring and drawing a line segment to the nearest cm
1.3 using appropriate units of measurement and their abbreviations cm, m, g, kg, ℓ
1.4 comparing and ordering
  • lengths
  • masses
  • volumes
1.5 solving word problems involving length/mass/ volume
	(a) recognise that the term 'weight' is commonly used to mean mass in everyday situations.
	(b) compare masses of objects using balance scales.
	(c) use everyday examples to develop a sense of
	  - how long 1 m/1 cm is, e.g. using a metre ruler, width of a fingernail.
	  - how heavy 1 kg/1 g is, e.g. using a packet of sugar/flour/ rice, a pin, a piece of paper.
	  - how much 1 litre of liquid is, e.g. using a bottle of mineral water/cooking oil, and 1-litre containers in different shapes.
	(d) use their arm span to show 1 m and estimate length in metres.
	(e) work in groups to measure the length of curves using a string.
	(f) work in groups to measure length/mass using appropriate units and explain their choices of units and how the measurement is done, e.g. measure the length of a longer object in metres and the mass of a heavier object in kg.
	(g) estimate length/mass/volume before measuring it and use the word 'about' (e.g. about 20 cm) to describe the estimation and measurement.

2. Time	**Students should have opportunities to:**
2.1 telling time to 5 minutes 2.2 use of 'a.m.' and 'p.m.' 2.3 use of abbreviations h and min 2.4 drawing hands on the clock face to show time 2.5 duration of 1 hour/half hour	(a) use a geared clock to tell time to 5 minutes and relate it to the events of a day. (b) count aloud in steps of 5 while the minute hand of a geared clock moves from one number to the next and make connections to the multiplication table of 5. (c) show time using a geared clock for others to read the time. (d) tell time and relate words such as 'morning', 'afternoon', 'night' to a.m. and p.m., and give examples such as "I watched a movie with my father at 7.30 p.m." (e) use everyday examples such as TV programme and bus schedules to tell and write time and to identify events that last about 1 hour/half hour, e.g. the Mathematics lesson lasted half an hour.
SUB-STRAND: GEOMETRY	
1. 2D Shapes	**Students should have opportunities to:**
1.1 identifying, naming and describing 2D shapes • semicircle	(a) relate semicircle and quarter circle to circle. (b) guess 2D shapes from given descriptions of the shapes.

Content	Learning Experiences
• quarter circle 1.2 identifying the basic shapes that make up a given figure 1.3 forming different 2D figures with • rectangle • square • triangle • semicircle • quarter circle 1.4 copying figures on dot grid or square grid	(c) recognise and describe the differences/similarities between two 2D shapes according to attributes such as straight lines, curves, sizes and colours. (d) work in groups to create composite figures (e.g. picture of a boat) using 2D shapes or applets, and get other groups to identify the basic shapes that make up the composite figures. (e) make/complete patterns with 2D shapes according to one or two attributes (size, colour, shape and orientation) and explain the patterns.
2. 3D Shapes	**Students should have opportunities to:**
2.1 identifying, naming, describing and classifying 3D shapes • cube • cuboid • cone • cylinder • sphere	(a) recognise, name and describe 3D shapes found in their environment. (b) make a guess of the 3D shapes in a bag by touch and feel only. (c) recognise and describe the differences/similarities between two 3D shapes according to attributes such as faces, edges, corners, sizes, colours and rolling. (d) work in groups to sort 3D shapes in different ways and explain how the shapes are sorted. (e) work in groups to create different 3D figures using 3D shapes or applets. (f) make/complete patterns with 3D shapes (except sphere) according to one or two attributes (size, shape, colour and orientation) and explain the patterns. (g) work in groups to create a pattern and invite other groups to guess the missing shape(s) and explain the pattern.

STATISTICS

SUB-STRAND: DATA REPRESENTATION AND INTERPRETATION	
1. Picture Graphs with Scales	**Students should have opportunities to:**
1.1 reading and interpreting data from picture graphs with scales 1.2 solving 1-step problems using data from picture graphs	(a) work in groups to write a question and answer it by collecting data from more than one class, or use data from the internet to make a picture graph and explain why a scale is used instead of one-to-one representation. (b) represent and interpret picture graphs in both vertical and horizontal forms, and make a story using information from a graph.

Content	Learning Experiences
PRIMARY THREE	

NUMBER AND ALGEBRA

SUB-STRAND: WHOLE NUMBERS

1. Numbers up to 10 000	Students should have opportunities to:
1.1 counting in hundreds/thousands 1.2 number notation, representations and place values (thousands, hundreds, tens, ones) 1.3 reading and writing numbers in numerals and in words 1.4 comparing and ordering numbers 1.5 patterns in number sequences	(a) discuss examples of big numbers (in thousands) in real life. (b) work in groups using number discs/number line to represent and compare numbers. (c) use number discs/play money to count in hundreds/thousands. (d) make sense of the size of 1000 and use it to estimate the number of objects in the size of thousands. (e) use place-value cards to illustrate and explain place values, e.g. the digit 3 stands for 3000, 300, 30 or 3 depending on where it appears in a number. (f) use number discs/place-value cards to compare numbers digit by digit from left to right, and use language such as 'greater than', 'greatest', 'smaller than', 'smallest', 'the same as' to describe the comparison. (g) use number discs/play money to represent a number that is 1, 10, 100 or 1000 more than/less than a 4-digit number. (h) describe a given number pattern before continuing the pattern or finding the missing number(s).
2. Addition and Subtraction	**Students should have opportunities to:**
2.1 addition and subtraction algorithms (up to 4 digits) 2.2 solving up to 2-step word problems involving addition and subtraction 2.3 mental calculation involving addition and subtraction of two 2-digit numbers	(a) associate the terms 'sum' and 'difference' with the comparison model, e.g. "The sum of 35 and 60 is 95 and their difference is 25." (b) work in groups using number discs to illustrate the standard algorithms for addition and subtraction up to 4 digits. (c) achieve mastery of addition and subtraction up to 4 digits by using applets or playing digital games. (d) solve a variety of problems: 1-step word problems, 2-part word problems (1 step for each part), 2-step word problems and non-routine problems to become familiar with the problem-solving process. (e) work in groups to create 2-step word problems involving addition and subtraction up to 4 digits for other groups to solve. (f) do mental addition and subtraction of two 2-digit numbers and discuss the different mental calculation strategies.

Content	Learning Experiences
3. Multiplication and Division	**Students should have opportunities to:**

3.1 multiplication tables of 6, 7, 8 and 9
3.2 multiplying and dividing within the multiplication tables
3.3 division with remainder
3.4 multiplication and division algorithms (up to 3 digits by 1 digit)
3.5 solving up to 2-step word problems involving the 4 operations
3.6 mental calculation involving multiplication and division within the multiplication tables
	(a) work in groups to make multiplication and division stories, and write multiplication and division equations for the stories.
	(b) use concrete objects and pictorial representations to illustrate the concepts of multiplication and division such as 'multiplying 6 by 5' and 'dividing 49 by 7'.
	(c) explore number patterns in the multiplication tables of 6, 7, 8 and 9 through activities such as colouring the hundred chart.
	(d) work in groups using number discs to illustrate the standard algorithms for multiplication and division up to 3 digits by 1 digit.
	(e) divide a number of concrete objects into equal groups to discover that sometimes there are objects left over as remainder and write the answer as quotient and remainder.
	(f) achieve mastery of multiplication and division facts by
	  - using multiplication-fact cards and division-fact cards.
	  - playing games including applets and digital games.
	  - writing a family of 4 basic facts within the multiplication tables given any one of the basic facts (e.g. 8 x 4 = 32, 4 x 8 = 32, 32 ÷ 4 = 8 and 32 ÷ 8 = 4 are a family of multiplication and division facts).
	(g) use the part-whole and comparison models to illustrate the concepts of multiplication and division and use the models to determine which operation (multiplication or division) to use when solving 1-step word problems.
	(h) use the comparison model to reinforce the language of comparison such as "Ali has 3 times as much money as Mary."
	(i) work in groups to create 2-step word problems involving the 4 operations for other groups to solve.
	(j) solve non-routine problems using different heuristics such as 'act it out' and 'draw a diagram' and share their ideas.

SUB-STRAND: FRACTIONS	
1. Equivalent fractions	**Students should have opportunities to:**
1.1 equivalent fractions 1.2 expressing a fraction in its simplest form 1.3 comparing and ordering unlike fractions with denominators of given fractions not exceeding 12 1.4 writing the equivalent fraction of a fraction given the denominator or the numerator	(a) discuss examples of fractions in everyday situations. (b) represent fractions as numbers on a number line. (c) use fraction discs or the part-whole model to represent two equivalent fractions, and explain why they are equal and how one can be obtained from the other, e.g. $\frac{2}{3} = \frac{4}{6}$. (d) make a list of the first 8 equivalent fractions of a given fraction and use this method to compare two unlike fractions. (e) work in groups to compare fractions using different strategies such as drawing a diagram,

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	comparing with respect to half, and explain the strategies used. (f) identify fractions that are not in their simplest form and reduce the fractions to their simplest form. (g) achieve mastery of equivalent fractions and fraction comparison through playing games using fraction cards (pictures and symbols) including digital games.
2. Addition and subtraction	**Students should have opportunities to:**
2.1 adding and subtracting two related fractions within one whole with denominators of given fractions not exceeding 12	(a) use fraction discs to represent two related fractions (i.e. fractions with related denominators), and explain how the two fractions are related. (b) use fraction discs to illustrate addition and subtraction of related fractions within one whole, e.g. $\dfrac{3}{4} + \dfrac{1}{8} = \dfrac{6}{8} + \dfrac{1}{8} = \dfrac{7}{8}$ (c) work in groups to make addition and subtraction stories involving like fractions/related fractions.
SUB-STRAND: MONEY	
1. Money	**Students should have opportunities to:**
1.1 adding and subtracting money in decimal notation 1.2 solving word problems involving addition and subtraction of money in decimal notation	(a) discuss the value of $1000 (e.g. things that can be bought with a $1000 note), and use play money to illustrate that $1000 is 10 times $100. (b) use play money to illustrate the addition and subtraction algorithms and make connections between the algorithms for money and for whole numbers. (c) use a variety of strategies for adding and subtracting money, e.g. make $1, make a whole number of dollars first, and explain the process. (d) work in groups to solve problems in real-world situations such as shopping and budgeting.
MEASUREMENT AND GEOMETRY	
SUB-STRAND: MEASUREMENT	
1. Length, Mass and Volume	**Students should have opportunities to:**

1.1 measuring
  • length in kilometres (km)
  • volume of liquid in millilitres (ml)
1.2 measuring length/mass/volume (of liquid) in compound units
1.3 converting a measurement in compound units to the smaller unit, and vice versa
	(a) develop a sense of
	  - how far 1 km is by relating it to the distance between two familiar landmarks or identifying/ locating a spot which is 1 km away from the school.
	  - how much 1 ml is using everyday examples, e.g. a drop of water from a dropper.
	(b) collect familiar objects with varying volume/capacity, e.g. cough syrup spoons, syrup bottles, food containers.
	(c) count aloud in steps of 100 ml to make 1 ℓ and relate 1 ℓ with 1000 ml, e.g. using a litre jug with

Primary Mathematics

Content	Learning Experiences

• kilometres and metres
• metres and centimetres
• kilograms and grams
• litres and millilitres
(numbers involved should be within easy manipulation)
1.4 solving word problems involving length/mass/volume/capacity excluding fractions and compound units
	100 ml markings.
	(d) work in groups to measure the volume of liquid in millilitres using cough syrup spoons, measuring beakers etc.
	(e) work in groups to estimate and measure using appropriate tools
	   - length of more than 1 m using measuring tapes.
	   - mass of more than 1 kg using measuring scales.
	   - volume of liquid more than 1 ℓ using measuring jars.
	(f) work in groups to measure the capacities of different sized containers using measuring tools such as measuring jars and beakers.

2. Time	**Students should have opportunities to:**
2.1 telling time to the minute 2.2 use of 'past' and 'to' to tell time 2.3 measuring time in hours and minutes 2.4 converting time in hours and minutes to minutes only, and vice versa 2.5 finding the starting time, finishing time or duration given the other two quantities 2.6 solving problems involving time in hours and minutes	(a) observe the movement of the hour and minute hands on a real/geared clock. (b) develop a sense of duration of 1 minute, and describe what can be done in a duration of 1 minute, e.g. number of squares drawn in 1 minute. (c) practise telling and writing time using everyday examples such as TV programmes, bus schedules, MRT operating hours and examination timetables. (d) represent given information such as starting time, finishing time and duration of activity on a timeline, and use it to solve problems. (e) work in groups to create problems involving time in hours and minutes for other groups to solve.
SUB-STRAND: AREA AND VOLUME	
1. Area and Perimeter	**Students should have opportunities to:**

1.1 concepts of area and perimeter of a plane figure
1.2 measuring area in square units, cm^2 and m^2, excluding conversion between cm^2 and m^2
1.3 perimeter of
  • rectilinear figure
  • rectangle
  • square
1.4 area of rectangle/square
	(a) compare and measure the areas of rectangles using different non-standard units, e.g. use their Mathematics textbook as an area unit to estimate and measure their desk and teacher's desk.
	(b) use real-life examples to explain the concepts of area and perimeter, and compare the sizes of rectangles/squares using area.
	(c) visualise the sizes of 1 cm² and 1 m², e.g. use newspaper to measure and make a square of area 1 m² (i.e. 1 m by 1 m).
	(d) work in groups to make different rectangles and squares using square tiles, study the relationship between the area/perimeter and length(s) of each side, and observe that shapes with same area can have different perimeters, and shapes with same perimeter can have different areas.
	(e) work in pairs to find the area of squares and rectangles drawn on square grid by counting and by formula.
	(f) estimate the area of a figure drawn on square grid by counting whole and partial squares within the figure.

Content	Learning Experiences
SUB-STRAND: GEOMETRY	
1. Angles	**Students should have opportunities to:**
1.1 concepts of angle 1.2 right angles, angles greater than/smaller than a right angle	(a) illustrate an angle as an amount of turning using geostrips/riveted straws and use language such as 'acute angle' and 'obtuse angle' to describe angles. (b) find angles in the environment and use a 'paper right angle' to identify right angles, angles greater than a right angle and angles smaller than a right angle.
2. Perpendicular and Parallel Lines	**Students should have opportunities to:**
2.1 perpendicular and parallel lines 2.2 draw perpendicular and parallel lines on square grid	(a) recognise the relationship between two straight lines on a plane that are perpendicular/parallel and give examples of perpendicular/parallel lines from 2D figures and the environment. (b) identify horizontal and vertical lines and explain how to determine if a line is horizontal/vertical, e.g. a line is vertical when it is parallel to a plumb line. (c) recognise that two vertical lines are parallel, and that a horizontal line and a vertical line are perpendicular. (d) work in pairs to explore how to construct perpendicular and parallel lines using set squares and protractor, and to check whether two given straight lines are perpendicular or parallel. (e) work in pairs to explore how different pairs of perpendicular and parallel lines can be drawn on square grid.

STATISTICS

Content	Learning Experiences
SUB-STRAND: DATA REPRESENTATION AND INTERPRETATION	
1. Bar Graphs	**Students should have opportunities to:**
1.1 reading and interpreting data from bar graphs 1.2 using different scales on axis 1.3 solving 1-step problems using data from bar graphs	(a) work in groups to discuss how to collect data, e.g. through interview or survey, and how to represent the data in a bar graph. (b) construct a bar graph using a spreadsheet e.g. Excel, and make a story using information from the graph. (c) discuss real-world examples of data presented in bar graphs.

Content	Learning Experiences
PRIMARY FOUR	

NUMBER AND ALGEBRA

SUB-STRAND: WHOLE NUMBERS

1. Numbers up to 100 000	Students should have opportunities to:

1.1 number notation, representations and place values (ten thousands, thousands, hundreds, tens, ones)
1.2 reading and writing numbers in numerals and in words
1.3 comparing and ordering numbers
1.4 patterns in number sequences
1.5 rounding numbers to the nearest 10, 100 or 1000
1.6 use of $\approx$
	(a) work in groups to
	   - look for examples of big numbers up to 100 000 from newspapers and magazines.
	   - estimate a big number (e.g. the seating capacity of the Singapore Indoor Stadium) and discuss how the estimation is done.
	(b) work in groups using number discs/number line to represent and compare numbers.
	(c) use place-value cards to illustrate and explain place values e.g. the digit 3 stands for 30 000, 3000, 300, 30 or 3 depending on where it appears in a number.
	(d) use number discs/place-value cards to compare numbers digit by digit from left to right, and use language such as 'greater than', 'greatest', 'smaller than', 'smallest' and 'the same as' to describe the comparison.
	(e) use number discs or digital manipulatives to represent a number that is 10, 100 or 1000 more than/less than a 5-digit number.
	(f) describe a given number pattern before continuing the pattern or finding the missing number(s).
	(g) place a given number on a number line between two consecutive tens/hundreds, and determine which ten/hundred is nearer to the given number.

2. Factors and Multiples	Students should have opportunities to:
2.1 factors, multiples and their relationship 2.2 determining if a 1-digit number is a factor of a given number within 100 2.3 finding the common factors of two given numbers 2.4 determining if a number is a multiple of a given 1-digit number 2.5 finding the common multiples of two given 1-digit numbers	(a) relate the concepts of factor and multiple to multiplication and division. (b) work in groups to express a given number within 100 as a product of two factors and share the different ways of writing the products e.g. 36 = 9 x 4 and 36 = 3 x 12. (c) make a list of the first 12 multiples of a given 1-digit number and use this method to identify the common multiples of two given 1-digit numbers. (d) make connections between the concept of common factor and simplifying a fraction, and between the concept of common multiple and finding a common denominator for two fractions.

Primary Mathematics

Content	Learning Experiences
3. Four Operations	**Students should have opportunities to:**

3.1 multiplication algorithm
   • up to 4 digits by 1 digit
   • up to 3 digits by 2 digits
3.2 division algorithm (up to 4 digits by 1 digit)
3.3 solving up to 3-step word problems involving the 4 operations
	(a) use number discs or concrete manipulatives to visualise, illustrate and explain the multiplication of a number by 10 and a multiple of 10
	(b) use the part-whole and comparison models to represent and solve word problems involving the four operations.
	(c) use a variety of mental strategies for the 4 operations and explain the process.
	(d) estimate the answer before doing the calculation and check the reasonableness of the calculated answer by comparing it with the estimated answer.
	(e) work in groups to create 3-step word problems involving the 4 operations for other groups to solve.
	(f) solve non-routine problems using different heuristics and share their ideas.

SUB-STRAND: FRACTIONS	
1. Mixed Numbers and Improper Fractions	**Students should have opportunities to:**
1.1 mixed numbers, improper fractions and their relationships	(a) give examples of fractions in everyday situations, including measurements, e.g. $\frac{1}{2}$ kg, $1\frac{1}{4}$ litres, $\frac{1}{2}$ m, etc. (b) use fraction discs/number line to represent and interpret fractions greater than one whole as improper fractions and mixed numbers. (c) compare two fractions using fraction discs, and then without using fraction discs by changing to common denominators. (d) compare and order whole numbers and fractions on a number line. (e) achieve mastery of conversion between mixed numbers and improper fractions by playing games using fraction cards (pictures and symbols) including digital games.
2. Fraction of a Set of Objects	**Students should have opportunities to:**

2.1 fraction as part of a set of objects	(a) divide a given set of concrete objects into equal parts and use this to
	   - illustrate the concept of fraction of a set (e.g. when a set of objects is divided into 3 equal parts, '$\frac{2}{3}$ of the set' is 2 out of the 3 equal parts).
	   - find a fraction of a set by adding up the objects in the parts (e.g. when a set of 24 objects are divided into 4 equal parts, '$\frac{3}{4}$ of the set' is 6 + 6 + 6 or 3 x 6 = 18 objects).
	(b) Use pictorial model to illustrate the concept of fraction of a quantity.

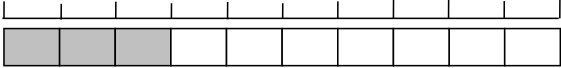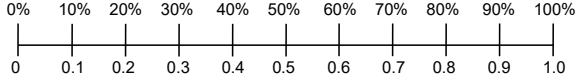| Content	Learning Experiences
3. Addition and Subtraction	**Students should have opportunities to:**
3.1 adding and subtracting fractions with denominators of given fractions not exceeding 12 and not more than two different denominators 3.2 solving up to 2-step word problems involving addition and subtraction	(a) use fraction discs to illustrate addition and subtraction of fractions with answer greater than one whole, and express the answer as a mixed number or improper fraction. (b) work in groups to create 2-step word problems involving addition and subtraction of fractions for other groups to solve.
SUB-STRAND: DECIMALS	
1. Decimals up to 3 decimal places	**Students should have opportunities to:**

1.1 notation, representations and place values (tenths, hundredths, thousandths)
1.2 comparing and ordering decimals
1.3 dividing a whole number by a whole number with quotient as a decimal
1.4 converting decimals to fractions
1.5 converting fractions to decimals when the denominator is a factor of 10 or 100
1.6 rounding decimals to
  • the nearest whole number
  • 1 decimal place
  • 2 decimal places
	(a) look for decimals in everyday situations e.g. advertisements from newspapers and magazines.
	(b) record length/mass/volume of liquid in decimal notation e.g. 1 m 62 cm is 1.62 m, and identify the whole-number parts, tenths and hundredths in the decimal.
	(c) recognise that a decimal is made up of a whole-number part and a fractional part, represent the decimal on a number line, and make connections between decimals, fractions and measurement.
	(d) use number discs to extend the place-value concept of whole numbers to decimals.
	(e) count in tenths/hundredths using number discs from 0.1 to 1.2, or from 0.01 to 0.12, e.g. 11 tenths is 1.1.
	(f) write whole numbers and decimals in 3 digits (or 4 digits), arrange these numbers in increasing/ decreasing order and explain how it is done.
	(g) use number discs to represent a number that is 0.1, 0.01 or 0.001 more than/less than a given decimal.
	(h) create, describe and continue number sequences such as 0.4, 0.8, 1.2, 1.6, …
	(i) compare decimals using number line.
	(j) compare two decimals by first comparing the whole-number parts, and then compare the tenths, hundredths, thousandths in that order.
	(k) represent equivalent decimals such as 0.2, 0.20 and 0.200, and explain that they are the same number.
	(l) divide a whole number by a 1-digit whole number and write the answer as a decimal instead of as quotient and remainder.
	(m) place a given decimal on a number line between two consecutive whole numbers/tenths/ hundredths, and determine which whole number/tenth/hundredth is nearer to the given decimal.

Primary Mathematics

Content	Learning Experiences
2. Addition and Subtraction	**Students should have opportunities to:**
2.1 adding and subtracting decimals (up to 2 decimal places)	(a) use number discs or digital manipulatives to illustrate the addition and subtraction algorithms and make connections between the algorithms for decimals and for whole numbers.
	(b) use a variety of mental strategies for addition and subtraction and explain the process.
	(c) work in groups on problems involving decimals in everyday situations such as shopping receipts, food prices in school canteen, and budgeting.
	(d) estimate the answer before doing the calculation and check the reasonableness of the calculated answer by comparing it with the estimated answer.
3. Multiplication and Division	**Students should have opportunities to:**
3.1 multiplying and dividing decimals (up to 2 decimal places) by a 1-digit whole number 3.2 solving up to 2-step word problems involving the 4 operations 3.3 rounding off answers to a specified degree of accuracy	(a) use number discs or digital manipulatives to illustrate the multiplication and division algorithms and make connections between the algorithms for decimals and for whole numbers.
	(b) estimate the product and quotient using multiplication and division within the multiplication tables and use the estimation to check the reasonableness of the calculated answer.
	(c) work in groups to create 2-step word problems based on everyday experiences, e.g. using data from supermarket advertisements/receipts for other groups to solve.
MEASUREMENT AND GEOMETRY	
SUB-STRAND: MEASUREMENT	
1. Time	**Students should have opportunities to:**
1.1 measuring time in seconds 1.2 24-hour clock 1.3 solving problems involving time in 24-hour clock	(a) develop a sense of 1 second or 10 seconds, e.g. what they can do in 1 second or the number of words they can write in 10 seconds.
	(b) read and write time in 24-hour clock from flight schedules or train schedules, and give reasons why 24-hour clock is used instead of 12-hour clock.
	(c) describe everyday events using 24-hour clock, including starting time, finishing time and duration.
	(d) represent given information such as starting time, finishing time and duration of activity on a timeline and use it to solve problems.
	(e) work in groups to create word problems involving time in 24-hour clock for other groups to solve.

Content	Learning Experiences
SUB-STRAND: AREA AND VOLUME	
1. Area and Perimeter	**Students should have opportunities to:**
1.1 finding one dimension of a rectangle given the other dimension and its area/perimeter 1.2 finding the length of one side of a square given its area/perimeter 1.3 finding the area of figures made up of rectangles and squares	(a) apply multiplication and division concepts to find one dimension of a rectangle given its area/perimeter and the other dimension. (b) draw and cut out squares of different sizes, from 1 cm² to 100 cm², and commit to memory the areas of the squares. (c) make a composite figure using cutouts of rectangles and squares or draw the figure on square grid, and calculate its area and perimeter. (d) visualise how a L-shaped figure can be partitioned into rectangles and squares, or can be formed by removing a rectangle/square from a bigger rectangle/square, and calculate the area and perimeter from given lengths.
SUB-STRAND: GEOMETRY	
1. Angles	**Students should have opportunities to:**
1.1 using notation such as $\angle ABC$ and $\angle a$ to name angles 1.2 measuring angles in degrees 1.3 drawing an angle of given size 1.4 relating quarter, half and complete turns to angles in degrees 1.5 8-point compass	(a) associate the amount of turning (rotation), clockwise or anti-clockwise, with an angle measured in degrees - $\frac{1}{4}$ turn is 90°. - $\frac{1}{2}$ turn is180°. - $\frac{3}{4}$ turn is 270°. - a complete turn with 360°. (b) estimate before measuring angles using a protractor. (c) draw angles using a protractor. (d) find the angles (in degrees) between two 8-point compass directions.

Content	Learning Experiences
2. Rectangle and Square	**Students should have opportunities to:**
2.1 properties of rectangle and square, excluding diagonal properties 2.2 drawing rectangles and squares on square grid	(a) describe the properties of rectangles and squares in terms of perpendicular and parallel lines, e.g. two pairs of parallel sides, and discuss how rectangles and squares are related, e.g. a square is a special rectangle. (b) work in pairs to explore how to draw different squares and rectangles on square grid. (c) observe the different orientations of a rectangle (or square) when it is rotated through 90° (quarter turn), 180° (half turn), 270° (three-quarter turn) and 360° (a complete turn), clockwise or anti-clockwise. (d) sketch and draw rectangles and squares according to given length(s) using ruler, protractor and set squares.
3. Line Symmetry	**Students should have opportunities to**
3.1 identifying symmetric figures 3.2 determining whether a straight line is a line of symmetry of a symmetric figure 3.3 completing a symmetric figure with respect to a given line of symmetry on square grid	(a) work in groups to look for examples of symmetric figures in their environment and determine the lines of symmetry. (b) visualise folding a symmetric figure along a line of symmetry, justify that the figure is symmetric about the line of symmetry, and relate the two halves of the symmetric figure as reflections of each other in the line of symmetry. (c) work in pairs to create symmetric figures with origami paper.

STATISTICS

SUB-STRAND: DATA REPRESENTATION AND INTERPRETATION	
1. Tables and Line Graphs	**Students should have opportunities to:**
1.1 completing a table from given data 1.2 reading and interpreting data from tables/line graphs 1.3 solve 1-step problems using data from tables/graphs	(a) relate the data represented in a table to the corresponding bar graph, and explain why the data is presented in a graph instead of a table. (b) discuss examples of data presented in bar graphs/composite bar graphs found in newspapers and magazines, and how the data was collected and displayed in graphical form. (c) construct a line graph using a spreadsheet e.g. Excel, and make connections between bar and line graphs, and explain which type of graph should be used or both can be used. (d) discuss examples of inappropriate representations of data from newspapers, e.g. whether certain representations are misleading.

Content	Learning Experiences

PRIMARY FIVE

NUMBER AND ALGEBRA

SUB-STRAND: WHOLE NUMBERS

1. Numbers up to 10 million	**Students should have opportunities to:**
1.1 reading and writing numbers in numerals and in words	(a) extend the number system to millions, and read and write large numbers in millions and thousands up to 10 million. (b) develop a sense of the size of 1 million by - discussing examples of numbers in millions up to 10 million e.g. population of Singapore, price of a property. - searching for examples of 1 million from the internet. - estimating the size of an indoor stadium that will have a capacity of 1 million spectators as compared to the Singapore Indoor Stadium.
2. Four Operations	**Students should have opportunities to:**
2.1 multiplying and dividing by 10, 100, 1000 and their multiples **without calculator** 2.2 order of operations **without calculator** 2.3 use of brackets **without calculator** 2.4 solving word problems involving the 4 operations	(a) use number discs to illustrate multiplication and division of a whole number by 10/100/1000, e.g. the result of multiplying 6 hundreds 2 tens 3 ones (623) by 10 is 6 thousands 2 hundreds 3 tens (6230). (b) discover the rules for the order of the 4 operations with a scientific calculator and explain why the rules are necessary. (c) estimate the answer before doing the calculation and check the reasonableness of the calculated answer by comparing it with the estimated answer. (d) solve problems using the part-whole and comparison models. (e) solve non-routine problems using different heuristics and share their ideas.

SUB-STRAND: FRACTIONS

1. Fraction and Division	**Students should have opportunities to:**
1.1 dividing a whole number by a whole number with quotient as a fraction 1.2 converting fractions to decimals	(a) divide a whole number by a 1-digit whole number and write the answer as a fraction, instead of as quotient and remainder, or as a decimal.

Primary Mathematics

Content	Learning Experiences
	(b) explain how fraction and division are related, e.g. $\frac{3}{5}$ is 3 divided by 5; when 3 pies are shared equally among 5 children, each child gets $\frac{3}{5}$ of a pie. (c) use the part-whole model to illustrate the concepts of fraction and division, and their relationship, e.g. draw a model to show 12 ÷ 3 as a whole divided into 3 equal parts which is also $\frac{1}{3}$ of 12.
2. Four Operations	**Students should have opportunities to:**
2.1 adding and subtracting mixed numbers 2.2 multiplying a proper/improper fraction and a whole number **without calculator** 2.3 multiplying a proper fraction and a proper/ improper fractions **without calculator** 2.4 multiplying two improper fractions 2.5 multiplying a mixed number and a whole number 2.6 solving word problems involving addition, subtraction and multiplication	(a) use fraction discs to illustrate addition and subtraction of mixed numbers which involve adding/ subtracting the whole-number parts, followed by adding/subtracting the fractional parts. (b) relate multiplication of whole number and fraction to finding the number of objects in a fraction of a set, e.g. $\frac{3}{4}$ x 60 = $\frac{3}{4}$ of 60. (c) discuss the advantages of doing 'cancellation' before multiplying out the fractions. (d) solve problems using the part-whole and comparison models. (e) work in groups to solve multi-step word problems.
SUB-STRAND: DECIMALS	
1. Four Operations	**Students should have opportunities to:**
1.1 multiplying and dividing decimals (up to 3 decimal places) by 10, 100, 1000 and their multiples **without calculator** 1.2 converting a measurement from a smaller unit to a larger unit in decimal form, and vice versa • kilometres and metres • metres and centimetres • kilograms and grams • litres and millilitres 1.3 solving word problems involving the 4 operations	(a) use number discs to illustrate multiplication and division of a decimal by 10/100/1000, e.g. the result of multiplying 6 ones 2 tenths 3 hundredths (6.23) by 10 is 6 tens 2 ones 3 tenths (62.3), and relate the process to multiplication and division of a whole number by 10/100/1000. (b) collect and talk about real-life examples of the uses of different units of measurement, e.g. specifications of furniture in a manual, weighing scales, height of a mountain in metres (m), car capacity in cubic centimetres (cm^3 or cc). (c) measure and compare amounts of liquid using measuring cylinders (ℓ) and beakers (ml) to determine the equivalence between the measurements, e.g. 0.2 ℓ = 200 ml. (d) use a linear scale to show the relationship between larger and smaller units of measurement. (e) work in pairs to convert between larger and smaller units through games or quizzes. (f) work in groups to create word problems based on everyday experiences for other groups to solve, e.g. using data from supermarket advertisements.

Primary Mathematics

Content	Learning Experiences
	(g) estimate the answer before doing the calculation and check the reasonableness of the calculated answer by comparing it with the estimated answer.

SUB-STRAND: PERCENTAGE

1. Percentage	**Students should have opportunities to:**
1.1 expressing a part of a whole as a percentage 1.2 use of % 1.3 finding a percentage part of a whole 1.4 finding discount, GST and annual interest 1.5 solving up to 2-step word problems involving percentage	(a) look for examples where percentages are used in real life, e.g. newspaper cuttings showing discounts, bank brochures showing interest rates, and discuss their usage. (b) discuss different ways of expressing a part of a whole, e.g. the number of squares shaded to show 30% on 100-square and 200-square grids. (c) use a percentage scale to illustrate the part-whole concept of percentage, and to show the relationship between percentage and fraction, e.g. $30\% = \dfrac{3}{10}$ 0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100% (d) use a linear scale to show the relationship between percentage and decimal 0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100% 0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0 (e) play card games/online games involving equivalent fractions, decimals and percentages, e.g. 20% is equivalent to $\dfrac{1}{5}$ or 0.2. (f) use the part-whole and comparison models to represent and solve percentage problems. (g) collect receipts that show discounts, GST, service charges etc., and use calculator to check how these values are calculated. (h) work in groups to plan a shopping list with a given budget using newspaper advertisements and promotion pamphlets.

Primary Mathematics

Content	Learning Experiences
SUB-STRAND: RATIO	
1. Ratio	**Students should have opportunities to:**
1.1 notation, representations and interpretation of a:b and a:b:c, where a, b and c are whole numbers, excluding ratios involving fractions and decimals 1.2 equivalent ratios 1.3 dividing a quantity in a given ratio 1.4 expressing a ratio in its simplest form 1.5 finding the ratio of two or three given quantities 1.6 finding the missing term in a pair of equivalent ratios 1.7 solving up to 2-step word problems involving ratio	(a) use objects in the classroom to practise simplifying ratios and using ratio language, e.g. "The ratio of the number of boys to the number of girls is 15 to 20", and 15:20 = 3:4. (b) work in groups to make different ratios from two or three given sets of objects, e.g. given 8 blue cubes and 12 green cubes, make different ratios by forming equal groups of varying sizes and recognise the ratios as equivalent ratios because the number of cubes remain unchanged, only groupings change. (c) make connections between simplifying fractions and ratios by dividing the terms of the fraction/ratio by a common factor. (d) solve problems using the part-whole and comparison models.
SUB-STRAND: RATE AND SPEED	
1. Rate	**Students should have opportunities to:**
1.1 rate as the amount of a quantity per unit of another quantity 1.2 finding rate, total amount or number of units given the other two quantities 1.3 solving word problems involving rate	(a) talk about examples of rate in everyday situations such as postage rates and utility rates (water and electricity consumption rates). (b) talk about a situation involving rate and recognise that there are three related quantities (rate, total amount, number of units) and given any two quantities, the third quantity can be calculated. (c) solve problems using proportional reasoning.
MEASUREMENT AND GEOMETRY	
SUB-STRAND: AREA AND VOLUME	
1. Area of Triangle	**Students should have opportunities to:**
1.1 concepts of base and height of a triangle 1.2 area of triangle 1.3 finding the area of figures made up of rectangles, squares and triangles	(a) associate the base and height of a triangle with the length and breadth of its related rectangle, and recognise the relationship between the area of the triangle and its related rectangle. (b) draw different triangles on square grid and identify the height of each triangle corresponding to a given base. (c) work in groups to determine the basic shapes (rectangle, square and triangle) that make up a composite figure, or use basic shape cutouts to form different composite figures.

Content	Learning Experiences
2. Volume of Cube and Cuboid	**Students should have opportunities to:**
2.1 building solids with unit cubes 2.2 measuring volume in cubic units, cm^3 and m^3, excluding conversion between cm^3 and m^3 2.3 drawing cubes and cuboids on isometric grid 2.4 volume of a cube/cuboid 2.5 finding the volume of liquid in a rectangular tank 2.6 relationship between ℓ (or ml) and cm^3	(a) use unit cubes (or connecting cubes) to build different solids (3D figures) and express their volumes in cubic units. (b) compare the sizes of solids in terms of their volumes. (c) build cuboids and cubes layer by layer using unit cubes (or connecting cubes) to establish the formula for the volume of a cuboid/cube. (d) build cubes of sizes 1 x 1 x 1, 2 x 2 x 2, 3 x 3 x 3, ... using unit cubes (or connecting cubes) and find the volumes of the cubes by counting and by formula. (e) pour 1 litre of water into a container measuring 10 cm by 10 cm by 10 cm to establish the equivalence of 1 litre (1000 ml) and 1000 cm³. (f) make connections between 1 cm² and 1 cm³, and between 1 m² and 1 m³, e.g. use newspaper and masking tape to make a square of area 1 m² and a cube of volume 1 m³. (g) work in groups to draw a cube or a cuboid taking into consideration size and orientation. (h) work in pairs to draw on square grid the top/side/front view of a solid made up of unit cubes.
SUB-STRAND: GEOMETRY	
1. Angles	**Students should have opportunities to:**
1.1 angles on a straight line 1.2 angles at a point 1.3 vertically opposite angles 1.4 finding unknown angles	(a) describe and illustrate the various angle properties. (b) look for examples of different types of angles in the environment. (c) use the angle properties to find unknown angles and explain how they obtain the answers.
2. Triangle	**Students should have opportunities to:**
2.1 properties of • isosceles triangle • equilateral triangle • right-angled triangle 2.2 angle sum of a triangle 2.3 finding unknown angles in geometric figures without additional construction of lines	(a) sort a set of different triangles into groups by their angles/lengths, explain how it is done and use terms such as 'acute-angled triangle', 'obtuse-angle triangle', 'right-angled triangle', 'isosceles triangle' and 'equilateral triangle' to describe the triangles. (b) look for the various types of triangles in the environment. (c) investigate and discover that the angle sum of any triangle is 180° using triangle cutouts or applets. (d) identify and justify the angle properties of triangles, e.g. fold an isosceles triangle cutout to show that the base angles are equal. (e) draw special triangles on square grid. (f) use the angle properties of triangles to find unknown angles and explain how they obtain the answers. (g) sketch and draw different triangles according to given angles and lengths using ruler, protractor and set squares.

Primary Mathematics

Content	Learning Experiences
3. Parallelogram, Rhombus and Trapezium	**Students should have opportunities to:**
3.1 properties of • parallelogram • rhombus • trapezium 3.2 finding unknown angles without additional construction of lines	(a) make a collection of quadrilaterals (4-sided figures) from pictures and photographs, and identify the various special quadrilaterals besides square and rectangles. (b) discuss how each special quadrilateral is different from the others, and explore its properties using cutouts or applets. (c) draw special quadrilaterals on square grid. (d) use the properties of special quadrilaterals to find unknown angles and explain how they obtain the answers. (e) sketch and draw special quadrilaterals according to given angles and lengths using ruler, protractor and set squares.

STATISTICS

SUB-STRAND: DATA ANALYSIS	
1. Average of a Set of Data	**Students should have opportunities to:**
1.1 average as 'total value $\div$ number of data' 1.2 relationship between average, total value and number of data	(a) discuss the meaning of average in real-life situations such as average height, average load in a lift, average temperature in a day or month. (b) recognise that there are three related quantities in a set of data (average, total value and number of data) and given any two quantities, the third quantity can be calculated.

Content	Learning Experiences
PRIMARY FIVE (FOUNDATION)	

NUMBER AND ALGEBRA

SUB-STRAND: WHOLE NUMBERS

1. Numbers up to 10 million	**Students should have opportunities to:**

1.1 reading and writing numbers in numerals and in words
1.2 comparing and ordering numbers up to 100 000
1.3 rounding numbers to the nearest 10, 100 or 1000
1.4 patterns in number sequences
1.5 use of $\approx$
	(a) extend the number system to millions, and read and write large numbers in millions and thousands up to 10 million.
	
	(b) develop a sense of the size of 1 million by:
	  - discussing examples of numbers in millions up to 10 million e.g. population of Singapore, price of a property.
	  - searching for examples of 1 million from the internet.
	  - estimating the size of an indoor stadium that will have a capacity of 1 million spectators as compared to the Singapore Indoor Stadium.
	(c) use number discs/place-value cards to compare numbers digit by digit from left to right, and use language such as 'greater than', 'greatest', 'smaller than', 'smallest' and 'the same as' to describe the comparison.
	(d) use number discs or digital manipulatives to represent a number that is 10, 100 or 1000 more than/less than a 5-digit number.
	(e) place a given number on a number line between two consecutive tens/hundreds, and determine which ten/hundred is nearer to the given number.

2. Four Operations	**Students should have opportunities to:**

2.1 addition and subtraction algorithms (up to 3 digits) **without calculator**
2.2 multiplication and division algorithms (up to 2 digits by 1 digit) **without calculator**
2.3 multiplying and dividing by 10, 100, 1000 and their multiples **without calculator**
2.4 order of operations
2.5 use of brackets
2.6 solving up to 3-step word problems involving the 4 operations
	(a) work in groups using number discs/play money to illustrate the standard algorithms for
	
	  - addition and subtraction up to 3 digits by playing games including applets and digital games.
	
	  - multiplication and division up to 2 digits by 1 digit.
	
	  - multiplication and division of a whole number by 10/100/1000, e.g. the result of multiplying 6 hundreds 2 tens 3 ones (623) by 10 is 6 thousands 2 hundreds 3 tens (6230).
	(b) divide a number of concrete objects into equal groups to discover that sometimes there are objects left over as remainder and write the answer as quotient and remainder.
	(c) discover the rules for the order of the 4 operations with a scientific calculator and explain why the rules are necessary.

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2.7 mental calculation involving
• addition and subtraction of a 3-digit number and ones/tens/hundreds
• multiplication and division within the multiplication tables
	(d) use the part-whole and comparison models to represent and solve word problems involving the 4 operations.
	(e) achieve mastery of multiplication and division facts by:
	  - using multiplication-fact cards, division-fact cards.
	  - playing games including applets and digital games.
	  - writing a family of 4 basic facts within the multiplication tables given any one of the basic facts (e.g. 8 x 4 = 32, 4 x 8 = 32, 32 ÷ 4 = 8 and 32 ÷ 8 = 4 are a family of multiplication and division facts).
	(f) estimate the answer before doing the calculation and check the reasonableness of the calculated answer by comparing it with the estimated answer.

3. Factors and Multiples	**Students should have opportunities to:**
3.1 factors, multiples and their relationship 3.2 determining if a 1-digit number is a factor of a given number within 100 3.3 finding the common factors of two given numbers 3.4 determining if a number is a multiple of a given 1-digit number 3.5 finding the common multiples of two given 1-digit numbers	(a) relate the concepts of factor and multiple to multiplication and division. (b) work in groups to express a given number within 100 as a product of two factors and share the different ways of writing the products e.g. 36 = 9 x 4 and 36 = 3 x 12. (c) make a list of the first 12 multiples of a given 1-digit number and use this method to identify the common multiples of two given 1-digit numbers. (d) make connections between the concept of common factor and simplifying a fraction, and between the concept of common multiple and finding a common denominator for two fractions.
SUB-STRAND: FRACTIONS	
1. Concepts of Fractions	**Students should have opportunities to:**
1.1 fraction as part of a whole 1.2 fraction as part of a set of objects	(a) give examples of fractions in everyday situations and use language such as '2 out of 3' to describe fractions. (b) use concrete objects, fraction discs and pictorial representations to represent and interpret fractions in terms of unit fractions e.g. $\frac{3}{5}$ is 3 units of $\frac{1}{5}$, $\frac{1}{5} + \frac{1}{5} + \frac{1}{5}$, or 3 fifths, and to compare the sizes of fractions referring to the same whole. (c) divide a given set of concrete objects into equal parts and use this to - illustrate the concept of fraction of a set (e.g. when a set of objects is divided into 3 equal parts, '$\frac{2}{3}$ of the set' is 2 out of the 3 equal parts). - find a fraction of a set by adding up the objects in the parts (e.g. when a set of 24 objects are

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	divided into 4 equal parts, '$\frac{3}{4}$ of the set' is 6 + 6 + 6 or 3 x 6 = 18 objects). (d) achieve mastery of fraction recognition by playing games using fraction cards (pictures and symbols), including applets and digital games.
2. Equivalent Fractions	**Students should have opportunities to:**
2.1 equivalent fractions 2.2 expressing a fraction in its simplest form 2.3 comparing and ordering unlike fractions, with denominators of given fractions not exceeding 12 2.4 writing the equivalent fraction of a fraction given the denominator or the numerator	(a) discuss examples of fractions in everyday situations. (b) represent fractions as numbers on a number line. (c) use fraction discs or the part-whole model to represent two equivalent fractions, and explain why they are equal and how one can be obtained from the other, e.g. $\frac{2}{3} = \frac{4}{6}$. (d) make a list of the first 8 equivalent fractions of a given fraction and use this method to compare two unlike fractions. (e) work in groups to compare fractions using different strategies such as drawing a diagram, comparing fractions with respect to half, and explain the strategies used. (f) identify fractions that are not in simplest form and reduce the fractions to their simplest form. (g) achieve mastery of equivalent fractions and fraction comparison by playing games using fraction cards (pictures and symbols) including digital games.
3. Mixed Numbers and Improper Fractions	**Students should have opportunities to:**
3.1 mixed numbers and improper fractions and their relationships	(a) give examples of fractions greater than one whole in everyday situations. (b) use fraction discs/number line to represent and interpret fractions greater than one whole as improper fractions and mixed numbers. (c) compare two fractions using fraction discs, and then without using fraction discs by changing to common denominators. (d) achieve mastery of conversion between mixed numbers and improper fractions by playing games using fraction cards (pictures and symbols) including digital games.
4. Four Operations	**Students should have opportunities to:**
4.1 adding and subtracting fractions with denominators of given fractions not exceeding 12 and not more than two different denominators **without calculator** 4.2 adding and subtracting mixed numbers	(a) use fraction discs to illustrate addition and subtraction of fractions with answer greater than one whole, and express the answer as a mixed number or improper fraction. (b) use fraction discs to illustrate addition and subtraction of mixed numbers which involve adding/subtracting the whole-number parts, followed by adding/subtracting the fractional parts.

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4.3 multiplying a proper/improper fraction and a whole number **without calculator** 4.4 multiplying a proper fraction and a proper/improper fraction **without calculator** 4.5 solving up to 2-step word problems involving addition, subtraction and multiplication	(c) relate multiplication of whole number and fraction to finding the number of objects in a fraction of a set e.g. $\frac{3}{4}$ x 60 = $\frac{3}{4}$ of 60. (d) discuss the advantages of doing 'cancellation' before multiplying out the fractions. (e) solve problems using the part-whole and comparison models. (f) work in groups to solve 2-step word problems.
SUB-STRAND: DECIMALS	
1. Decimals up to 3 decimal places	**Students should have opportunities to:**

1.1 notation, representations and place values (tenths, hundredths, thousandths)
1.2 comparing and ordering decimals
1.3 converting decimals to fractions
1.4 converting fractions to decimals when the denominator is a factor of 10 or 100
1.5 rounding decimals to
   • the nearest whole number
   • 1 decimal place
   • 2 decimal places
	(a) look for decimals in everyday situations, e.g. advertisement from newspapers and magazines.
	(b) record length/mass/volume of liquid in decimal notation e.g. 5 m 26 cm is 5.26 m, and identify the whole-number parts, tenths and hundredths in the decimal.
	(c) recognise that a decimal is made up of a whole-number part and a fractional part, represent the decimal on a number line, and make connections between decimals, fractions and measurement.
	(d) use number discs to extend the place-value concept of whole numbers to decimals.
	(e) count in tenths/hundredths using number discs from 0.1 to 1.2, or from 0.01 to 0.12 e.g. 11 tenths is 1.1.
	(f) write whole numbers and decimals in 3 digits (or 4 digits), arrange these numbers in increasing/ decreasing order and explain how it is done.
	(g) use number discs to represent a number that is 0.1, 0.01 , 0.001 more than/less than a given number.
	(h) create, describe and continue number sequences such as 0.4, 0.8, 1.2, 1.6...
	(i) compare decimals using number line.
	(j) compare two decimals by first comparing the whole-number parts, and then compare the tenths, hundredths, thousandths in that order.
	(k) represent equivalent decimals such as 0.2, 0.20 , 0.200 and explain that they are the same number.
	
	(l) divide a whole number by a 1-digit whole number and write the answer as a decimal instead of as quotient and remainder.
	(m) place a given decimal on a number line between two consecutive whole numbers/tenths/ hundredths, and determine which whole number/tenth/hundredth is nearer to the given decimal.

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2. Four operations	**Students should have opportunities to:**

2.1 adding and subtracting decimals (up to 2 decimal places) **without calculator**
2.2 multiplying and dividing decimals (up to 3 decimal places) by 10,100,1000
2.3 a measurement from a smaller unit to a larger unit in decimal form, and vice versa
   • kilometres and metres
   • metres and centimetres
   • kilograms and grams
   • litres and millilitres
2.4 solving up to 2-step word problems involving the 4 operations
	(a) use number discs or digital manipulatives to illustrate the addition and subtraction algorithms and make connections between the algorithms for decimals and for whole numbers.
	(b) use number discs to illustrate multiplication and division of a decimal by 10/100/1000 e.g. the result of multiplying 6 ones 2 tenths 3 hundredths (6.23) by 10 is 6 tens 2 ones 3 tenths (62.3), and relate the process to multiplication and division of a whole number by 10/100/1000.
	(c) collect and talk about real-life examples of the uses of different units of measure e.g. specifications of furniture in a manual, weighing scales, height of a mountain in metres (m), car capacity in cubic centimetres (cm³ or cc).
	(d) measure and compare amounts of liquid using measuring cylinders (ℓ) and beakers (ml) to determine the equivalence between measurements, e.g. 0.2 ℓ = 200 ml.
	(e) use a linear scale to show the relationship between larger and smaller units of measurement.
	(f) work in pairs to convert between larger and smaller units through games or quizzes.
	(g) work in groups on problems involving decimals in everyday situations such as shopping receipts, food prices in school canteen, and budgeting.
	(h) estimate the answer before doing the calculation and check the reasonableness of the calculated answer by comparing it with the estimated answer.

SUB-STRAND: RATE AND SPEED	
1. Rate	**Students should have opportunities to:**
1.1 rate as the amount of a quantity per unit of another quantity 1.2 finding rate, total amount or number of units given the other two quantities 1.3 solving up to 3-step word problems involving rate	(a) talk about examples of rate in everyday situations such as postage rates and utility rates (water and electricity consumption rates). (b) talk about a situation involving rate and recognise that there are three related quantities (rate, total amount, number of units) and given any two quantities, the third quantity can be calculated. (c) solve problems using proportional reasoning.

Primary Mathematics

MEASUREMENT AND GEOMETRY

SUB-STRAND: MEASUREMENT

1. Time	Students should have opportunities to:
1.1 measuring time in hours and minutes 1.2 converting time in hours and minutes to minutes only, and vice versa 1.3 finding the starting time, finishing time or duration given the other two quantities 1.4 24-hour clock 1.5 solving problems involving time in 24-hour clock	(a) practise telling and writing time using everyday examples such as TV programmes, bus schedules, MRT operating hours and exam timetables. (b) represent given information such as starting time, finishing time and duration of activity on a timeline, and use it to solve problems. (c) read and write time in 24-hour clock from flight schedules or train schedules, and give reasons why 24-hour clock is used instead of 12-hour clock. (d) describe everyday events using 24-hour clock, including starting time, finishing time and duration. (e) represent given information such as starting time, finishing time and duration of activity on a timeline and use it to solve problems.

SUB-STRAND: AREA AND VOLUME

1. Area and Perimeter	Students should have opportunities to:
1.1 concept of area and perimeter of a plane figure 1.2 measuring area in square units, cm² and m², excluding conversion between cm² and m² 1.3 area and perimeter of rectangle/square 1.4 finding one dimension of a rectangle given the other dimension and its area/perimeter 1.5 finding the length of one side of a square given its area/perimeter 1.6 finding the area of figures made up of rectangles and squares	(a) discuss the use of appropriate units of measurement (length, area and perimeter). (b) use real-life examples to explain the concepts of area and perimeter, and compare the sizes of rectangles/squares using area. (c) work in pairs to find the area of rectangles and squares drawn on square grid by counting and by formula. (d) work in groups to make different rectangles and squares using square tiles, study the relationship between the area/perimeter and length(s) of each side, and observe that shapes with same area can have different perimeters, and shapes with same perimeter can have different areas. (e) estimate the area of a figure drawn on square grid by counting whole and partial squares within the figure. (f) apply multiplication and division concepts to find one dimension of a rectangle given its area/perimeter and the other dimension. (g) use square tiles to build squares of different sizes, from 1 cm² to 100 cm², and commit to memory the areas of the squares. (h) make a composite figure using cutouts of rectangles and squares or draw the figure on square grid, and calculate its area and perimeter. (i) visualise how a L-shaped figure can be partitioned into rectangles and squares, or can be formed by removing a rectangle/square from a bigger rectangle/square, and calculate the area and perimeter from given lengths.

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2. Volume of Cube and Cuboid	**Students should have opportunities to:**
2.1 building solids with unit cubes 2.2 measuring volume in cubic units, cm³ and m³ excluding conversion between cm³ and m³ 2.3 drawing cubes and cuboids on isometric grid	(a) use unit cubes (or connecting cubes) to build different solids (3D figures) and express their volumes in cubic units. (b) compare the sizes of solids in terms of their volumes. (c) make connections between 1 cm² and 1 cm³, and between 1 m² and 1 m³ e.g. use newspaper and masking tape to make a square of area 1 m² and a cube of volume 1 m³. (d) work in groups to draw a cube or cuboid taking into consideration size and orientation.
SUB-STRAND: GEOMETRY	
1. Perpendicular and Parallel Lines	**Students should have opportunities to:**
1.1 perpendicular and parallel lines 1.2 draw perpendicular and parallel lines on square grid	(a) recognise the relationship between two straight lines on a plane that are perpendicular/parallel and give examples of perpendicular/parallel lines from 2D figures and the environment. (b) identify horizontal and vertical lines and explain how to determine if a line is horizontal/vertical e.g. a line is vertical when it is parallel to a plumb line. (c) recognise that two vertical lines are parallel, and that a horizontal line and a vertical line are perpendicular. (d) work in pairs to explore how to construct perpendicular and parallel lines using set squares and protractor, and to check whether two given straight lines are perpendicular or parallel (e) work in pairs to explore how different pairs of perpendicular and parallel lines can be drawn on square grid.
2. Angles	**Students should have opportunities to:**
2.1 using notation such as $\angle$ ABC and $\angle\, a$ to name angles 2.2 measuring angles in degrees 2.3 drawing an angle of a given size 2.4 angles on a straight line 2.5 angles at a point 2.6 vertically opposite angles 2.7 finding unknown angles	(a) estimate before measuring angles using a protractor. (b) draw angles using a protractor. (c) describe and illustrate the various angle properties. (d) look for examples of different types of angles in the environment. (e) use the angle properties to find unknown angles and explain how they obtain the answers.

Primary Mathematics

Content	Learning Experiences
3. Rectangle and Square	**Students should have opportunities to:**
3.1 properties of rectangle and square, excluding diagonal properties 3.2 drawing rectangle and square on square grid	(a) describe the properties of rectangles and squares in terms of perpendicular and parallel lines, e.g. two pairs of parallel sides, and discuss how rectangles and squares are related, e.g. a square is a special rectangle. (b) work in pairs to explore how to draw different squares and rectangles on square grid. (c) observe the different orientations of a rectangle (or a square) when it is rotated through 90° (quarter turn), 180° (half turn), 270° (three-quarter turn) and 360° (a complete turn), clockwise or anti-clockwise. (d) sketch and draw rectangles and squares according to given length(s) using ruler, protractor and set squares.

STATISTICS

SUB-STRAND: DATA REPRESENTATION AND INTERPRETATION	
1. Tables, Bar Graphs and Line Graphs	**Students should have opportunities to:**
1.1 reading and interpreting data from tables/graphs 1.2 completing a table from given data 1.3 solving 1-step problems using data from tables/graphs	(a) work in groups to discuss how to collect data e.g. through interview or survey, and how to represent the data in a table/bar graph. (b) relate the data represented in a table to the corresponding bar graph and explain why the data is presented in a graph instead of a table. (c) discuss examples of data presented in bar graphs found in newspapers and magazines, and how the data was collected and displayed in graphical form. (d) construct a bar graph/line graph using a spreadsheet, e.g. Excel, and make connections between bar and line graphs, and explain which type of graph should be used or both can be used. (e) discuss examples of inappropriate representations of data from newspapers e.g. whether certain representations are misleading.