To Serve with Quality

MATHEMATICS PRIMARY FIVE (Standard)

Overview of Mathematics Curriculum

The Mathematics framework shows the underlying principles of an effective mathematics programme. It sets the direction for the teaching, learning, and assessment of mathematics.

The development of mathematical problem-solving ability is dependent on five interrelated components, namely, Concepts, Skills, Processes, Attitudes and Metacognition.
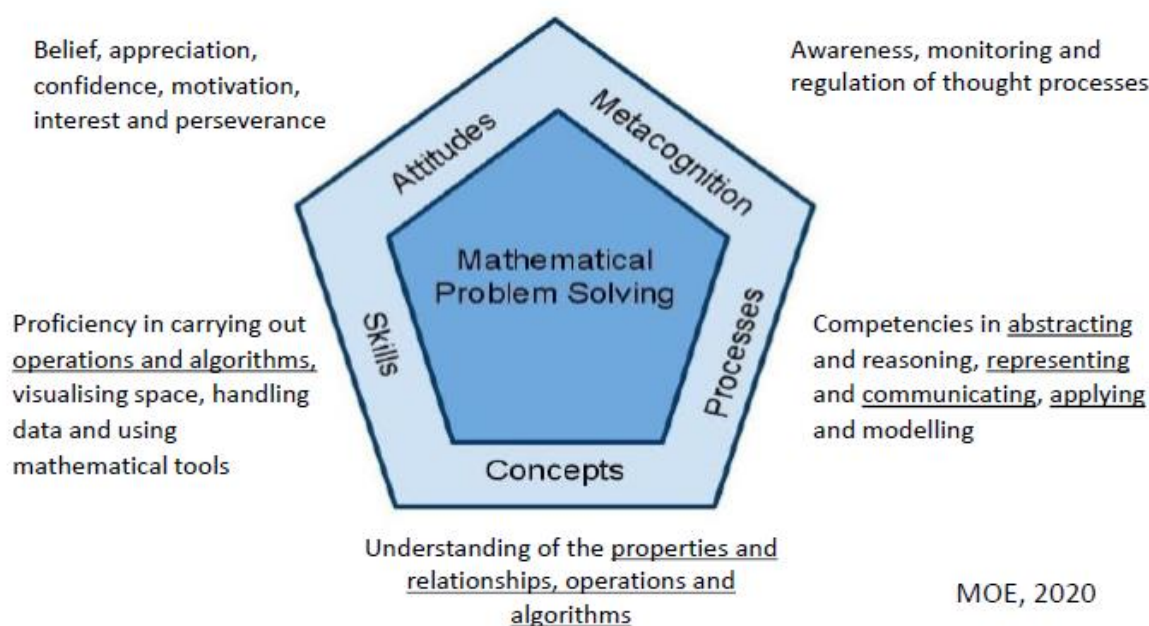
The understanding of mathematical concepts is essential for solving problems. In the primary mathematics curriculum, concept in numbers, algebra, measurement, geometry and statistics are explored.

Mathematical processes refer to the practices of mathematicians that are important to solve problems and build new knowledge. This includes abstracting, reasoning, representing and communicating. Justifying a result, deriving new results and generalising patterns involve reasoning. Expressing one's ideas, solutions and arguments involves representing and communicating.

Metacognition, or thinking about thinking, refers to the awareness of, and the ability to control one's thinking processes, in particular the selection and use of problem-solving strategies. It includes monitoring and awareness of one's affective responses towards a problem.

Mathematics Syllabus

The teaching of Mathematics in Singapore primary school uses the spiral curriculum. This means that many of the topics that have been taught in the lower primary, such as whole numbers, fractions and measurement will be introduced again in both middle and upper primary at a higher complexity. This progression allows the students to grasp Mathematical concepts that are appropriate to their age. It is therefore important for the students to be grounded in such foundation concepts.

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		

Primary 5 (**Standard Mathematics**) students will learn the following:

STRAND: NUMBER AND ALGEBRA	STRAND : MEASUREMENT AND GEOMETRY
SUB-STRAND 1: WHOLE NUMBERS	**SUB-STRAND 1: AREA AND VOLUME**
Numbers up to 10 million - reading and writing numbers in numerals and in words **Four Operations** - multiplying and dividing by 10, 100, 1000 and their multiples **without calculator** - order of operations - order of operations **without calculator** - use of brackets **without calculator**	**Area of triangle** - concepts of base and height of a triangle - area of triangle - finding areas of composite figures made up of rectangles, squares and triangles **Volume of cube and cuboid** - building solids with unit cubes - measuring volume in cubic units, cm^3 /m^3, excluding conversion between cm^3 and m^3 - drawing cubes and cuboids on isometric grid - volume of a cube/cuboid - finding the volume of liquid in a rectangular tank - relationship between ℓ (or ml) with cm^3

STRAND: NUMBER AND ALGEBRA	STRAND : MEASUREMENT AND GEOMETRY
SUB-STRAND 2: FRACTION	**SUB-STRAND 2: GEOMETRY**
Fraction and division - dividing a whole number by a whole number with quotient as a fraction - converting fractions to decimals **Four operations** - adding and subtracting mixed numbers - multiplying a proper/improper fraction and a whole number **without calculator** - multiplying a proper fraction and a proper/improper fraction **without calculator** - multiplying two improper fractions - multiplying a mixed number and a whole number - solving word problems involving addition, subtraction and multiplication	**Angles** - angles on a straight line - angles at a point - vertically opposite angles - finding unknown angles **Triangle** - properties of isosceles triangle, equilateral triangle and right-angled triangle - angle sum of a triangle - finding unknown angles without additional construction of lines **Parallelogram, rhombus and trapezium** - properties of parallelogram, rhombus and trapezium - finding unknown angles without additional construction of lines

STRAND: NUMBER AND ALGEBRA	STRAND : MEASUREMENT AND GEOMETRY
SUB-STRAND 3: DECIMAL	

Four Operations
- multiplying and dividing decimals (up to 3 decimal places) by 10, 100, 1000 and their multiples **without calculator**
- 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
- solving word problems involving the 4 operations	

SUB-STRAND 4: PERCENTAGE	
Percentage - expressing a part of a whole as a percentage - use of % - finding a percentage part of a whole - finding discount, GST and annual interest - solving word problems involving percentage	

STRAND: NUMBER AND ALGEBRA	STRAND : MEASUREMENT AND GEOMETRY
SUB-STRAND 5: RATE	
Rate - rate as the amount of a quantity per unit of another quantity - finding rate, total amount, or number of units given the other two quantities - solving word problems involving rate	

Content covered for the other levels can be found in https://www.moe.gov.sg/primary/curriculum/syllabus

Mathematical Processes

Mathematical processes refer to the process skills involved in the process of acquiring and applying mathematical knowledge. This includes:

- Reasoning, communication and connection
- Application
- Thinking skills and heuristics

The table below describe some of the indicators related to each

Mathematical Processes	Indicators
Reasoning, Communication and Connection	- Use appropriate notations and symbols to present and communicate mathematical ideas - Reason by: - Observing patterns, similarities and differences - Drawing logical conclusion and making inferences - Explaining or justifying solutions - Make connections within mathematics and between mathematics and everyday life
Application	- Apply mathematical concepts and skills to solve problems in a variety of contexts within or outside mathematics, including: - Identifying the appropriate mathematical representation for a problem - Using appropriate mathematical concepts and skills to solve a problem - Interpreting the mathematical solution in the context of the problem and making sense of the solution
Thinking skills and heuristics	- Use thinking skills such as: comparing, sequencing, and deduction - Use a problem-solving model - Use heuristics such as: - Drawing a diagram - Making a list - Guess and check - Working backwards

Mathematics Curriculum at SQPS

1. Teaching Approaches

Math lessons are delivered using the Concrete-Pictorial-Abstract (C-P-A) approach. To introduce a Mathematical concept, teachers will use manipulatives to provide hands-on experience. This age-appropriate approach will provide scaffolding for the primary students to help them grasp abstract mathematical concepts.

The concrete manipulatives will be followed by pictorial representations to help the students visualise the concepts. Finally, the students will move on to the abstract representation in the form of mathematical equations.

2. Topical Review and Topical Worksheet

To supplement workbook practices, the students are given topical worksheets and topical reviews. The topical reviews serve as summary of the concepts and skills learnt as stated in the syllabus. The reviews are done periodically at the end of the topics. The results will provide feedback to both teachers and parents on students' learning progress.

In addition, the topical worksheets provide supplementary practice to expose students to a variety of questions and prepare them for the formal assessment.

3. Heuristic Curriculum

One important aspect in Mathematical problem solving is the development of Mathematical processes and thinking skills. The heuristic curriculum will expose students to the different problem-solving strategies that they need to learn such as:

- drawing a diagram
- look for a pattern
- guess and check
- making a list
- before and after concept

Each heuristic worksheet will focus on one specific heuristic with scaffolding and sufficient practice in the form of parallel questions.

Mathematical Problem-Solving Approach

To equip students with better problem-solving skills, the school make a deliberate effort to teach Mathematical process skills through problem solving. The students are taught a systematic problem-solving model called STAR approach.

How do you do solve Mathematics problem sum?

- **S**tudy the problem carefully
- **T**hink of a strategy
- **A**ct on the solution
- **R**eflect on the final answer

STAR approach in Math Problem solving

	Study	What am I given? *(annotate objects and values, show connections)*
		What am I asked to find?
	Think	What strategy should I use?
		Can I use model or diagram/table?
	Act	I will apply the strategy.
		I write out my steps and equations.
	Reflect	Have I answered the question?
		Does my answer make sense (reasonable)?
		Have I checked for Number Transfer, Unit, Calculation?
		Can I solve it differently?

During Math lessons, teachers will 'think aloud' to give attention to these processes and make them visible to students. Through practice, students will develop habits and strategies to help them be better and more independent learners.

Example of problem-solving using STAR approach:

Study: annotation strategy

*Note: for clarity of annotation process, students are advised to use a pen or pencil instead of highlighter.
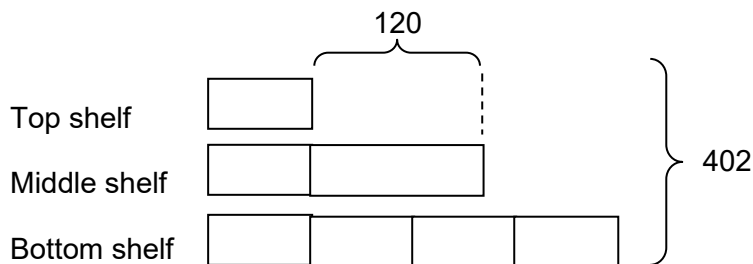
There were (402) books in a bookcase <u>altogether</u>. The books had three shelves.

The <u>middle shelf</u> had (120 more) books than the top shelf.

The <u>bottom shelf</u> had (4 times) as many books as the top shelf.

<u>How many books</u> were there on the <u>bottom shelf</u>?

Think: model drawing

Act: equation and working

402 – 120 = 282

6 units = 282
1 unit = 282 ÷ 6 = 47
4 units = 4 x 47 = 188

$$\begin{array}{r} 402 \\ - 120 \\ \hline 282 \end{array}$$

$$\begin{array}{r} 47 \\ 6\overline{)282} \\ \underline{24} \\ 42 \\ \underline{-42} \\ 0 \end{array}$$

$$\begin{array}{r} 47 \\ \times 4 \\ \hline 188 \end{array}$$

Reflect: check for number transfer, unit and calculation

There were <u>188</u> books on the bottom shelf.

4. **Remediation Class for Mathematics**

With reference to results obtained at continual or semestral assessment, students who did not perform well will be supported with remediation class where they will be coached in a small group setting. This will enable the teachers to do targeted teaching. Teachers teaching these classes will adjust the pace of the lesson according to the profile of the students.

During remediation class, there will be re-teaching of the concepts that they have learnt in class. Additional written work will also be provided to give enough opportunity for the students to practice and learn from their mistakes. In addition, students are expected to have additional revision time at home to ensure retention of important concepts that have been taught in class.

5. **High Progress Resources**

High progress students will be provided with additional written work to stretch their learning. The questions provided in the resources will give them opportunities to use mathematical thinking and mathematical communication. In addition, these exercises will train them to apply the Mathematical concept that they have learnt in unfamiliar context.

6. **Use of ICT**

As part of the effort to cultivate self-directed learning, the school make use of Koobits and SLS (Student Learning Space) learning portal to supplement the teaching and learning of Mathematics. Koobits platform allows the students to do daily challenge through bite-size Math quizzes and games. This will help improve the students' basic numeracy skills and strengthen their factual fluency. In addition, the SLS portal is used by the teachers to assign ICT lessons that will reinforce the concepts that have been taught in class.

7. **Math Activities Outside Classroom**

To increase students' interest in learning Mathematics, the school uses its broadcast system and notice boards to engage students with Math quizzes and puzzles. The puzzles and displays will create awareness of Mathematics application beyond the classroom learning.

Assessment

School-based Assessment

To ascertain students' progress in learning, students will sit for a formal assessment at the end of the year. Prior to the conduct of the examinations, the school will provide practice paper based on previous year's assessment. This will help the students build the rigour required to do well during the examination.

The following tables show the P5 end-of-year examination format for Standard Mathematics (SMA). This format is similar to the PSLE format.

Paper	Booklet	Item Type	Number of questions	Number of marks per question	Total marks	Duration
1 (No calculator)	A	Multiple-choice	10	1	10	1 h 10 min
			8	2	16	
	B	Short-Answer	12	2	24	
2 (Calculator)		Short-Answer	5	2	10	1 h 20 min
		Structured/ Long-Answer	10	3, 4 or 5	40	
Total			**45**	**-**	**100**	**2 h 30 min**

Notes:
1. Both papers will be scheduled on the same day with a break between the two papers.
2. Paper 1 comprises two booklets. The use of calculators is **not** allowed.
3. Paper 2 comprises one booklet. The use of calculators is allowed.

In addition, the teachers will conduct termly assessment periodically to evaluate student's understanding of the topics taught. This will help both the teachers and students to identify learning gaps and address any misconceptions.

	Term 1	Term 2	Term 3	Term 4
Mode of assessment	-	WA1	WA2	End-of-year examination
Weighting	-	15%	15%	70%

Assessment Objectives

The questions in Mathematics paper can be grouped into categories based on their cognitive demand. There are 3 levels of assessment objectives (AO):

- AO1: recall Mathematical facts, concepts, rules and formulae: perform straightforward computations and algebraic procedures.

    Example:
    Ben puts 60 stickers into Box A and Box B in the ratio of 3 : 1.
    How many stickers are there in Box A?

- AO2: interpret information; understand and apply mathematical concepts and skills in a variety of contexts.

    Example:
    A container can either contain 150 small boxes or 30 large boxes. Ahmad wants to have a mixture of the small boxes and large boxes. He packs in 12 large boxes. What is the most number of small boxes he can pack into the container?

- AO3: reason mathematically; analyse information and make inferences; select appropriate strategies to solve problems.

    Example:
    The total mass of 7 similar files and 3 similar envelopes is 106.5 g.
    Each file weighs 1.5 g heavier than each envelope. Find the mass of one file.

Expectation of Students

Students are expected to complete all the homework assigned by the subject teachers neatly. This will provide opportunities for students to revise and evaluate the learning that has taken place in school. This will also provide feedback to their teachers on the misconceptions that need to be addressed pertaining to the topic.

To do well in Mathematics, students are taught to present their Math solutions in a clear and systematic way. This will ensure that they will be awarded the full mark allocated for each question. This standardisation is made according to the standards used by MOE during PSLE marking.

In general, students are expected to:

- commit certain knowledge to memory to allow for more speed. For example, students must know the multiplication tables very well in order to cut down time while working out the solution.

- highlight mathematical key words and processes. There is a tendency to attempt questions without careful reading of the information given. When students missed out critical information, made assumptions or did not consider all the conditions of a problem, errors would be made.

- know the terminologies and have conceptual understanding. For example, students must know whether to measure the length of the radius or diameter in questions related to Geometry. Students must be able to identify the height or base in a triangle and for questions on Percentage, students must know how to identify the correct base in a given context. They must not assume a common base for two percentages given as they were based on different quantities.

- be proficient in unit conversion, e.g. kg-g conversion as well as h-min conversion.

- represent the problem using model to help in visualisation (when needed). There must also be correct use of Math equation / number sentence.

- present the Math Working/calculation logically and neatly (unless when calculator is allowed).

- finalise and conclude the solution to the problem with a word statement.

Additional example of Heuristics Questions

1. In a Mathematics test, 20 questions were given. 5 marks were awarded for each correct answer and 2 marks were deducted for each wrong answer. Kumar answered all the questions and his score was 79. How many wrong answers did he have?

Method 1: Systematic Listing

20 questions in all		+ 5 / correct	-2 / wrong	Check
No. of correct questions	No. of wrong questions	Awarded marks	Deducted marks	79 marks total
20	0	20 x 5 = 100	0	100 – 0 = 100 (×)
19	1	19 x 5 = 95	1 x 2 = 2	95 – 2 = 93 (×)
18	2	18 x 5 = 90	2 x 2 = 4	90 – 4 = 86 (×)
17	③	17 x 5 = 85	3 x 2 = 6	85 – 6 = 79 (√)

He had <u>3</u> wrong answers.

Method 2: Making a Supposition

Suppose all 20 questions are correct, then each answer will be awarded 5 marks.

20 x 5 = 100

His score was 79 marks only. So, 21 marks must be deducted.

100 – 79 = 21

For every correct answer that becomes a wrong answer, 7 marks must be deducted.

5 + 2 = 7

To remove 21 marks, we should find how many groups of 7 there are.

21 ÷ 7 = 3

He had <u>3</u> wrong answers.

2. Linda had a sum of money. She spent 30% of it on a book and 10% of it on a pen. Both the book and the pen cost $80 altogether. How much money had she left?

30% + 10% = 40%

40% ---- 80 ⟶

1% ---- 80 ÷ 40 = 2

60% ---- 2 x 60 = 120

He had $120 left.

Common mistake in writing the equation:
40% = 80
(40% is equal to 0.4, not 80)
It should be written as 40% ---- 80
or 40% → 80
(40% represents $80)

How Parents Can Support the Child's Learning at Home

Parents are important partners in ensuring a child's mathematical success. A warm, inviting numeracy rich learning environment at home is the first step to fostering a love of mathematics in children. The following are some strategies and opportunities to encourage and sustain math learning in the home:

✓ Parents as models of mathematical learning
  ◦ Engage your child in interesting mathematical activities helps stimulate a lifelong enjoyment of mathematics.
  ◦ Build your child's self-confidence and optimism and help them see math learning as valuable as well as fun.
  ◦ Set a positive mindset for the mathematics learning that takes place at school. Parents cannot replace the school experience but they are a significant influence on their children's developing attitudes towards, and enjoyment of, mathematics.

✓ Have a growth mindset
  ◦ Believe that every child can be successful in math. Encouragement and practice will help.
  ◦ Encourage persistence. (Some math problems take time to solve) It is alright if your child does not get it right at the first attempt or takes a longer time to figure out the math problem.
  ◦ Encourage your child to experiment with different approaches to mathematics. There is often more than one way to solve a math problem.

✓ Promote mathematical reasoning
  ◦ Encourage your child to talk about and show a math problem in a way that makes sense (i.e., draw a picture, explain using concrete objects, etc)
  ◦ When your child is solving math problems ask questions such as:
      - What operation do you use? Why?
      - Do you see any patterns?
      - Does the answer make sense? How do you know?

✓ Connect math to everyday life and help your child understand how math influences them (i.e. shapes of traffic signs, walking distance to school, telling time, weighing and reading mass of objects).

✓ Use of Games and Storybooks to practise Mathematical concepts

✓ Use of ICT resources effectively
  The following websites can be explored to introduce math concepts through fun computer games.
  o https://www.mathplayground.com/
  o https://www.coolmathgames.com/

<u>Resources</u>

The following resources are used to facilitate Math lesson in the classroom. The materials for the different levels will be specified in the book list provided by the school before the beginning of the school year.

- Math textbook and practice book
- Math exercise book
- Topical worksheet
- Practice papers
- Koobits