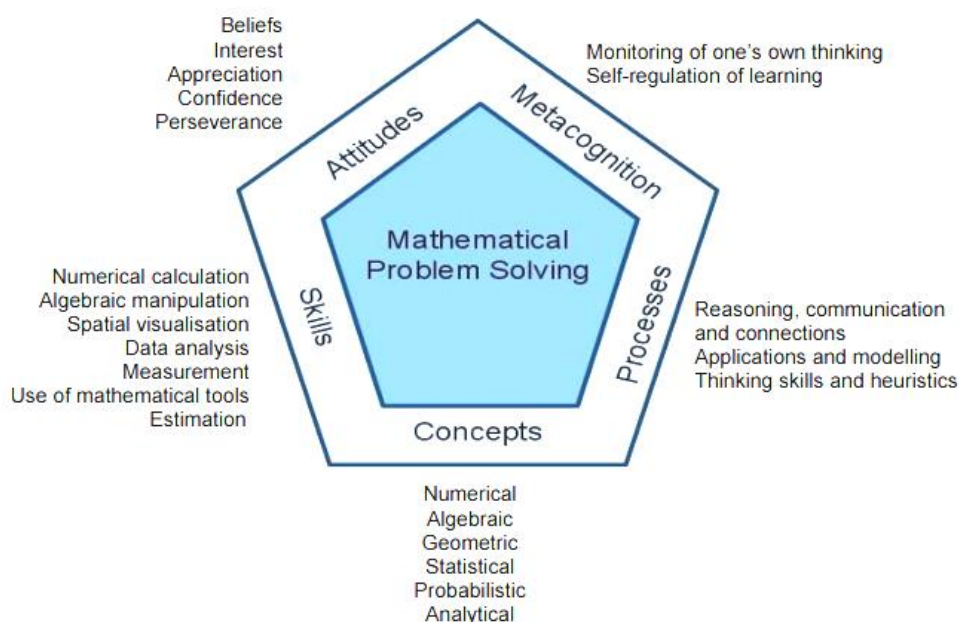*To Serve with Quality*

MATHEMATICS PRIMARY SIX (Standard)

Overview of Mathematics Curriculum

The Mathematics framework shows the underlying principles of an effective mathematics programme that is applicable to all levels, from the primary to A-levels. It sets the direction for the teaching, learning, and assessment of mathematics.

Mathematical problem solving is central to mathematics learning. It involves the acquisition and application of mathematics concepts and skills in a wide range of situations, including non-routine, open-ended and real-world problems.

The development of mathematical problem solving ability is dependent on five interrelated components, namely, *Concepts*, *Skills*, *Processes*, *Attitudes* and *Metacognition*.

Source: Ministry of Education, Singapore

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 6 (**Standard Mathematics**) students will learn the following:

STRAND: NUMBER AND ALGEBRA	STRAND : MEASUREMENT AND GEOMETRY	STRAND: STATISTICS
SUB-STRAND 1: FRACTIONS	**SUB-STRAND 1: AREA AND VOLUME**	**SUB-STRAND 1: DATA REPRESENTATION AND INTERPRETATION**

Four Operations
- dividing a proper fraction by a whole number **without calculator**
- dividing a whole number/proper fraction by a proper fraction **without calculator**
- solving word problems involving the 4 operations
	Area and Circumference of Circle
	- area and circumference of circle
	- finding the area and perimeter of
	  • semicircle
	  • quarter circle
	- finding the area and perimeter of figures made up of square, rectangle, triangle, semicircle and quarter circle
	
	Volume of cube and cuboid
	
	- finding one dimension of a cuboid given its volume and the other dimensions
	- finding the length of one edge of a cube given its volume
	- finding the height of a cuboid given its volume and base area
	- finding the area of a face of a cuboid given its volume and one dimension
	- use of $\sqrt{}$, $\sqrt[3]{}$
		Average of a set of data
		
		- average as 'total value number of data' $\square$
		- relationship between average, total value and number of data

STRAND: NUMBER AND ALGEBRA	STRAND : MEASUREMENT AND GEOMETRY	STRAND: STATISTICS
SUB-STRAND 2: PERCENTAGE	**SUB-STRAND 2: GEOMETRY**	

Percentage
- finding the whole given a part and the percentage
- finding percentage increase/decrease
- solving word problems involving percentage
	Special Quadrilaterals
	- finding unknown angles in geometrical figures involving:
	    • square
	    • rectangle
	    • triangle
	    • parallelogram
	    • rhombus
	    • trapezium	

SUB-STRAND 3: RATIO		
Ratio - equivalent ratios - dividing a quantity in a given ratio - expressing a ratio in its simplest form - finding the ratio of two or three given quantities - finding the missing term in a pair of equivalent ratios - relationship between fraction and ratio - solving word problems		

STRAND: NUMBER AND ALGEBRA	STRAND : MEASUREMENT AND GEOMETRY	STRAND: STATISTICS
SUB-STRAND 4: ALGEBRA		
Algebra - using a letter to represent an unknown number - simplifying simple linear expressions excluding brackets - evaluating simple linear expressions by substitution simple linear equations involving whole number coefficient only		

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:

- model drawing
- before and after concept
- simplifying the problem
- making a list
- looking for a pattern
- working backwards

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.
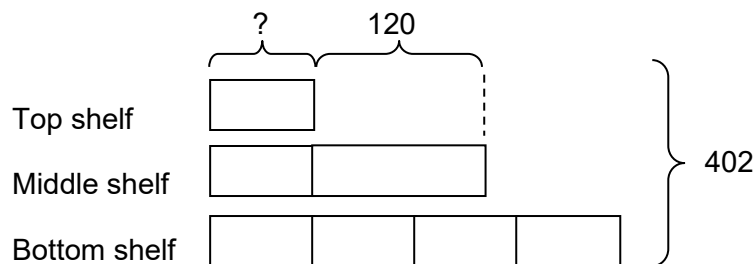
There were (402) books in a bookcase <u>altogether</u>. The books had three shelves.

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

```
        ?        120
      ┌──┐ ┌──────────┐
      ┌────┬──────────┐ ┊   ⎫
Top shelf │    │          │ ┊   ⎪
      └────┴──────────┘   ⎬ 402
      ┌────┬──────────┐   ⎪
Middle shelf │    │          │   ⎭
      └────┴──────────┘
      ┌────┬────┬────┬────┐
Bottom shelf │    │    │    │    │
      └────┴────┴────┴────┘
```

Act: equation and working

402 – 120 = 282

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

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

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

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

Reflect: check for number transfer, unit and calculation

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

4. **Remediation/Supplementary Class for Mathematics**

To prepare P6 students for the PSLE, they will be attending supplementary lesson. This will provide more time for the students to complete the syllabus and do more revision.

In addition, students who did not perform well might be called for remediation class where they will be coached in a small-group setting. This will enable the teachers to do a more targeted teaching. Additional written work will be provided to give enough opportunity for the students to practice and learn from their mistakes. Students are also 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 termly assessment. Prior to the conduct of the assessment, 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.

Primary Six students will sit for Continual Assessment 1 and Semestral Assessment 1 in Term 1 and Term 2 respectively. Preliminary Examinations will be conducted in Term 3.

PSLE

At the end of Primary 6, all students will sit for PSLE paper. P6 students will be tested using the new format in their SA at the end of every semester.

The following tables show the new PSLE format for <u>Standard Mathematics</u> (SMA):

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.

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 questions. 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.

- have conceptual understanding. For example, students must know how to:

  - measure the length of the radius or diameter in questions related to area and perimeter.
  - identify the height or base in a triangle.
  - identify the correct base (100%) for question on percentage.

- be proficient in unit conversion, e.g.

  - 1 kg = 1000 g
  - 1 m = 100 cm
  - 1 h = 60 min

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

- 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 3 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 3 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/

Resources

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.

- MPAH (My Pals are Here) textbook and workbook
- Math exercise book
- Topical worksheet
- Practice papers
- Koobits