CAUTION: SERIOUS LEARNING AHEAD

PUNGGOL GREEN PRIMARY
PARENT LEARNING FEST 2019

PROBLEM SOLVING @
UPPER PRIMARY LEVELS
STD MATHEMATICS WORKSHOP
Objectives of workshop:

✓ To introduce parents to types of questions students are required to solve at the Upper Primary levels, in alignment to Assessment Objectives levels

✓ To highlight to parents some common mistakes made by students, the possible reasons for the mistakes and tips on correcting and eliminating them
Format of Standard Mathematics paper:

<table>
<thead>
<tr>
<th>Paper</th>
<th>Booklet</th>
<th>Item Type</th>
<th>Number of questions</th>
<th>Number of marks per question</th>
<th>Total marks</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>A</td>
<td>Multiple-choice</td>
<td>10</td>
<td>1</td>
<td>10</td>
<td>1 h</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>5</td>
<td>2</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>B</td>
<td>Short-answer</td>
<td>5</td>
<td>1</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>10</td>
<td>2</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>Short-answer</td>
<td>5</td>
<td>2</td>
<td>10</td>
<td>1 h 30 min</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Structured/Long-answer</td>
<td>12</td>
<td>3, 4 or 5</td>
<td>45</td>
<td>1 h 30 min</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td></td>
<td>47</td>
<td>-</td>
<td>100</td>
<td>2 h 30 min</td>
</tr>
</tbody>
</table>

Use of calculators are allowed only for Paper 2.
## Item Types:

<table>
<thead>
<tr>
<th>Item Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multiple-choice question</td>
<td>Four options provided, of which only one is the correct answer.</td>
</tr>
<tr>
<td>Short-answer question</td>
<td>May comprise one or two parts i.e. (a), (b)</td>
</tr>
<tr>
<td></td>
<td>Answers are to be written in answer space. Any unit required in an answer is provided, candidate has to give answer in given unit.</td>
</tr>
</tbody>
</table>
**Item Types:**

<table>
<thead>
<tr>
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<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Long-answer question</td>
<td>Typically multi-step problems where candidates has to show method of solution <em>(working steps)</em> clearly and write answer(s) in space(s) provided.</td>
</tr>
<tr>
<td></td>
<td>Marks are awarded for key steps of solutions.</td>
</tr>
<tr>
<td></td>
<td>Units are to be written whenever necessary).</td>
</tr>
</tbody>
</table>
**Assessment Objectives (AOs) (Standard):**


<table>
<thead>
<tr>
<th>AO</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>AO1</td>
<td>pupils should be able to: recall mathematical facts, concepts, rules and formulae; perform straightforward computations and algebraic procedures.</td>
</tr>
<tr>
<td></td>
<td><em>This AO includes basic numerical and geometrical properties, basic skills of measuring, units of measurement, comparing and ordering numbers and quantities, and retrieving information in statistical and geometrical forms.</em></td>
</tr>
<tr>
<td>AO2</td>
<td>interpret information; understand and apply mathematical concepts and skills in a variety of contexts.</td>
</tr>
<tr>
<td></td>
<td><em>This AO includes data interpretation and spatial visualisation.</em></td>
</tr>
<tr>
<td>AO3</td>
<td>reason mathematically; analyse information and make inferences; select appropriate strategies to solve problems.</td>
</tr>
<tr>
<td></td>
<td><em>This AO includes reasoning inductively and deductively, analysis of relationships among quantities and geometric figures and making inferences from mathematical data or results.</em></td>
</tr>
</tbody>
</table>
AO1: Recall mathematical facts, concepts, rules and formulae; perform straightforward computations
Typically 1 or 2-marks Multiple Choice or Short Answer Questions

Suggested question exemplars:

- Write 89 210 in words.
- Find the product of $\frac{4}{5}$ and $\frac{5}{6}$.
- Express $30 + h - 1 + 6h$ in the simplest form.
AO2: Interpret information; understand and apply mathematical concepts and skills in a variety of contexts
Includes data interpretation and spatial visualization

Suggested question exemplar:
- Mrs Lee paid $124 for a dress after a 20% discount. What was the price of the dress before the discount?

Interpret

Understand
$124 is only 80% of the price of the dress
Actual price of the dress is 100%

Apply math concept
80% → $124
20% → 124 ÷ 4 = $31
100% → $31 × 5 = $155
AO2: Interpret information; understand and apply mathematical concepts and skills in a variety of contexts
Includes data interpretation and spatial visualization

Suggested question exemplar:
➢ In the figure below, ABCD is a square. CD = CE and ∠DCE = 52°. Find ∠ADE.

Interpret

CDE is an isosceles triangle

Understand

Properties of square
Properties of isosceles triangle

Apply math concept

∠CDE = (180° – 52°) ÷ 2
= 64°
∠ADE = 90° – 64°
= 26°
AO3: Reason mathematically; analyze information and make inferences; select appropriate strategies to solve problems

Suggested question exemplar:

Mrs Goh baked some cookies. \( \frac{2}{3} \) of the cookies she baked were chocolate chips cookies and the rest were peanut butter cookies. She gave away \( \frac{3}{4} \) of the chocolate chips cookies and \( \frac{1}{2} \) of the peanut butter cookies. She had 140 cookies left. How many cookies did she bake in total?
AO3: Reason mathematically; analyze information and make inferences; select appropriate strategies to solve problems

Suggested question exemplar:
The average score of a class for a Math test is 86%. There is an equal number of boys and girls in the class. The average score of the girls is 91%. Each statement below is either true, false or not possible to tell from the information given. For each statement, put a tick (✓) in the correct column.

<table>
<thead>
<tr>
<th>Statement</th>
<th>True</th>
<th>False</th>
<th>Not possible to tell</th>
</tr>
</thead>
<tbody>
<tr>
<td>All the girls scored more than all the boys.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The average score of the boys is less than 86%.</td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>
Can you figure out what is wrong?
Types of mistakes/errors commonly encountered in Mathematics assignments:

<table>
<thead>
<tr>
<th>Type of Mistake</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Careless Mistakes</td>
<td>Usually arises due to poor work habits, lack of focus, poor organizational skills</td>
</tr>
<tr>
<td>Computation and Precision Errors</td>
<td>Usually arises due to lack of fluency in basic computational skills</td>
</tr>
<tr>
<td>Conceptual Understanding Errors</td>
<td>Due to lack of understanding of Mathematical concepts and a weak foundation in conceptual understanding</td>
</tr>
</tbody>
</table>
Examples of careless mistakes:

- Writing/Copying the wrong number/operation

Qn: A worker is paid $72 on a weekday and $85 on a Saturday. How much does the worker earn if she works from Monday to Saturday?

Ans: \((\$75 \times 5) + \$85 = \$460\)
Examples of careless mistakes:

- Not following instructions

Qn: Express $\frac{1}{3}$ as a decimal correct to 2 decimal places.

Ans: 0.3
Examples of careless mistakes:

• Missing/Incorrect units

Qn: The length of a rectangle is $w$ cm and its breadth is 6 cm. Find the area of the rectangle in terms of $w$.

Ans: 6 $w$ cm
Examples of careless mistakes:

• Missing steps in order to get the final answer.

Qn: Gary and Samy drank \(\frac{7}{12}\) l of orange juice.

Gary drank \(\frac{1}{6}\) l of the juice.

How much more juice did Samy drink than Gary?

Ans: \(\frac{7}{12} - \frac{1}{6} = \frac{7}{12} - \frac{2}{12}\)

\[\begin{align*}
\frac{5}{12} \quad \text{STOP here (Juice drank by Samy)}
\end{align*}\]

\[\frac{5}{12} - \frac{2}{12} = \frac{3}{12} = \frac{1}{4}\]
Tips to fix careless mistakes:

Get child to practise good work habits:

✓ Read and re-read the question
✓ Organize answer space neatly
✓ Write neatly and legibly
✓ Underline/highlight/circle key information
✓ Annotate to demonstrate understanding of key information in context
✓ Write down all the steps
✓ Make notes for every step of the solution
Tips to fix careless mistakes:
Get child to practise good work habits:

Qn: Doris is 3 years older than Chitra. Nurul is 3 years younger than Chitra. The sum of their ages is 48 years. How old is Nurul?

Notes:
Doris → oldest
Nurul → youngest
Total → 48

Solution:

\[
\begin{align*}
N & \quad ? \\
C & \quad 3 \\
D & \quad 3 \quad 3 \\
\end{align*}
\]

3 units → 48 – 3 – 3 – 3 = 39
1 unit → 39 ÷ 3 = 13

Answer: 13 years
Tips to fix careless mistakes:

Get child to practise checking work upon completion:

✓ Check reasonableness of answers
✓ Estimate to check answers
✓ Work backwards to check answers
Tips to fix careless mistakes:
Get child to practise checking work upon completion:

Qn: \(\frac{5}{8}\) of the students in a hall were boys. \(\frac{7}{10}\) of the boys wore glasses. 48 boys did not wear glasses. How many students were there in the hall?

**Solution:**
No. of students in the hall = \(\frac{7}{10} \times 48\)

\[= 33.6\]

Answer: **33.6**

Reasonable to have 33.6 students??
Should the number of students be more or fewer than 48? Why?
Examples of computation and precision errors:

Appropriate/inappropriate use of equal signs:
- E.g. Find the value of \(25 - 9 \times 2 + 3\).

\[
\begin{align*}
25 - 9 \times 2 + 3 &= 25 - 18 + 3 \\
&= 7 + 3 \\
&= 10
\end{align*}
\]

\[
\begin{align*}
25 - 9 \times 2 + 3 &= 25 - 18 \\
&= 7 + 3 \\
&= 10
\end{align*}
\]
Examples of computation and precision errors:

Appropriate/inappropriate use of equal signs:

Siti had $100. After buying 12 chicken pies and a cake, she had $43.30 left. The cake cost $39.90. Find the cost of each chicken pie.

Solution:

$100 - $43.30 = $56.70 - $39.90 = $16.80 ÷ 12 = $1.40

Solution:

Cost of 12 chicken pies = $100 - $43.30 - $39.90
= $16.80
Cost of each chicken pie = $16.80 ÷ 12
= $1.40

Answer: $1.40
Examples of computation and precision errors:

Appropriate/inappropriate use of equal signs:
E.g. Mrs Ong had 219.4 cm of ribbon.
  She cut it into 12 equal pieces and used 5 pieces to make a flower.
  Find the total length of ribbon used to make the flower.
  (Express your answer correct to 1 decimal place)

Suggested Solution:
219.4 ÷ 12 ≈ 18.28
18.28 × 5 = 91.4
Answer: 91.4 cm

Student A’s Solution:
219.4 ÷ 12 ≈ 18.3
18.3 × 5 = 91.5
Answer: 91.5 cm

Student B’s Solution:
219.4 ÷ 12 = 18.28
18.28 × 5 = 91.4
Answer: 91.4 cm
Examples of computation and precision errors:

Appropriate/inappropriate use of equal signs:

- E.g. There were 400 students in a hall. 60% of them were girls.

  How many girls were there?

  \[
  100\% \rightarrow 400 \text{ students} \\
  1\% \rightarrow 400 \div 100 = 4 \text{ students} \\
  60\% \rightarrow 4 \times 60 = 240 \text{ students}
  \]

  \[
  60\% \text{ of students} = 60\% \times 400 \\
  = 240
  \]

  \[
  60\% = 60\% \times 400 \\
  = 240
  \]

  \[
  60\% \text{ of students} = 60 \times 400 \\
  = 24000 \div 100 \\
  = 240
  \]
Tips to fix computation/precision mistakes:

Practise appropriate use of equal signs:
• Equal signs ‘=’ to be used whenever possibly appropriate.
• General guideline: Present solutions according to formats shown in Coursebooks/Activity Books
**Tips to fix computation/precision mistakes:**

Ensure mastery of basic factual fluency. Commit to memory:

- Multiplication Tables (2 to 10)
- Simple addition and subtraction facts
- Mathematical rules e.g. order of operations, properties of geometrical figures
- Mathematical facts: conversion of units
- Etc.. Etc…

Have good grasp of mental calculation strategies
Conceptual understanding errors:

Such errors typically arise due to students purely attempting to 'memorise' solutions, procedures or formulae without fully understanding the underlying concepts in the problems.

Without a strong conceptual understanding during their foundation years, students tend to make such errors, getting through the problems by merely 'plugging in numbers' to equations.
Tips to fix conceptual understanding errors:

• Have **frequent dialogue** with child to find out what he/she is thinking.
• **Ask questions** to guide child in understanding the problem.
• Present the problem in a different way, using pictures, using smaller numbers etc.
Some common conceptual understanding errors (Whole Numbers):

Concept of comparison:
E.g. Rope A is 25 m long. Rope A is 8 m longer than Rope B. What is the length of Rope B?

Solution:
Length of Rope B = 25 m + 8 m
= 33 m
Answer: 33 m

Which rope is longer?
Which rope is shorter?
How can you prove it?
Is your solution reasonable?
How can you check?
Some common conceptual understanding errors (Fractions):

Concept of fractions representing actual quantities and fractions representing parts of a whole:
E.g. A baker mixed $3\frac{1}{2}$ kg of flour with $1\frac{1}{4}$ kg of sugar to make a waffle mixture. She used $\frac{2}{5}$ of the mixture in the morning.

How much mixture did she have left?

Solution:
Amount of mixture left = $3\frac{1}{2} + 1\frac{1}{4} - \frac{2}{5}$

= $4 \frac{7}{20}$

Answer: $4 \frac{7}{20}$ kg

✓ What is the whole?
✓ What do you understand by $\frac{2}{5}$ of the mixture?
✓ Is it the same as $\frac{2}{5}$ kg?
Some common conceptual understanding errors (Fractions):

Concept of what the whole represents:

• Sally had some money.
  She spent \( \frac{1}{2} \) of her money and gave \( \frac{3}{10} \) of her money to her parents.
  She spent $480. How much money did she have left?

• Raj saved $480. He spent \( \frac{1}{2} \) of his savings and gave \( \frac{3}{10} \) of the remainder to his parents. How much money did he have left?

• Juliana had some money. She gave \( \frac{3}{10} \) of it to her parents and spent another $480. She then had \( \frac{1}{2} \) of her money left.
  How much did she have at first?

✓ What is the whole?
✓ Show the given information in a model.
Some common conceptual understanding errors (Decimals):

Place value concept:
E.g. Which is larger 3.401 or 3.41?

Solution:
3.401 because the decimal is longer. Moreover, 401 is larger than 41.

✓ How do you read the given decimals?
✓ Put them in a place value chart.
✓ What does each of the digits represent?
Some common conceptual understanding errors:

Different representations of relationships between two or more quantities:
E.g. Alice and Brenice shared some stickers in the ratio $3 : 1$.
   - Alice had $\frac{2}{3}$ as many stickers as Candice.
   - Candice had 21 more stickers than Brenice.

a) What is the ratio of the number of stickers Alice had to the number of stickers Brenice had to the number of stickers Candice had?
b) How many stickers did they have altogether?

✓ Draw a model to show each girl’s share of stickers.
✓ Who had the most stickers? Who had the least stickers?
**LET'S MAKE SENSE OF PROBLEMS**

As you start working through the task, here are some questions to guide you along...

- What does this problem tell you? What is it asking for?
- Is there another way to explain what you know, through words or drawings?
- Which words in the problem are most important? Why?
- Is there something in the problem that can be eliminated or is missing?
- What is another related problem?
- How can you convince others that your answer makes sense?
- Would another method work better?

(Adapted from Ready Mathematics Discourse Cards by Curriculum Associates)

**REASON, EXPLAIN AND CRITIQUE**

It is important to know why we are doing what we are doing. Here are some questions to guide us through...

- What was your estimate for the answer?
- Is this solution reasonable?
- Other than redoing the problem in the same way, how can you check if your answers are appropriate?
- What worked well/did not work well?
- How can you revise your strategy to make it better?

Being able to explain well often makes us a better thinker and learner.

(Adapted from Ready Mathematics Discourse Cards by Curriculum Associates)
LET’S REFLECT AND CONNECT

Some questions to help you get started with the tasks...

- What are some of the mathematical ideas in this question?
- Which mathematics topics does this question make you think of?
- How is this problem like one we solved before? How is it different?
- Do you see any patterns?
- Is there a general rule you could use?

Questions spark off the AHA moments!

Sometimes all it takes is a good question to start us in the right direction!

(Adapted from Ready Mathematics Discourse Cards by Curriculum Associates)

LET’S REFLECT AND CONNECT

Now that you have conquered the task, it is time to take a step back to reflect...

- What ideas/methods did you use to solve the problem?
- How would your method work with other problems?
- How is your method similar/different from your partner’s?
- What are the advantages/disadvantages of your method?
- Is there a real-life situation where this method could be used?
- What are some things you learnt?
- What other questions do you have?

(Adapted from Ready Mathematics Discourse Cards by Curriculum Associates)
THANK YOU!