APSMO
2025 OLYMPIADS

Important

The information contained in this file is ONLY for the use of registered participants of the 2025 Australasian Problem Solving Mathematical Olympiads.

APSMO
2025 OLYMPIADS

Organisation and Procedures

For full details, see the Members' Area

To ensure the integrity of the competition, the Olympiads must be administered under examination conditions.

DO	DO NOT
• Supervise students at all times • Seat students apart • Maintain silence • Provide blank working paper • Give time warnings when 3 minutes remain, and again when 1 minute remains • Collect, mark and retain the papers	• Print the Olympiad papers prior to the Olympiad Date • Read the questions aloud to the students • Interpret the questions for students • Permit any discussion or movement around the room • Permit the use of calculators or other electronic devices

- Olympiad papers are scored by the PICO using the *Solutions and Answers* sheet provided.
- Results should be submitted in the Members' Area within 7 days of the Olympiad.
- Original student answer sheets should be retained by the PICO until the end of the year.
- *Solutions and Answers sheets* are not to be handed out to students. They are a teaching resource for use in class ***after*** completion of the Olympiad paper.

Timing of the Olympiad

- The *Total Time Allowed* for the Olympiad is **30 minutes**.

Absent Student Policy

A student who is legitimately absent on the Olympiad date, may sit the Olympiad under examination conditions on their first day back at school (if that date is within 2 weeks of the original Olympiad date). If these conditions cannot be met, the student must be marked as absent on the submitted results.

The Absent Student Policy is available in the **Contest Administration** section of the Members' Area.

APSMO

MATHS OLYMPIAD

2025: DIVISION J
WEDNESDAY 7 MAY 2025

OLYMPIAD 1

Total Time Allowed: ***30 Minutes***
Calculators NOT Permitted

Write your answers in the boxes on the back.

Keep your answers hidden by folding backwards on this line.

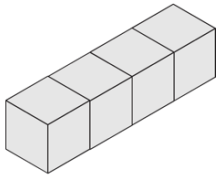
1A. What number could you use to replace A to make the following number sentence true?

$720 \div A = 2 \times 2 \times 3 \times 3 \times 5$

1B. This solid block is made by connecting four 1×1×1 cubes.

The solid block is painted grey, and then separated back into its four cubes.

What percentage of the total surface area of the four separate cubes is now grey?



1C. In a cryptarithm, each letter represents a different digit.

What is the least possible value of the cryptarithm ABC + DEF + GHI?

Note: zero cannot be the leading digit of a number in a cryptarithm.

$$\begin{array}{r} A\ B\ C \\ D\ E\ F \\ +\ G\ H\ I \\ \hline ? \end{array}$$

1D. 15 chairs are in a row on a school stage, numbered one through 15.

Four children, standing next to the chair numbered one, take turns to walk across the stage.

Aparajit goes first and removes every fourth chair.

Barbara crosses the stage next and removes every fourth chair from the remaining chairs.

Next is Topher. He also removes every fourth chair from the remaining chairs.

Finally, Xavier walks across the stage removing every fourth chair from the remaining chairs.

What is the sum of the numbers on the remaining chairs?

1E. Jack delivers newspapers from a basket on his bike.

Jack's bike, with 8 newspapers in the basket, weighs 10 kilograms.

Jack's bike, with 32 newspapers in the basket, weighs 13 kilograms.

What is the weight of Jack's bike in kilograms?

APSMO

2025: DIVISION J
WEDNESDAY 7 MAY 2025

OLYMPIAD
1

Student Name:

1A.

1B.

1C.

1D.

1E.

Fold Here. Keep your answers hidden.

APSMO

2025: DIVISION J
WEDNESDAY 7 MAY 2025

OLYMPIAD 1

Solutions and Answers

For teacher use only. Not for Distribution.

1A: 4	**1B:** 75%	**1C:** 711	**1D:** 40	**1E:** 9(kg)

1A. The question is:

What number could you use to replace A to make the following number sentence true?

$720 \div A = 2 \times 2 \times 3 \times 3 \times 5$

METHOD 1 *Strategy*: *Convert to a more convenient form.*

$$\begin{aligned} 720 \div A &= 2 \times 2 \times 3 \times 3 \times 5 \\ &= 4 \times 9 \times 5 \\ &= 36 \times 5 \\ &= 180 \end{aligned}$$

$720 \div A = 180$

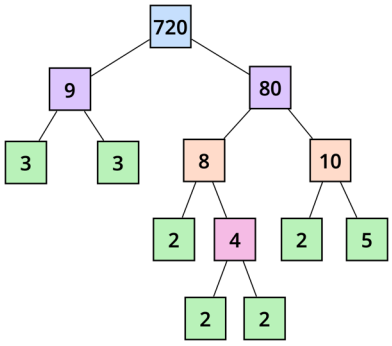
We can use inverse operations to show that $720 \div 180 = A$

Therefore:

$$\begin{aligned} A &= 720 \div 180 \\ &= (90 \times 8) \div (90 \times 2) \\ &= 8 \div 2 \\ &= \mathbf{4} \end{aligned}$$

METHOD 2 *Strategy*: *Draw a factor tree.*

We can draw a factor tree of 720, dividing until all factors are prime numbers.

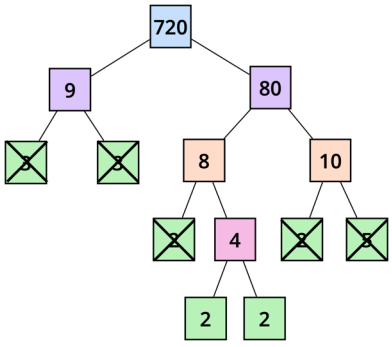


To find A, we can identify and eliminate the factors included in the number sentence
$720 \div A = 2 \times 2 \times 3 \times 3 \times 5$

The remaining prime factors are 2, 2.

Therefore,

$$\begin{aligned} A &= 2 \times 2 \\ &= \mathbf{4} \end{aligned}$$

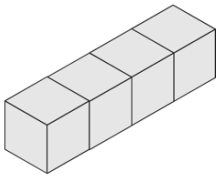


1B. The question is:

This solid block is made by connecting four 1×1×1 cubes.

The solid block is painted grey, and then separated back into its four cubes.

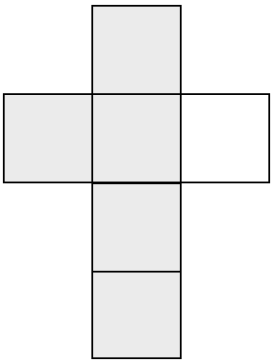
What percentage of the total surface area of the four separate cubes is now grey?



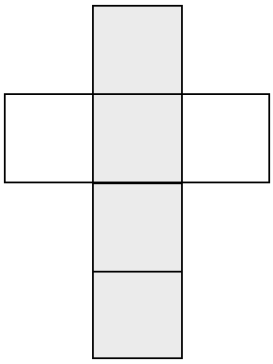
METHOD 1 *Strategy*: *Draw a diagram.*

Separate the 4 cubes, and open them into nets.

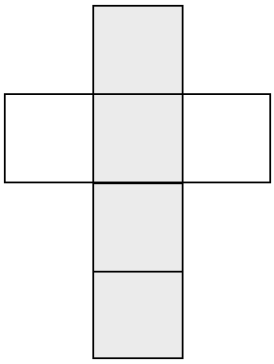
In total there are 4 cubes with 6 faces each = 24 faces.



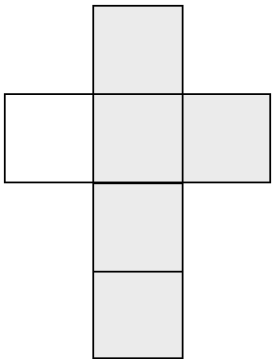
5 faces are painted on the first cube.



4 faces are painted on the second cube.



4 faces are painted on the third cube.



5 faces are painted on the fourth cube.

A total of 18 out of 24 faces are painted grey.

Therefore, **75%** of the total surface area of the separated cubes is now grey.

METHOD 2 *Strategy*: *Build a table to record the number of unpainted faces.*

There are 4 cubes in the block. We can build a table to record the number of unpainted faces.

	Cube 1	Cube 2	Cube 3	Cube 4	**Total**
Number of unpainted faces:	1	2	2	1	6
Total number of faces:	6	6	6	6	24

1 + 2 + 2 + 1 = 6 of the 24 separated cubes' faces are not painted grey.

Therefore, **75%** of the total surface area of the separated cubes is now grey.

APSMO

2025: DIVISION J
WEDNESDAY 7 MAY 2025

OLYMPIAD 1

1C. The question is:

What is the least possible value of the cryptarithm ABC + DEF + GHI?

Note: zero cannot be the leading digit of a number in a cryptarithm.

$$\begin{array}{r} A\ B\ C \\ D\ E\ F \\ +\ G\ H\ I \\ \hline ? \end{array}$$

METHOD *Strategy 1*: *Assign the digits of the least value to the hundred and tens columns.*

The leading digit in a 3 digit number cannot be zero, the lowest value digits we can assign to **A**, **D** and **G** are **1**, **2** and **3**.

$$\begin{array}{r} \mathbf{1}\ B\ C \\ \mathbf{2}\ E\ F \\ +\ \mathbf{3}\ H\ I \\ \hline ? \end{array}$$

The digit zero can be placed in the tens column. Therefore, the lowest value digits we can assign to **D**, **E** and **F** are **0**, **4** and **5**.

$$\begin{array}{r} 1\ \mathbf{0}\ C \\ 2\ \mathbf{4}\ F \\ +\ 3\ \mathbf{5}\ I \\ \hline ? \end{array}$$

The lowest value digits remaining that can be placed in the units column are **6**, **7** and **8**.

$$\begin{array}{r} 1\ 0\ \mathbf{6} \\ 2\ 4\ \mathbf{7} \\ +\ 3\ 5\ \mathbf{8} \\ \hline ? \end{array}$$

Add the 3 numbers together to find the least possible value:

ABC + DEF + GHI

= 106 + 247 + 258

= **711**

$$\begin{array}{r} {\scriptstyle 1\ 2\ \ } \\ 1\ 0\ 6 \\ 2\ 4\ 7 \\ +\ 3\ 5\ 8 \\ \hline \mathbf{7\ 1\ 1} \end{array}$$

METHOD *Strategy 2:* *Start with assigning the lowest value digit.*

Zero cannot be assigned to the hundreds column as a cryptarithm cannot have zero as a leading digit. The column with the highest value zero can be assigned to is the tens column. **Zero** can be assigned to **B**.

$$\begin{array}{r} A\ \mathbf{0}\ C \\ D\ E\ F \\ +\ G\ H\ I \\ \hline \end{array}$$

The next three lowest value digits can be assigned to **A**, **D** and **G**.

$$\begin{array}{r} \mathbf{1}\ 0\ C \\ \mathbf{2}\ E\ F \\ +\ \mathbf{3}\ H\ I \\ \hline \end{array}$$

E and **H** in the tens column have not been assigned a digit. The lowest remaining digits that can be assigned are **4** and **5**.

$$\begin{array}{r} 1\ 0\ C \\ 2\ \mathbf{4}\ F \\ +\ 3\ \mathbf{5}\ I \\ \hline \end{array}$$

Finally, **C**, **F** and **I** are assigned the next three lowest value digits.

$$\begin{array}{r} 1\ 0\ \mathbf{6} \\ 2\ 4\ \mathbf{7} \\ +\ 3\ 5\ \mathbf{8} \\ \hline \end{array}$$

ABC + DEF + GHI

= 106 + 247 + 258

= **711**

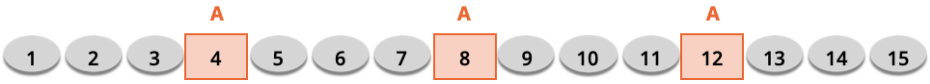
$$\begin{array}{r} {\scriptstyle 1\ 2\ \ } \\ 1\ 0\ 6 \\ 2\ 4\ 7 \\ +\ 3\ 5\ 8 \\ \hline \mathbf{7\ 1\ 1} \end{array}$$

1D. The question is:
What is the sum of the numbers on the remaining chairs?

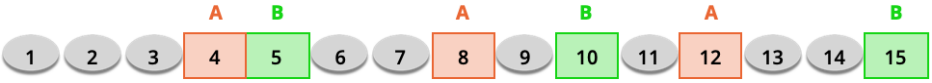
METHOD 1 ***Strategy:*** *Draw a diagram.*

Draw a diagram of the 15 chairs.

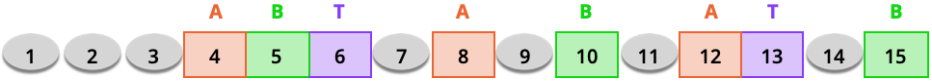
First, eliminate the chairs removed by Aparajit:



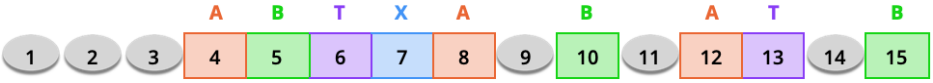
Next, eliminate the chairs removed by Barbara:



Then eliminate the chairs removed by Topher:



Finally, eliminate the chairs removed by Xavier:



The remaining chairs are 1, 2, 3, 9, 11 and 14.

The the sum of the numbers on the remaining chairs is:

1 + 2 + 3 + 9 + 11 + 14 = **40**

METHOD ***Strategy 2***: *Build a table.*

Build a table to record which chairs move into the 4th, 8th and 12th position across the stage as chairs are removed.

Aparajit goes first and removes chair 4, 8 and 12, resulting in new chairs in the 4th, 8th and 12th position.

Then, Barbara removes chair 5, 10 and 15, once again resulting in new chairs in the 4th, 8th and 12th position.

Next, Topher removes chair 6 and 13.

Xavier only removes chair 7, as there is no chair left to fill the 8th position.

	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th	12th	13th	14th	15th
Aparajit	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Barbara	1	2	3	5	6	7	9	10	11	13	14	15			
Topher	1	2	3	6	7	9	11	13	14						
Xavier	1	2	3	7	9	11	14								

The remaining chairs are 1, 2, 3, 9, 11 and 14.
The sum of the numbers on the remaining chairs is:

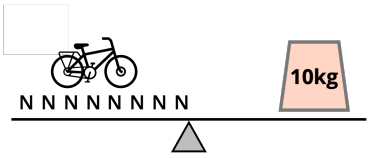
1 + 2 + 3 + 9 + 11 + 14 = **40**

1E. The question is:

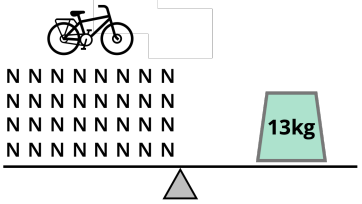
Jack delivers newspapers from a basket on his bike. Jack's bike, with 8 newspapers in the basket, weighs 10 kilograms. Jack's bike, with 32 newspapers in the basket, weighs 13 kilograms. What is the weight of Jack's bike in kilograms?

METHOD *Strategy 1:* *Draw a diagram and use logic.*

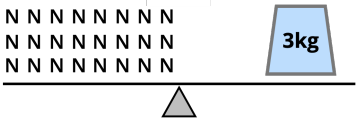
We know that Jack's bike and 8 newspapers weighs 10kg.



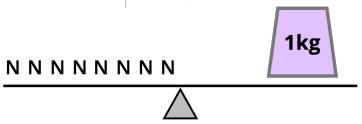
We also know his bike with 32 newspapers weighs 13kg.



The weight of the bike and newspapers increased by 3kg when an extra 24 newspapers were added.



If 24 newspapers weigh 3kg, 8 newspapers weigh 1kg.



Jack's bike with 8 newspapers weighed 10kg.

We can subtract the 8 newspapers, weighing 1kg, to find that Jack's bike weighs **9kg**.

METHOD 2 *Strategy:* *Reason algebraically.*

If B is the weight of the bike in kg and N is the weight of a newspaper, in kg.

$B + 8N = 10$ (1)

$B + 32N = 13$ (2)

The extra weight of 24 newspapers must weigh 3kg.

So, $24N = 3$

$8N = 1$

Therefore, replacing $8N$ in (1)

$B + 1 = 10$

$B = 9$

The bike weighs **9kg**.