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

2025: DIVISION J
WEDNESDAY 11 JUNE 2025

MATHS OLYMPIAD

OLYMPIAD 2

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

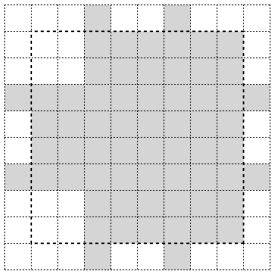
Write your answers in the boxes on the back.

Keep your answers hidden by folding backwards on this line.

2A. Express 6 halves + 6 quarters + 6 eighths as a decimal number.

2B. An 8 × 8 square has a 2 × 2 square removed from two of the corners of the square, and then eight 1 × 1 squares are glued to the edges as shown.

The area of the new shape is 64 square units.
How many units is the perimeter of the new shape?



2C. Use the 3 given equations to find the value of △+△ .

□ + □ = △ + ○

△ + □ + ○ = 27

□ + ○ + ○ = 31

2D. How many three-digit odd whole numbers have a digit sum of 7?

2E. In the cryptarithm shown, different letters represent different digits.
No letter represents zero.
What is the greatest possible value of APSMO?

$$\begin{array}{r} MATH \\ +MATH \\ \hline APSMO \end{array}$$

APSMO

2025: DIVISION J
WEDNESDAY 11 JUNE 2025

MATHS OLYMPIAD

OLYMPIAD 2

Student Name:

2A.

2B.

2C.

2D.

2E.

Fold Here. Keep your answers hidden.

APSMO

2025: DIVISION J
WEDNESDAY 11 JUNE 2025

OLYMPIAD 2

Solutions and Answers

For teacher use only. Not for Distribution.

2A: 5.25	**2B:** 48 (units)	**2C:** 14	**2D:** 12	**2E:** 16,384

Click to launch the Paper 2 solutions video.

2A. The question is:

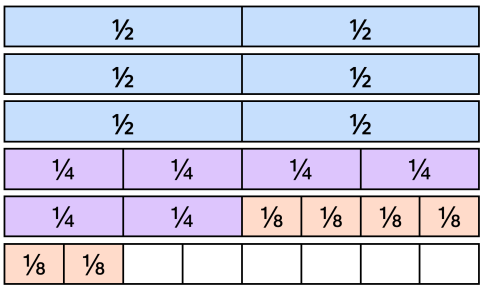
Express 6 halves + 6 quarters + 6 eighths as a decimal number.

Strategy: *Simplify the fraction.*

$6 \times \frac{1}{2} + 6 \times \frac{1}{4} + 6 \times \frac{1}{8}$
$= \frac{6}{2} + \frac{6}{4} + \frac{6}{8}$
$= 3 + \frac{6}{4} + \frac{6}{8}$
$= 3 + 1\frac{1}{2} + \frac{3}{4}$
$= 4\frac{1}{2} + \frac{3}{4}$
$= 5\frac{1}{4}$
As a decimal
= 5.25

Strategy: *Draw a diagram.*

We can draw a diagram to model the fractions.



$= 5\frac{1}{4}$
As a decimal
= 5.25

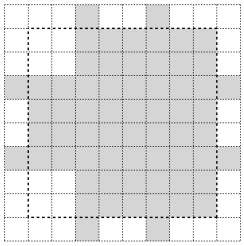
Strategy: *Convert to decimals.*

$6 \times \frac{1}{2} + 6 \times \frac{1}{4} + 6 \times \frac{1}{8}$
$= 3 + 1.5 + 0.75$
= 5.25

2B. The question is:

An 8 × 8 square has a 2 × 2 square removed from two of the corners of the square, and then eight 1 × 1 squares are glued to the edges as shown.

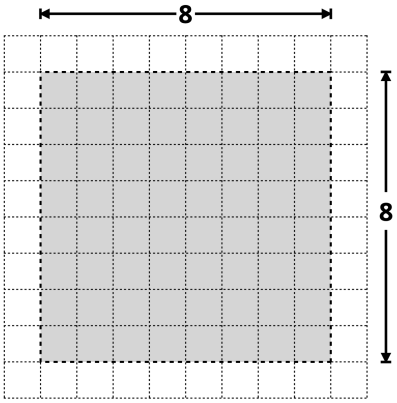
The area of the new shape is 64. How many units is the perimeter of the new shape?



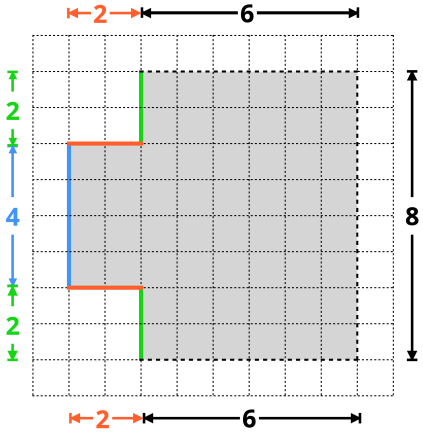
Strategy: *Divide a complex shape.*

By considering how the shape is constructed, we can calculate the perimeter of the shape using the perimeter of the original square.

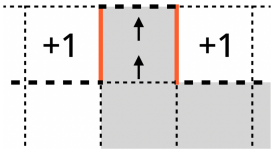
An 8 × 8 square has a perimeter of 8 + 8 + 8 + 8 = 32 units, or 4 × 8 = **32 units**.

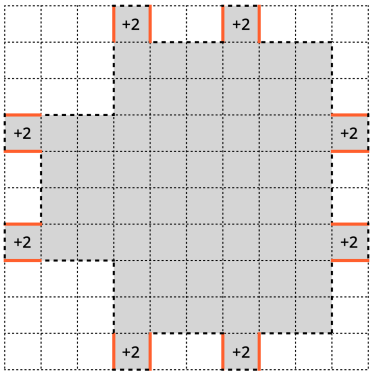


The perimeter remains the same when the 2 × 2 squares are removed.
2 + 6 + 8 + 6 + 2 + 2 + 4 + 2 = **32 units.**



For each square glued on the perimeter is increased by 2 units.





We can combine the **32 units** from the square and the **16 units** from the glued on squares to calculate the perimeter of the new shape.

The perimeter is 32 + 16 = **48 units**

2B. The question is:

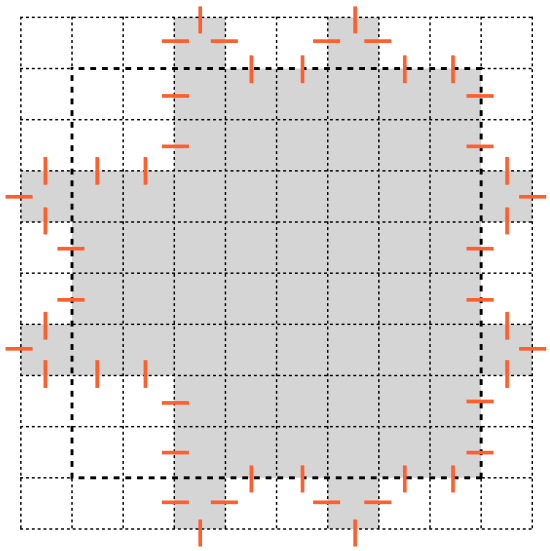
The area of the new shape is 64. How many units is the perimeter of the new shape?

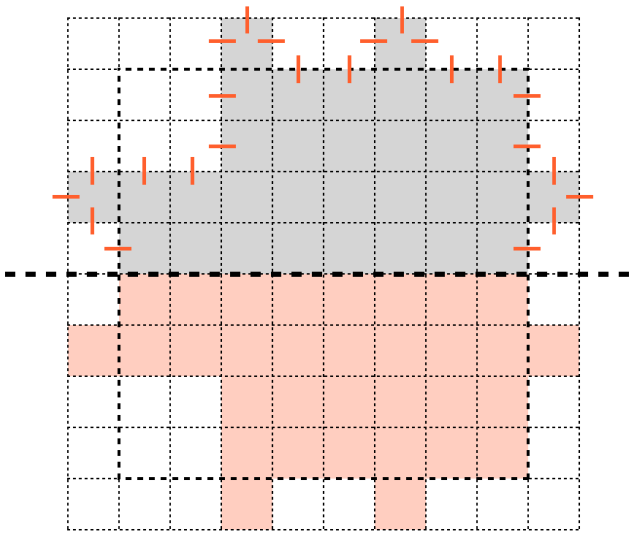
Strategy: *Count the number of units around the perimeter of the shape.*

Tally and count the **48 units** around the perimeter of the shape.

If the area of the shape is 64 square units, the shape is made up of smaller squares with dimensions 1 unit × 1 unit.

As the shape is symmetrical, the result can be found by counting and doubling one side.





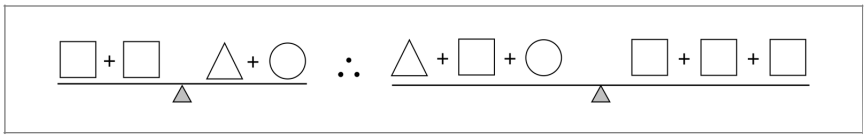
2C. The question is:

Use the 3 given equations to find the value of △+△ .

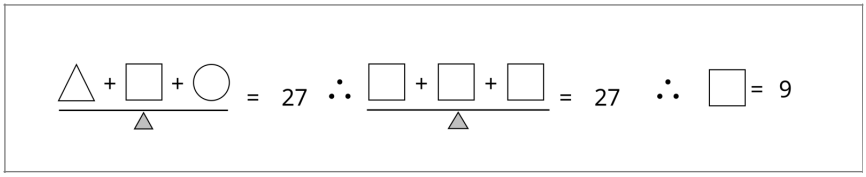
Strategy: *Use logic to determine the value of each shape.*

The first equation states that two squares are equal to a triangle and a circle.

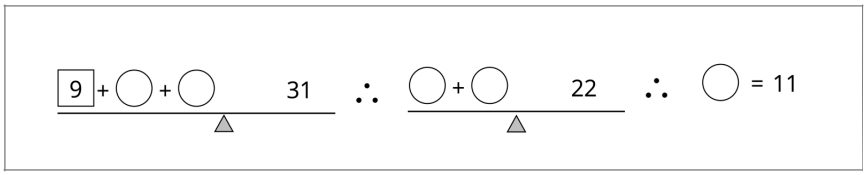
If we add a square to both sides, a triangle, square and circle equals 3 squares.



The second equation states that a triangle, square and circle equal 27. Therefore three squares also equal 27. One square is equal to 9.

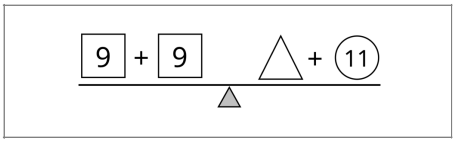


The third equation states that a square and 2 circles equal 31.
A square equals 9; therefore, 2 circles equals 22. One circle is equal to 11.



We can use the value of a square and a circle to determine what a triangle is equal to using the first equation.

A triangle and circle are worth 18.
One triangle is worth 7.
Therefore the value of two triangles is **14**.



Strategy: *Reason algebraically.*

Let S, C and T represent the square, circle and triangle.

Finding S

From equation 1:

T + C = S + S

∴ T + C = 2S

From equation 2:

T + S + C = 27

(T + C) + S = 27

(2S) + S = 27

3S = 27

∴ **S = 9**

Finding C

From equation 3:

S + C + C = 31

9 + (C + C) = 31

9 + 2C = 31

2C = 22

∴ **C = 11**

Finding T

From equation 1:

S + S = T + C

9 + 9 = T + 11

(9 × 2) = T + 11

18 = T + 11

18 - 11 = T

∴ **T = 7**

The value of two triangles is
7 + 7 = **14.**

2D. The question is:
How many three-digit odd whole numbers have a digit sum of 7?

Strategy: *Make an organised list.*

The number must have a digit sum of 7.
Therefore the final digit cannot be either 9 or 7.
List all possible numbers that end in 5. The remaining digits must add to 2:
205
115

List all possible numbers that end in 3. The remaining digits must add to 4:
403
313
223
133

List all possible numbers that end in 1. The remaining digits must add to 6:
601
511
421
331
241
151

There are **12** three-digit odd numbers that have a digit sum of 7.

Strategy: *Make an organised list (alternative approach).*

Find all possible sets of 3 numbers that add to 7 and identify all odd arrangements of these numbers.

1, **0** and **6** add to 7. There is one odd combination: 601	**1**, **1** and **5** add to 7. There are 3 odd combinations: 511 151 115	**1**, **3** and **3** add to 7. There are 3 odd combinations: 331 313 133
1, **2** and **4** add to 7. There are 2 odd combinations: 421 241	**2**, **2** and **3** add to 7. There is one odd combination: 223	**0**, **3** and **4** add to 7. There is one odd combination: 403
0, **2** and **5** add to 7. There is one odd combination: 205	There are **12** three-digit odd numbers that have a digit sum of 7.	

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WEDNESDAY 11 JUNE 2025

OLYMPIAD 2

2E. The question is:

In the cryptarithm shown, different letters represent different digits.
No letter represents zero.
What is the greatest possible value of APSMO?

$$\begin{array}{r} M\,A\,T\,H \\ +\,M\,A\,T\,H \\ \hline A\,P\,S\,M\,O \end{array}$$

Strategy: *Eliminate all but one possibility.*

There are several letters that appear multiple times in the cryptarithm:
A, M, T and H.
Wherever they appear, they will need to have the same value.

$$\begin{array}{r} M\,A\,T\,H \\ +\,M\,A\,T\,H \\ \hline A\,P\,S\,M\,O \end{array}$$

Assign **1** to **A**. This is the only possible value that can be reached when two 4 digit numbers are added together.

$$\begin{array}{r} M\,1\,T\,H \\ +\,M\,1\,T\,H \\ \hline 1\,P\,S\,M\,O \end{array}$$

We want APSMO to have the highest value. Can M be **9**?
This would mean that **P** = 8 as there is no carry from the hundreds column if A = 1 .
The hundreds column would therefore be 1 + 1 = **S,** making **S** = **2.**
S cannot be **3**, as this would need **T** as well as **M** to be **9** and include a carry from the tens column.

$$\begin{array}{r} {\scriptstyle 1} \\ 9\,1\,T\,H \\ +\,9\,1\,T\,H \\ \hline 1\,8\,2\,9\,O \end{array}$$

If M = **9**, **T** must equal **4** with a carry from the units column.
H cannot be **5** because the units would add to 10 and we cannot use 0.
Can H be **6**?
The units cannot add to 12 as **2** is **S.**
H can't be **7** as 7 + 7 = 14 and **4** is T. **8** and **9** are already used.
There is no solution if **M** is **9.**

$$\begin{array}{r} {\scriptstyle 1} \\ 9\,1\,4\,H \\ +\,9\,1\,4\,H \\ \hline 1\,8\,2\,9\,O \end{array}$$

The next highest number to try is M = **8**.
This would mean that **P** = **6** as there is no carry from the hundreds column if A = 1 .
T must be **9** for M to equal **8,** and there cannot be a carry from the units column.
This will result in a carry from the tens column, so **S** must equal **3.**

$$\begin{array}{r} {\scriptstyle 1} \\ 8\,1\,9\,H \\ +\,8\,1\,9\,H \\ \hline 1\,6\,3\,8\,O \end{array}$$

To continue, we need to find values for **H** and **O** from our remaining numbers, 7, 5, 4 and 2 that are also double each other.
The only remaining numbers that fit the requirements are **2** and **4.**
H is **2** and **O** is **4.**

$$\begin{array}{r} {\scriptstyle 1} \\ 8\,1\,9\,2 \\ +\,8\,1\,9\,2 \\ \hline 1\,6\,3\,8\,4 \end{array}$$

The greatest possible value of APSMO is 8,192 + 8,192 = **16,384**