MATHS GAMES

APSMO

2025 MATHS GAMES

Important

The information contained in this file is ONLY for the use of registered participants of the 2025 APSMO Maths Games.

Organisation and Procedures

For full details, see the Members' Area

- Maths Games papers are to be conducted under test conditions.

DO	DO NOT
• Supervise students at all times. • Maintain silence. • Provide blank working paper. • Collect, mark and retain the papers.	• Print the papers prior to the scheduled 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.

- Papers should be scored by the PICO using the *Solutions and Answers* sheet provided.
- Original student answer sheets should be retained by the PICO until the end of the year.

Absent Students

- A student who is legitimately absent on the date of the Maths Games paper, may sit the paper on their return to school.
- If an absent student does not sit the paper on their return to school they should be marked as 'absent'.
- *Note: This policy differs from the Maths Olympiads Absent Student Policy which has additional requirements*.

APSMO

WEDNESDAY 7 MAY 2025

MATHS GAMES

SENIOR

Suggested Time: ***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. Charlie's flight left Sydney for Tokyo at 9:05pm on Tuesday evening.

When he landed in Tokyo the next day, he immediately called his sister back in Sydney.

His sister received the call at 6:55am on Wednesday morning.

How long was the flight, in hours and minutes?

1B. Billy is stacking logs in his log pile.

He would like 1 log on the top layer, 2 logs on the second layer, 3 logs on the third layer, and so on.

If Billy has 66 logs, how many logs would there be in the bottom layer?

1C. Four adult tickets and three children's tickets cost $75.50.

Three adult tickets and four children's tickets cost $71.50.

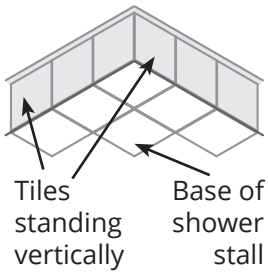
How much does one adult ticket cost?

1D. Sally is using square tiles to tile the base of a square shower stall.

She places an extra row of tiles to stand vertically around all four sides of the base, as shown.

The entire job requires 96 tiles.

How many tiles will be placed vertically?



1E. A triples game of lawn bowls needs two teams of three players.

A pairs game has two teams of two players.

52 players book in to play bowls.

List the different numbers of triples games that can be arranged, so that all of the players are included in either a triples or a pairs game.

APSMO

WEDNESDAY 7 MAY 2025

MATHS GAMES

SENIOR

1A.

1B.

1C.

1D.

1E.

Student Name:

Fold here. Keep your answers hidden.

APSMO
WEDNESDAY 7 MAY 2025

MATHS GAMES
SENIOR

Solutions and Answers
(Items in parentheses are not required)

1A: 9h 50min	**1B:** 11	**1C:** $12.50	**1D:** 32	**1E:** 0, 2, 4, 6, 8

1A. How long was the flight, in hours and minutes?

Strategy 1: **Build a Table**

Charlie's flight left Sydney at **9:05pm** on Tuesday evening.

One hour later, it will be **10:05pm** on Tuesday evening.

Day + am/pm	Tuesday pm			Wednesday am							
Sydney time	9:05	10:05	11:05	12:05	1:05	2:05	3:05	4:05	5:05	6:05	7:05
Elapsed time	0h	1h	2h	3h	4h	5h	6h	7h	8h	9h	10h

At **6:05am** Sydney time on Wednesday, Charlie has been in the air for **9** hours.

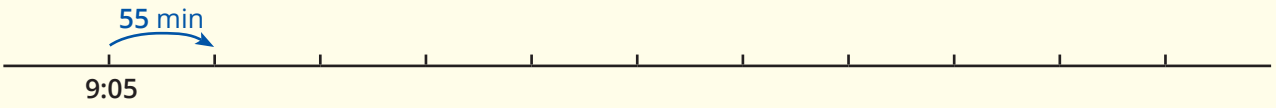
He lands at **6:55am** Sydney time. This is **55 – 5 = 50** minutes after **6:05am** (**10** minutes before **7:05am**).

Day + am/pm	Tuesday pm			Wednesday am							
Sydney time	9:05	10:05	11:05	12:05	1:05	2:05	3:05	4:05	5:05	6:05	6:55
Elapsed time	0h	1h	2h	3h	4h	5h	6h	7h	8h	9h	9h 50min

Charlie's flight was **9 hours and 50 minutes** long.

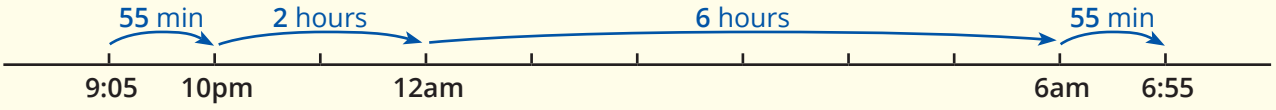
Strategy 2: **Draw a Diagram**

By **10:00pm**, Charlie has been in the air for **60 – 5 = 55 minutes**.



It is another **12 – 10 = 2 hours** until **12am**, and then another **6 hours** until **6am**.

In another **55 minutes**, it's **6:55am**.



Charlie was in the air for **2 + 6 = 8 hours**, and **55 + 55 = 110 minutes**.

110 minutes is equal to **1 hour and 110 – 60 = 50 minutes**.

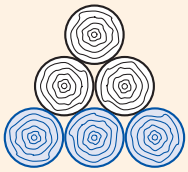
Charlie's flight was **8 + 1 = 9 hours and 50 minutes** long.

Follow-Up: *A few days later, Charlie's sister received a message from Charlie at 8:35am. It said that he was just about to take off from Tokyo. The flight was 9 hours and 40 minutes long. What time was Charlie expecting to land in Sydney?* [6:15pm]

1B. How many logs should Billy have in the bottom layer?

***Strategy 1:* Draw a Diagram, and Build a Table**

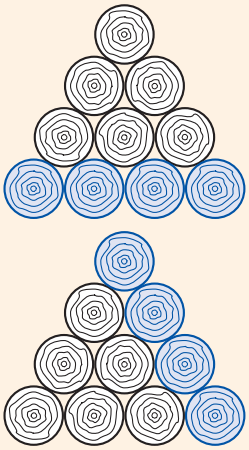
If Billy had **3** logs in the bottom layer, there would be **3** layers in total, and **1 + 2 + 3 = 6** logs in the pile.



Logs in bottom layer	3									
Total logs in pile	6									

If Billy had **4** logs in the bottom layer, the number of logs would increase by **4**, for a total of **6 + 4 = 10**.

We can think of the extra **4** logs being added at the bottom of the pile, or alternatively being added to one side, as shown in the diagram.



If Billy adds the logs to the side, we can imagine him just continuing to add logs until all **66** logs have been placed.

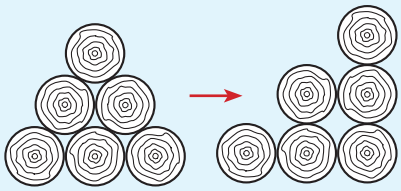
Every new layer has one more log than the previous layer.

Logs in bottom layer	3	4	5	6	7	8	9	10	11	
Total logs in pile	6	10	15	21	28	36	45	55	66	

To accommodate **66** logs, Billy will need to have **11** logs in the bottom layer.

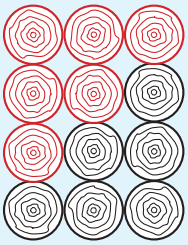
***Strategy 2:* Convert to a More Convenient Form**

Suppose, instead of arranging the logs evenly across the base, Billy places them in vertical stacks.



If he doubles the stack, the result is a rectangle with the same number of logs on the base.

The height is equal to the base + **1**.

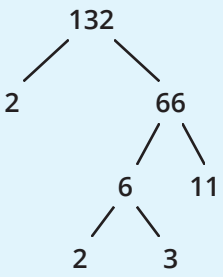


If we double Billy's **66** logs, there would be **2 × 66 = 132** logs.

Finding factors of **132**:

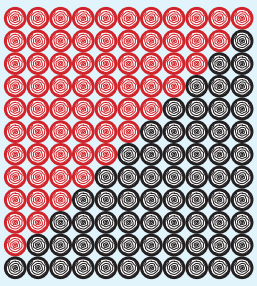
132 = 2 × 2 × 3 × 11

= 12 × 11.



132 logs can be arranged into a rectangle that is **12** logs high and **11** logs wide.

Therefore, Billy's **66** logs can be arranged into a triangular pile with **11** logs in the bottom layer.



Follow-Up: *Billy then tried stacking his 66 logs in a rectangular arrangement, so that the number of logs on the base was greater than the height of the stack. In how many different ways could he do this?* [4: 66 × 1, 33 × 2, 22 × 3, 11 × 6]

1C. How much does one adult ticket cost?

Strategy 1: **Find a Pattern**

Three adult tickets and four children's tickets cost **$71.50**.

Adult | Adult | Adult | Child | Child | Child | Child = **$71.50**

Four adult tickets and three children's tickets cost **$75.50**.

Adult | Adult | Adult | Adult | Child | Child | Child = **$75.50**

The difference between an adult ticket and a children's ticket is **$75.50 – $71.50 = $4.00.**

To exchange a children's ticket for an adult ticket, we'd need to pay an extra **$4.00.**

Adult | Adult | Adult | Adult | Adult | Child | Child = **$79.50**

Adult | Adult | Adult | Adult | Adult | Adult | Child = **$83.50**

Adult | Adult | Adult | Adult | Adult | Adult | Adult = **$87.50**

Seven adult tickets cost **$87.50**, so one adult ticket must cost **$87.50 ÷ 7 = $12.50**.

Method 1: Written algorithm

$$\begin{array}{r} 12.5 \\ 7\overline{)\,87.50} \\ 7 \\ \hline 17.50 \\ 14 \\ \hline 3.50 \\ 3.5 \\ \hline \end{array}$$

Method 2: Reason arithmetically

- $7 \times \$10 = \$70$; $\$87.50 - \$70 = \$17.50$
- $7 \times \$2 = \$14$; $\$17.50 - \$14 = \$3.50$
- $7 \times \$0.50 = \$3.50$

Therefore, $7 \times (\$10 + \$2 + \$0.50) = \$87.50$.

Strategy 2: **Reason Algebraically**

Let x represent the price of an adult ticket in dollars, and y the price of a children's ticket in dollars.

The price of an adult ticket is $x = \$12.50$.

Method 1

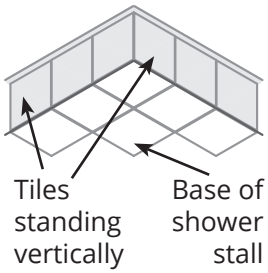
	$4x + 3y = 75.5$	(1)
	$3x + 4y = 71.5$	(2)
(1) + (2):	$7x + 7y = 147$	
	$x + y = 21$	
	$3x + 3y = 63$	(3)
(1) – (3):	$x = 12.5$	

Method 2

	$4x + 3y = 75.5$	(1)
(1) × 4:	$16x + 12y = 302$	(1a)
	$3x + 4y = 71.5$	(2)
(2) × 3:	$9x + 12y = 214.5$	(2a)
(1a) – (2a):	$7x = 87.5$	
	$x = 12.5$	

Follow-Up: *It costs $50 for a "family" ticket for 2 adults and 2 children. The ticket includes 2 serves of popcorn. For this to be a good deal, how much would one serve of popcorn have to cost?* [More than $4.00]

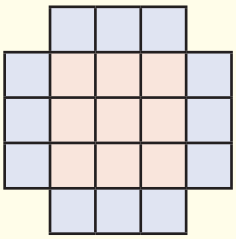
1D. How many tiles will be placed vertically?



Strategy 1: **Draw a Diagram, and Build a Table**

We can begin by laying out all of the tiles horizontally.

For example, if the base of the shower stall was **3** tiles long and **3** tiles wide, then laying out all of the tiles horizontally would result in this arrangement.



There would be $3 \times 3 = 9$ tiles on the base, and $4 \times 3 = 12$ tiles that would be placed vertically, for a total of $9 + 12 = 21$ tiles.

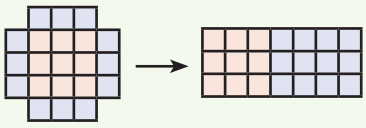
Using this idea, we can continue working out numbers of tiles until we reach a total of **96**.

Length / width of base	3	4	5	6	7	8
No. of tiles on base	9	$4 \times 4 = 16$	$5 \times 5 = 25$	$6 \times 6 = 36$	$7 \times 7 = 49$	$8 \times 8 = 64$
No. of vertical tiles	12	$4 \times 4 = 16$	$4 \times 5 = 20$	$4 \times 6 = 24$	$4 \times 7 = 28$	$4 \times 8 = 32$
Total number of tiles	21	$16 + 16 = 32$	$25 + 20 = 45$	$36 + 24 = 60$	$49 + 28 = 77$	$64 + 32 = 96$
		+11	+13	+15	+17	+19

32 tiles will be placed vertically.

Strategy 2: **Draw a Diagram, and Convert to a More Convenient Form**

We can rearrange the diagram from Strategy 1 to form a rectangle.



Its width is the width of the base.

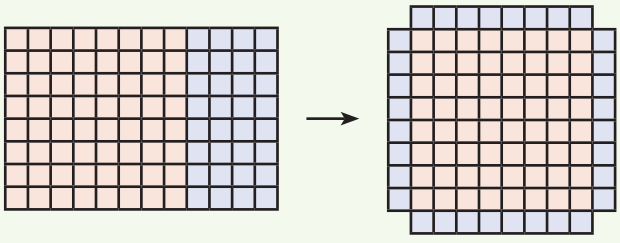
Its length is the length of the base, plus **4**.

The entire job requires **96** tiles. Factors of **96** are:

1, 2, 3, 4, 6, 8, 12, 16, 24, 32, 48, 96

We can see that $8 \times 12 = 96$, and $8 + 4 = 12$.

So, from a 8×12 rectangle, we can create the net of the tiled shower base.

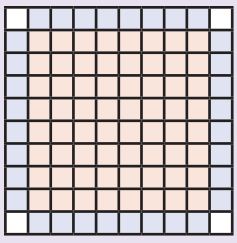


$4 \times 8 =$ **32** tiles will be placed vertically.

Strategy 3: **Draw a Diagram, and Convert to a More Convenient Form (Alternative Approach)**

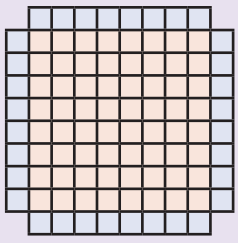
If we add **4** extra tiles in the corners, the arrangement will become a square.

A square comprising $96 + 4 = 100$ tiles will have **10** tiles to a side.



Removing the **4** extra tiles, we can see that there are **8** tiles on each side that will be placed vertically.

$4 \times 8 =$ **32** tiles will be placed vertically.



Follow-Up: *How many tiles will be placed vertically if 140 tiles in total were used?* [40]

1E. How many different numbers of triples games can be arranged?

***Strategy 1:* Build a Table, and Find a Pattern**

Each pairs game requires **2 × 2 = 4** players: **2** players on each of **2** teams.

Each triples game requires **2 × 3 = 6** players: **3** players on each of **2** teams.

The maximum number of triples games will occur if we assign as many groups of **6** as possible out of the group of **52** players.

Since **8 × 6 = 48**, and **52 – 48 = 4**, it is possible to have **8** triples games and **1** pairs game.

Triples games	8								
Triples players	48								
Pairs players	4								
Pairs games	1								

If there were **7** triples games, those games would need **7 × 6 = 42** players.

However, the remaining **52 – 42 = 10** players cannot all be assigned to pairs games, which need **4** players each.

Triples games	8	7							
Triples players	48	42							
Pairs players	4	10							
Pairs games	1								

Repeating this process for all of the different possible numbers of triples games, we might notice a pattern - that it is not possible to have an odd number of triples games.

The possible numbers of triples games are **0, 2, 4, 6 and 8**.

Triples games	8	7	6	5	4	3	2	1	0
Triples players	48	42	36	30	24	18	12	6	0
Pairs players	4	10	16	22	28	34	40	46	52
Pairs games	1		4		7		10		13

***Strategy 2:* Find a Pattern, and Draw a Diagram**

The lowest common multiple of **4** and **6** is **12**.

1 × 4 = 4	1 × 6 = 6
2 × 4 = 8	2 × 6 = 12
3 × 4 = 12	3 × 6 = 18

For every **12** players, there can be:

- **2** triples games with **6** players each, or
- **3** pairs games with **4** players each.

We can now draw a diagram to show how different numbers of games might occur.

The possible numbers of triples games are **0, 2, 4, 6 and 8**.

Follow-Up: *How many different numbers of triples games could there be if there were 100 players?* [9: possible numbers are 0, 2, 4, 6, 8, 10, 12, 14, 16]