



APSMO
2025 MATHS GAMES

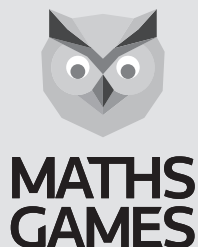
IMPORTANT

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2025 MATHS GAMES

ORGANISATION AND PROCEDURES

For full details, see the Members' Area

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

DO

- Supervise students at all times.
- Maintain silence.
- Provide blank working paper.
- Collect, mark and retain the papers.

DO NOT

- 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.*



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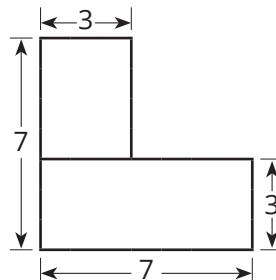
WEDNESDAY 10 SEPTEMBER 2025

MATHS GAMES JUNIOR

Suggested Time: 30 Minutes. Calculators NOT Permitted.

- 4A.** Two $7\text{ cm} \times 3\text{ cm}$ rectangles are overlapped to form an L shape as shown.

What is the perimeter of the L shape, in centimetres?



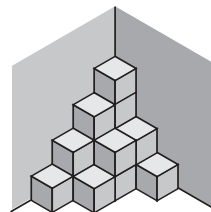
Write your answers in the boxes on the back.

←
Keep your answers hidden by folding backwards on this line.

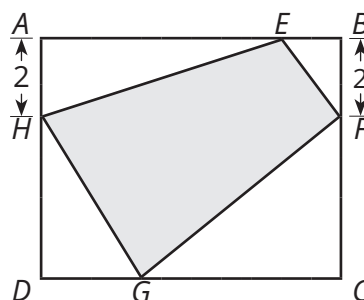
- 4B.** Miss Taylor has a "number of the day".
Charlie multiplied the number by 13.
Joey multiplied the number by 7.
The sum of Charlie's result, and Joey's result, is 180.
What is Miss Taylor's "number of the day"?

- 4C.** A supermarket sells pastries in boxes of 3 and boxes of 5.
Annie bought 10 boxes, containing 44 pastries in total.
How many of the boxes contained 5 pastries?

- 4D.** This tower is made by stacking identical $1\text{ cm} \times 1\text{ cm} \times 1\text{ cm}$ cubes in the corner of the room. The cubes are glued together in this arrangement. The entire tower is then removed from the room and painted all over, including the base. How many 1 cm^2 square faces are painted?



- 4E.** $ABCD$ is a rectangle.
Point H is 2 cm from point A , and point F is 2 cm from point B , as shown.
The quadrilateral $EFGH$ has an area of 15 square centimetres.
What is the area of $ABCD$, in square centimetres?





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WEDNESDAY 10 SEPTEMBER 2025

MATHS GAMES
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4A.

Student Name:

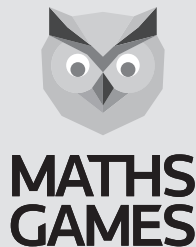
4B.

4C.

4D.

4E.

Fold here. Keep your answers hidden.



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Solutions and Answers

(Items in parentheses are not required)

4A: 28 (cm)

4B: 9

4C: 7

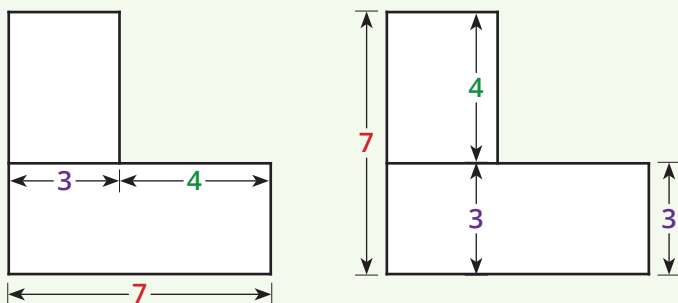
4D: 50

4E: 30 (cm²)

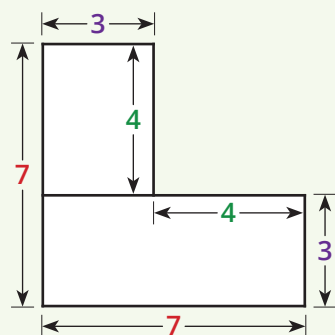
4A. What is the perimeter of the L shape?

Strategy 1: Divide a Complex Shape

There are two unknown sides of the L shape.
Each of these sides is $7\text{ cm} - 3\text{ cm} = 4\text{ cm}$ long.

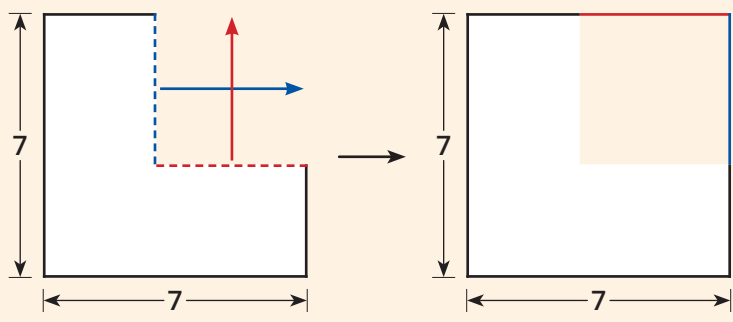


The perimeter of the L shape is $7 + 7 + 3 + 3 + 4 + 4 = 28\text{ cm}$.



Strategy 2: Convert to a More Convenient Form

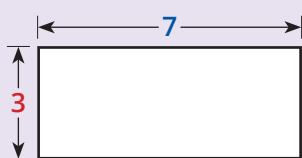
We can rearrange two of the sides of the L shape, to form a square with side lengths 7 cm .



The perimeter of the L shape is $4 \times 7\text{ cm} = 28\text{ cm}$.

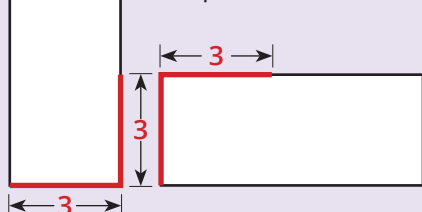
Strategy 3: Divide a Complex Shape (Alternative Approach)

The perimeter of each of the rectangles is equal to $7 + 7 + 3 + 3 = 20\text{ cm}$.



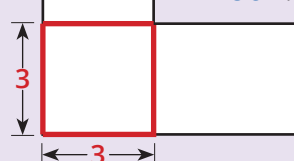
The total perimeter of the two rectangles is $2 \times 20 = 40\text{ cm}$.

When overlapping the rectangles, there are four 3 cm lengths that are not in the perimeter of the L shape.

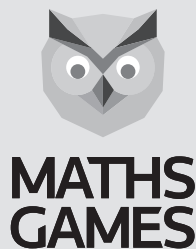


Subtracting those four 3 cm lengths, we find that the perimeter of the L shape is

$$\begin{aligned} &40\text{ cm} - 4 \times 3\text{ cm} \\ &= 40\text{ cm} - 12\text{ cm} \\ &= 28\text{ cm}. \end{aligned}$$



Follow-Up: If the two rectangles were overlapped at 90° to form a plus sign, what would be the perimeter of this new shape? [28 cm]



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4B. What is Miss Taylor's "number of the day"?

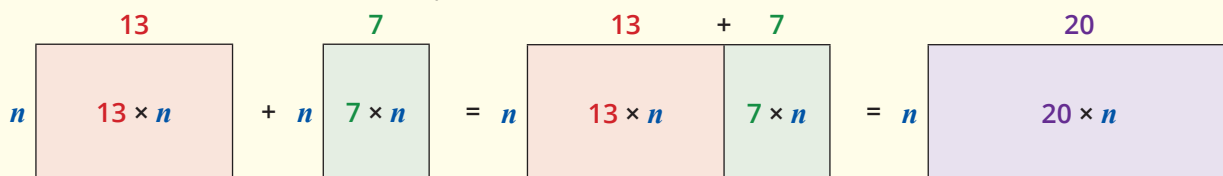
Strategy 1: Convert to a More Convenient Form

Let's represent Miss Taylor's "number of the day" with the letter n .

Charlie multiplied Miss Taylor's number by **13**.
His result can be represented as the area of a rectangle with height n units, and width **13** units.

Joey multiplied the number by **7**.
His result can be represented as the area of a rectangle with height n units and width **7** units.

We can use these area models to represent the sum of their results.



The sum of their results is $20 \times n = 180$.

Miss Taylor's "number of the day" is $n = 180 \div 20 = 9$.

Strategy 2: Build a Table, and Find a Pattern

Suppose that Miss Taylor's "number of the day" was **1**.

The sum of Charlie's and Joey's results would then be

$$13 \times 1 + 7 \times 1 = 20.$$

Number of the Day	Charlie's Result	Joey's Result	Sum
1	13	7	20

We can continue increasing our value for the "number of the day".

In doing so, we can see that increasing that number by 1, increases the sum of Charlie's and Joey's results by 20.

If the number of the day is 3, the sum of Charlie's and Joey's results is $13 \times 3 + 7 \times 3 = 60$.

Number of the Day	Charlie's Result	Joey's Result	Sum
1	13	7	20
2	26	14	40
3	39	21	60

+20
+20

The sum of Charlie's and Joey's results is **180**.

To achieve this sum by continuously adding 20, we would need to do so $180 \div 20 = 9$ times.

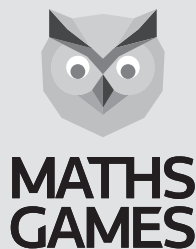
We might also recognise that $3 \times 60 = 180$, and so the number of the day would be $3 \times 3 = 9$.

Miss Taylor's "number of the day" is **9**.

Number of the Day	Charlie's Result	Joey's Result	Sum
1	13	7	20
2	26	14	40
3	39	21	60
⋮	⋮	⋮	⋮
9	117	63	180

+20
+20

Follow-Up: Miss Taylor's next number of the day is $\frac{1}{2}$. Charlie and Joey do the same operations. What is the sum of their results? [10]



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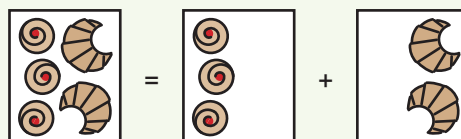
WEDNESDAY 10 SEPTEMBER 2025

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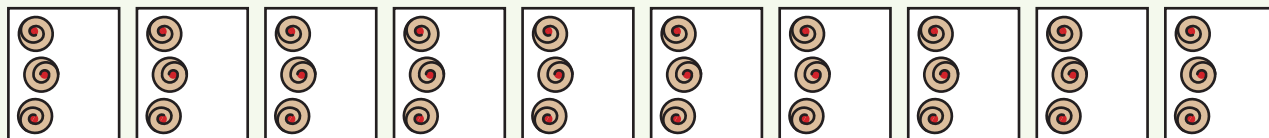
4C. How many of the boxes contained 5 pastries?

Strategy 1: Convert to a More Convenient Form

Annie can buy pastries in boxes of 3, and boxes of 5.
 A box of 5 pastries can be represented as 3 pastries, plus another 2 pastries.

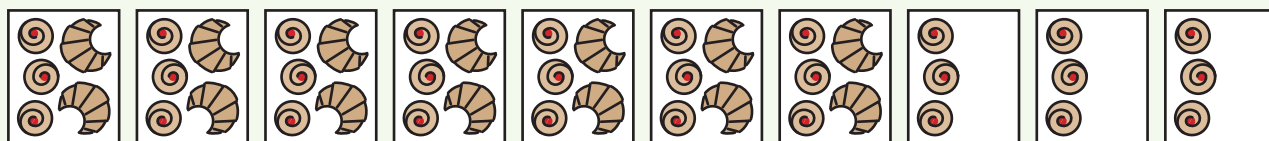


We can begin by thinking of Annie's 10 boxes of pastries as 10 boxes each containing 3 pastries.



So far, Annie has $3 \times 10 = 30$ pastries.
 Annie has 44 pastries in total, so there are $44 - 30 = 14$ extra pastries.

There must be 2 extra pastries in $14 \div 2 = 7$ packets.



7 of the boxes contained 5 pastries.

Strategy 2: Build a Table, and Find a Pattern

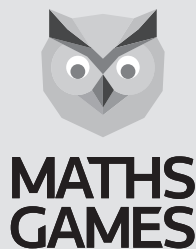
Suppose Annie bought as many boxes of 5 pastries as she could.
 With 44 pastries in total, there would be 9 boxes that contain pastries.
 Since the 9th box would only have 4 pastries, we know that one of those pastries must move to box number 10.

Box No.	1	2	3	4	5	6	7	8	9	10
Contents	3 round	3 round	3 round	3 round	3 round	3 round	3 round	3 round	4 round	1 round

Box number 10 needs to contain at least three pastries.
 We can make this happen by moving two of the pastries from box number 8.
 Annie bought 3 boxes that each contain 3 pastries, and 7 boxes that each contain 5 pastries.

Box No.	1	2	3	4	5	6	7	8	9	10
Contents	3 round	3 round	3 round	3 round	3 round	3 round	3 round	1 round	1 round	3 round

Follow-Up: What is the largest number of boxes Annie could have bought, to have a total of 44 pastries? [14]



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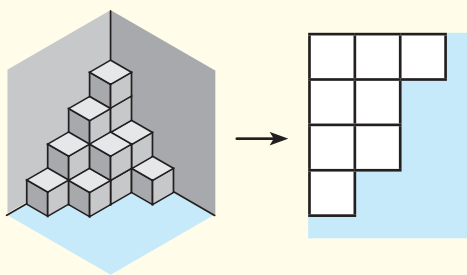
WEDNESDAY 10 SEPTEMBER 2025

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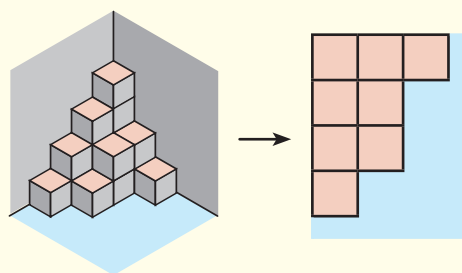
4D. How many 1cm^2 square faces are painted?

Strategy 1: Divide a Complex Shape, and Find a Pattern

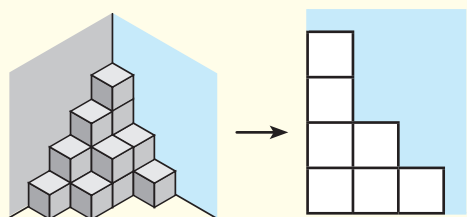
We can see that there are 8 faces on the base of the tower.



If we view the tower from above, we also see the same layout of 8 faces, which are facing upward.

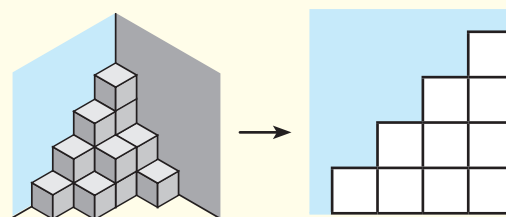


There are 7 faces against the right wall.



If we stand on the left of the tower, and look towards the right wall, we will see the same layout of 7 faces, facing towards the left.

There are 10 faces against the left wall.



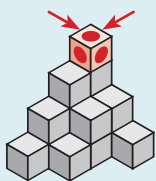
If we stand on the right of the tower, and look towards the left wall, we will see the same layout of 10 faces, facing towards the right.

In total, $8 + 8 + 7 + 7 + 10 + 10 = 50$ of the 1cm^2 square faces are painted.

Strategy 2: Make an Organised List

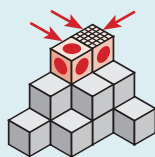
We can count exposed faces in an organised way.

There are **5** exposed faces on the cube in the top layer.



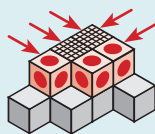
There is one cube in the 2nd layer where the top is not exposed.

In total, there are **7** exposed faces on the cubes in the 2nd layer.



There are two cubes in the 3rd layer that are under cubes in the 2nd layer.

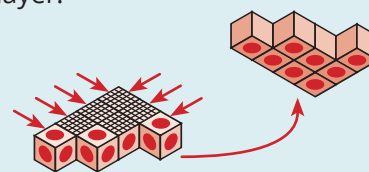
There are **13** exposed faces on the cubes in the 3rd layer.



In the bottom layer, there are **17** exposed faces on the top and sides.

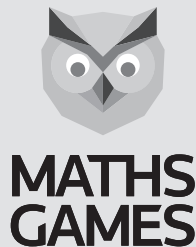
There are also **8** exposed faces on the base.

In total, there are **25** exposed faces on the cubes in the bottom layer.



There is paint on $5 + 7 + 13 + 25 = 50$ square centimetre faces.

Follow-Up: How many of the cubes have exactly 5 of their faces painted? [3]



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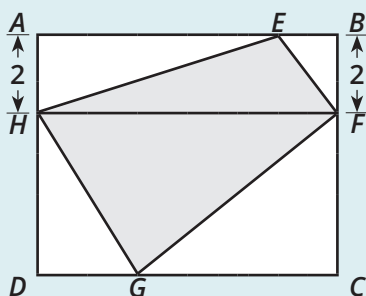
WEDNESDAY 10 SEPTEMBER 2025

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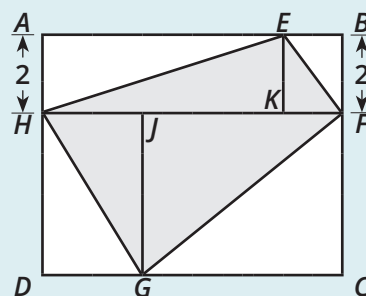
4E. What is the area of $ABCD$ in square centimetres?

Strategy 1: Divide a Complex Shape

$ABCD$ is a rectangle.
 Since H is 2 cm from A , and F is 2 cm from B , we can construct a line HF that is parallel to AB .

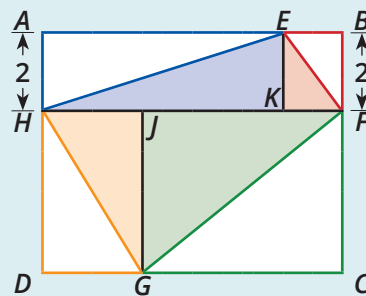


We can divide these rectangles further by constructing vertical lines through E and G , creating new points K and J .



We can see that triangle EKH is half of the area of the rectangle $AEKH$.
 Likewise, each of the other three resulting rectangles contributes half of its area to the quadrilateral $EFGH$.
 The area of $EFGH$ is half of the area of $ABCD$.

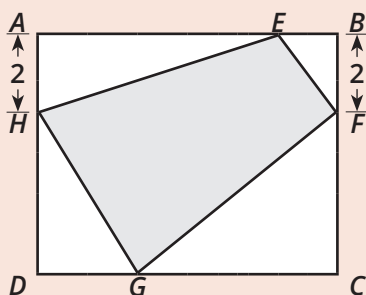
The area of $ABCD$ is therefore $2 \times 15 \text{ cm}^2 = 30 \text{ cm}^2$.



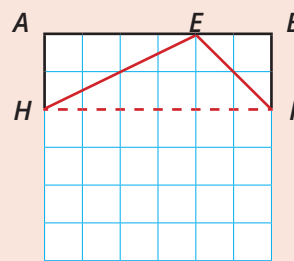
Strategy 2: Solve a Simpler Related Problem

We know that:

- $ABCD$ is a rectangle,
- AH and BF are both 2 cm long, and
- $EFGH$ has an area of 15 cm^2 .

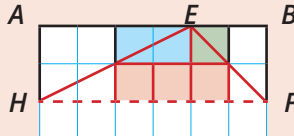
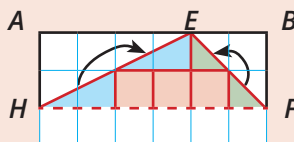


Noting that we are missing a lot of measurements, we can try to redraw an approximation of the diagram on grid paper, beginning with the 2 cm wide strip at the top.



By counting square units, we can see that the portion of $EFGH$ included in this section is 6 cm^2 .

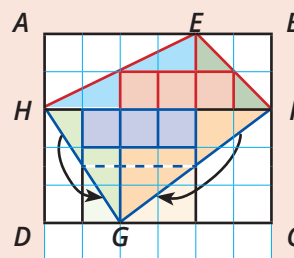
The part of $EFGH$ that is not included is $15 - 6 = 9 \text{ cm}^2$.



We can continue the diagram down the grid until we have another 9 cm^2 of area.

While this diagram may not be identical to that provided in the question, it does satisfy all of the requirements from the question.

The area of $ABCD$ is $6 \text{ cm} \times 5 \text{ cm} = 30 \text{ cm}^2$.



Follow-Up: Suppose, in this question, we changed AH and BF to both be 4 cm long. What would the area of $ABCD$ be? [30 cm^2]