APSMO

2025 OLYMPIADS

MATHS OLYMPIAD

IMPORTANT

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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

- 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

DO NOT

- 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.

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MATHS OLYMPIAD

2025: DIVISION J
WEDNESDAY 10 SEPTEMBER 2025

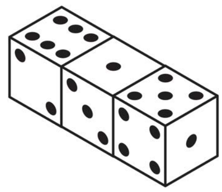
OLYMPIAD 4

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

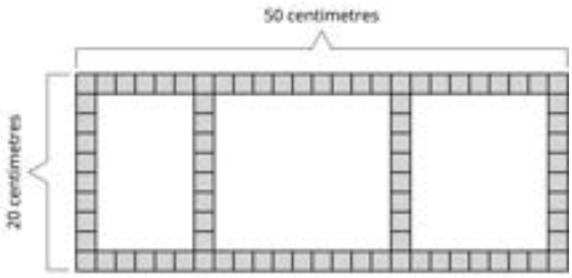
Write your answers in the boxes on the back.

Keep your answers hidden by folding backwards on this line.

4A. Three dice, each with faces numbered 1 through 6, are arranged as shown.
Seven faces are visible.
Find the sum of the numbers on all the faces that are not visible.



4B. Emily is creating an artwork on a 20 cm by 50 cm canvas.
After painting the canvas white, Emily uses a 2 cm × 2 cm stamp to create a border around the edge.
She also makes 2 lines of stamps parallel to the 20 cm sides as shown.
What is the area of the white space in square centimetres?
(Note: Diagram not drawn to scale)



4C. Three children are playing the game Fleet.
The goal is to capture red ships and blue ships to earn points.
James captures 3 red ships and 5 blue ships, earning 49 points.
Gerry captures 7 red ships and 3 blue ships, earning 71 points.
Chris captures 15 red ships and 12 blue ships.
How many points does Chris earn?

4D. The four-digit numbers *A*42*B* and *B*91*A* have a product of 20,252,025.
What is the two-digit number *AB*?

4E. Margaret River is 275 kilometres from Perth along a certain route.
A cyclist starts from Perth at 11 am. and travels along this route towards Margaret River at a steady rate of 35 km/h.
Another cyclist starts from Margaret River at midday and travels along this route towards Perth at a steady rate of 45 km/h.
At what time do the cyclists pass each other?

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2025: DIVISION J
WEDNESDAY 10 SEPTEMBER 2025

OLYMPIAD 4

Student Name:

4A.

4B.

4C.

4D.

4E.

Fold Here. Keep your answers hidden.

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MATHS OLYMPIAD

2025: DIVISION J
WEDNESDAY 10 SEPTEMBER 2025

OLYMPIAD 4

Solutions and Answers

For teacher use only. Not for Distribution.

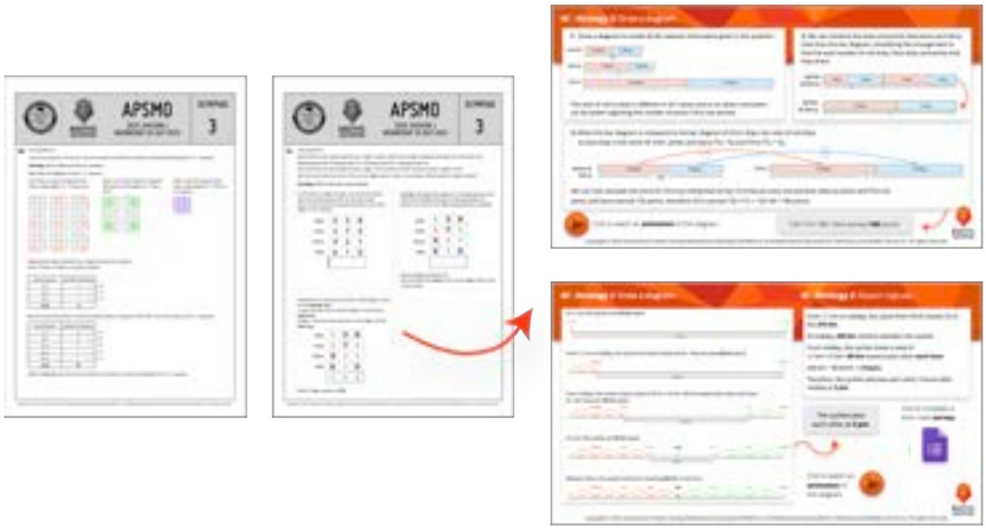
4A: 41	**4B:** 672	**4C:** 180	**4D:** 35	**4E:** 3 pm

NEW FORMAT – MATHS OLYMPIAD JUNIOR SOLUTIONS

For Paper 4, we are sharing solutions in a new way. They have been presented in a landscape 'slide' format that will make it easier for teachers to review the solutions with their class/team. As always, we encourage teams to review, consider and discuss the solutions on, or as close as possible, to the day they complete the paper.

In this new format, the steps to solve each problem are clearly explained and illustrated on the slides and, for selected problems, there are also links to watch animated solutions online.

There is also a link to a survey for teams to complete once they have reviewed the solutions so that we can gauge how well this format has been received. Please take a little time to share your teams' feedback so we can best support problem solving in your school.



How to use:

- Print and distribute Paper 4.
- When your team has completed Paper 4, show them the solutions online, or using this PDF.
- Click here to go to the solution slideshow online.
- If showing this PDF as a presentation or a slideshow, look for an option to view a single page at a time. Different PDF viewers may use different terms for this.
- When you are navigating through the pages, click on the orange play buttons to watch short animations of solutions.
- Please complete the team survey and share your feedback with APSMO. A link to the survey is on the final page.

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The Australasian Problem Solving Mathematical Olympiads: Junior Division Olympiad

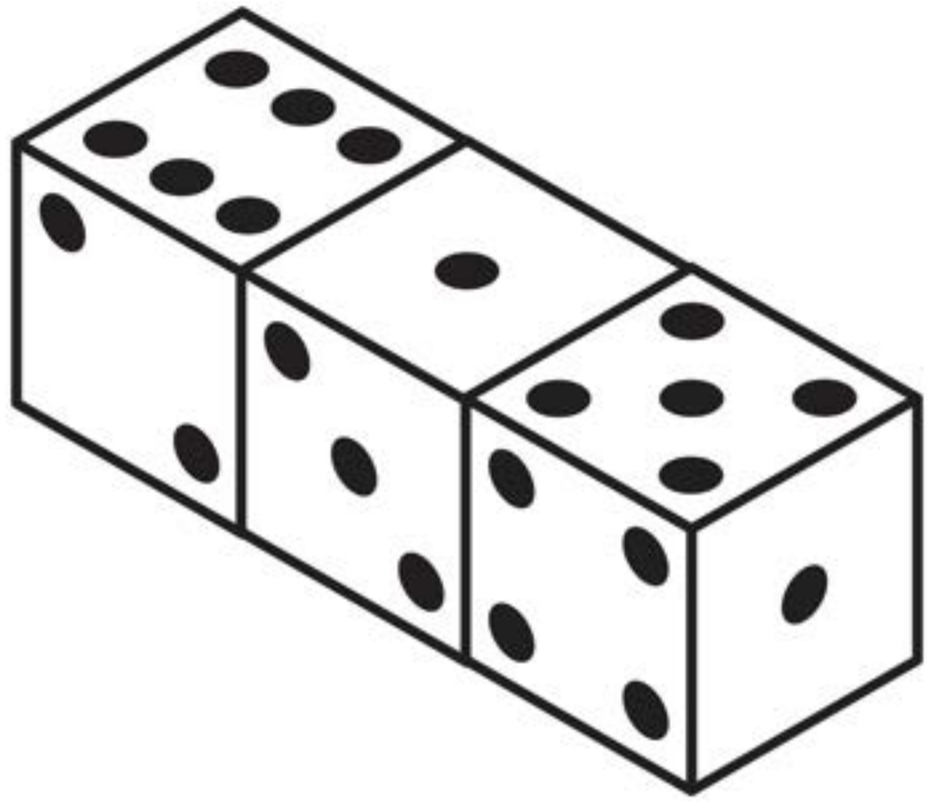
Paper 4: Wednesday, September 10 2025

Question 4A

Three dice, each with faces numbered 1 through 6, are arranged as shown.

Seven faces are visible.

Find the sum of the numbers on all the faces that are not visible.



Strategy 1: Find the sum of the numbers on all the faces.

Strategy 2: Identify the 8 faces that are not visible.

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4A - Strategy 1:

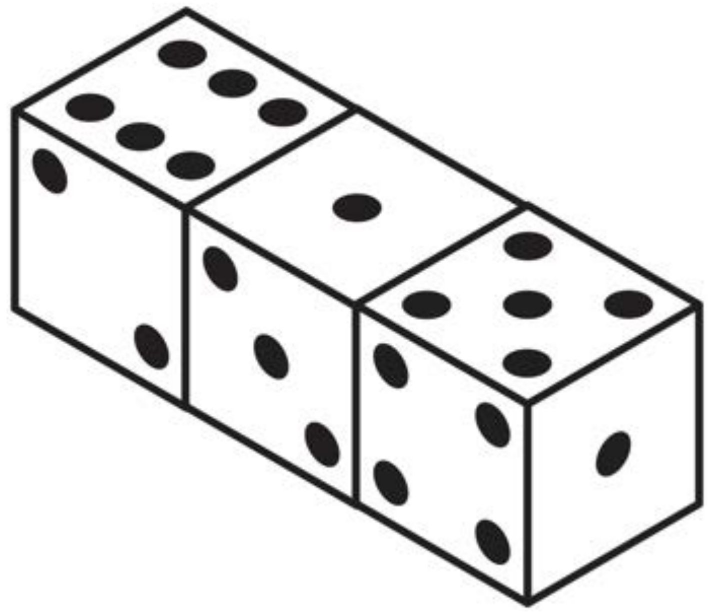
Find the sum of the numbers on all the faces.

The sum of the six numbers on one die is 1+2+3+4+5+6=**21**

The sum of the numbers on all three dice is 3×21=**63**.

The sum of the visible numbers is 22, so the sum of the numbers on all the faces that are not visible is

63-22=**41**.



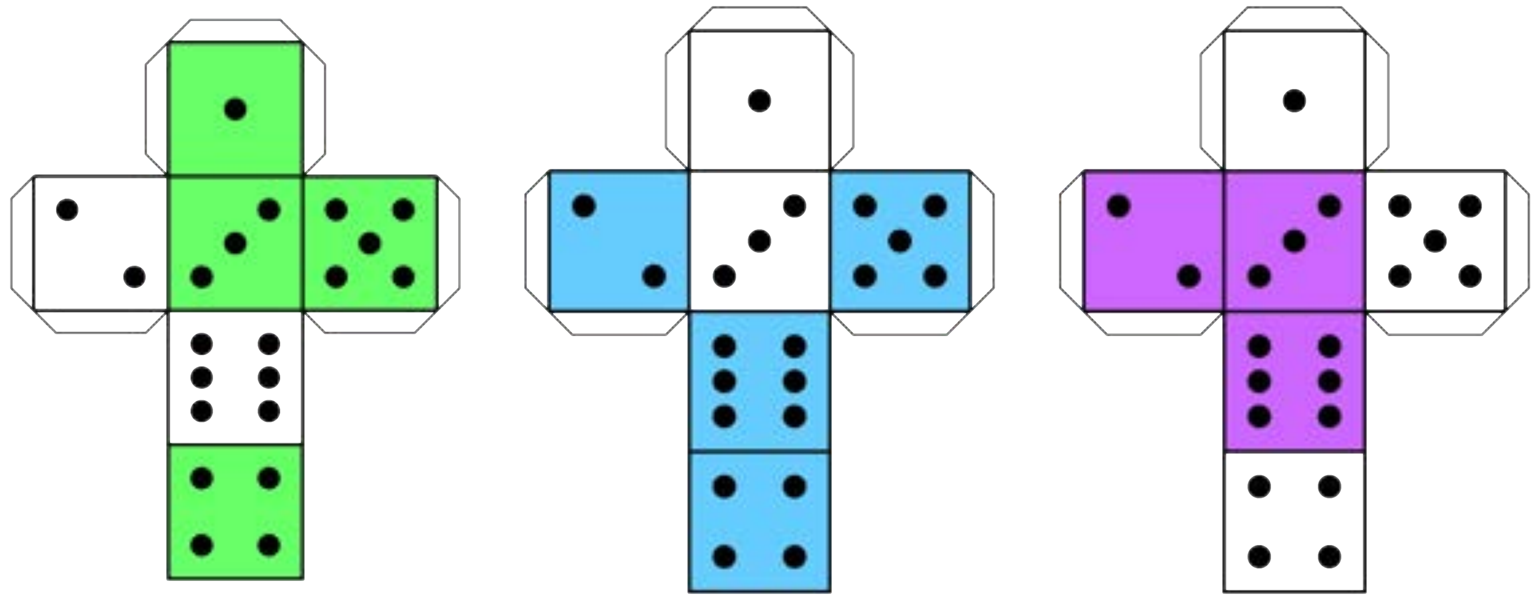
4A - Strategy 2:

Identify the 8 faces that are not visible.

We cannot see the 1, 3, 4 or 5 on the first dice. 1+3+4+5=**13**

We cannot see the 2, 4, 5 or 6 on the second dice. 2+4+5+6=**17**

We cannot see the 2, 3 or 6 on the third dice. 2+3+6=**11**



13+17+11=**41**

The sum of the numbers on all the faces that are not visible is **41**.

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The Australasian Problem Solving Mathematical Olympiads: Junior Division Olympiad

Paper 4: Wednesday, September 10 2025

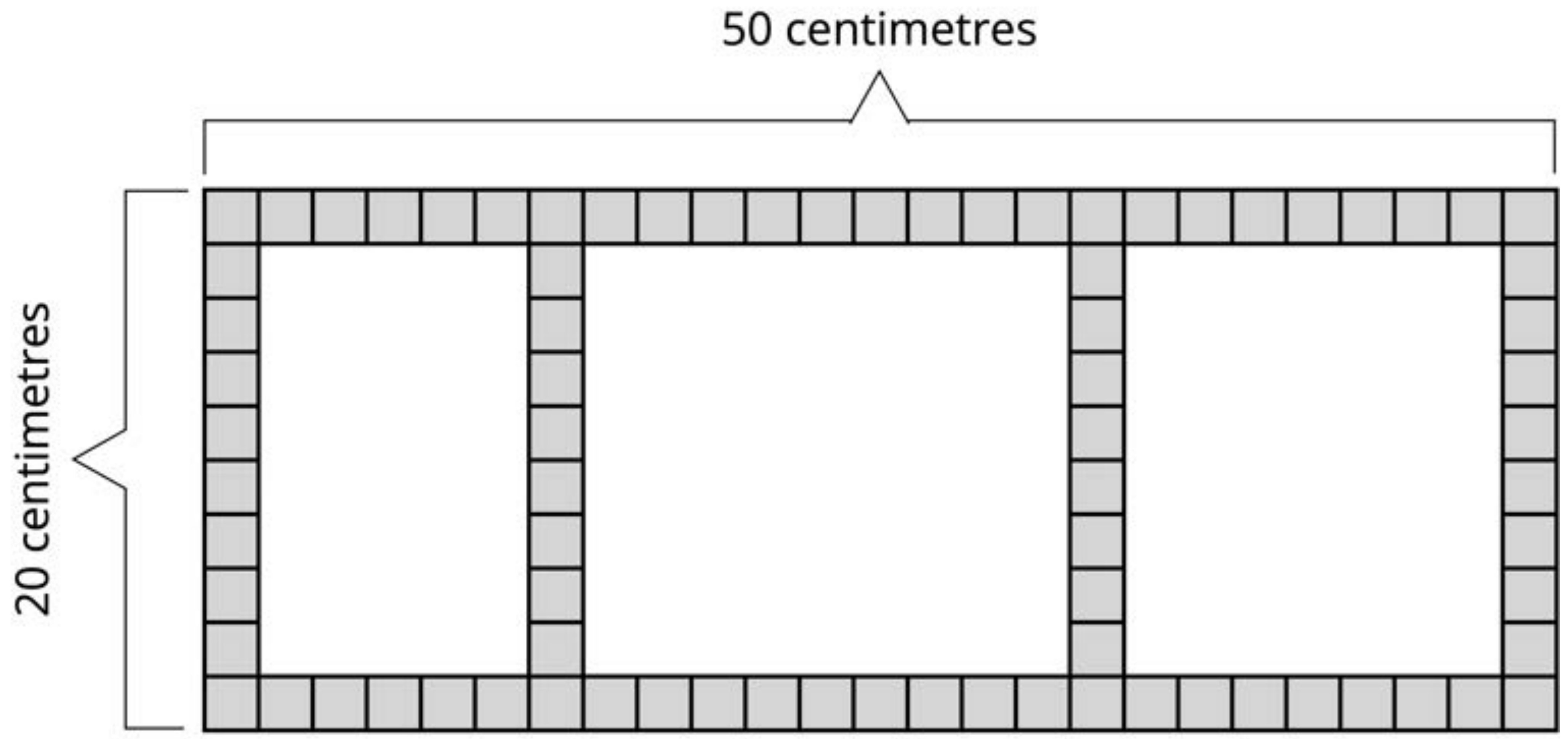
Question 4B

Emily is creating an artwork on a 20 cm by 50 cm canvas.

After painting the canvas white, Emily uses a 2 cm × 2 cm stamp to create a border around the edge.

She also makes 2 lines using the stamps parallel to the 20 cm side as shown.

What is the number of square centimetres in the remaining white space?



Strategy 1: Calculate and subtract the total area of the stamps.

Strategy 2: Draw a diagram and solve a simpler problem.

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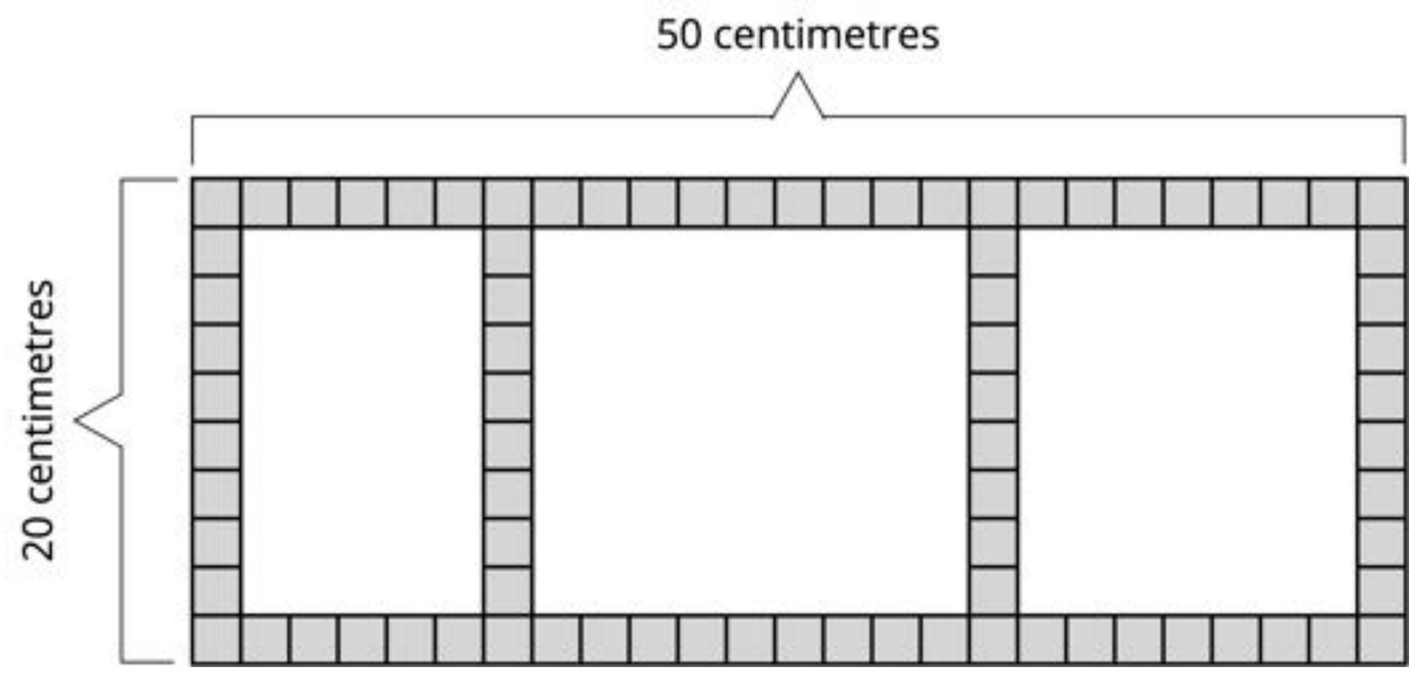
4B - Strategy 1: Calculate and subtract the total area of the stamps.

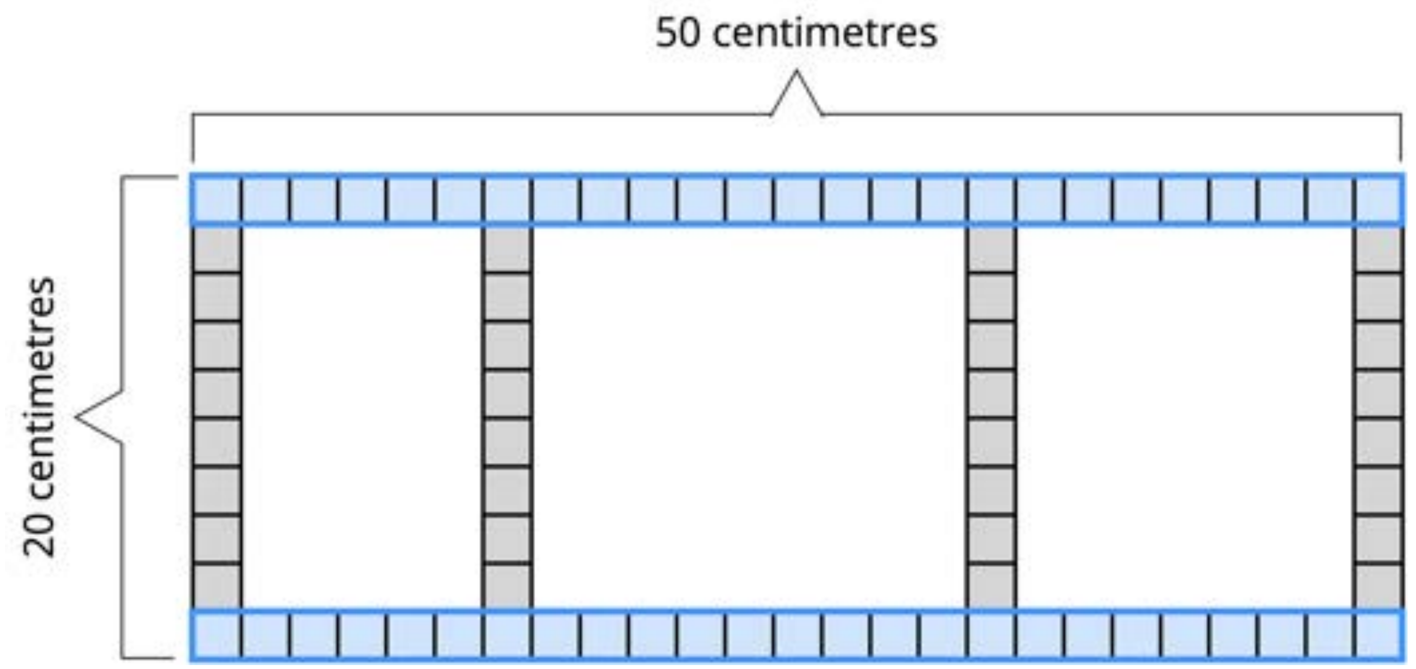
1. If we remove the area of the stamps from the total area of the canvas, we will identify the number of square centimetres remaining. The total area of the canvas is $20\,cm \times 50 = \mathbf{1000\,cm^2}$.



2. The number of stamps (shown in **blue**) along the 2 borders on the 50 centimetre sides of the canvas is $25 \times 2 = 50$ stamps.

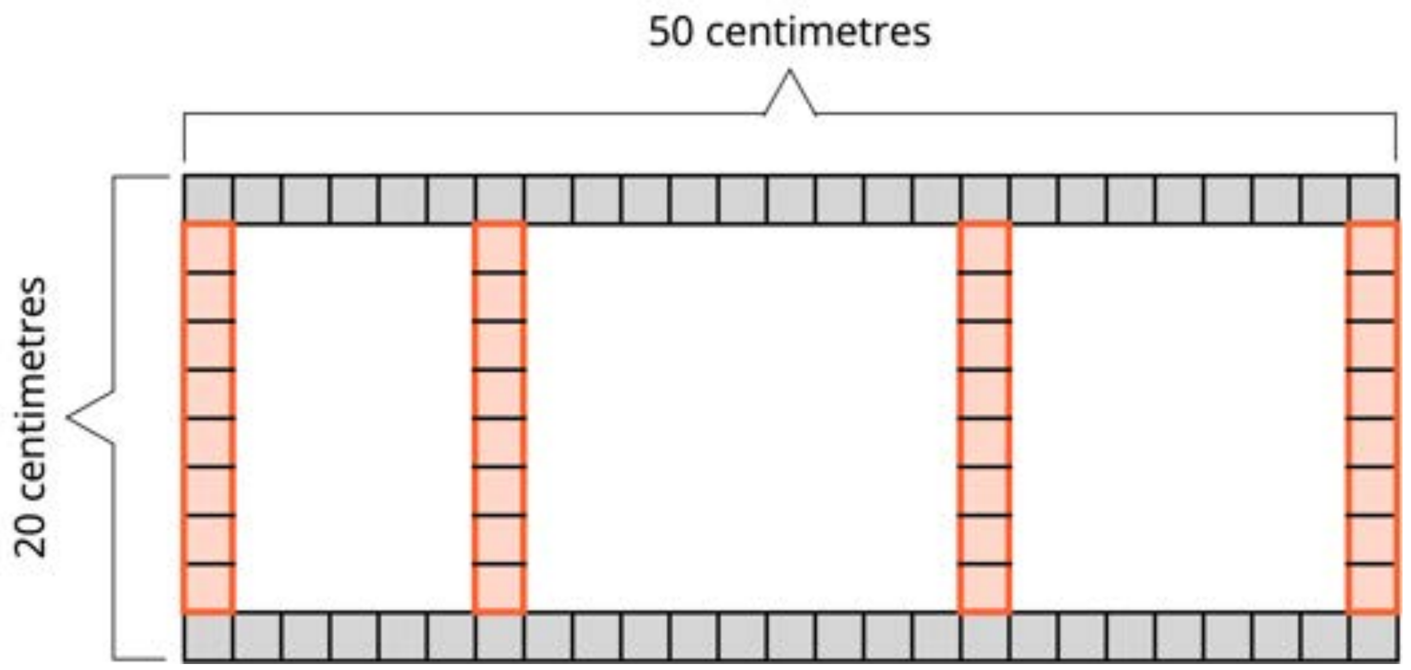
Each stamp has an area of $2\,cm \times 2\,cm = 4\,cm^2$

$50 \times 4\,cm^2 = \mathbf{200\,cm^2}$



3. There are 2 borders and 2 lines of stamps (shown in **orange**) on the 20 centimetre side of the canvas, excluding the stamps along the 50 cm side, is $8 \times 4 = 32$ stamps. Each stamp has an area of $2\,cm \times 2 = 4\,cm^2$

$32 \times 4\,cm^2 = \mathbf{128\,cm^2}$



4. The total area of the stamps is $\mathbf{200\,cm^2} + \mathbf{128\,cm^2} = \mathbf{328\,cm^2}$

We subtract the total area of the stamps from the total area of the white space to find the remaining white space:

$1000\,cm^2 - 328\,cm^2 = \mathbf{672\,cm^2}$

The number of square centimetres in the remaining white space is **672**.

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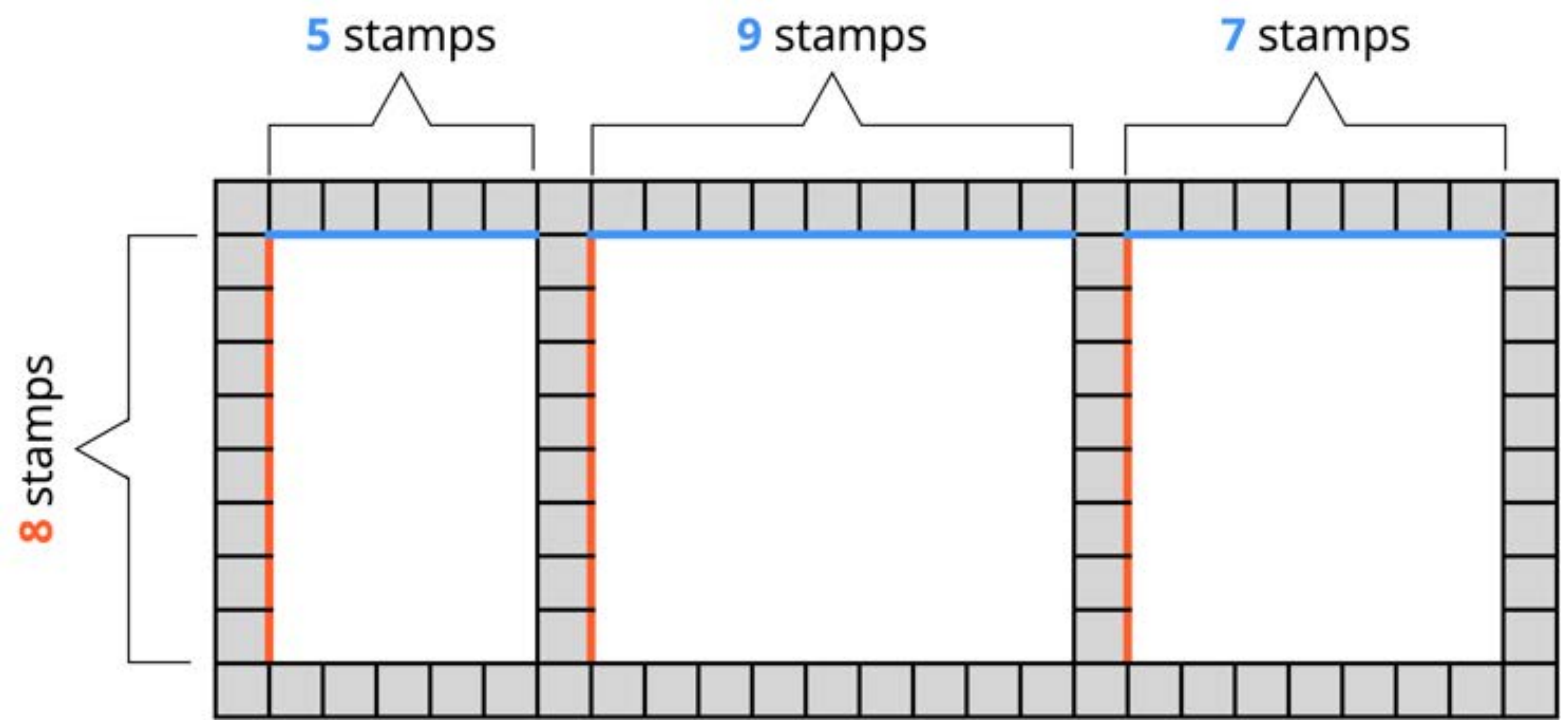
4B - Strategy 2: Draw a diagram and solve a simpler problem.

1. Once Emily has finished placing stamps, there are 3 areas of white space remaining on the canvas. These are separated by 2 lines of 2 cm × 2 cm stamps parallel to the 20 centimetre side.

Instead of calculating the area of each space, we can simplify the diagram by moving the 2 lines so they align with the left side of the canvas.



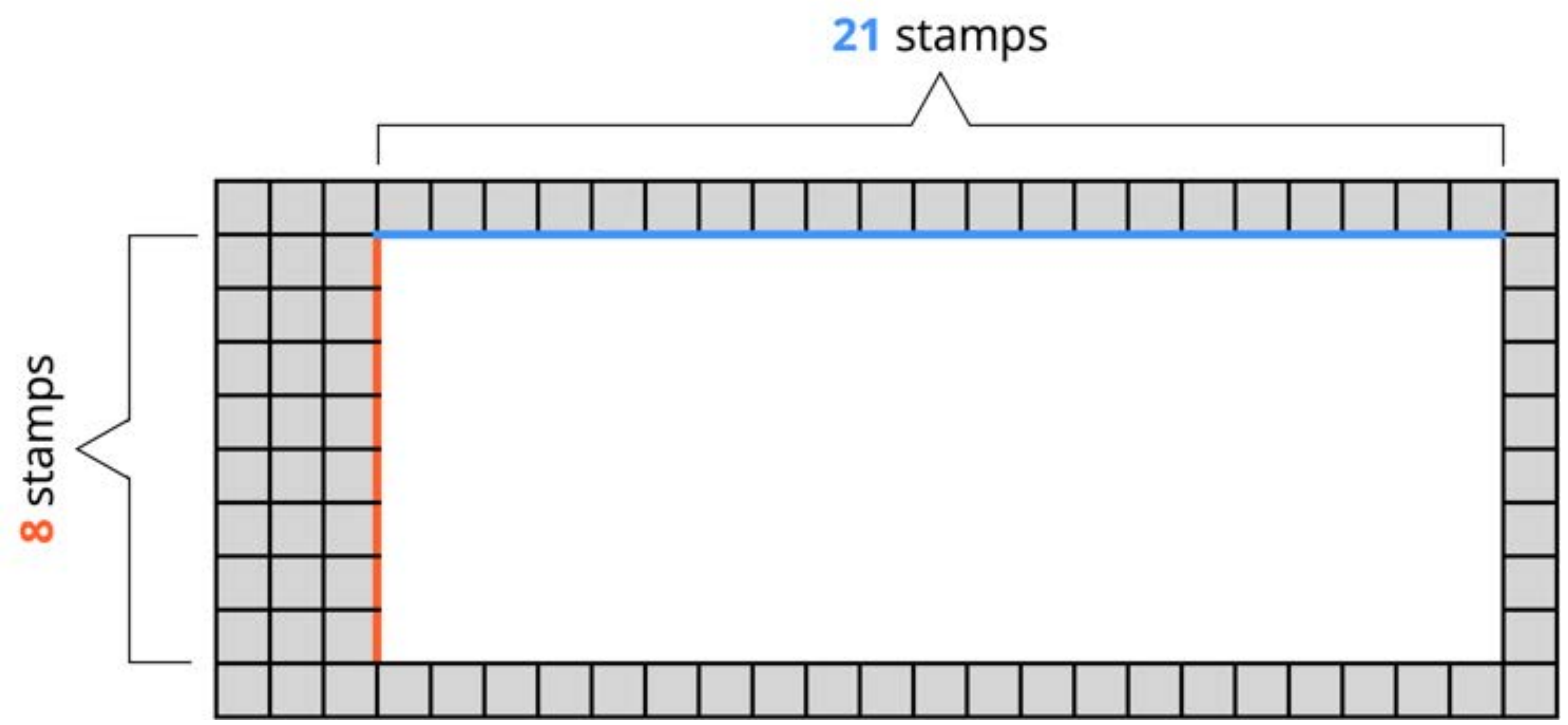
2. This leaves a single white space that has an area of 8 × 21 stamps.

As each stamp is 2 cm × 2 cm, the area of the white space is:

$(2\,\text{cm} \times 8) \times (2\,\text{cm} \times 21)$

$= 16\,\text{cm} \times 42\,\text{cm}$

$= \mathbf{672\,cm^2}$



Click to watch an **animation** of this diagram.

The number of square centimetres in the remaining white space is **672**.

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Three children are playing the game Fleet.

The goal is to capture red ships and blue ships to earn points.

James captures 3 red ships and 5 blue ships, earning 49 points.

Gerry captures 7 red ships and 3 blue ships, earning 71 points.

Chris captures 15 red ships and 12 blue ships.

How many points does Chris earn?

Strategy 1: Build a table and look for a pattern.

Strategy 2: Draw a diagram.

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4C -Strategy 1: Build a table and look for a pattern.

1. Build a table to look for patterns. Record the type and number of ships that James, Gerry and Chris captured, and the points we know.

	Red Ships	Blue Ships	**Points:**
James	3	5	49
Gerry	7	3	71
Chris	15	12	?

2. While Chris has 5 times as many red ships as James, the number of blue ships he has is **not** 5 times the amount that James has.

	Red Ships	Blue Ships	**Points:**
James	**3**	**5**	49
Gerry	7	3	71
Chris	**15**	**12**	?

3. Similarly, while Chris has 4 times as many blue ships as Gerry, he does not have 4 times as many red ships as Gerry does.

	Red Ships	Blue Ships	**Points:**
James	3	5	49
Gerry	**7**	**3**	71
Chris	**15**	**12**	?

4. However, when we **combine** the ships that James and Gerry captured, as well as the points they earned, there is a pattern. Chris has **1½ times** as many red ships as the others do combined, as well as 1½ times the number of blue ships.

	Red Ships	Blue Ships	**Points:**
James & Gerry	10	8	120
Chris	15	12	180

We can **multiply** the combined number of points James and Gerry earned by **1½** to find the number of points that Chris earned.

$120 \times 1\frac{1}{2} = 180$ Chris earned **180** points.

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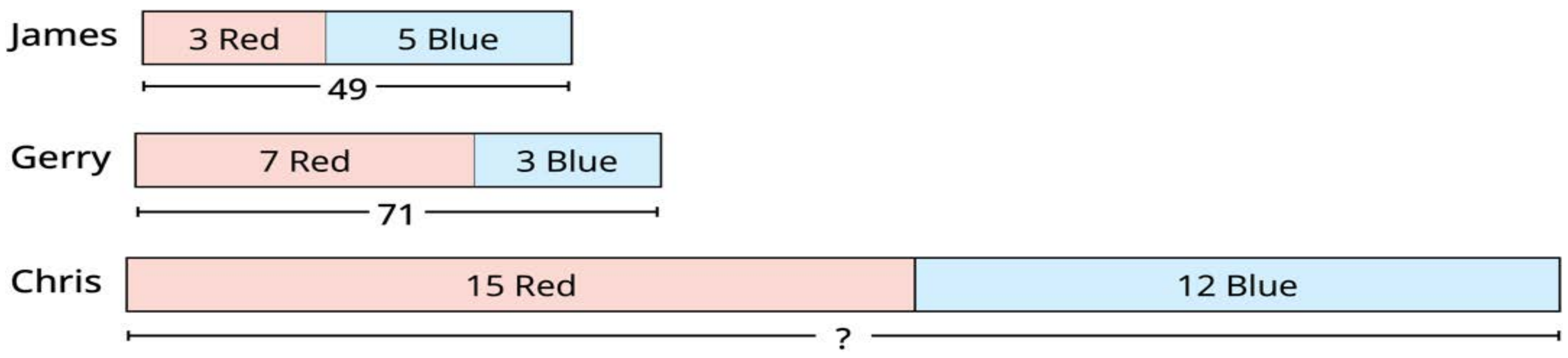
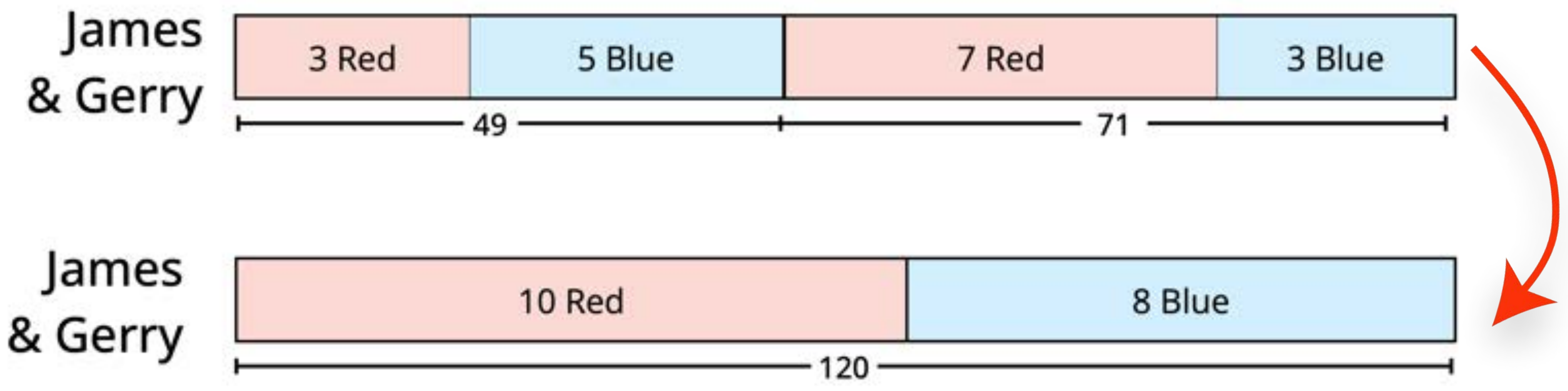
4C - Strategy 2: Draw a diagram.

1. Draw a diagram to model all the relevant information given in the question:

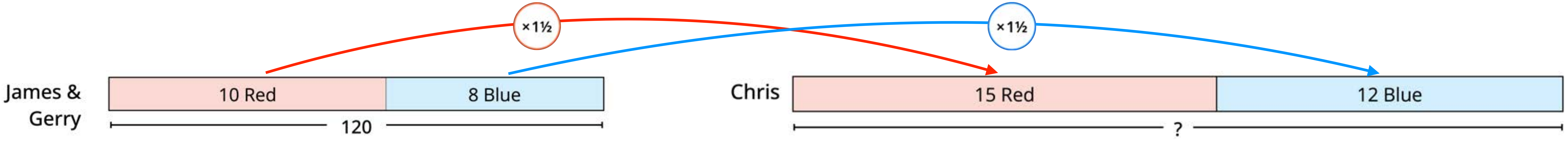


The ratio of red to blue is different in all 3 cases and so no direct conclusion can be drawn regarding the number of points Chris has earned.

2. We can combine the ships and points that James and Gerry have into one bar diagram, simplifying the arrangement to find the total number of red ships, blue ships and points that they share.



3. When this bar diagram is compared to the bar diagram of Chris' ships, the ratio of red ships to blue ships is the same for both James and Gerry ($\frac{10}{8} = \frac{5}{4}$) and Chris ($\frac{15}{12} = \frac{5}{4}$).



We can now calculate the score for Chris by noting that he has 1½ times as many red and blue ships as James and Chris do.

James and Gerry earned 120 points, therefore Chris earned 120 × 1½ = 120 + 60 = 180 points.

Click to watch an **animation** of this diagram and student work samples.

120 × 1½ = 180 Chris earned **180** points.

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The Australasian Problem Solving Mathematical Olympiads: Junior Division Olympiad

Paper 4: Wednesday, September 10 2025

Question 4D

The four-digit numbers *A*42*B* and *B*91*A* have a product of 20,252,025.
What is the two-digit number *AB*?

Strategy: Reason logically using number properties.

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4D - Strategy: Reason logically using number properties.

1. We can reduce our search for ***A*** and ***B*** by reasoning logically with number properties:

$$\begin{array}{r} A\ 4\ 2\ B \\ \times\ B\ 9\ 1\ A \\ \hline 2\ 0\ 2\ 5\ 2\ 0\ 2\ 5 \end{array}$$

- Neither ***A*** or ***B*** can be even numbers as the product of ***A***42***B*** × ***B***91***A*** an **odd** number.
- The product ends in **5**. This means either ***A*** or ***B*** **must** be **5**.
- ***A*** and ***B*** **can't both be 5**, or **more than 5**, as the product of 5,000 × 5,000 is 25,000,000

The remaining digits for *A* and *B* are **1**, **3** and **5**.
As either *A* or *B* must be **5**, there are 4 possible combinations remaining:

	A	B
i	5	1
ii	5	3
iii	1	5
iv	3	5

2. These combinations can be checked by completing the full calculation, however this is not necessary as the final 2 digits in the product of ***A***42***B*** × ***B***91***A*** can be found by calculating 2***B*** and 1***A***.

The digits in the other 2 columns do not contribute to the units and tens column.

A **cannot** be **5** when *B* is **1**.
The final 2 digits in the product of this combination are 1 and 5.

$$\begin{array}{r} 5\ 4\ 2\ 1 \\ \times\ 1\ 9\ 1\ 5 \\ \hline 0\ 5 \\ 1\ 0 \\ \hline 1\ 5 \end{array}$$

A **cannot** be **5** when *B* is **3**.
The final 2 digits in the product of this combination are 4 and 5.

$$\begin{array}{r} 5\ 4\ 2\ 3 \\ \times\ 3\ 9\ 1\ 5 \\ \hline 1\ 1\ 5 \\ 2\ 3\ 0 \\ \hline 3\ 4\ 5 \end{array}$$

A **cannot** be **1** when *B* is **5**.
The final 2 digits in the product of this combination are 7 and 5.

$$\begin{array}{r} 1\ 4\ 2\ 5 \\ \times\ 5\ 9\ 1\ 1 \\ \hline 2\ 5 \\ 2\ 5\ 0 \\ \hline 2\ 7\ 5 \end{array}$$

3. *A* can be **3** when *B* is **5**.
The final 2 digits in the product of this combination are 2 and 5.
A42***B*** and ***B***91***A*** have a product of 20,252,025 when ***A*** is **3** and ***B*** *is* ***5***.

$$\begin{array}{r} 3\ 4\ 2\ 5 \\ \times\ 5\ 9\ 1\ 3 \\ \hline 7\ 5 \\ 2\ 5\ 0 \\ \hline 3\ 2\ 5 \end{array}$$

The two-digit number *AB* is **35.**

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Margaret River is 275 kilometres from Perth along a certain route.

A cyclist starts from Perth at 11 am. and travels along this route towards Margaret River at a steady rate of 35 km/h.

Another cyclist starts from Margaret River at midday and travels along this route towards Perth at a steady rate of 45 km/h.

At what time do the cyclists pass each other?

Strategy 1: Draw a diagram.

Strategy 2: Reason logically.

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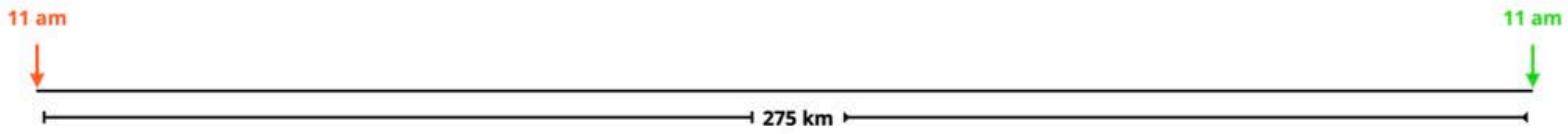
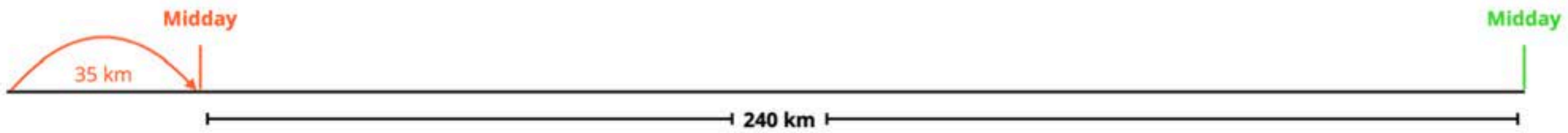
4E - Strategy 1: Draw a diagram.

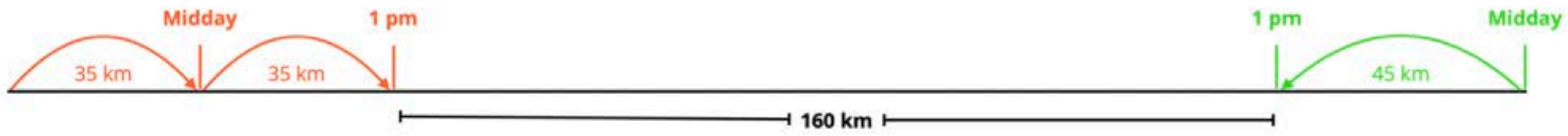
At 11 am the cyclists are **275 km** apart.



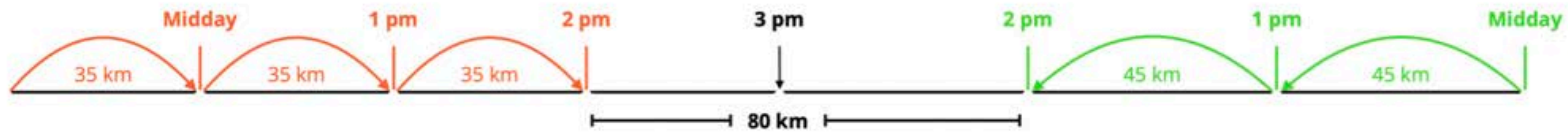
From 11 am to midday, the cyclist from Perth travels 35 km. They are now **240 km** apart.



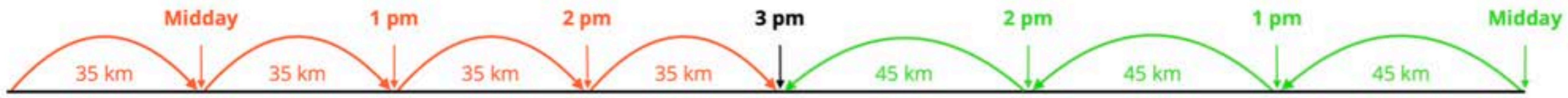
From midday, the cyclists travel a total of 35 km + 45 km = 80 km toward each other each hour.
At 1 pm they are **160 km** apart.



At 2 pm the cyclists are **80 km** apart.



Between them, the cyclists travel the remaining **80 km** in one hour.



4E - Strategy 2: Reason logically.

From 11 am to midday, the cyclist from Perth travels 35 of the **275 km**.

At midday, **240 km** remains between the cyclists.

From midday, the cyclists travel a total of
35 km + 45 km = **80 km** toward each other **each hour**.

240 km ÷ 80 km/h = **3 hours.**

Therefore, the cyclists will pass each other 3 hours after midday at **3 pm**.

The cyclists pass each other at **3 pm.**

Click to complete a short class **survey:**

Click to watch an **animation** of this diagram.

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