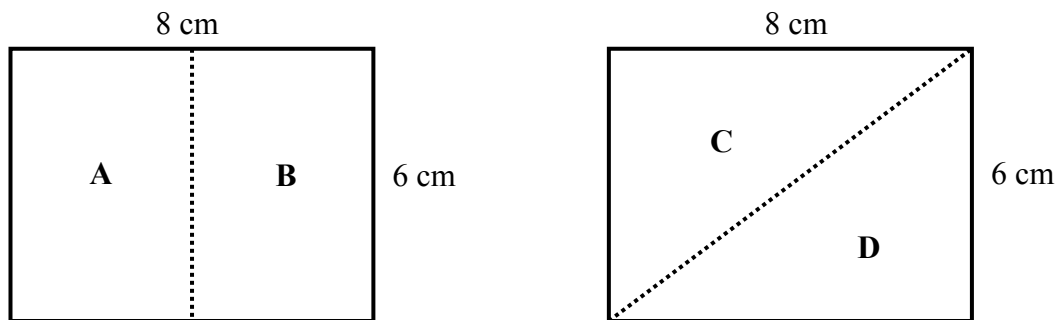


Question 1**15 Marks**

The diagram below shows two rectangular sheets of paper, with sides of length 6 cm and 8 cm. Each sheet is cut in half along the dotted line, to form the pieces **A**, **B**, **C**, and **D**.



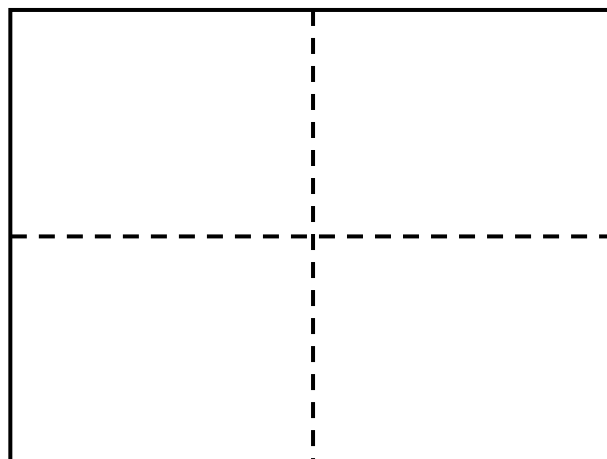
- (a) Is the area of the rectangular piece **A** equal to the area of the triangular piece **D**?
Give a reason for your answer.

Answer: Yes

Reason: Each is half of the same rectangle

Or: Area of A = $\frac{1}{2} \times (8 \times 6) = 24 \text{ cm}^2$ and Area of D = $\frac{1}{2} (8 \times 6) = 24 \text{ cm}^2$

- (b) Draw **all** the axes of symmetry of the following rectangle.



Question 2**10 Marks**

Students in a class were carrying out a survey on sleeping patterns of people aged between 40 years and 60 years, inclusive. The following questions were considered for the survey.

In each case, give **one reason** why the question is unsuitable, and rewrite it in a **suitable form**.

- (a) Question 1: Put a tick (✓) in **one** box below to indicate your age, in years.

40 – 45

☐

45 – 50

☐

50 – 55

☐

55 – 60

☐

Explanation: Ages overlap

Suitable form: *For example:*

Put a tick (✓) in one box below to indicate your age, in years.

40 – 44

☐

45 – 49

☐

50 – 54

☐

55 – 60

☐

- (b) Question 2: Normal people sleep eight hours a night. Do you sleep eight hours a night?

Explanation: Encourages people to say that they sleep eight hours a night.

Suitable form: *For example:* How many hours a night do you sleep?

Or: Do you sleep eight hours (or more) a night?

Question 3**35 Marks**

A game is played using the two spinners shown below.

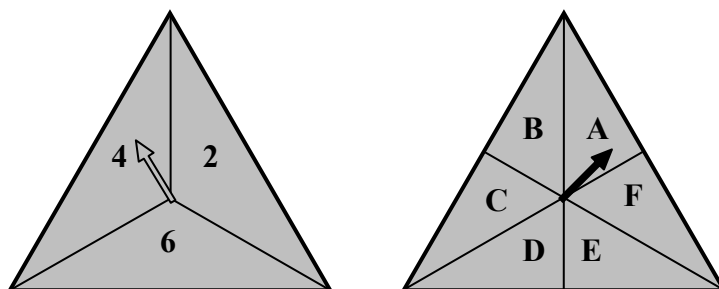
The first spinner has three segments labelled **2**, **4**, and **6**.

The arrow has the same chance of stopping at each number.

The second spinner has six segments labelled **A**, **B**, **C**, **D**, **E**, and **F**.

The arrow has the same chance of stopping at each letter.

Two possible outcomes are **(2, A)** and **(6, D)**.



(i) List all the possible outcomes in the table below.

	A	B	C	D	E	F
2	(2, A)	(2, B)	(2, C)	(2, D)	(2, E)	(2, F)
4	(4, A)	(4, B)	(4, C)	(4, D)	(4, E)	(4, F)
6	(6, A)	(6, B)	(6, C)	(6, D)	(6, E)	(6, F)

(ii) How many outcomes contain the letter **E**?

3 outcomes

(iii) What is the probability that the outcome contains the letter **E**?

$\frac{3}{18}$ or $\frac{1}{6}$

(iv) What is the probability that the outcome contains the number **6**?

$\frac{6}{18}$ or $\frac{1}{3}$

(v) What is the probability that the outcome contains **E**, or **6**, or both?

$\frac{8}{18}$ or $\frac{4}{9}$

Question 4

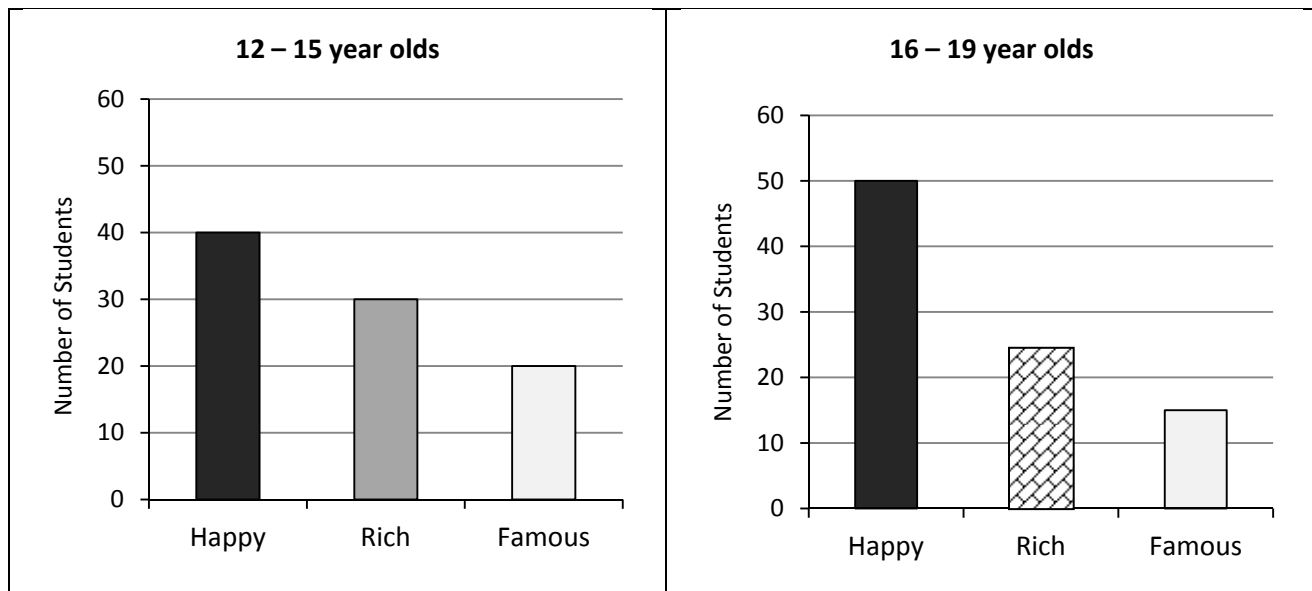
30 Marks

In a survey, two groups of students were asked whether they would prefer to be **Happy**, **Rich**, or **Famous**.

The first group consisted of 12 – 15 year olds.

The second group consisted of 16 – 19 year olds.

Most of the survey results are displayed in the bar charts below.



- (i) How many 12 – 15 year olds were surveyed, in total?

$$40 + 30 + 20 = 90$$

- (ii) There was the same number of students in each group.

Use this information to fill in the missing bar in the graph for the 16 – 19 year olds.

$$50 + 15 = 65$$

$$90 - 65 = 25$$

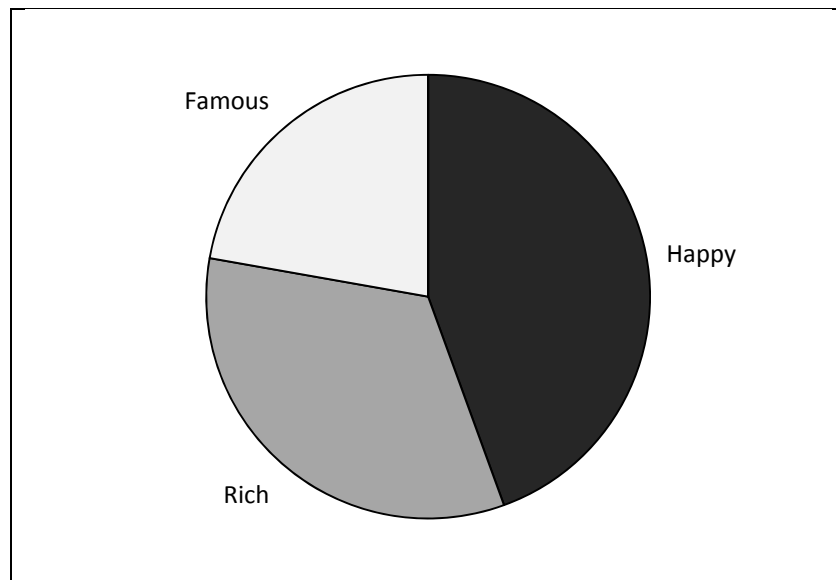
See graph

- (iii) What fraction in each group would prefer to be **Happy**?

12 - 15 year olds: $\frac{40}{90}$ or $\frac{4}{9}$

16 - 19 year olds: $\frac{50}{90}$ or $\frac{5}{9}$

The results from one of the groups are displayed in the pie chart below.



- (iv) Does this pie chart represent the results of the 12 – 15 year olds, or the 16 – 19 year olds?
Give a reason for your answer.

Answer: 12 – 15 year olds

Reason: **Happy** is less than half of pie chart, *or equivalent.*

Or measures at least one angle, and calculates what angle should be from data on previous page.

Question 5**50 Marks**

A class of 20 students took an on-line test.

The time, in seconds, it took each student to complete the test is shown below.

15 22 17 49 12 24 15 23 8 21
16 15 20 9 26 32 8 19 18 30

(i) Represent the data on a stem-and-leaf diagram.

0	8	8	9					
1	2	5	5	5	6	7	8	9
2	0	1	2	3	4	6		
3	0	2						
4	9							
Key: 1 6 = 16 seconds								

(ii) Find the **range** of the data.

$$\text{Range} = 49 - 8 = 41 \text{ seconds}$$

(iii) Find the **mode** of the data.

$$\text{Mode} = 15 \text{ seconds}$$

(iv) Find the **mean** of the data. Give your answer correct to the nearest second.

$$\begin{aligned}\text{Mean} &= (8+8+9+12+15+15+15+16+17+18+19+20+21+22+23+24+26+30+32+49) / 20 \\ &= 399/20 \\ &= 19.95 \\ &= 20 \text{ seconds (correct to the nearest second)}\end{aligned}$$

Seán had a problem with his computer and it took him longer than the other students to complete the on-line test.

(v) How long did it take Seán to complete the test?

49 seconds

(vi) The teacher said she would leave out Seán's time when she calculated the mean.

Would you expect her answer to be bigger or smaller than the mean of the whole class?

Give a reason for your answer.

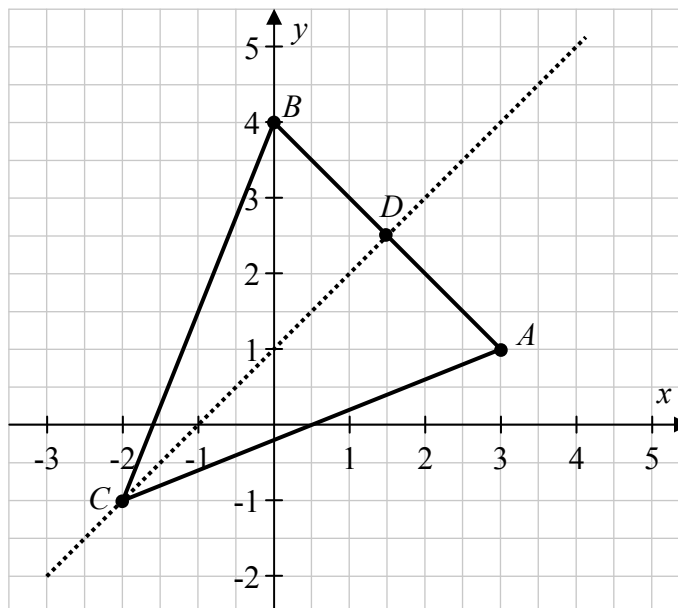
Answer: Smaller

Reason: 49 is a large number; or $(399 - 49)/19 = 18.42...$

Question 6

35 Marks

- (i) Plot the points $A(3,1)$, $B(0,4)$, and $C(-2,-1)$ on the grid below. Join the points to form a triangle.



- (ii) By calculating $|AC|$ and $|BC|$, show that $|AC| = |BC|$.

$$|AC| = \sqrt{2^2 + 5^2} = \sqrt{29}$$

$$|BC| = \sqrt{2^2 + 5^2} = \sqrt{29}$$

- (iii) What type of triangle is $\triangle ABC$?

Isosceles

- (iv) D is the midpoint of $[AB]$. Find the co-ordinates of D .

$$D = \left(\frac{3}{2}, \frac{5}{2} \right) \text{ or } (1.5, 2.5)$$

- (v) Draw the line CD on the diagram.

- (vi) Show that the triangles $\triangle ADC$ and $\triangle BDC$ are congruent. Use SSS or SAS.

SSS:

$\triangle ADC$ $\triangle BDC$

$$|AC| = |BC| \dots\dots \text{from (ii)}$$

$$|BD| = |DA| \dots\dots D \text{ is midpoint of } [AB]$$

$$|CD| = |CD| \dots\dots \text{common}$$

SAS:

$\triangle ADC$ $\triangle BDC$

$$|AC| = |BC| \dots\dots \text{from (ii)}$$

$$|BD| = |DA| \dots\dots D \text{ is midpoint of } [AB]$$

$$|\angle CBD| = |\angle CAD| \dots\dots \text{isosceles triangle}$$

Question 7**20 Marks**

- (a) The following terms can be used to describe the probability that an event happens.

Likely Certain Unlikely Impossible 50 : 50

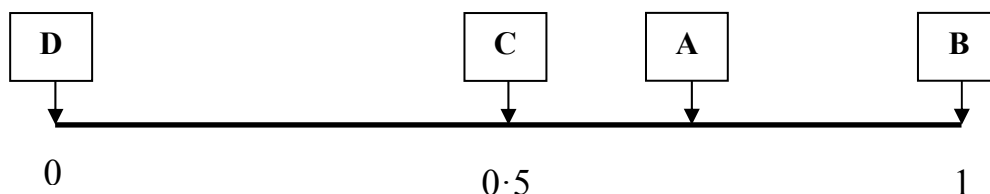
For each event in the table below, use one of these terms to describe the probability that it happens.

Event	Probability
When a fair coin is tossed you get a head.	50:50
If you buy a lottery ticket for next Saturday's draw, you will win the jackpot.	Unlikely
The 1st of January will be New Year's Day.	Certain

- (b) Four events, **A**, **B**, **C**, and **D**, are listed below.

- A:** You pick a red ball from a bag containing 3 black and 7 red balls.
B: You get a natural number less than 7 when you roll a regular six-sided die.
C: You pick a red card from a deck of playing cards.
D: You pick a yellow ball from a bag containing 4 red balls and 2 white balls.

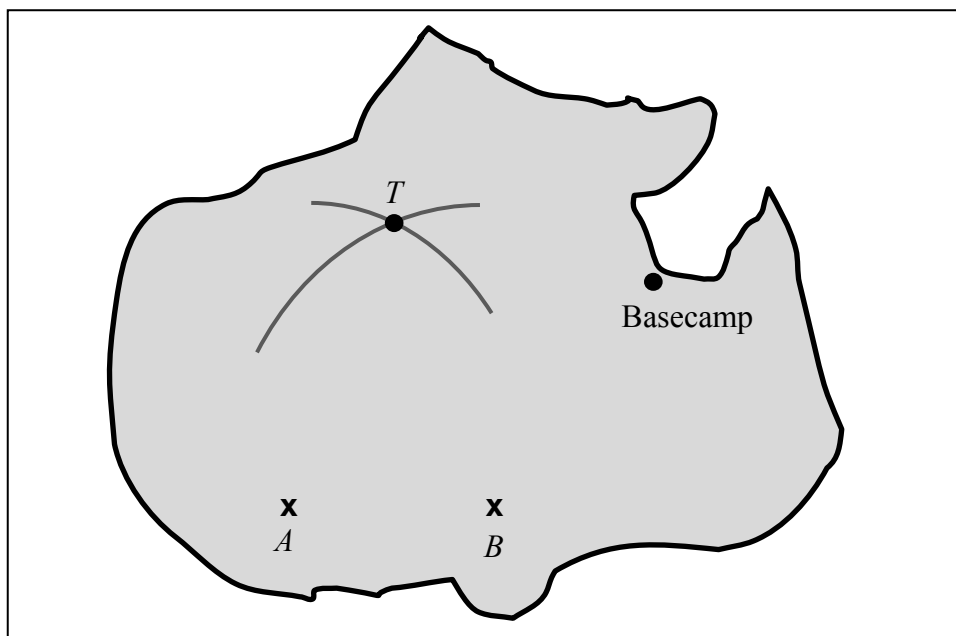
Write each of the letters **A**, **B**, **C**, and **D** into the correct box on the probability scale below, to show the probability of each event.



Question 8**25 Marks**

On a reality TV show, contestants have to perform tasks on an island. They are given the map of the island shown below.

Two points, A and B , are marked with **x**'s. Basecamp is also marked.



The contestants are told that treasure is buried on the island at a point T .

T is 20 km from A and 20 km from B .

- (i) The map is drawn to a scale of 1 cm to 5 km. **On the map**, how far is T from the point A ?

$$20 \div 5 = 4 \text{ cm}$$

- (ii) Using a compass, construct the point T on the map. Label the point T .

- (iii) Measure the distance from the point T to Basecamp on your map, and hence find the actual distance, in km, from the point T to Basecamp.

On map: 3.5 cm.

Actual distance = $3.5 \times 5 = 17.5$ km.

- (iv) The contestants find the treasure at 13:00 and return to Basecamp immediately.

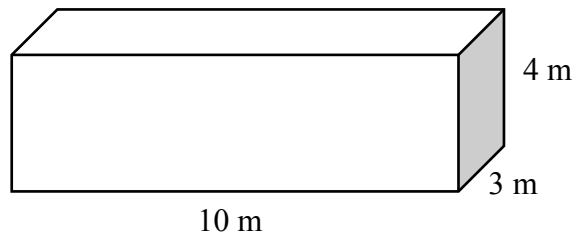
If they walk at an average speed of 6 km per hour, find the time they reach Basecamp.

$$\text{Time} = \frac{\text{Distance}}{\text{Speed}} = \frac{17.5}{6} = 2\frac{11}{12} \text{ hours, i.e. 2 hours and 55 minutes.}$$

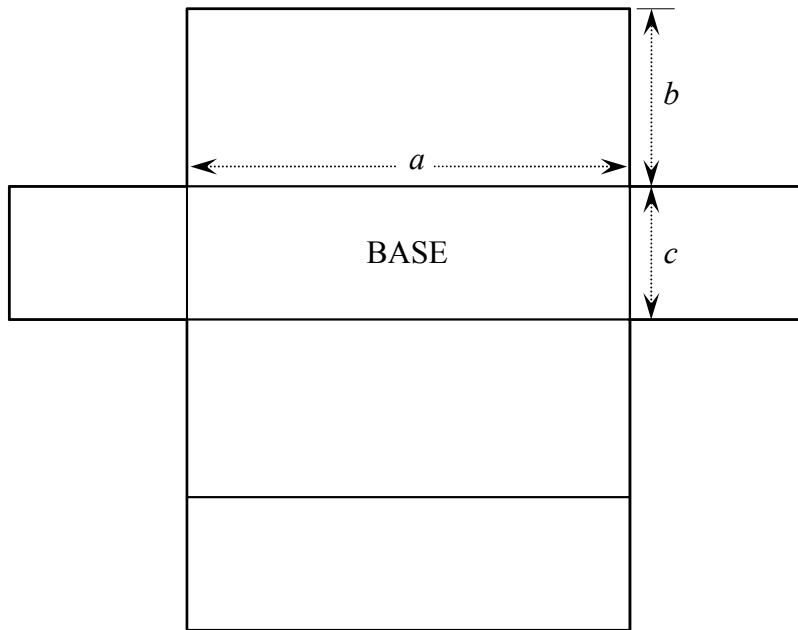
Answer: 15:55.

Question 9**20 Marks**

A rectangular tank has a length of 10 m, a width of 3 m, and a height of 4 m, as shown.



A diagram of the net of this tank is shown below.



- (i) Write down the values of a , b , and c .

 $a =$

10 m

 $b =$

4 m

 $c =$

3 m

- (ii) Find the total surface area of the tank, in m^2 .

$$2 \times [(10 \times 4) + (10 \times 3) + (4 \times 3)] = 164 \text{ m}^2$$

- (iii) Find the volume of the tank, in litres. Note: $1 \text{ m}^3 = 1000 \text{ litres}$.

$$\text{Volume} = 10 \times 4 \times 3 = 120 \text{ m}^3$$

$$\text{In litres} = 120 \times 1000 = 120\,000 \text{ litres}$$

- (iv) The tank is filled with water to a depth of 50 cm.
Find the volume of water in the tank, in litres.

<p><i>Either:</i></p> $10 \times 0.5 \times 3 = 15 \text{ m}^3$ <p>In litres = $15 \times 1000 = 15\,000$ litres</p>	<p><i>Or:</i></p> <p>50 cm is $\frac{1}{8}$ th of height, so will be $\frac{1}{8}$ th of vol.</p> $\frac{1}{8} \times 120\,000 = 15\,000 \text{ litres.}$
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Question 10

15 Marks

Ray is fitting draught excluders around the outside of one of his windows.
To do this, he needs to find the perimeter of the window.

The window is in the shape of a semicircle above a rectangle, as shown.

The diameter of the semicircle is 1.2 metres.

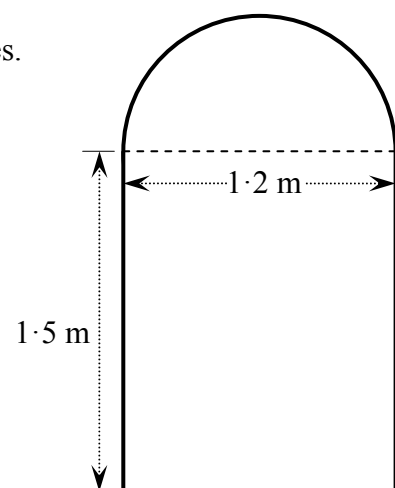
The length of the rectangle is 1.5 metres.

- (i) What is the radius of the semicircle?

$$1.2 \div 2 = 0.6 \text{ m}$$

- (ii) Find the length of the semicircle.
Give your answer in metres, correct to two decimal places.

$$\begin{aligned} \text{Half of } 2\pi r &= 0.5 \times (2 \times \pi \times 0.6) \\ &= 1.88 \text{ m (correct to two decimal places)} \end{aligned}$$

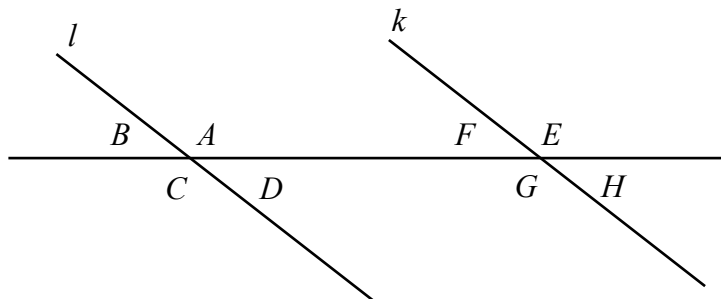


- (iii) Find the perimeter of Ray's window.
Give your answer in metres, correct to two decimal places.

$$1.88 + 1.5 + 1.2 + 1.5 = 6.08 \text{ m (correct to two decimal places)}$$

Question 11**10 Marks**

In the diagram below, the line l is parallel to the line k .
The angles A , B , C , D , E , F , G , and H are marked on the diagram.



(i) Write down a pair of angles that are **vertically opposite**.

B and D ,
or A and C ,
or F and H ,
or E and G .

(ii) Write down a pair of angles that are **corresponding**.

B and F ,
or A and E ,
or C and G ,
or D and H .

(iii) Write down a pair of angles that are **alternate**.

A and G ,
or D and F .
Also accept the externally alternate angles:
 B and H ,
or C and E .

(iv) Given $|\angle A| = 137^\circ$, find the measure of the angles G and H .

$$|\angle G| = |\angle A| = 137^\circ$$

$$|\angle H| = 180^\circ - |\angle A| = 43^\circ$$

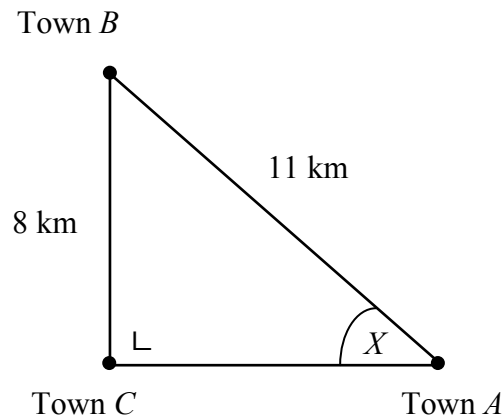
Question 12**20 Marks**

The towns A , B , and C are shown in the diagram below.

The distance between A and B is 11 km.

The distance between B and C is 8 km.

The angle at C is a right angle.



- (i) Write down the length of the **hypotenuse** of the triangle ABC .

Hypotenuse = 11 km

The angle X is marked in the diagram.

- (ii) Write down the length of the side **opposite** the angle X .

Opposite = 8 km

- (iii) Find $\sin X$.

$$\sin X = \frac{8}{11}$$

- (iv) Use your answer to (iii) to find the size of the angle X .
Give your answer correct to the nearest degree.

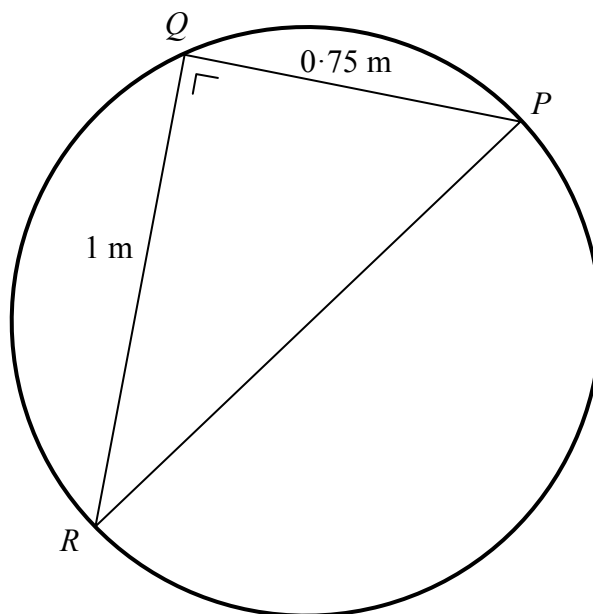
$$X = \sin^{-1}\left(\frac{8}{11}\right) = 47^\circ \text{ (correct to the nearest degree)}$$

Question 13**10 Marks**

A circular table is shown in the diagram below. Aoife is trying to find the centre of the table.

She constructs the right-angled triangle PQR as shown, with $|QR| = 1$ m and $|\angle RQP| = 90^\circ$.

She measures $|QP|$, and finds that $|QP| = 0.75$ m.



Aoife says that the centre of the circular table must be on $[PR]$.

- (i) Explain why Aoife is correct.

$|\angle PQR| = 90^\circ$, so $[PR]$ is a diameter

- (ii) Use the Theorem of Pythagoras to calculate the length $|PR|$.
Give your answer in centimetres.

Working in cm:

$$|PR|^2 = 100^2 + 75^2 = 15\,625$$

$$|PR| = \sqrt{15\,625} = 125 \text{ cm}$$

Working in m:

$$|PR|^2 = 1^2 + 0.75^2 = 1.5625$$

$$|PR| = \sqrt{1.5625} = 1.25 \text{ m} = 125 \text{ cm.}$$

- (iii) Find the radius of the table. Give your answer in centimetres.

$$125 \div 2 = 62.5 \text{ cm}$$

Question 14

5 Marks

Without measuring, divide the line segment $[AB]$ below into 3 equal segments.

