Coimisiún na Scrúduithe Stáit
State Examinations Commission

Junior Certificate Examination 2014

Mathematics
(Project Maths – Phase 3)

Paper 2

Ordinary Level

Monday 9 June – Morning, 9:30 to 11:30

300 marks

Examination number

Centre stamp

Running total	

For examiner			
Question	Mark	Question	Mark
1		11	
2		12	
3		13	
4		14	
5			
6			
7			
8			
9			
10		Total	

Grade

Instructions

There are 14 questions on this examination paper. Answer **all** questions.

Questions do not necessarily carry equal marks. To help you manage your time during this examination, a maximum time for each question is suggested. If you remain within these times you should have about 10 minutes left to review your work.

Write your answers in the spaces provided in this booklet. You may lose marks if you do not do so. You may also ask the superintendent for more paper. Label any extra work clearly with the question number and part.

The superintendent will give you a copy of the *Formulae and Tables* booklet. You must return it at the end of the examination. You are not allowed to bring your own copy into the examination.

You will lose marks if all necessary work is not clearly shown.

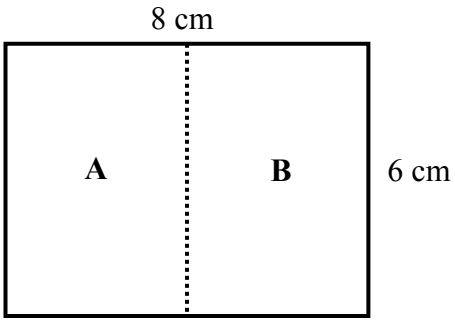
Answers should include the appropriate units of measurement, where relevant.

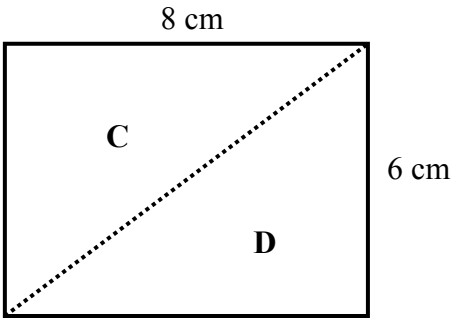
Answers should be given in simplest form, where relevant.

Write the make and model of your calculator(s) here:

Question 1 **(Suggested maximum time: 5 minutes)**

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**.



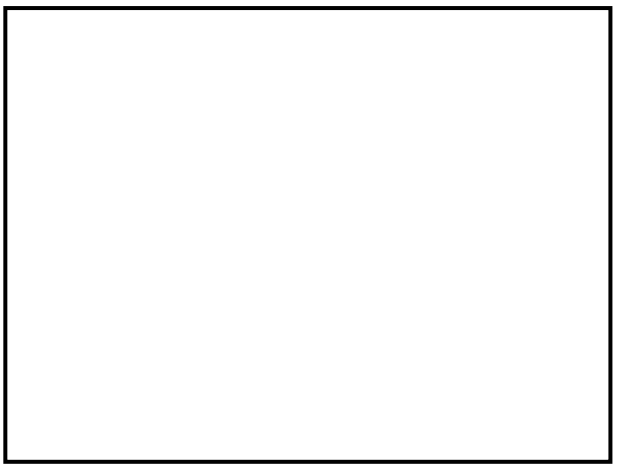


(a) Is the area of the rectangular piece **A** equal to the area of the triangular piece **D**? Give a reason for your answer.

Answer:

Reason:

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



Question 2 **(Suggested maximum time: 5 minutes)**

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
❒	❒	❒	❒

Reason:

Suitable form:

(b)

Question 2: Normal people sleep eight hours a night. Do you sleep eight hours a night?

Reason:

Suitable form:

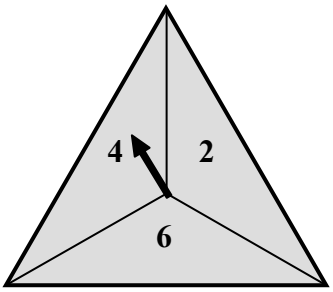
Question 3 **(Suggested maximum time: 5 minutes)**

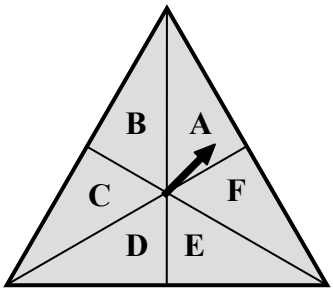
A game is played using the two spinners shown below.

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**)					
4						
6				(**6**, **D**)		

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

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

Answer = ——

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

Answer = ——

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

Answer = ——

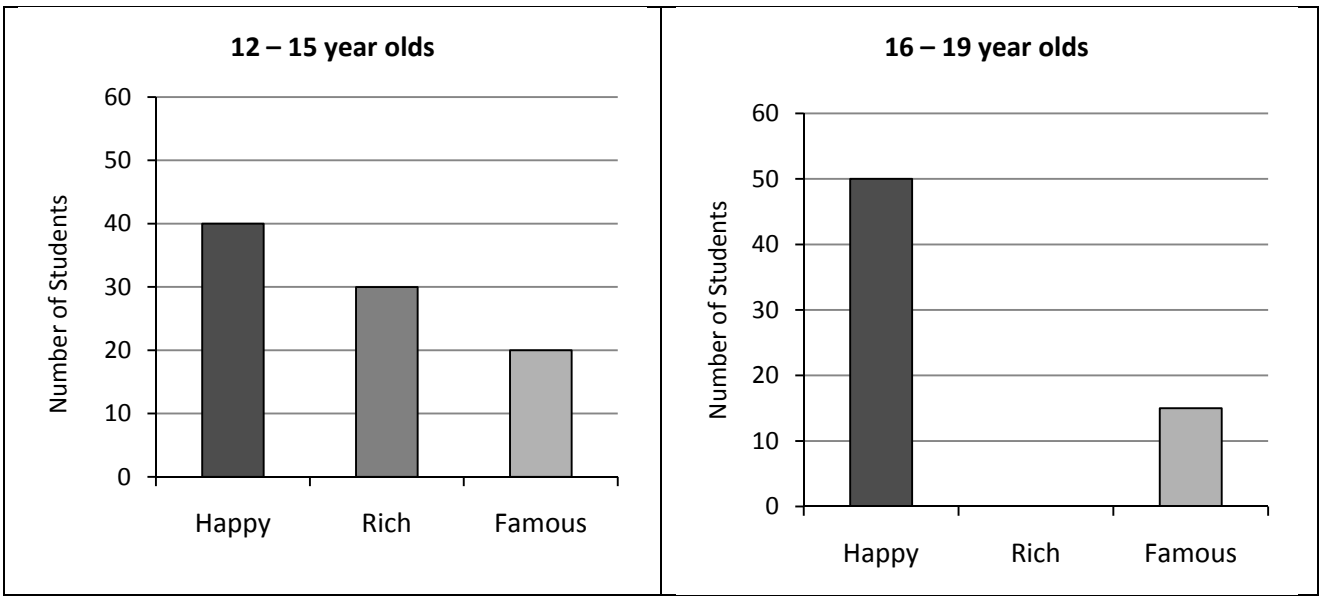
Page running

Question 4 **(Suggested maximum time: 10 minutes)**

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?

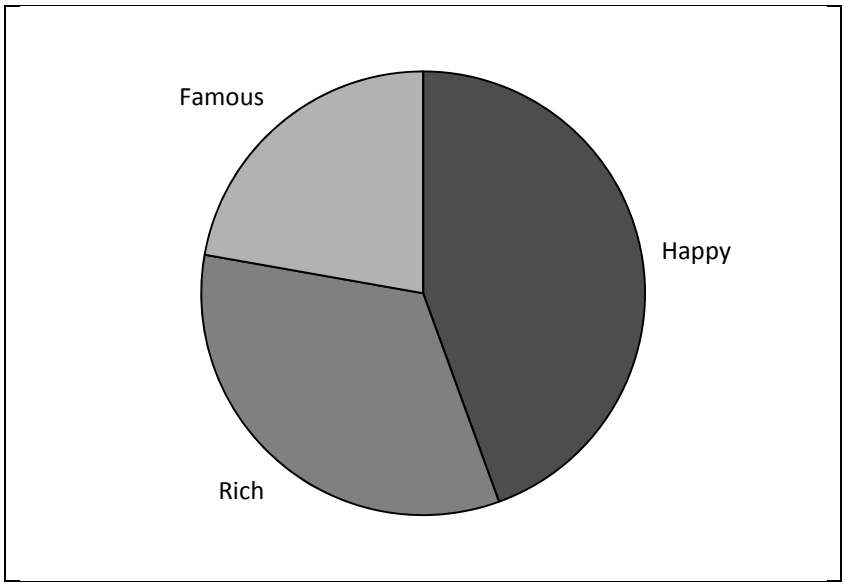
(ii) There was the same number of students in each group.
Use this information to fill in the missing bar in the graph for the 16 – 19 year olds.

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

12 – 15 year olds:

16 – 19 year olds:

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:

Reason:

Question 5 **(Suggested maximum time: 15 minutes)**

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								
1								
2								
3								
4								

Key: 1 | 6 = ____

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

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

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

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?

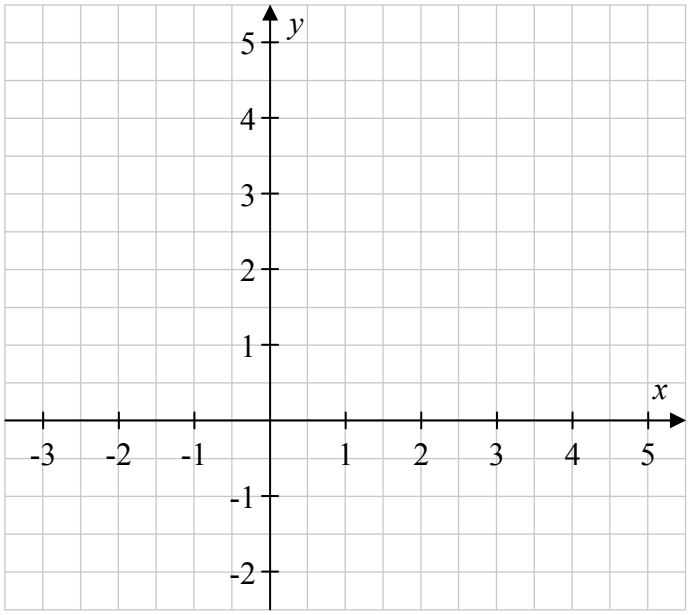
(vi) The teacher said she would leave out Seán's time when she calculated the mean.
Would you expect her answer to be bigger or smaller than the mean of the whole class?
Give a reason for your answer.

Answer:

Reason:

Question 6 **(Suggested maximum time: 15 minutes)**

(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 $|AC| = |BC|$.

$|AC|$:

$|BC|$:

(iii) What type of triangle is ΔABC?

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

(v) Draw the line CD on the diagram.

(vi) Show that the triangles ΔADC and ΔBDC are congruent. Use SSS or SAS.

Question 7 **(Suggested maximum time: 5 minutes)**

(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.	
If you buy a lottery ticket for next Saturday's draw, you will win the jackpot.	
The 1st of January will be New Year's Day.	

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

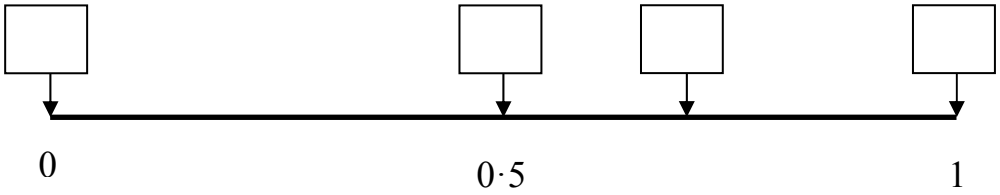
A: You pick a red ball from a bag containing 3 black and 7 red balls.

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.

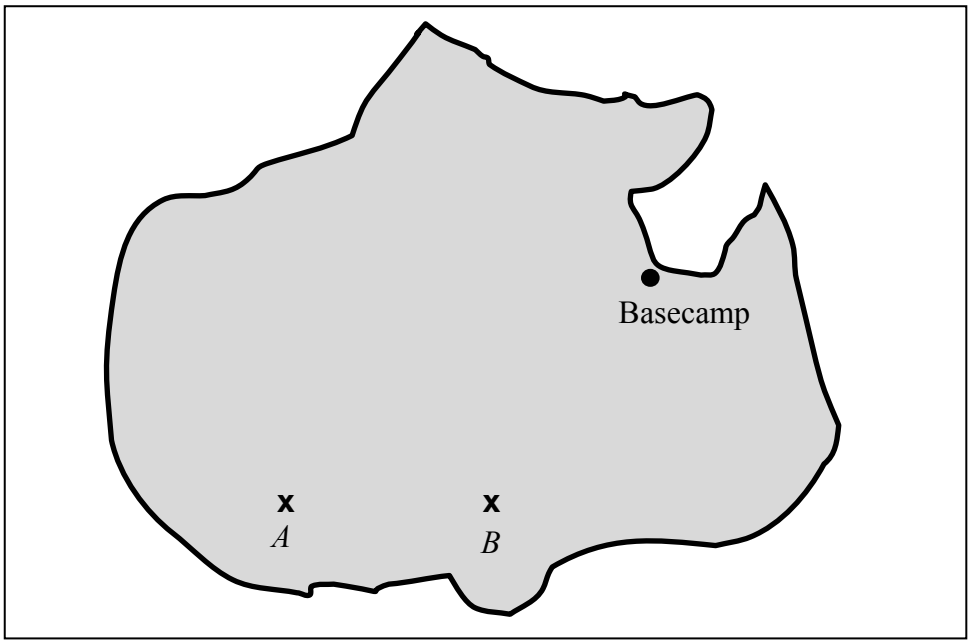
Write each of the letters **A**, **B**, **C**, and **D** into the correct box on the probability scale below, to show the probability of each event.



Question 8 **(Suggested maximum time: 10 minutes)**

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*?

Answer: _____ cm

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

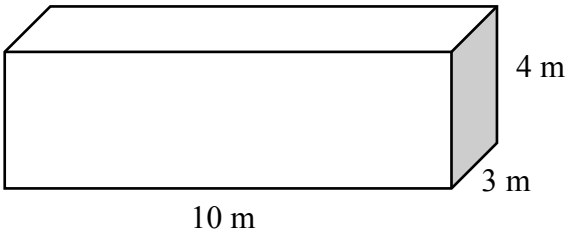
(iii) Measure the distance from the point *T* to Basecamp on your map, and hence find the actual distance, in km, from the point *T* to Basecamp.

Answer: _____ km

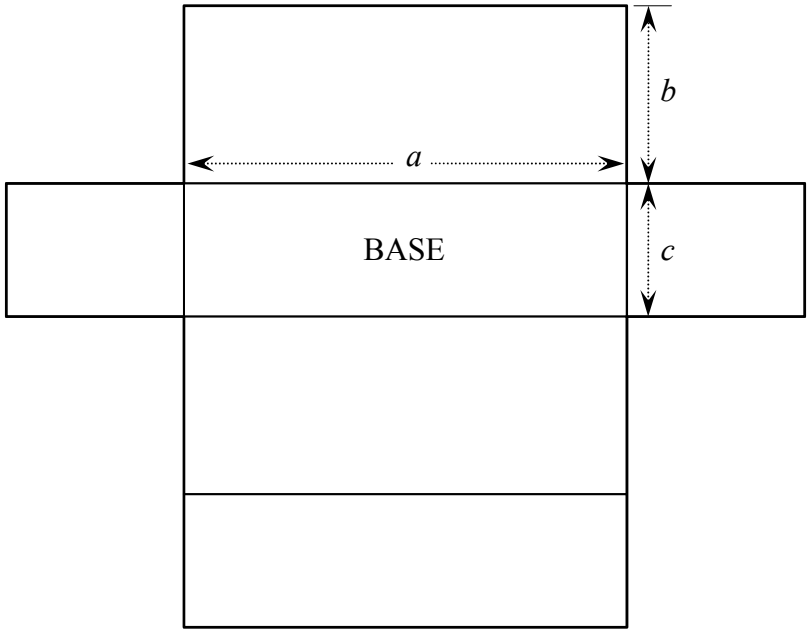
(iv) The contestants find the treasure at 13:00 and return to Basecamp immediately.
If they walk at an average speed of 6 km per hour, find the time they reach Basecamp.

Question 9 **(Suggested maximum time: 10 minutes)**

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.

$a =$ ____ $b =$ ____ $c =$ ____

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

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

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

Question 10 **(Suggested maximum time: 5 minutes)**

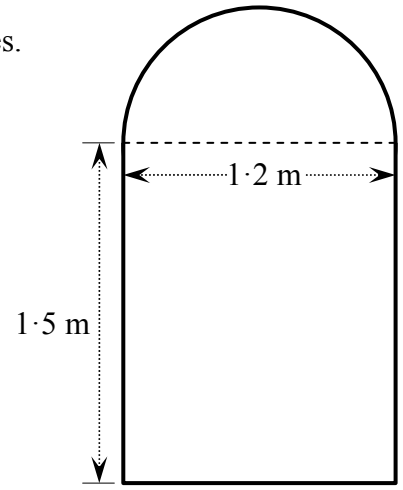
Ray is fitting draught excluders around the outside of one of his windows.
To do this, he needs to find the perimeter of the window.

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?

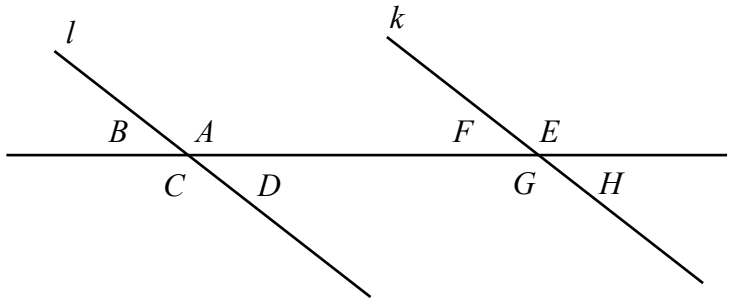
(ii) Find the length of the semicircle.
Give your answer in metres, correct to two decimal places.



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

Question 11 **(Suggested maximum time: 5 minutes)**

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**: ☐ and ☐.

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

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

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

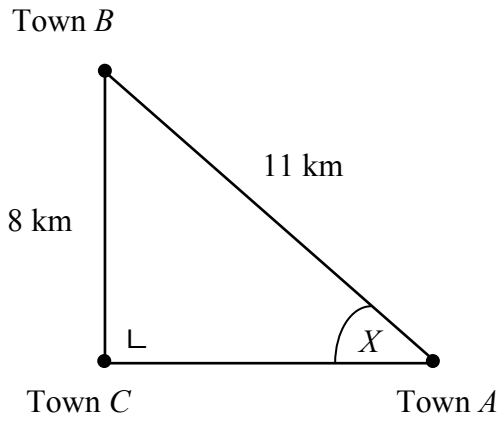
$|\angle G| =$ $|\angle H| =$

Question 12 **(Suggested maximum time: 10 minutes)**

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 =

The angle X is marked in the diagram.

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

Opposite =

(iii) Find $\sin X$.

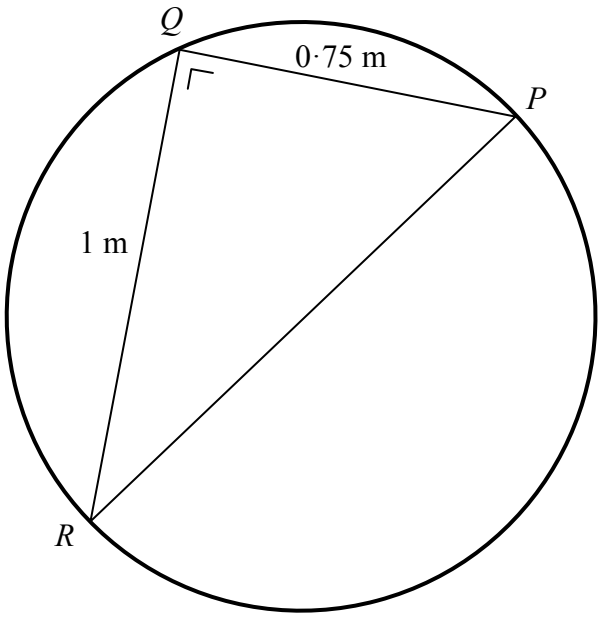
(iv) Use your answer to **(iii)** to find the size of the angle X.
Give your answer correct to the nearest degree.

Question 13 **(Suggested maximum time: 5 minutes)**

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 $|\angle RQP| = 90°$.

She measures $[QP]$, and finds that $|QP| = 0 \cdot 75$ m.



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

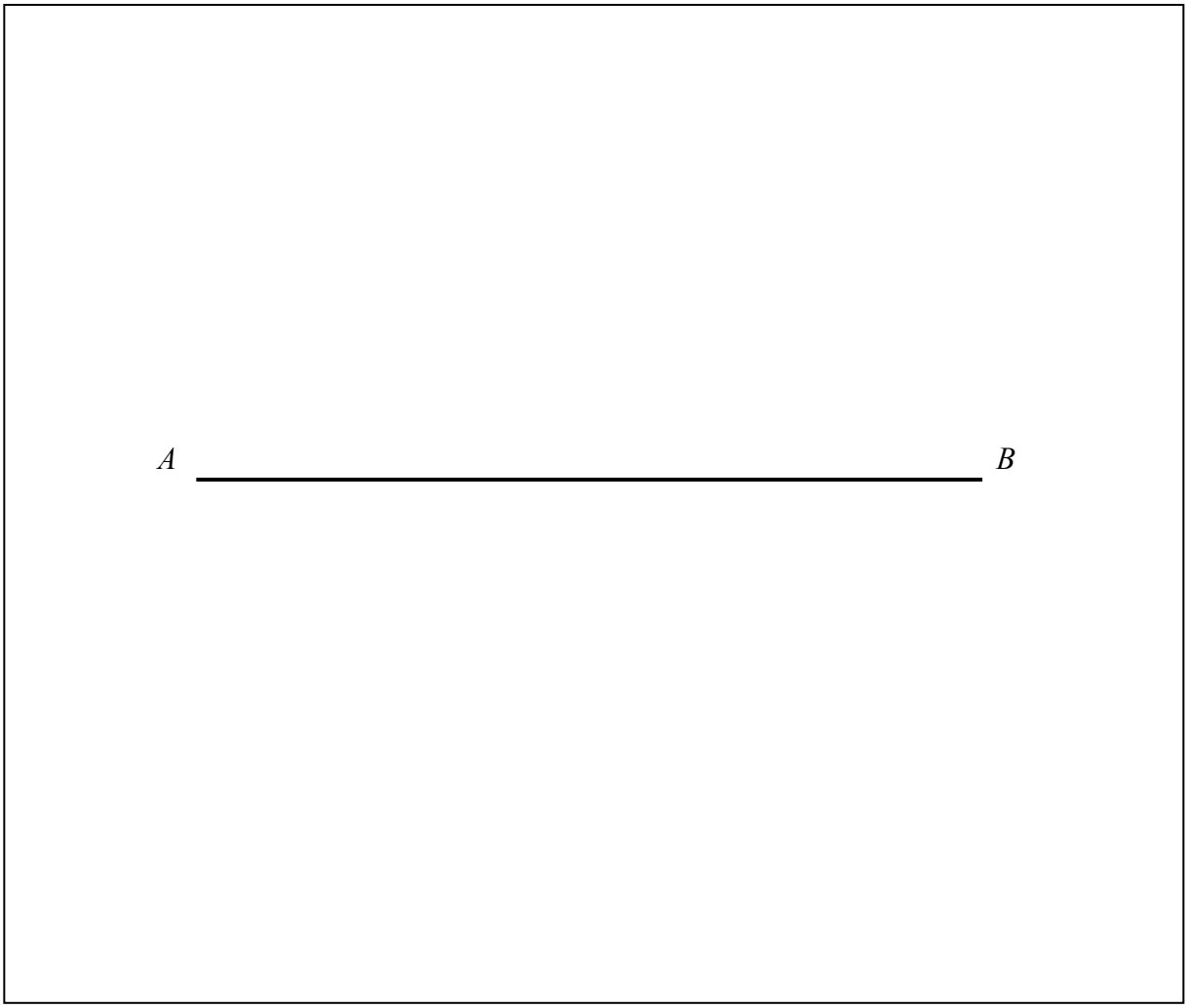
(i) Explain why Aoife is correct.

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

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

Question 14 **(Suggested maximum time: 5 minutes)**

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



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