Coimisiún na Scrúduithe Stáit
State Examinations Commission

Junior Certificate Examination 2014

Mathematics
(Project Maths – Phase 3)

Paper 2

Ordinary Level

Model Solutions – Paper 2

Note: The model solutions for each question are not intended to be exhaustive – there may be other correct solutions. Any Examiner unsure of the validity of the approach adopted by a particular candidate to a particular question should contact his / her Advising Examiner.

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.

Question 15 carries a total of 50 marks.

Write your answers in the spaces provided in this booklet. You may lose marks if you do not do so. There is space for extra work at the back of the booklet. 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.

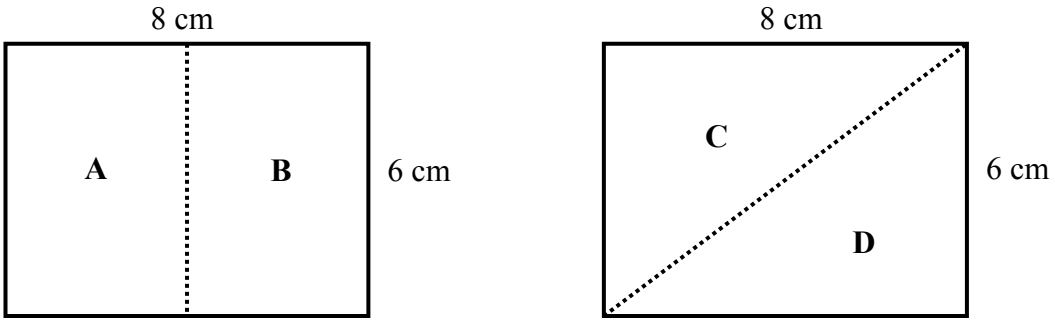
Answers should include the appropriate units of measurement, where relevant.

Answers should be given in simplest form, where relevant.

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

Question 1 **15 Marks**

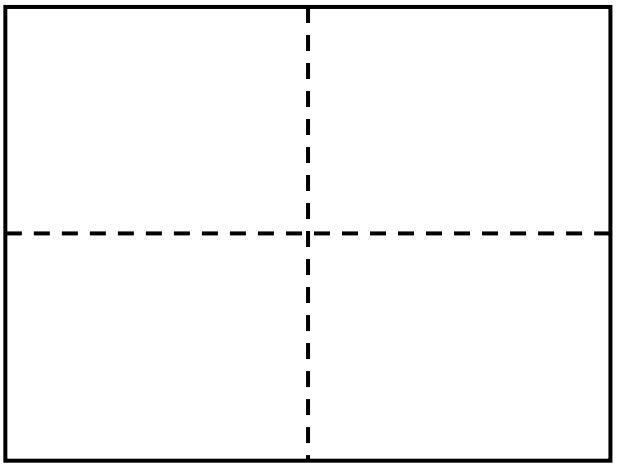
The diagram below shows two rectangular sheets of paper, with sides of length 6 cm and 8 cm. Each sheet is cut in half along the dotted line, to form the pieces **A**, **B**, **C**, and **D**.



(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 = $^1/_2 \times (8 \times 6) = 24$ cm^2 and Area of D = $^1/_2 (8 \times 6) = 24$ 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?

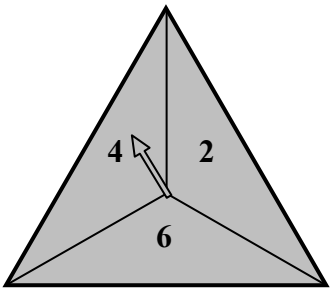
Question 3 **35 Marks**

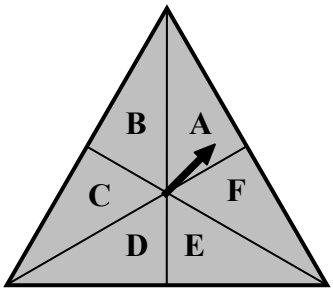
A game is played using the two spinners shown below.

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**?

$^3/_{18}$ or $^1/_6$

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

$^6/_{18}$ or $^1/_3$

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

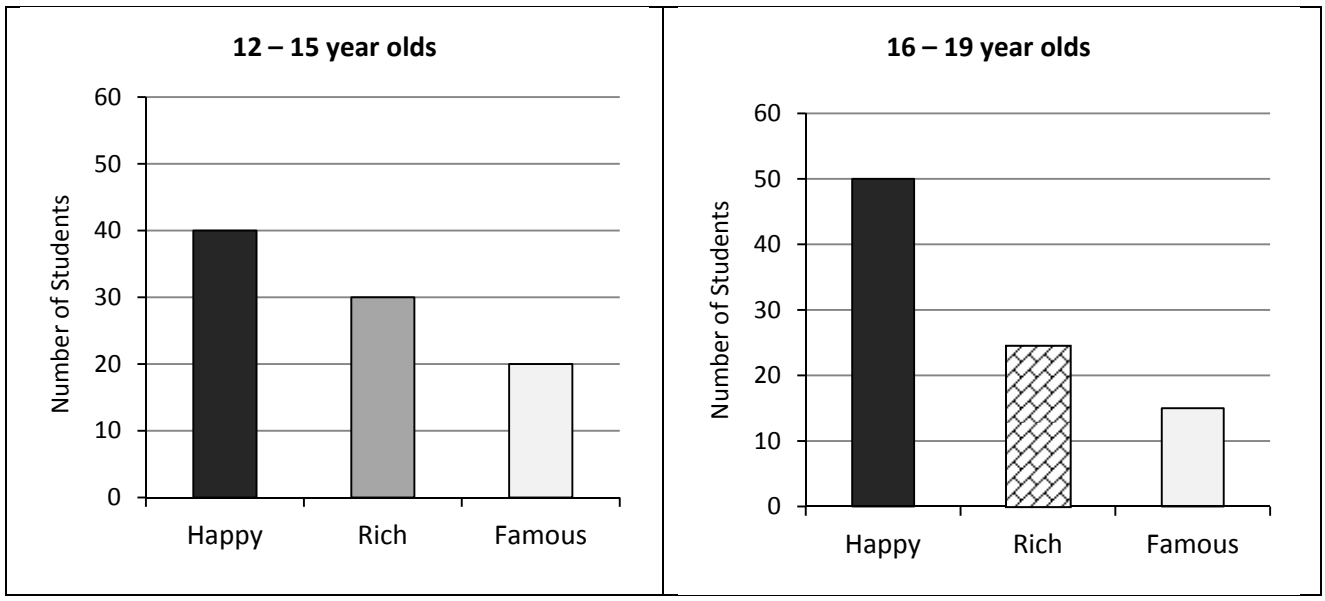
$^8/_{18}$ or $^4/_9$

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.

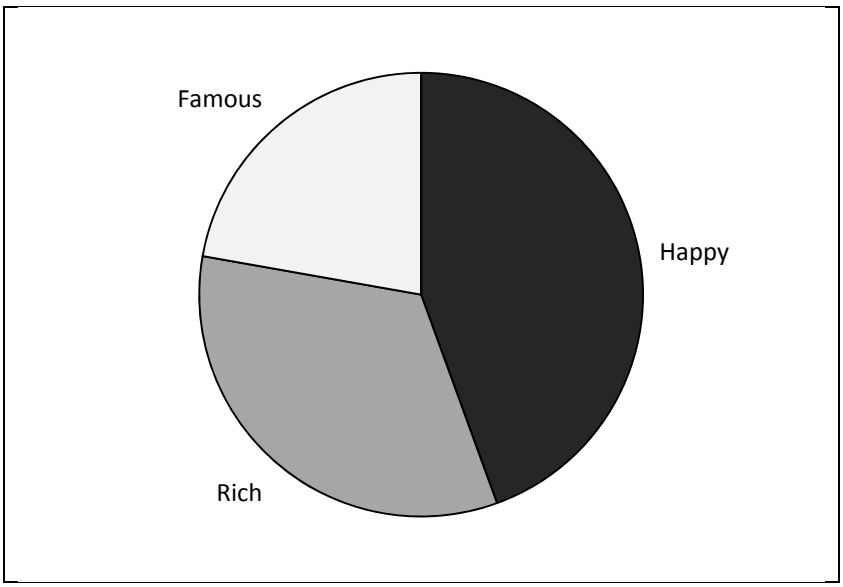
Use this information to fill in the missing bar in the graph for the 16 – 19 year olds.

50 +15 = 65 90 – 65 = 25 *See graph*

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

12 - 15 year olds: $^{40}/_{90}$ or $^{4}/_{9}$	16 - 19 year olds: $^{50}/_{90}$ or $^{5}/_{9}$

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.

Range = 8 – 49 = 41 seconds

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

Mode = 15 seconds

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

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 seconds (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?

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?

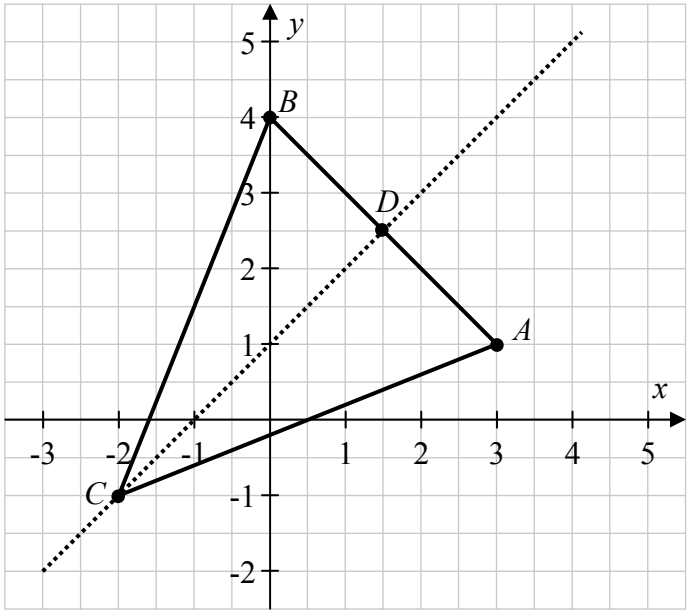
Give a reason for your answer.

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 ΔABC?

Isosceles

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

$D = (\,^3/_2\,,\ ^5/_2)$ or $(1{\cdot}5, 2{\cdot}5)$

(v) Draw the line CD on the diagram.

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

SSS:			SAS:		
ΔADC		ΔBDC	ΔADC		ΔBDC
$\|AC\|$	=	$\|BC\|$..... from **(ii)**	$\|AC\|$	=	$\|BC\|$..... from **(ii)**
$\|BD\|$	=	$\|DA\|$ ..... D is midpoint of $[AB]$	$\|BD\|$	=	$\|DA\|$ ..... D is midpoint of $[AB]$
$\|CD\|$	=	$\|CD\|$ ..... common	$\|\angle CBD\|$	=	$\|\angle CAD\|$.... 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.

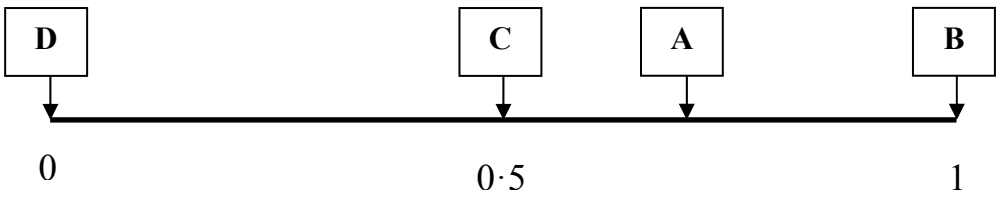
A: You pick a red ball from a bag containing 3 black and 7 red balls.

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.

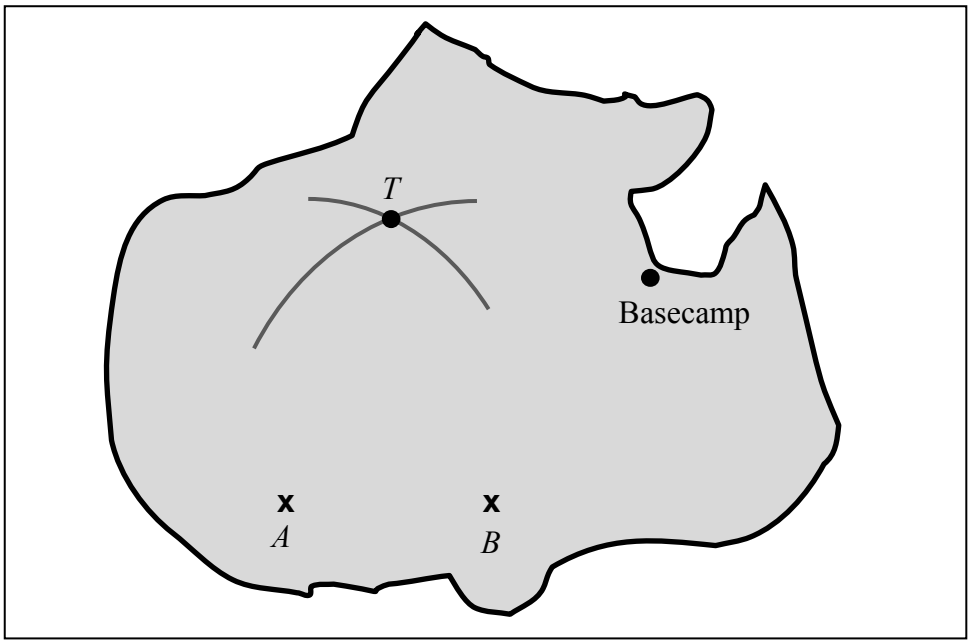
Write each of the letters **A**, **B**, **C**, and **D** into the correct box on the probability scale below, to show the probability of each event.



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*?

$20 \div 5 = 4$ 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.

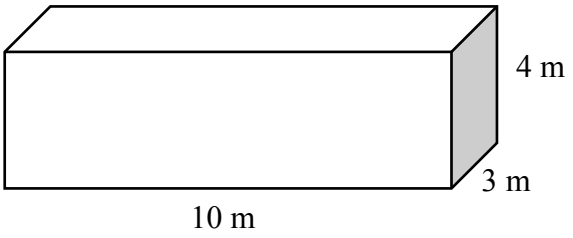
On map: $3 \cdot 5$ cm. Actual distance $= 3 \cdot 5 \times 5 = 17 \cdot 5$ km.

(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.

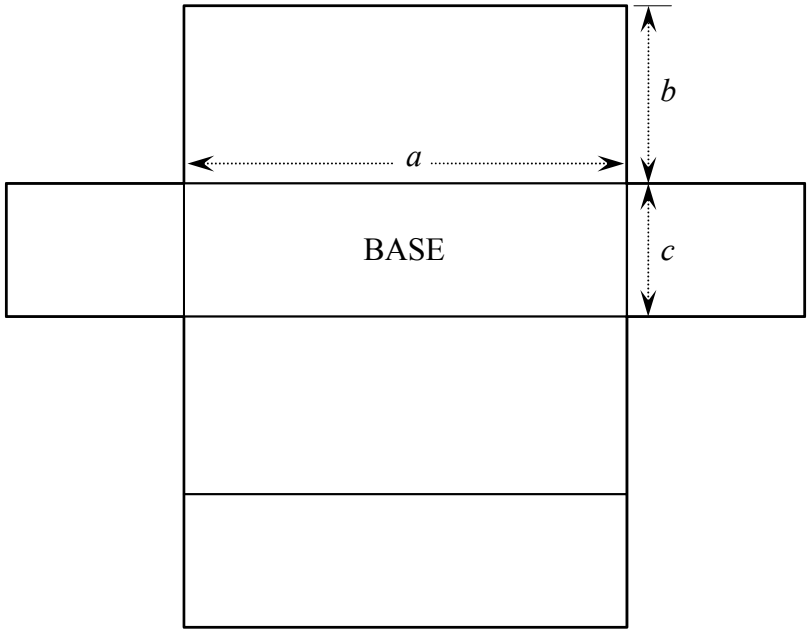
$\text{Time} = \frac{\text{Distance}}{\text{Speed}} = \frac{17 \cdot 5}{6} = 2\frac{11}{12}$ hours , i.e. 2 hours and 55 minutes. Answer: 15:55.

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 $\quad b =$ 4 m $\quad c =$ 3 m

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

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

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

Volume $= 10 \times 4 \times 3 = 120\ m^3$

In litres $= 120 \times 1000 = 120\ 000$ litres

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

Either: $10 \times 0{\cdot}5 \times 3 = 15\ \text{m}^3$ In litres $= 15 \times 1000 = 15\,000$ litres	*Or*: 50 cm is $^1/_8$ th of height, so will be $^1/_8$ th of vol. $^1/_8 \times 120\,000 = 15\,000$ litres.

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.

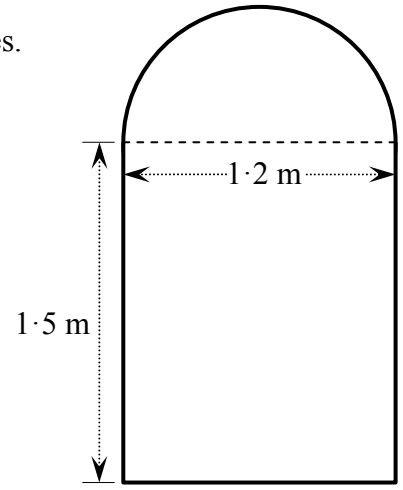
The diameter of the semicircle is 1·2 metres.
The length of the rectangle is 1·5 metres.

(i) What is the radius of the semicircle?

$1{\cdot}2 \div 2 = 0{\cdot}6$ m

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

Half of $2\pi r = 0{\cdot}5 \times (2 \times \pi \times 0{\cdot}6)$
$= 1{\cdot}88$ m (correct to two decimal places)

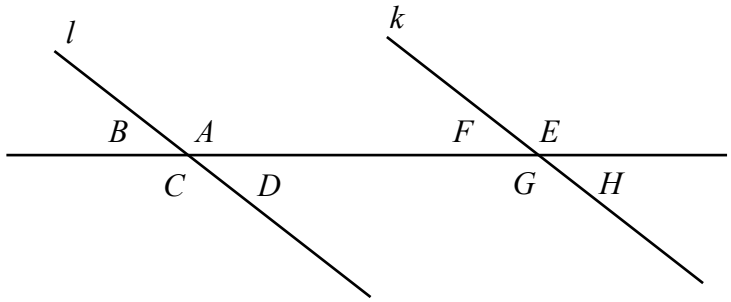


(iii) Find the perimeter of Ray's window.
Give your answer in metres, correct to two decimal places.

$1{\cdot}88 + 1{\cdot}5 + 1{\cdot}2 + 1{\cdot}5 = 6{\cdot}08$ 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 $|\angle A| = 137°$, find the measure of the angles G and H.

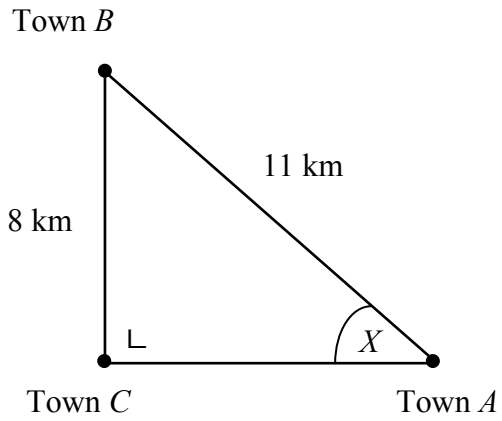
$\|\angle G\| = \|\angle A\| = 137°$	$\|\angle H\| = 180° - \|\angle A\| = 43°$

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 $\sin X$.

$\sin X = {}^{8}/_{11}$

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

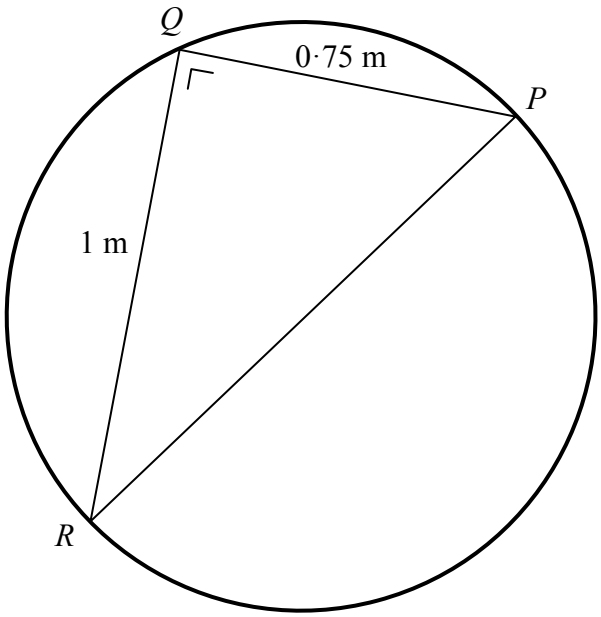
$X = \sin^{-1}({}^{8}/_{11}) = 47°$ (correct to the nearest degree)

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 $|\angle RQP| = 90°$.

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.

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

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

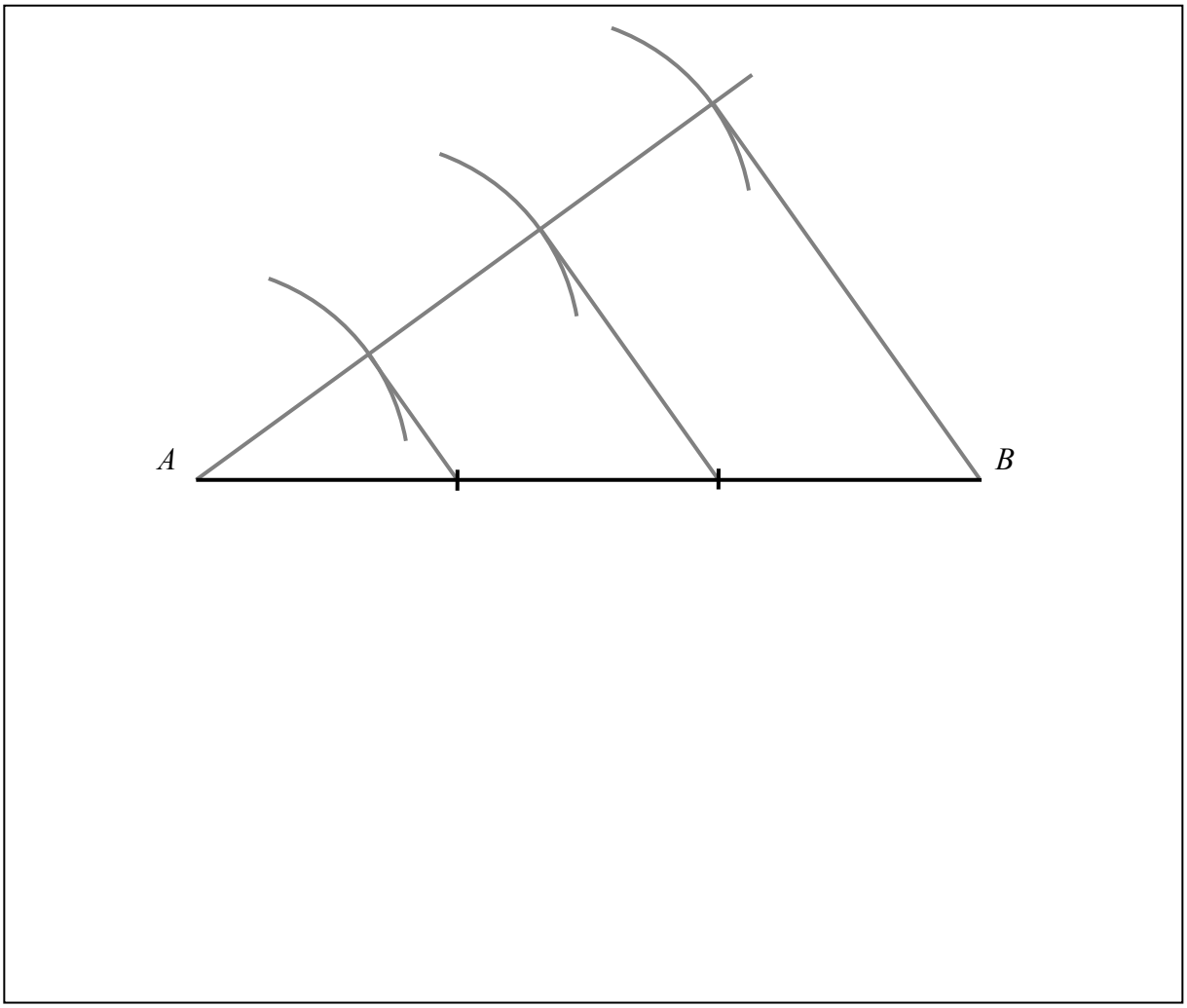
Working in cm: $\|PR\|^2 = 100^2 + 75^2 = 15\,625$ $\|PR\| = \sqrt{15\,625} = 125$ cm	*Working in m*: $\|PR\|^2 = 1^2 + 0{\cdot}75^2 = 1{\cdot}5625$ $\|PR\| = \sqrt{1{\cdot}5625} = 1{\cdot}25$ m $= 125$ cm.

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

$125 \div 2 = 62{\cdot}5$ cm

Question 14 **5 Marks**

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



Structure of the marking scheme

Candidate responses are marked according to different scales, depending on the types of response anticipated. Scales labelled A divide candidate responses into two categories (correct and incorrect), scales labelled B divide responses into three categories (correct, partially correct, and incorrect), and so on. The scales and the marks that they generate are summarised in this table:

	A	B	C
5	0, 5	0, 3, 5	0, 3, 4, 5
10		0, 6, 10	0, 4, 8, 10
15		0, 7, 15	0, 7, 13, 15

A general descriptor of each point on each scale is given below. More specific directions in relation to interpreting the scales in the context of each question are given in the scheme, where necessary.

Marking scales – level descriptors

A-scales (two categories)

- incorrect response (no credit)
- correct response (full credit)

B-scales (three categories)

- response of no substantial merit (no credit)
- partially correct response (partial credit)
- correct response (full credit)

C-scales (four categories)

- response of no substantial merit (no credit)
- response with some merit (low partial credit)
- almost correct response (high partial credit)
- correct response (full credit)

In certain cases, typically involving incorrect rounding, omission of units, a misreading that does not oversimplify the work, or an arithmetical error that does not oversimplify the work, a mark that is one mark below the full-credit mark may be awarded. Thus, for example, in Scale 10C, 9 marks may be awarded.

Unless otherwise specified, accept correct answer with or without work.

Accept a candidate's work in one part of a question for use in subsequent parts of the question, unless this oversimplifies the work involved.

Summary of mark allocations and scales to be applied

Question 1 (15)

(a) 5B

(b) 10C

Question 2 (10)

(a) 5C

(b) 5B

Question 3 (35)

(i) 15C

(ii) 5B

(iii) 5B

(iv) 5B

(v) 5B

Question 4 (30)

(i) 10C

(ii) 5B

(iii) 10C

(iv) 5C

Question 5 (50)

(i) 15C

(ii) 5C

(iii) 5A

(iv) 10C

(v) 5A

(vi) 10B

Question 6 (35)

(i) 10C

(ii) 5C

(iii) 5A

(iv)&(v) 10C

(vi) 5C

Question 7 (20)

(a) 10C

(b) 10C

Question 8 (25)

(i) 5A

(ii) 5C

(iii) 10C

(iv) 5C

Question 9 (20)

(i) 5C

(ii) 5C

(iii) 5C

(iv) 5C

Question 10 (15)

(i) 5B

(ii) 5C

(iii) 5C

Question 11 (10)

(i) & (ii) & (iii) 5C

(iv) 5B

Question 12 (20)

(i) & (ii) 15B

(iii) & (iv) 5C

Question 13 (10)

(i) & (ii) 5C

(iii) 5B

Question 14 (5)

5C

Detailed marking notes

Question 1 (15)

(a)	Scale 5B (0, 3, 5) *Partial Credit*:	Calculates one area correctly; *or* Correct relevant formula; *or* Writes 8×3 or 8×6 or $\frac{1}{2} \times 8 \times 6$; *or* Correct answer but no reason given ; *or* States diagonal bisects the area of a rectangle; *or* States vertical line given is axis of symmetry .
(b)	Scale 10C (0, 4, 8, 10) *Low Partial Credit*: *High Partial Credit*:	One correct axis of symmetry. Two correct axes plus extras.

Question 2 (10)

(a)	Scale 5C (0, 3, 4, 5) *Low Partial Credit*: *High Partial Credit*:	Correct explanation. Correct explanation and suitable form with deficiencies, e.g. leaves out years, or oversimplifies e.g. no intervals; *or* Correct suitable form with no explanation.
(b)	Scale 5B (0, 3, 5) *Partial Credit*: *Full Credit*:	Correct reason given; *or* Suitable form given. Accept any reference to "normal" being problematic for reason.

Question 3 (35)

(i)	Scale 15C (0, 7, 13, 15) *Low Partial Credit*: *High Partial Credit*: *Full Credit*:	At least 2 correct entries. At least 14 correct entries. Allow elements in couples in reverse order.
(ii)	Scale 5B (0, 3, 5) *Partial Credit*:	Correct outcomes indicated in table or correct outcomes listed.
(iii)	Scale 5B (0, 3, 5) *Partial Credit*:	A numerator of 3; *or* A denominator of 18.
(iv)	Scale 5B (0, 3, 5) *Partial Credit*:	A numerator of 6; *or* A denominator of 18; *or* Correct outcomes indicated in table but no probability given .
(v)	Scale 5B (0, 3, 5) *Partial Credit*:	A numerator of 8; *or* A denominator of 18; *or* $^3/_{18} + {}^6/_{18}$.

Question 4 (30)

(i)	Scale 10C (0, 4, 8, 10) *Low Partial Credit*: *High Partial Credit*:	 40 + 30 = 70 (or equivalent); *or* 40 + 30 or 40 + 20 or 30 + 20; *or* Gives answer of 65 (i.e. 16 – 19 year olds). 40 + 30 + 20
(ii)	Scale 5B (0, 3, 5) *Partial Credit*: *Full Credit*:	 Gets correct number of students but does not fill in missing bar; *or* Missing bar filled in incorrectly with work shown; *or* 50 + 15 = 65; *or* 90 – 65; *or* 50 + 15. Correct bar without work.
(iii)	Scale 10C (0, 4, 8, 10) *Low Partial Credit*: *High Partial Credit*:	 Gets one correct fraction; *or* Denominator of 90; *or* One correct numerator. Gets correct fractions for rich or famous
(iv)	Scale 5C (0, 3, 4, 5) *Low Partial Credit*: *High Partial Credit*:	 Correct answer but no reason given; *or* 40/90 or 30/90 or 20/90 or 50/90 or 25/90 or 15/90; *or* Use of 360°; *or* Indicates correct angle in pie chart. No / incorrect answer but measures 160° and $40/90 \times 360° = 160°$ (or equivalent).

Question 5 (50)

(i)	Scale 15C (0, 7, 13, 15) *Low Partial Credit*: *High Partial Credit*: *Full Credit –1*: *Full Credit*:	 At least 5 correct entries with/without key completed. At least 18 correct entries with/without key completed. All entries in diagram correct but key incorrect/not completed. Order in entries not necessary.
(ii)	Scale 5C (0, 3, 4, 5) *Low Partial Credit*: *High Partial Credit*:	 Recognises 8 is the minimum value, or 49 is the maximum. 8 – 49
(iii)	Scale 5A (0, 5)	
(iv)	Scale 10C (0, 4, 8, 10) *Low Partial Credit*: *High Partial Credit*:	 Denominator of 20; *or* Numerator of 399; *or* Attempt at addition of any two numbers in list; *or* Correct relevant formula. 399/20.

(v)	Scale 5A (0, 5)	
(vi)	Scale 10B (0, 6, 10) *Partial Credit*: *Full Credit –1*: *Full Credit*:	 Correct answer but no reason; *or* No / incorrect answer but calculates new mean. Accept (399 – 49)/20 = 17·5. Correct answer and (399 – 49) / 20 = 17·5 (misreading). Accept: Taking out 49 would push mean down, *or similar.*

Question 6 (35)

(i)	Scale 10C (0, 4, 8, 10) *Low Partial Credit*: *High Partial Credit*:	 One or two points plotted correctly; *or* Confuses x and y coordinates in points with / without triangle drawn. Points plotted correctly but not joined; *or* 3 points plotted, 1 or 2 correct, and triangle drawn.
(ii)	Scale 5C (0, 3, 4, 5) *Low Partial Credit*: *High Partial Credit*:	 Correct distance formula (including Pythagoras's Theorem); *or* Correct substitution into slope or midpoint formula; *or* Incorrect labelling and finds 1 distance correctly. 1 distance calculated correctly; *or* Incorrect labelling and finds 2 distances correctly.
(iii)	Scale 5A (0, 5)	
(iv)&(v)	Scale 10C (0, 4, 8, 10) *Low Partial Credit*: *High Partial Credit*:	 *D* indicated on diagram correctly, but no coordinates given; *or* Line *CD* drawn correctly, but *D* not indicated on diagram; *or* Correct substitution into distance or slope formula; *or* Correct midpoint formula. *D* found correctly but line not drawn; *or* *D* indicated on diagram and *CD* drawn.
(vi)	Scale 5C (0, 3, 4, 5) *Low Partial Credit*: *High Partial Credit*:	 1 correct statement. 2 correct statements.

Question 7 (20)

(a)	Scale 10C (0, 4, 8, 10) *Low Partial Credit*: *High Partial Credit*:	 1 correct answer. 2 correct answers.
(b)	Scale 10C (0, 4, 8, 10) *Low Partial Credit*: *High Partial Credit*:	 1 correct entry. 2 or 3 correct entries.

Question 8 (25)

(i)	Scale 5A (0, 5)	
(ii)	Scale 5C (0, 3, 4, 5) *Low Partial Credit*: *High Partial Credit*:	 Reasonable attempt at construction outside tolerance (± 0·2 cm). Construction correct but T not labelled.
(iii)	Scale 10C (0, 4, 8, 10) *Low Partial Credit*: *High Partial Credit*: *Full Credit –1*:	 Measures 3.5 correctly. Distance outside tolerance (± 0·2 cm) multiplied by scale correctly. $3{\cdot}5 \times 5 \neq 17{\cdot}5$.
(iv)	Scale 5C (0, 3, 4, 5) *Low Partial Credit*: *High Partial Credit*:	 $17{\cdot}5 \div 6$ (or equivalent); *or* $15\ {}^{11}/_{12}$ or $15{\cdot}916$; *or* Numerator of $17{\cdot}5$; *or* Denominator of 6; *or* Correct relevant formula, i.e. Time = Dist/Speed (or equivalent). Converts to 2 hours 55 minutes (2:55).

Question 9 (20)

(i)	Scale 5C (0, 3, 4, 5) *Low Partial Credit*: *High Partial Credit*:	 1 value correct. 2 values correct.
(ii)	Scale 5C (0, 3, 4, 5) *No Credit*: *Low Partial Credit*: *High Partial Credit*:	 $10 \times 4 \times 3$ merits no credit. 10×4 or 10×3 or 4×3. 82 (i.e. does not multiply by 2).

(iii)	Scale 5C (0, 3, 4, 5) *Low Partial Credit*: *High Partial Credit*:	 10×4 or 10×3 or 4×3; *or* States Volume = L × B × H; *or* Multiplication by 1000. Answer of 120; *or* $10 \times 4 \times 3$.
(iv)	Scale 5C (0, 3, 4, 5) *Low Partial Credit*: *High Partial Credit*:	 States height/volume of water is one eighth height /volume of tank; *or* 50 cm = 0·5 m. Answer of 15; *or* $10 \times 0{\cdot}5 \times 3$.

Question 10 (15)

(i)	Scale 5B (0, 3, 5) *Partial Credit*:	 Divides length by 2; *or* States radius is half the diameter.
(ii)	Scale 5C (0, 3, 4, 5) *Low Partial Credit*: *High Partial Credit*: *Full Credit*:	 Use of $r = 0{\cdot}6$ m; *or* Correct relevant formula. Answer of $3{\cdot}77$ or $2 \times \pi \times 0{\cdot}6$ or $\pi \times 1{\cdot}2$. Accept $\pi = 22/7$ or $3{\cdot}14$ or $3{\cdot}142$ (or more accurate approximations of π).
(iii)	Scale 5C (0, 3, 4, 5) *Low Partial Credit*: *High Partial Credit*:	 Addition of 2 relevant dimensions; *or* States perimeter = 2(length) + width + semicircle. Addition of 3 relevant dimensions.

Question 11 (10)

(i) – (iii)	Scale 5C (0, 3, 4, 5) *Low Partial Credit*: *High Partial Credit*:	 1 correct pair of angles. 2 correct pairs of angles.
(iv)	Scale 5B (0, 3, 5) *Partial Credit*:	 1 correct angle; *or* A relevant step, e.g. $\lvert \angle A \rvert = \lvert \angle C \rvert$.

Question 12 (20)

(i)&(ii)	Scale 15B (0, 7, 15) *Partial Credit*:	 1 correct; *or* Reverses values.
(iii)&(iv)	Scale 5C (0, 3, 4, 5) *Low Partial Credit*: *High Partial Credit*: *Full Credit –1*:	 Sin X = opposite/hypotenuse (or equivalent); *or* Ratio involving sides. Part (iii) correct. Fully correct (iii) and (iv), except that calculator is in incorrect mode.

Question 13 (10)

(i)&(ii)	Scale 5C (0, 3, 4, 5) *Low Partial Credit*: *High Partial Credit*: *Full Credit*:	 Any relevant work in (i) **or** (ii). E.g.(i): Reference to right angle or right-angled triangle; *or* States that [*PR*] is a diameter. E.g. (ii): States or partial use of Pythagoras's Theorem. (i) correct; *or* Relevant work in (i) **and** (ii); *or* Significant work in (ii), e.g. Answer of $1{\cdot}25$ or $\sqrt{1 \cdot 5625}$, or $\lvert PR \rvert^2 = 15625$. (i) **and** (ii) correct.
(iii)	Scale 5B (0, 3, 5) *Partial Credit*:	 Attempt at dividing 125 by 2; *or* States radius is half the diameter.

Question 14 (5)

	Scale 5C (0, 3, 4, 5) *No Credit*: *Low Partial Credit*: *High Partial Credit*:	 No credit awarded if no construction shown. Draws ray from *A* or *B*. Draws ray and three arcs of equal radii.

Bonus marks for answering through Irish

Bonus marks are applied separately to each paper, as follows:

If the mark achieved is 225 or less, the bonus is 5% of the mark obtained, rounded **down**.
For instance, 198 marks $\times$ 5% = 9·9 $\Rightarrow$ bonus = 9 marks.

If the mark achieved is above 225, the following table applies:

Bunmharc (Mark achieved)	Marc Bónais (Bonus mark)	Bunmharc (Mark achieved)	Marc Bónais (Bonus mark)
226	11	261 – 266	5
227 – 233	10	267 – 273	4
234 – 240	9	274 – 280	3
241 – 246	8	281 – 286	2
247 – 253	7	287 – 293	1
254 – 260	6	294 – 300	0