2025.M28

2025L003G2EL

Coimisiún na Scrúduithe Stáit
State Examinations Commission

Leaving Certificate Examination 2025

Mathematics

Paper 2

Ordinary Level

Monday 9 June Morning 9:30 - 12:00

300 marks

Examination Number	☐☐☐☐☐☐
Date of Birth	☐☐/☐☐/☐☐
Centre Stamp	

For example, 3rd February 2005 is entered as 03 02 05

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Instructions

There are **two** sections in this examination paper.

Section A	Concepts and Skills	150 marks	6 questions
Section B	Contexts and Applications	150 marks	4 questions

Answer questions as follows:

- any **five** questions from Section A – Concepts and Skills
- any **three** questions from Section B – Contexts and Applications.

Write your Examination Number in the box on the front cover.

Write your answers in blue or black pen. You may use pencil in graphs and diagrams only.

This examination booklet will be scanned and your work will be presented to an examiner on screen. Anything that you write outside of the answer areas may not be seen by the examiner.

Write all answers into this booklet. There is space for extra work at the back of the booklet.
If you need to use it, 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.

In general, diagrams are not to scale.

You will lose marks if your solutions do not include relevant supporting work.

You may lose marks if the appropriate units of measurement are not included, where relevant.

You may lose marks if your answers are not given in simplest form, where relevant.

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

Section A Concepts and Skills 150 marks

Answer **any five questions** from this section.

Question 1 **(30 marks)**

(a) The table below shows the total monthly rainfall for Athenry for 2023.
Each value is rounded to the nearest mm.

Month	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sept**	**Oct**	**Nov**	**Dec**
Total rainfall (mm)	114	42	186	93	64	94	224	129	148	180	114	203

Source: www.met.ie

(i) The total rainfall in Athenry for June 2023 was 94 mm.
The total rainfall in Athenry for June 2024 was 72 mm.

Find the percentage decrease in rainfall from June 2023 to June 2024.
Give your answer correct to 1 decimal place.

(ii) Work out the mean and the standard deviation of the total monthly rainfall for Athenry from the table above.
Give both answers correct to the nearest whole number.

Mean = ____________

Standard deviation = ____________

(b) The table below shows the same monthly rainfall values and is ranked from the lowest to the highest.

Total rainfall (mm)
42
64
93
94
114
114
129
148
180
186
203
224

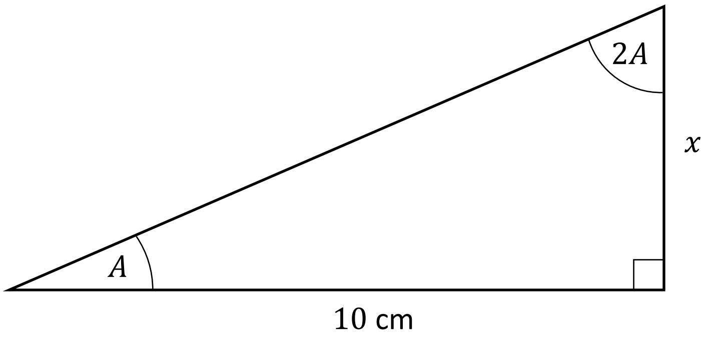
The upper quartile (Q_3) of the data above is 183 mm.
Find the value of the lower quartile (Q_1) **and** hence, work out the interquartile range of the total monthly rainfall for Athenry for 2023.

Lower quartile (Q_1) $=$

Interquartile range $=$

Question 2 **(30 marks)**

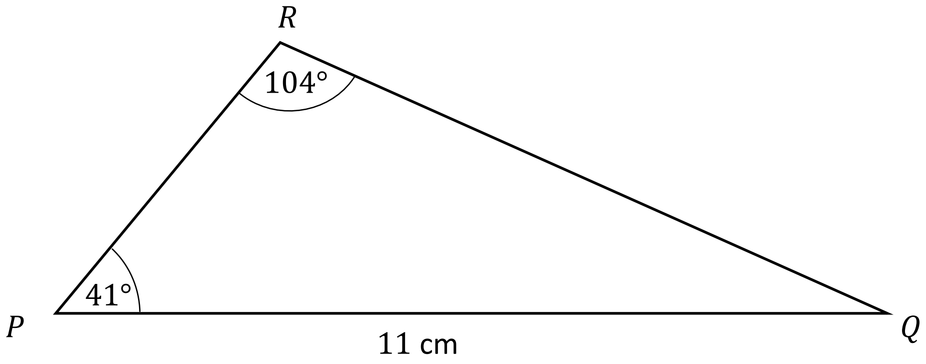
(a) There are two angles, A and $2A$, in a right-angled triangle as shown in the diagram below.



(i) Show that the size of the angle A is $30°$.

(ii) The lengths of two of the sides are x and 10 cm, as shown in the diagram above. Using $A = 30°$, find the value of x, correct to 2 decimal places.

(b) The triangle PQR is shown below.
Some of its measurements are also shown.

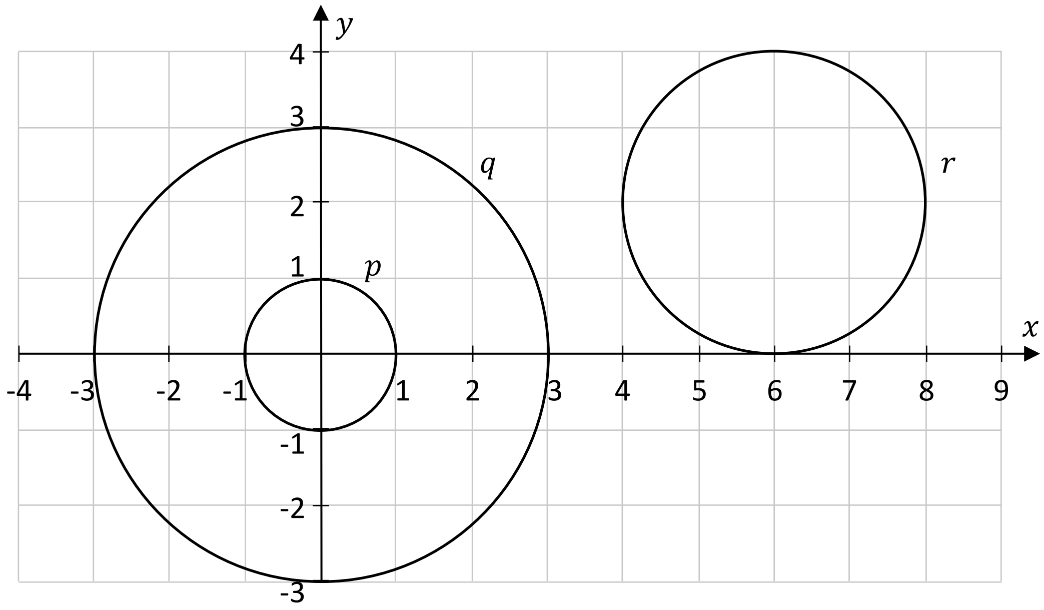


Work out the distance from P to R.
Give your answer in cm, correct to 1 decimal place.

Question 3 **(30 marks)**

(a) The diagram below shows three circles, labelled p, q, and r.

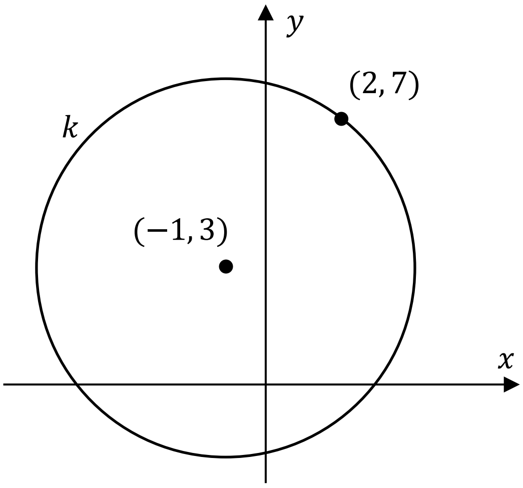
Write each of the letters p, q, and r in the correct place in the table so that each circle matches its equation.



p, q, or r	Equation of circle
	$x^2 + y^2 = 9$
	$(x-6)^2 + (y-2)^2 = 4$
	$x^2 + y^2 = 1$

(b) The circle c has centre $(3, -4)$ and radius 7.
Write down the equation of c.

(c) The circle k has centre $(-1, 3)$.
The point $(2, 7)$ is on the circle k, as shown in the diagram below.



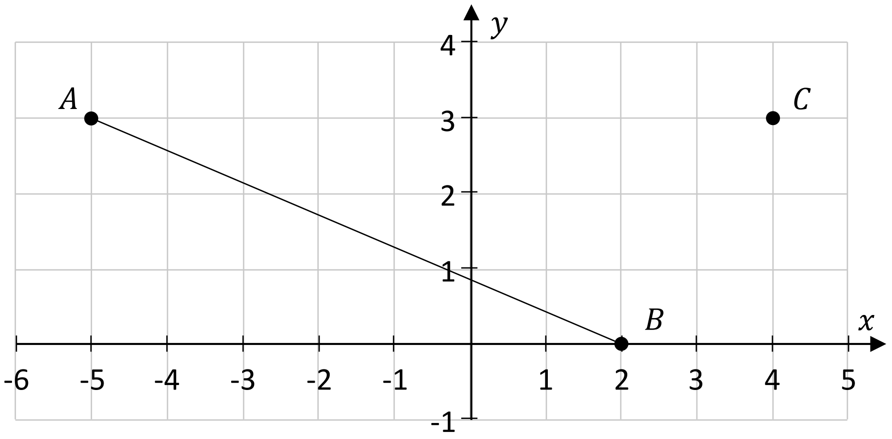
(i) Find the radius of the circle k.

(ii) Hence, or otherwise, write down the co-ordinates of **two** points that are on the circle k, **other than** $(2, 7)$.

Give your answers in the form (a, b) where $a, b \in \mathbb{Z}$.

Question 4 **(30 marks)**

(a) $A\ (-5\ , 3)$ and $B\ (2, 0)$ are two points on the co-ordinate plane, as shown in the diagram below.



(i) Find the slope of the line AB.

(ii) Hence, work out the equation of the line AB.
Give your answer in the form $ax + by + c = 0$, where $a, b, c \in \mathbb{Z}$.

(iii) $C\ (4, 3)$ is a third point on the co-ordinate plane.

Work out the **area** of the triangle ABC.
Hint: the point C is plotted on the diagram on the previous page.

(b) The lines l and k have the following equations:

$$l: \quad y = \frac{2}{3}x - 5$$

$$k: \quad 2x + 3y - 7 = 0$$

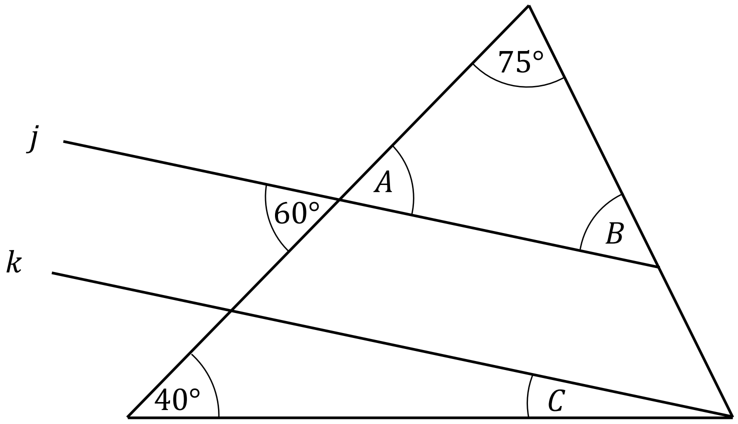
Investigate if the lines l and k are parallel, perpendicular, or neither.
Show working out to support your answer.

l and k are: (Tick (✓) **one** box only)	parallel	perpendicular	neither
	☐	☐	☐

Working out:

Question 5 **(30 marks)**

(a) j and k are two parallel lines, as shown in the diagram below.
The size of some angles are also shown.



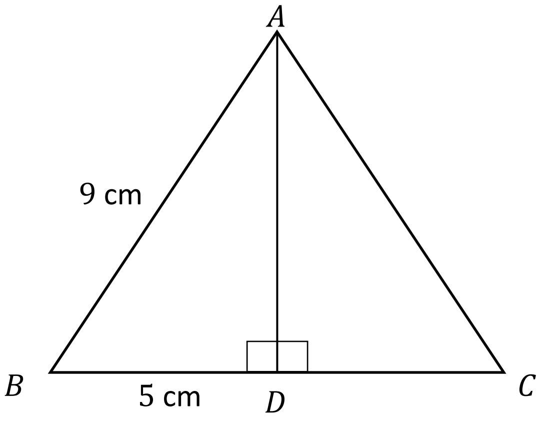
Find the size of the angles A, B, and C.

$|\angle A| =$

$|\angle B| =$

$|\angle C| =$

(b) The diagram below shows the **isosceles** triangle ABC, where $|AB| = |AC|$.
D is the midpoint of $[BC]$.
AD is perpendicular to BC.
$|AB| = 9$ cm and $|BD| = 5$ cm.



(i) Use the theorem of Pythagoras to work out the distance from A to D, that is, find $|AD|$.
Give your answer correct to 1 decimal place.

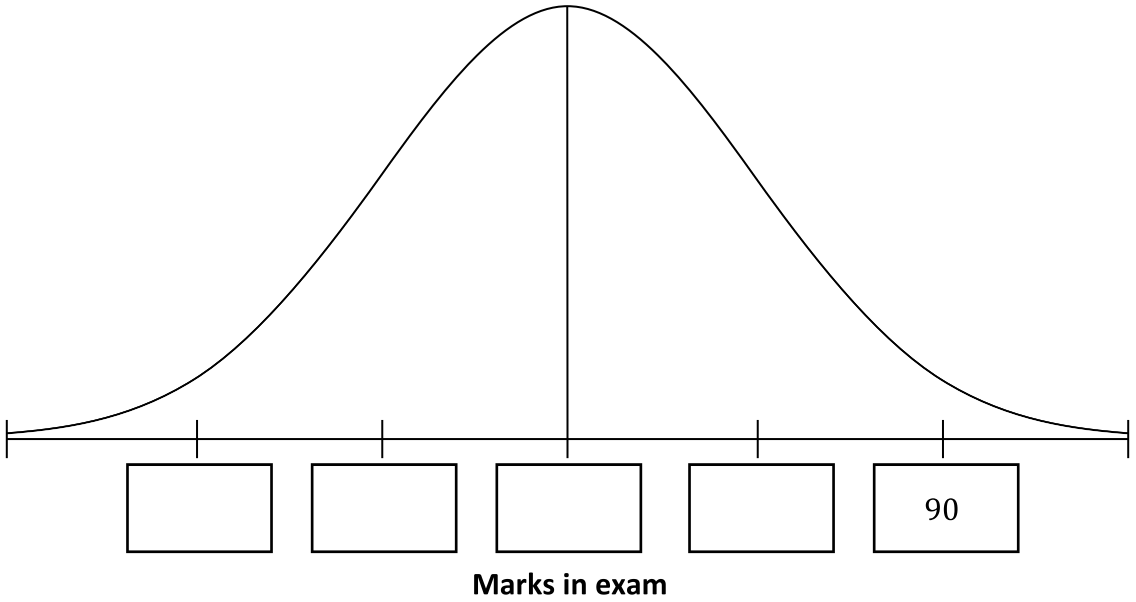
(ii) Show that the triangles ABD and ACD are congruent.
Give a reason for any statement you make.

Question 6 **(30 marks)**

(a) The marks in an exam were normally distributed, as shown in the diagram below.
The mean mark was 62 and the standard deviation was 14.

Use the empirical rule to answer parts **(a)(i)**, **(ii)** and **(iii)**.

(i) Use the mean and standard deviation to fill in the missing numbers along the horizontal axis on the diagram below.



(ii) A student is chosen at random.
Find the probability that this student had a mark between 34 and 90.

(iii) 150 students sat the exam.
Estimate the number of students who got marks between 48 and 76 in the exam.

(b) Eoin writes down 5 positive whole numbers, from smallest to largest.
For these 5 numbers:

- the median is 9
- the mode is 6
- the range is 11
- the mean is 10.

Find the 5 numbers that Eoin writes down.

Answer = ____ , ____ , ____ , ____ , ____

Section B Contexts and Applications 150 marks

Answer **any three questions** from this section.

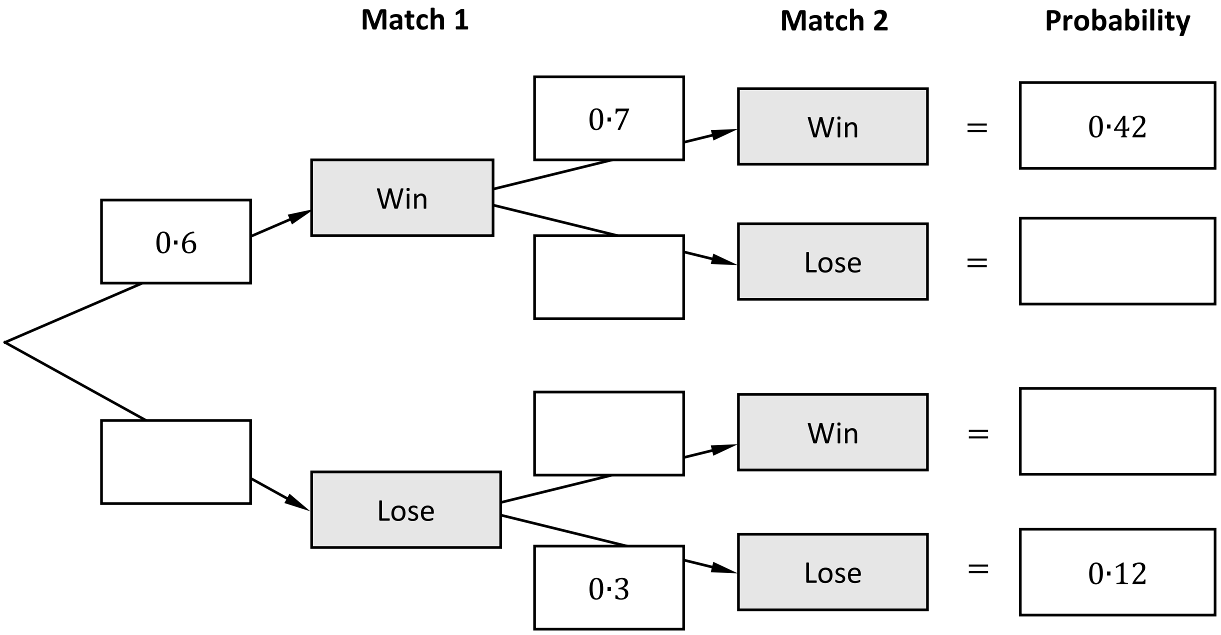
Question 7 **(50 marks)**

(a) Seán is playing two tennis matches.
He either wins or loses each match.
The probability that he wins the first match is $0{\cdot}6$ and the probability that he wins the second match is $0{\cdot}7$. The outcomes of the two matches are independent.

Use this information above to complete the tree diagram below, by:

(i) writing the probability associated with each branch of the tree diagram into the appropriate box **and**

(ii) working out the probability for each outcome and writing it in the appropriate box in the final column.



(iii) Based on the tree diagram, what is the probability that Seán wins **at least 1** match?

(b) Sarah also plays tennis.
Each time that Sarah plays a service game, the probability that she wins is $0·78$.
Assume that winning each service game is independent.

(i) What is the probability that Sarah will lose her next service game (that is, that she won't win her next service game)?

(ii) What is the probability that the first service game that Sarah loses is her third service game? Give your answer correct to 3 decimal places.

This question continues on the next page.

(c) **(i)** A child's football is in the shape of a sphere and has a **diameter** of 18 cm.
Find the **volume** of this ball.
Give your answer, in cm^3, in terms of π.

(ii) An adult's football is in the shape of a sphere and has a volume of $5424{\cdot}6$ cm^3.

Work out the radius of the adult's football.
Give your answer correct to 1 decimal place.

(d) The Expected Goals (xG) is a method used to measure the probability that a particular type of shot will result in a goal. During a game, a team had 15 shots on goal. The statistician gave each shot a probability of resulting in a goal, as shown in the table below.

Probability of resulting in a goal	10%	20%	40%	70%
Number of shots	6	5	3	1

Use the information in the table to work out the **Expected Goals** of the team in this game, that is, the expected value of the number of goals that would be scored from these 15 shots.

Question 8 **(50 marks)**

(a) The table below shows the number of new private cars sold in 2023 (to the nearest hundred) broken down by fuel type. It also shows the percentage of these cars that were of each fuel type (correct to 2 decimal places) and the size of the angle that would represent each fuel type in a pie chart.

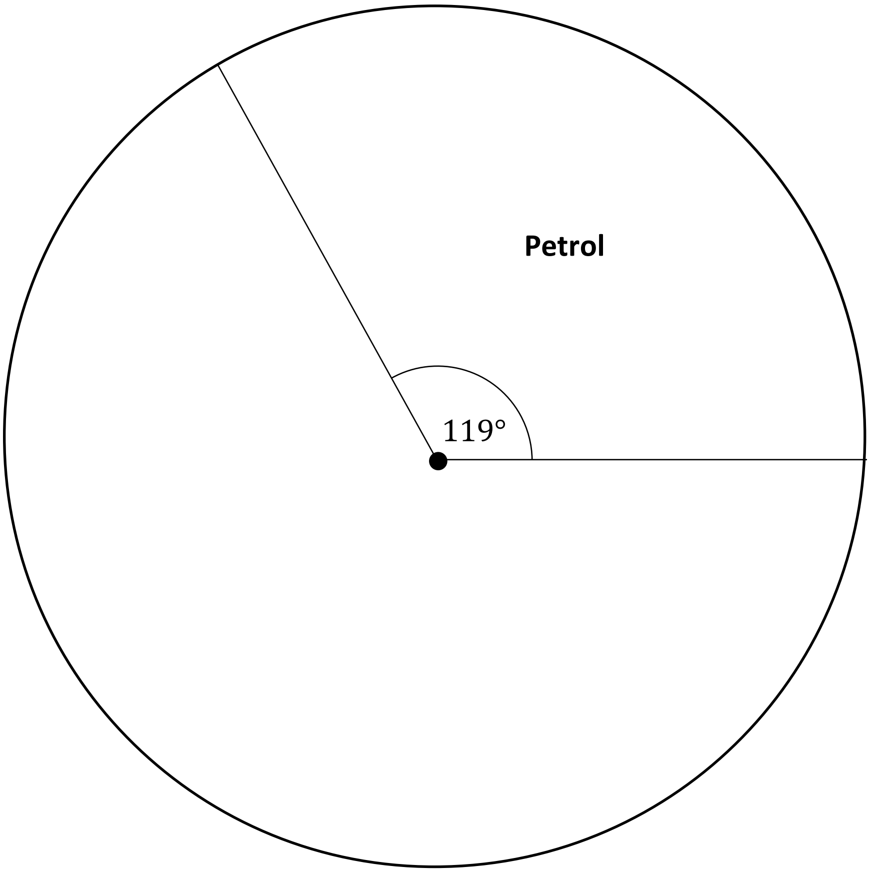
Fuel type	Number of new cars	Percentage of new cars	Angle in pie chart
Petrol	38 700	32·96%	119°
Diesel	25 900		
Fully Electric	22 500	19·17%	
Hybrid	30 300		93°
Total	117 400	100%	360°

Source: www.cso.ie

(i) Complete the table above by working out the two missing percentages for Diesel and for Hybrid **and** the size of the two missing angles for Diesel and Fully Electric.

Give each percentage correct to 2 decimal places **and** give the size of each angle correct to the nearest degree.

(ii) Use the information from the table on the previous page to complete the pie chart for Diesel, Fully Electric and Hybrid. Label each sector clearly with the fuel type.



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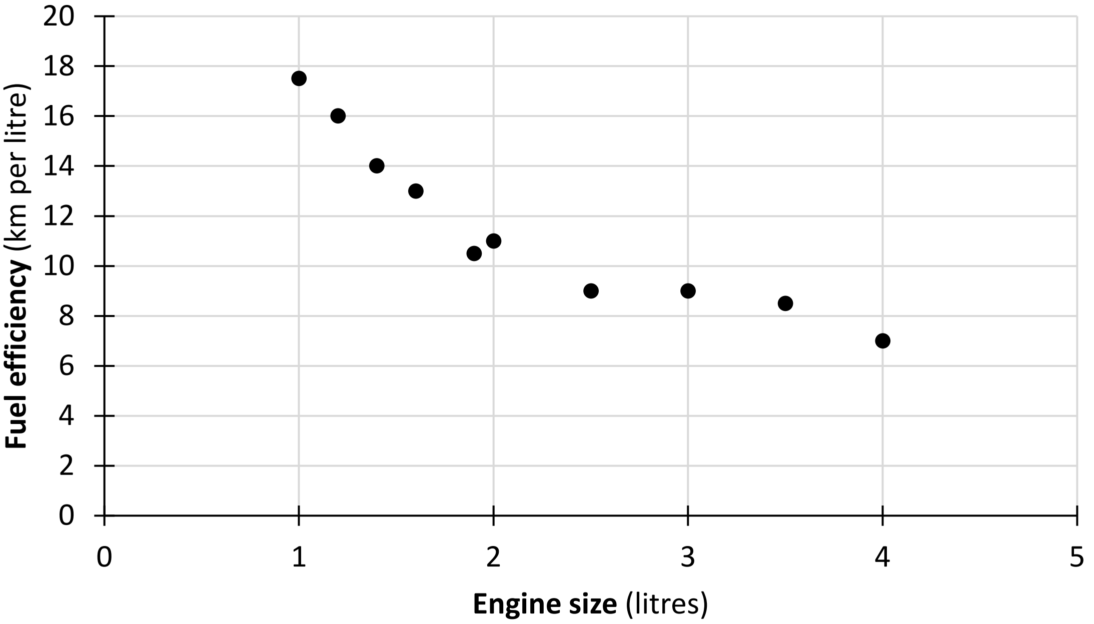
(b) The scatter plot below shows the fuel efficiency of ten popular petrol car types and their engine sizes.



(i) There is a correlation between engine size and fuel efficiency.

Based on the diagram above, pick a description from the list below that best describes the correlation between engine size and fuel efficiency.
Explain your choice in relation to fuel efficiency and engine size.

The correlation is:	Strong positive	Strong negative	Weak positive	Weak negative
(Tick (✓) **one** box only)	☐	☐	☐	☐

Explanation:

(ii) Tom says that the correlation coefficient for two sets of data is 5.
Explain why this **cannot** be correct.

(c) A random sample of 815 cars was picked from new cars in 2024.

(i) Show that, for this sample, the margin of error for a population proportion is $3{\cdot}5\%$, correct to 1 decimal place.

(ii) 106 of the 815 new cars bought in 2024 were electric cars.
Work out the percentage of new cars in this sample that were electric cars.
Give your answer correct to the nearest percent.

(iii) In 2023, $19{\cdot}2\%$ of all new cars bought were electric. A reporter claimed that the proportion of new electric cars being bought in 2024 was different to 2023.

Use your answers to parts **(c)(i)** and **(c)(ii)** to test the claim that the percentage of new electric cars being bought in 2024 is different from that in 2023, at the 5% level of significance.

Show relevant calculations, state your conclusion, and give a reason for your conclusion.

Calculations:

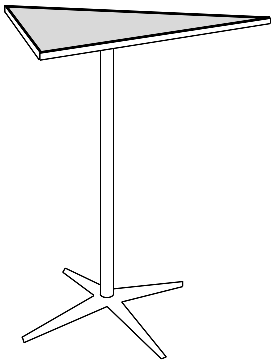
Conclusion:

Reason for the conclusion:

Question 9 **(50 marks)**

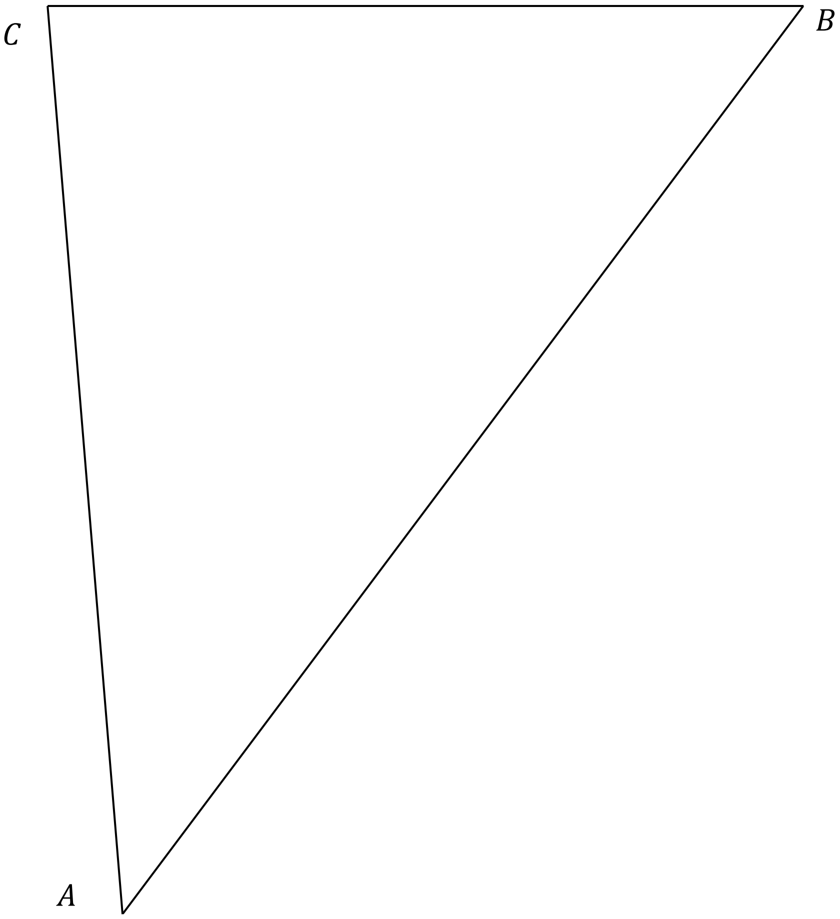
(a) Clodagh is making a wooden table for her woodwork class.
The triangle ABC below is a scaled diagram of the table-top.

The table-top is supported by one leg attached to the centroid, as shown in the diagram on the right.

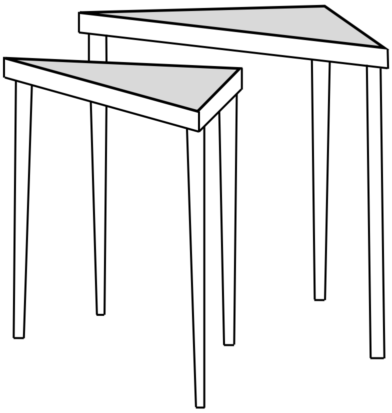


(i) On the diagram below, construct the midpoint of the side $[AB]$. Label this point D.
(If using measurements and calculations, show all calculations clearly).

(ii) Hence, construct the **centroid** of the triangle ABC.
Label this point O.



(b) Finn is making a pair of triangular tables, one bigger than the other.
The bigger table-top is an enlargement of the smaller table-top.
The scale factor of the enlargement is k.



(i) The longest side of the bigger table-top is 45 cm.
The longest side of the smaller table-top is 36 cm.

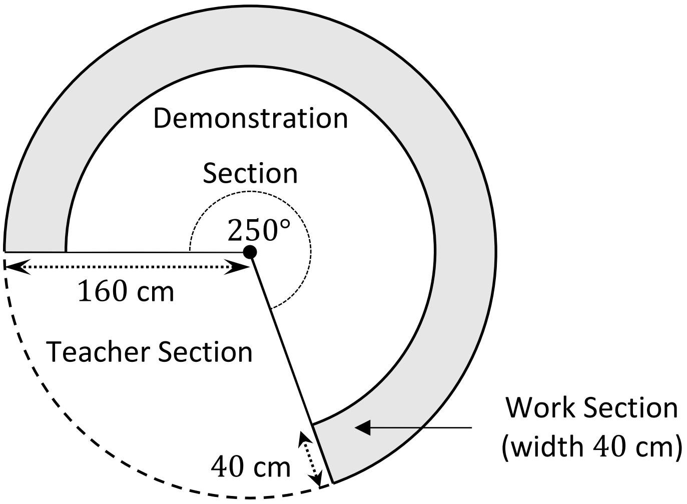
Show the scale factor $k = 1{\cdot}25$.

(ii) The shortest side of the smaller table-top is $25{\cdot}5$ cm.
Work out the length of the shortest side of the **bigger** table-top, correct to 1 decimal place.

(iii) The area of the bigger table-top is 724 cm^2.
Use $k = 1{\cdot}25$ to find the area of the **smaller** table-top.
Give your answer correct to the nearest cm^2.

This question continues on the next page.

(c) A table used for a cookery demonstration is in the shape of a sector of a circle with a radius of 160 cm. The table has a Teacher Section, a Demonstration Section, and a Work Section for the participants as shown in the diagram below.


Demonstration Section
250°
160 cm
Teacher Section
40 cm
Work Section (width 40 cm)

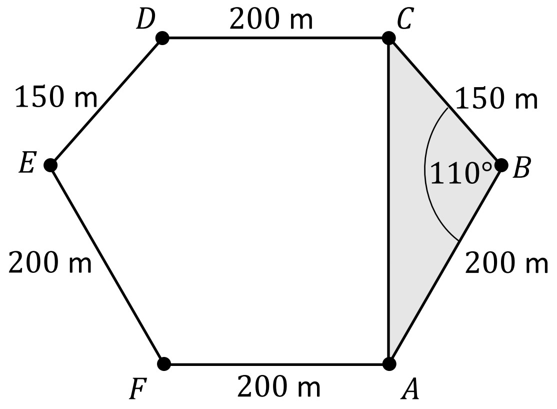
(i) The shaded area is the Work Section. It has a width of 40 cm.
Work out the area of the Work Section.
Give your answer correct to the nearest cm^2.

(ii) Each participant attending the demonstration needs at least 60 cm along the **outer** circumference of the Work Section of the table to carry out the food preparation.

Find the maximum number of participants who can attend the demonstration.

Question 10 **(50 marks)**

Aoibhe is a member of a sea swimming club. The club has six markers in the water, labelled A, B, C, D, E, and F, as shown in the diagram below.



(a) $ABCDEF$ is a six-sided shape where:

AF is parallel to CD and AF is perpendicular to AC.

$|AB| = |CD| = |EF| = |FA| = 200$ m, and $|BC| = |DE| = 150$ m.

(i) Aoibhe swims from A to B, to C, to D, to E, to F, and back to A.

Find the **total** distance Aoibhe swims.

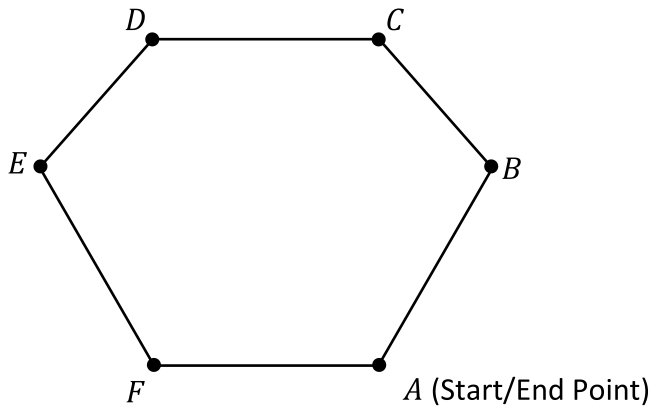
(ii) The size of the angle ABC is 110°.
Work out the **area**, correct to the nearest m^2, of the triangle ABC, that is, the area of the shaded region in the diagram above.

(iii) Aoibhe swims straight from A to C.
Use the **cosine rule** to work out the distance from A to C.
Give your answer correct to the nearest metre.

(iv) Hence, or otherwise, work out the **total area** of the water enclosed by the six markers.

This question continues on the next page.

(b) Point A is the nearest point to the shore and is the start and end point for all swims.



Aoibhe wants to see how many routes she could swim, starting at A, by swimming to each of the five markers (B, C, D, E, and F) once and only once and finishing at A.

For Example, Aoibhe could swim the route:

A	E	C	F	D	B	A

(i) Give another example of such a route Aoibhe could swim.

A						A

(ii) Work out how many such routes are possible.

(iii) On a particular day Aoibhe wants to start at A, swim to **two** markers other than A, and then return to A. For example, Aoibhe could swim the route:

A	E	B	A

Work out how many such routes are possible.

Page for extra work.
Label any extra work clearly with the question number and part.

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Leaving Certificate – Ordinary Level

Mathematics Paper 2

Monday 9 June
Morning 9:30 - 12:00