L.119

2024-L119-1-EL-01/32

Pre-Leaving Certificate Examination, 2024

Mathematics

Paper 2

Ordinary Level

Time: 2 hours, 30 minutes

300 marks

CANDIDATE DETAILS

DAY and MONTH of BIRTH / For example, 3rd February is entered as 03/02

NAME

SCHOOL

TEACHER

School Stamp

For Examiner only	
Question	Mark
A. 1.	
2.	
3.	
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5.	
6.	
B. 7.	
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Total	
%	

2024-L119-1-EL-01/32

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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 Name and Individual Details in the grid 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:

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Section A — Concepts and Skills — 150 marks

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

Question 1 **(30 marks)**

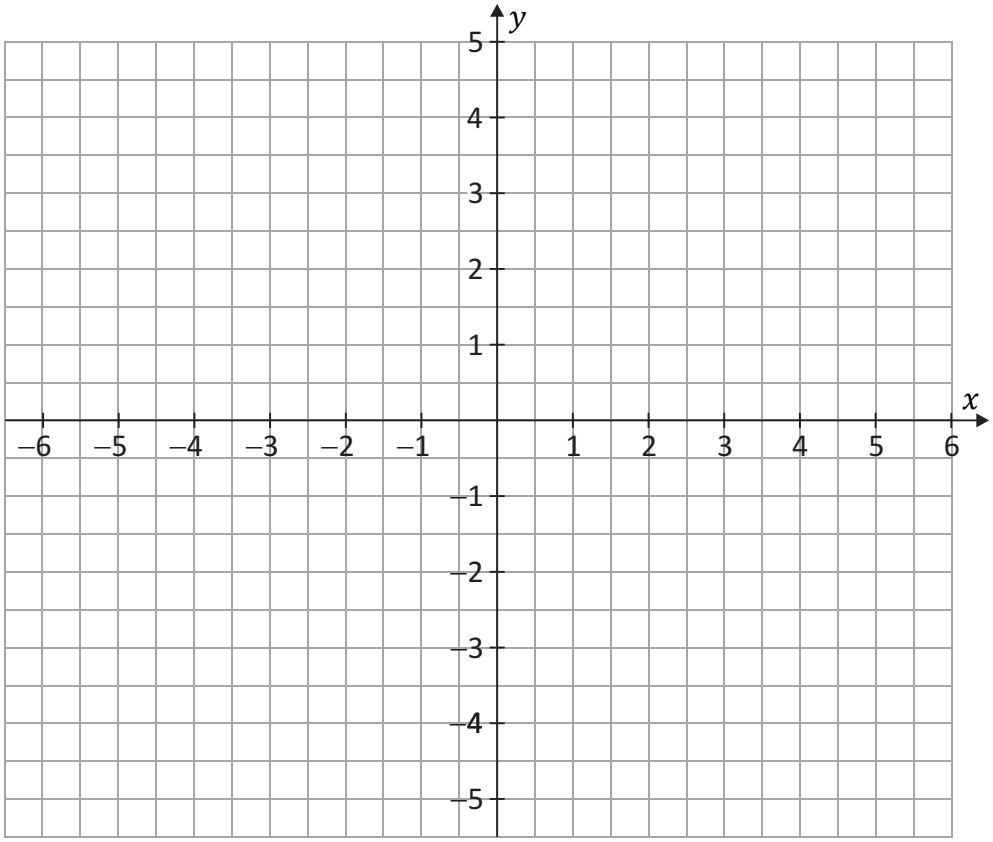
(a) The line l passes through the points $P(-3, 6)$ and $Q(9, -2)$.

(i) Work out the slope of line l.

(ii) Show that the equation of line l is $2x + 3y - 12 = 0$.

(b) k is the line $3x - 2y + 8 = 0$.
Show, using slopes, that line k is perpendicular to line l.

(c) Draw the lines l and k on the co-ordinate diagram below and find R, the point of intersection of the two lines. Label each line clearly.



(d) Lines l and k cut the x-axis at the points S and T, respectively.
Find the area of the triangle RST.

Question 2 **(30 marks)**

The circle k has equation $(x-4)^2+(y+3)^2=25$.

(a) Write down the centre and radius of circle k.

Centre of $k=$ (,) Radius of $k=$ _____

(b) Show that the point $P(7,-7)$ is on circle k.

(c) The line PQ is a diameter of circle k.
Work out the co-ordinates of point Q.

(d) Use algebra to find the co-ordinates of the points of intersection of circle k and the x-axis and y-axis.

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Question 3 **(30 marks)**

(a) Tom throws a fair, standard, six-sided die three times.

Find, as a fraction, the probability that:

(i) Tom gets a '6' on each of his first two throws;

(ii) Tom gets his first '6' on his third throw;

(iii) Tom gets a '6' on at least one of his throws.

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(b) A four-digit number is formed from the digits 1, 2, 4, 5, 7 and 8.
No digit can be used more than once in a number.

(i) How many different numbers are possible?

(ii) How many of these numbers do **not** contain a '7'?

(iii) One number is selected at random.
Find the probability that this number is greater than 3000.

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Question 4 **(30 marks)**

A Maths teacher gave her class a test on algebra out of 50 marks.
The stem-and-leaf plot shows the individual marks awarded in the test.

						8	0
				7	4	2	1
		8	5	4	4	4	2
		9	6	3	2	0	3
	8	5	4	2	2	0	4
							5

Key: 0 | 8 = 8 marks

(a) Find the mode **and** the median of the data.

Mode = _____ Median = _____

(b) **(i)** Use your calculator to find the mean **and** the standard deviation of the marks awarded. Give your answers correct to 2 decimal places.

Mean = _____ Standard deviation = _____

(ii) What percentage of the marks awarded in the test were within one standard deviation of the mean?

(c) The teacher repeated the same test for the class the following week.
The individual marks for the repeated test were as follows:

15	43	50	18	29
19	20	24	45	34
21	36	23	40	37
26	42	48	29	38

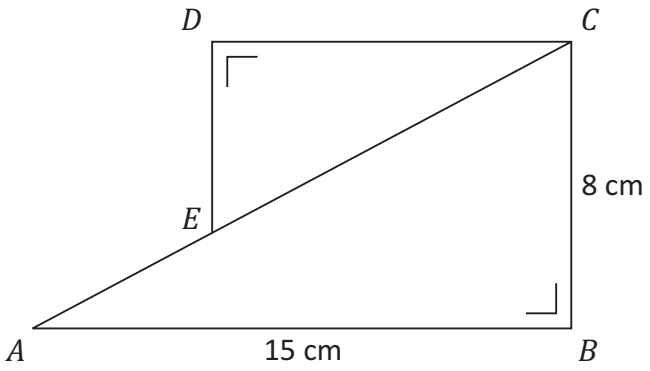
(i) Complete the stem-and-leaf plot to show the marks awarded in the repeated test.

Original Test								Repeated Test							
						8	0								
				7	4	2	1								
		8	5	4	4	4	2								
		9	6	3	2	0	3								
	8	5	4	2	2	0	4								
							5								
					Key:		0	8 = 8 marks							

(ii) What does the stem-and-leaf plot show about the marks awarded in the two tests?

Question 5 **(30 marks)**

The diagram below shows two triangles, ABC and CDE.
$|AB| = 15$ cm and $|BC| = 8$ cm, $|\angle ABC| = 90°$ and $|\angle CDE| = 90°$, as shown.
AB is parallel to DC.



(a) **(i)** Use trigonometry to find $|\angle CAB|$, correct to 1 decimal place.

(ii) Hence, find $|\angle ECD|$. Justify your answer.

Answer:

Justification:

(b) Use the Theorem of Pythagoras to find $|AC|$, the length of $[AC]$.

(c) **(i)** The point E divides $[AC]$ in the ratio $1:2$.
Work out $|EC|$, the length of $[EC]$.
Give your answer correct to 2 decimal places.

(ii) Hence, work out $|DC|$, the length of $[DC]$.
Give your answer correct to the nearest whole number.

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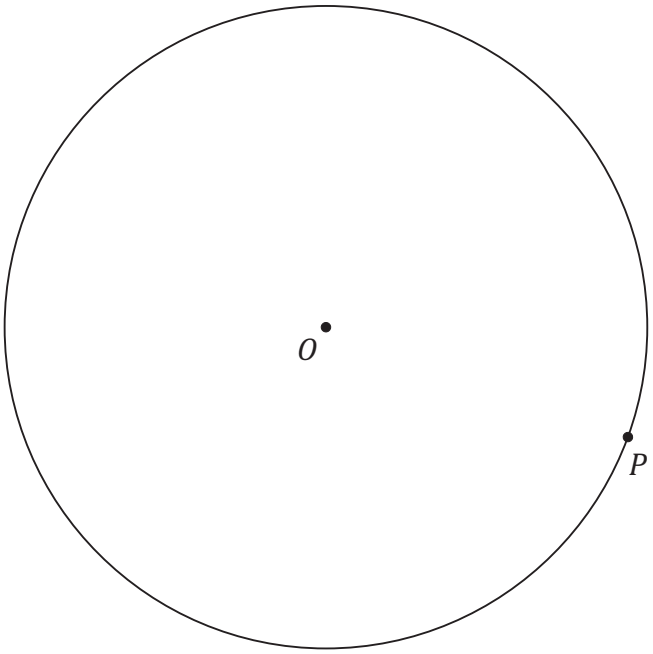
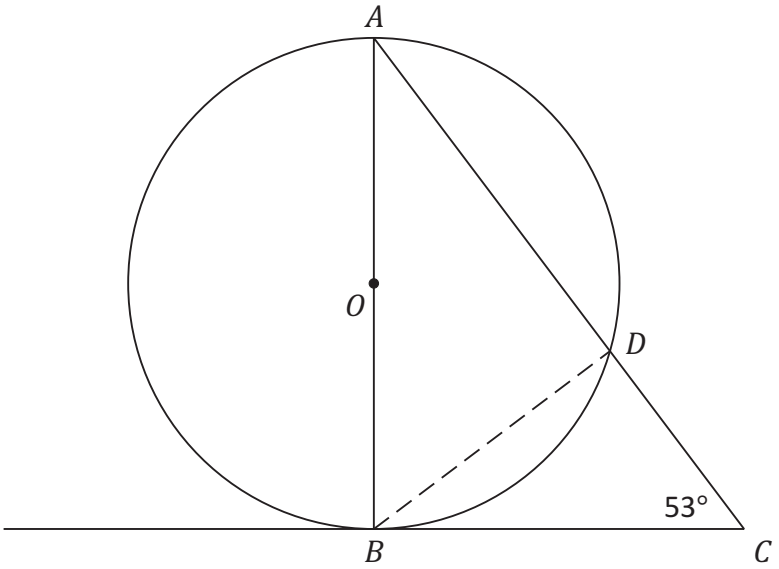
Question 6 **(30 marks)**

(a) **(i)** Write down a geometric statement that can be used to construct a tangent to a circle at a point.

(ii) Using only a compass and a straight edge, construct the tangent to the circle below at the point P.
Show all of your construction lines and arcs clearly.



(b) The diagram below shows a circle with centre O.
The line BC is a tangent to the circle at the point B.
$[AB]$ is a diameter of the circle and $[AC]$ intersects the circle at the point D.
$|\angle BCA| = 53°$.



(i) Write down $|\angle BDA|$, the size of the angle BDA.
Give a reason for your answer.

Answer:

Reason:

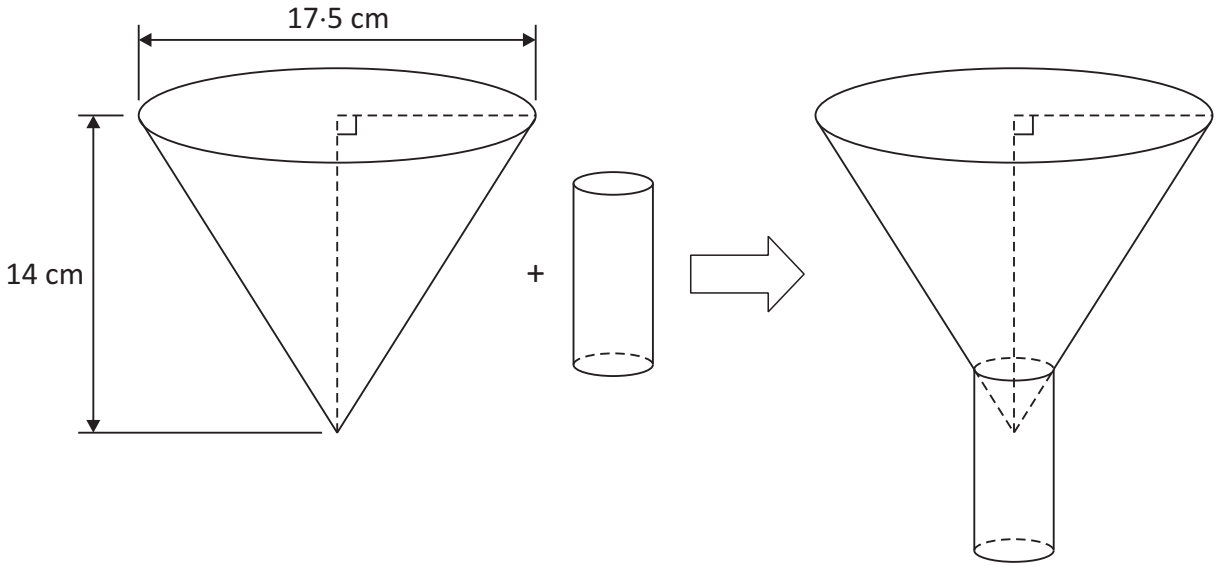
(ii) Work out $|\angle ABD|$, the size of the angle ABD.

Section B — Contexts and Applications — 150 marks

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

Question 7 **(50 marks)**

A funnel is used to transfer liquids or fine-grained substances into a small opening.
It is in the shape of an inverted truncated right circular cone on top of a cylinder, as shown.
The cone has a diameter of 17·5 cm and a vertical height of 14 cm before the bottom part is removed.



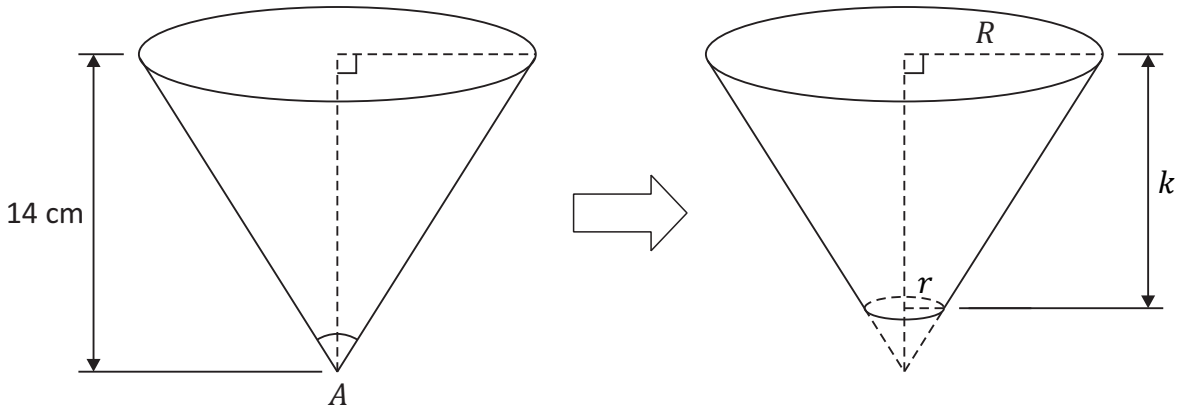
(a) The **top diameter** of the truncated cone is 5 times the diameter of the cylinder.

(i) Write down R, the top radius of the truncated cone.

(ii) Find the diameter of the cylinder **and** hence write down r, the radius of the cylinder.

Diameter = _____ Radius, r = _____

(b) The diagram on the right below shows the truncated cone section of the funnel, where k is the height of the truncated cone after the bottom part is removed.



(i) The apex is the pointed tip of the cone, marked A on the diagram on the left above. Show that $|\angle A|$, the size of the angle at the apex, is 64°, correct to the nearest degree.

(ii) Using similar triangles or trigonometry, show that the height of the bottom part of the cone removed is 2·8 cm, correct to 1 decimal place.
Hence, find k, the height of the truncated cone.

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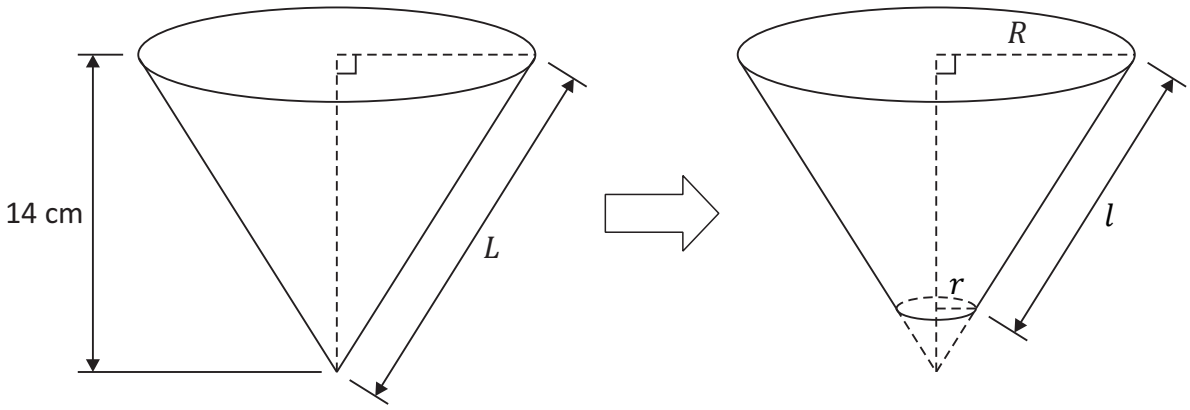
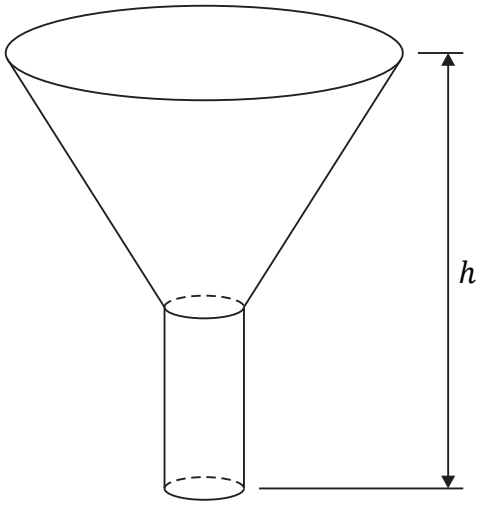
(c) The diagrams below show the slant heights of the cone **before** and **after** the bottom part is removed.



(i) Work out L, the slant height of the cone **before** the bottom part is removed.
Hence, work out l, the slant height of the cone **after** the bottom part is removed.
Give your answers in cm, correct to 1 decimal place.

(ii) Hence, work out the curved surface area of the cone **after** the bottom part is removed.
Give your answer correct to 2 decimal places.

(d) The diagram below shows the overall height of the funnel.



The volume of the cylindrical section of the funnel is $24{\cdot}5\pi$ cm^3.
Work out h, the overall height of the funnel.

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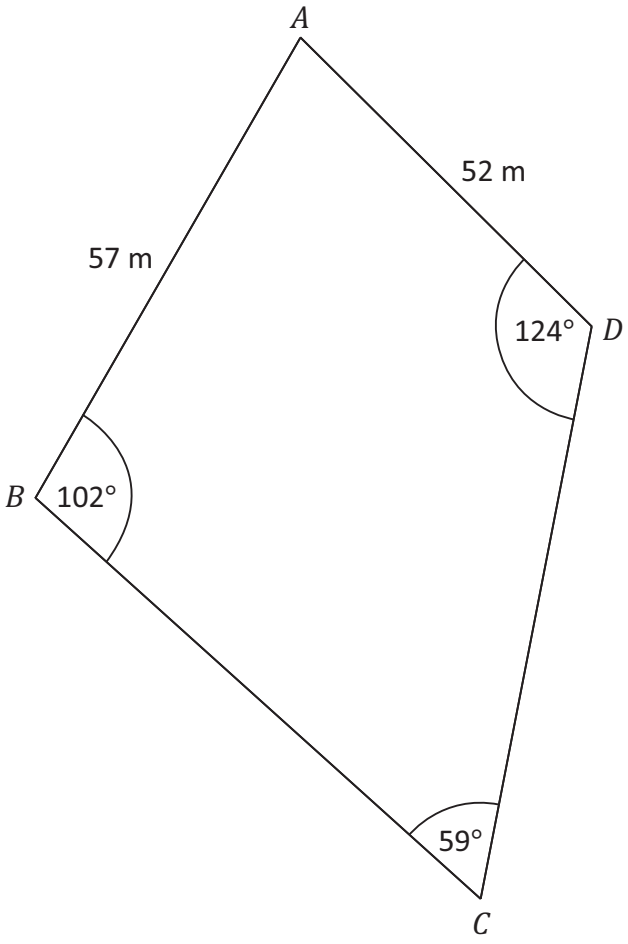
Question 8 **(50 marks)**

The diagram below shows a building site in the shape of a quadrilateral $ABCD$ (not to scale).
The following measurements were recorded by an engineer on site.

$|AB| = 57$ m,
$|AD| = 52$ m,
$|\angle ABC| = 102°$,
$|\angle BCD| = 59°$ and
$|\angle CDA| = 124°$.



(a) **(i)** Work out $|\angle DAB|$, the size of the angle DAB.

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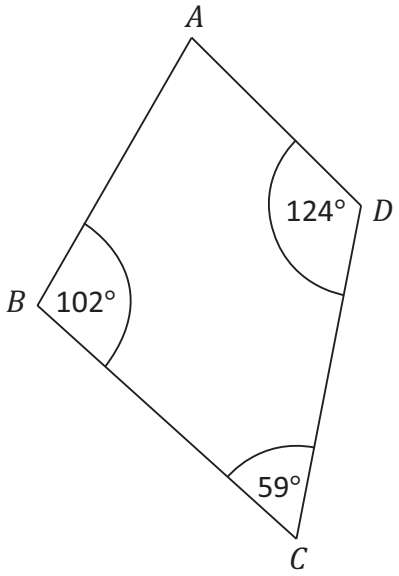
(ii) Use the Cosine Rule to show that $|BD| = 66{\cdot}47$ m, correct to 2 decimal places.

(b) **(i)** Consider the triangle ABD.
Use the Sine Rule to find $|\angle ABD|$, correct to the nearest degree.

This question continues on the next page.

(ii) Hence, work out $|\angle DBC|$ and $|\angle CDB|$.

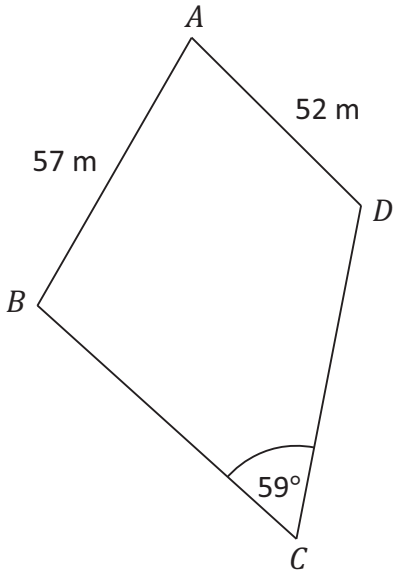


$|\angle DBC| =$ _____ $|\angle CDB| =$ _____

(iii) Work out $|BC|$ and $|CD|$, correct to the nearest metre.
Hence, find the perimeter of the site.

$|BC| =$ _____ $|CD| =$ _____

(c) Work out the area of the site, correct to the nearest m^2.



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Question 9 **(50 marks)**

Afforestation is the planting of trees in areas which were not previously covered in trees. The two main types of trees planted in Ireland are broadleaf trees (oak, ash, birch, etc.) and conifers (scots pine, yew, etc.).

The table below shows the areas, in hectares, planted in Ireland between 2014 and 2022.

Year	Broadleaf	Conifer	Total area
2014	1348	4808	6156
2015	1263	5030	6293
2016	1270	5230	
2017	1161	4375	5536
2018	1073		4025
2019	893	2657	3550
2020		1616	2434
2021	829	1187	2016
2022	959	1314	2273

(a) **(i)** Fill in the missing values in the table above.

(ii) What percentage of the total area planted in 2020 was planted with conifers? Give your answer correct to 1 decimal place.

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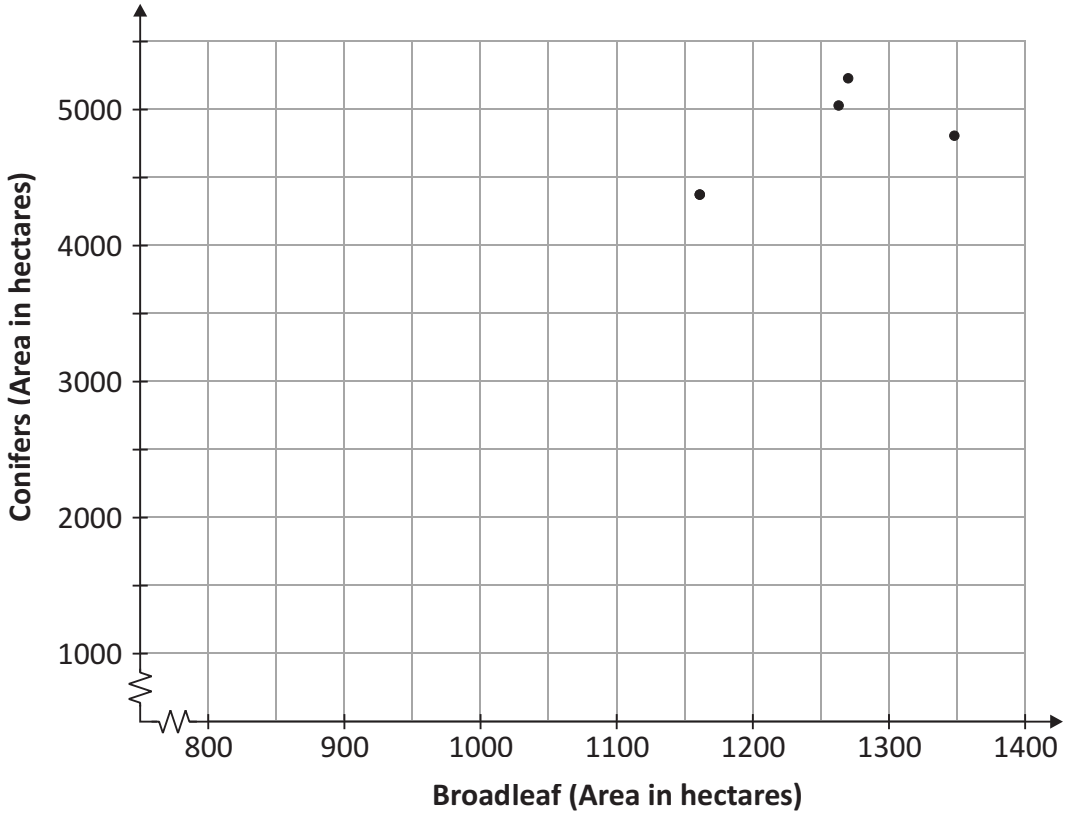
(iii) Identify the year with the largest annual decrease in total area of afforestation.
Hence, work out this decrease.

Year = _____ Decrease = _____

(b) Part of a scatterplot of the data in the table is shown below.
The first four data points are plotted.

(i) Complete the scatterplot.



(ii) One of the numbers in the table on the right is the correlation coefficient for the data above, correct to 1 decimal place.

Tick (✓) the number that you think most accurately reflects the data. Explain your choice.

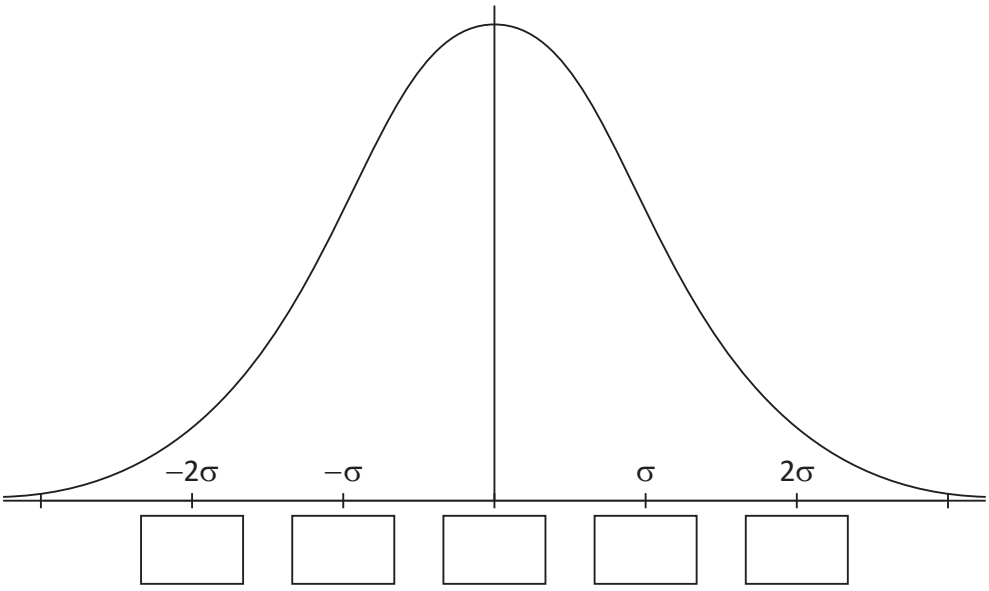
0·9	
0·2	
–0·2	
–0·9	

Explanation:

This question continues on the next page.

(c) As part of a replanting project, a garden nursery grew 1000 crab apple trees to plant in the local community. The heights of one-year-old saplings (young trees) were found to be normally distributed with a mean of 82 cm and a standard deviation of 7 cm.

(i) The diagram below shows the distribution of heights of one-year-old saplings. Fill in the missing numbers on the horizontal axis.



Heights of one-year-old crab apple saplings

(ii) Use the Empirical Rule to find an interval that contains the heights of approximately 95% of the saplings.

(iii) Only saplings with a height greater than or equal to 89 cm are planted.
Use the Empirical Rule to estimate the approximate number of crab apple saplings ready for planting.

(d) The garden nursery claims that 70% of people in the local community have a crab apple tree in their garden.
A random sample of 625 local people took part in a survey to investigate this claim.
400 of those surveyed said that they have a crab apple tree in their garden.

(i) Work out the margin of error for this sample.
Write your answer as a percentage.

(ii) Create a 95% confidence interval for the percentage of people in the local community who have a crab apple tree in their garden.

(iii) Use your answer to **part (c)(ii)** above to conduct a hypothesis test, at the 5% level of significance, to test the garden nursery's claim. Clearly state your conclusion in the context of the question **and** give a reason for your conclusion.

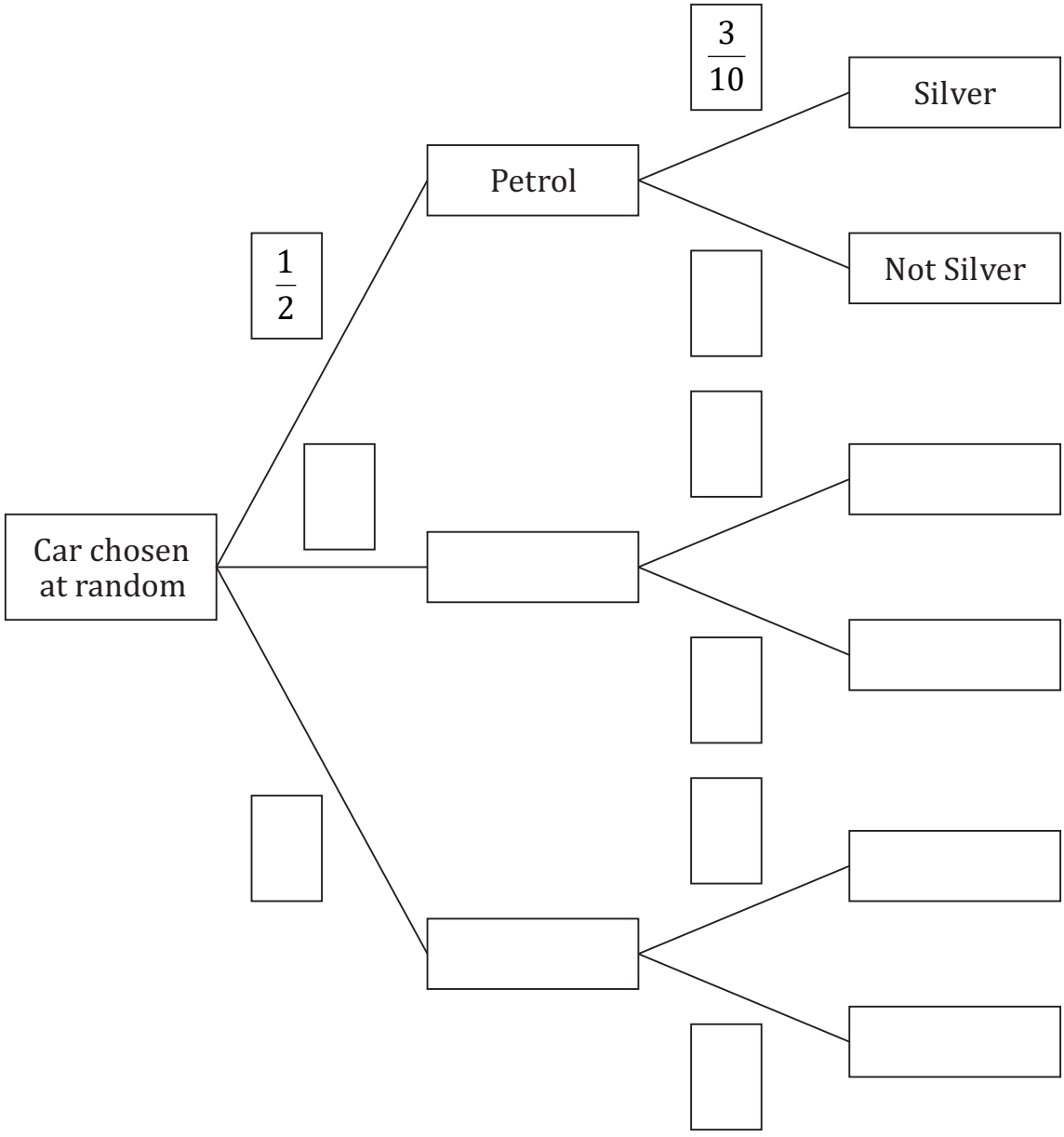
Conclusion:

Reason:

Question 10 **(50 marks)**

Aoife is a Transition Year student and she carried out a survey of the cars in the school car park on a particular day. She noted that 15 cars run on petrol, 12 cars run on diesel and 3 cars are electric/hybrid. She also recorded the colour of each car and determines that there are 9 silver coloured cars.

(a) **(i)** Use this information to complete the tree diagram below.
Show the probability associated with each branch.
Give your answers in the form $\frac{a}{b}$, where $a, b \in \mathbb{N}$.



Space for working out.

(ii) Find the probability that a car chosen at random from the car park will be a diesel car which is **not** silver.

(b) Aoife stands at the gate of the car park and records the order in which cars leave the school.

(i) Find, as a fraction, the probability that the first 3 cars to leave the school are silver.

(ii) Find, as a fraction, the probability that the first 3 cars to leave the school are a petrol car, a diesel car and an electric/hybrid car in that order.

(iii) Find, as a fraction, the probability that the first 3 cars to leave the school are a petrol car, a diesel car and an electric/hybrid car in **any** order.

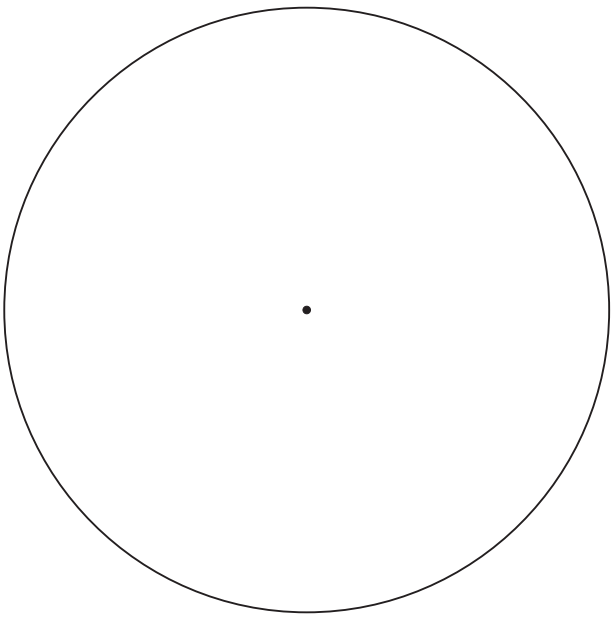
This question continues on the next page.

(iv) Find, as a fraction, the probability that none of the first 3 cars to leave the school are diesel cars.

(c) **(i)** The table shows the fuel type of the cars in the school car park.
Complete the table to show the angle for each fuel type in a pie chart.

Fuel Type	Number of cars	Angle (Degrees)
Petrol	15	
Diesel	12	
Electric/Hybrid	3	

(ii) Complete the pie chart below to show the fuel type of the cars in the school car park.
Label each section clearly.



You may use this page for extra work.
Label any extra work clearly with the question number and part.

Q. & part	

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Pre-Leaving Certificate Examination, 2024

Mathematics – Ordinary Level – Paper 2

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