

SAMPLE PAPER 6

Leaving Certificate

Mathematics

Paper 2

Higher Level

Time: 2 hours, 30 minutes

300 marks

Examination number

Centre stamp

Running total	
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For examiner	
Question	Mark
1	
2	
3	
4	
5	
6	
7	
8	
9	
Total	

Grade

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	3 questions

Answer all nine questions.

Write your answers in the spaces provided in this booklet. You will 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.

Marks will be lost if all necessary work is not clearly shown.

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

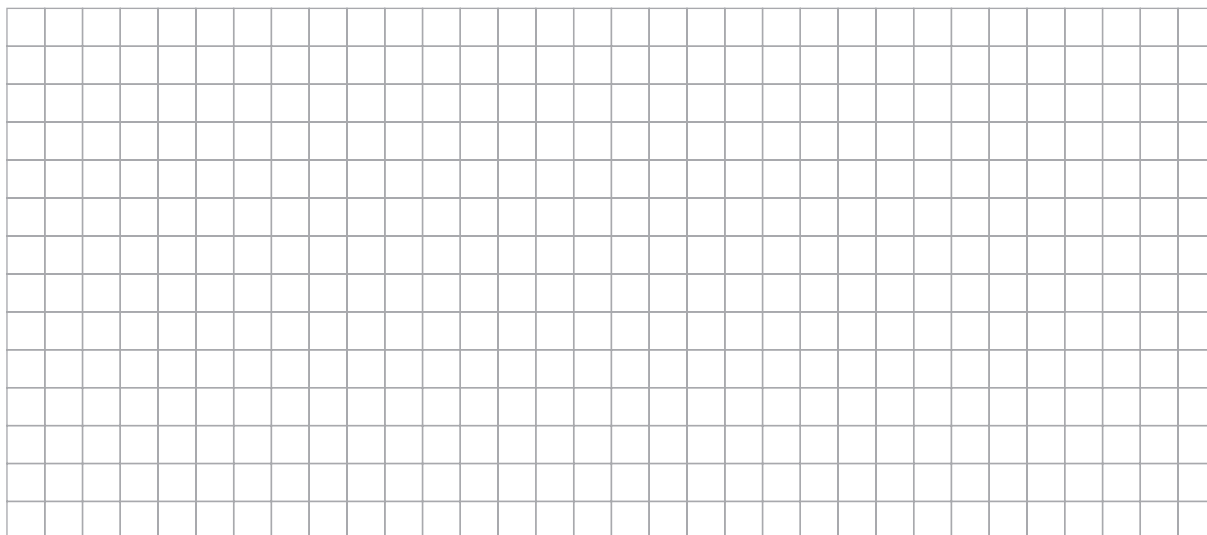
Answers should be given in simplest form, where relevant.

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

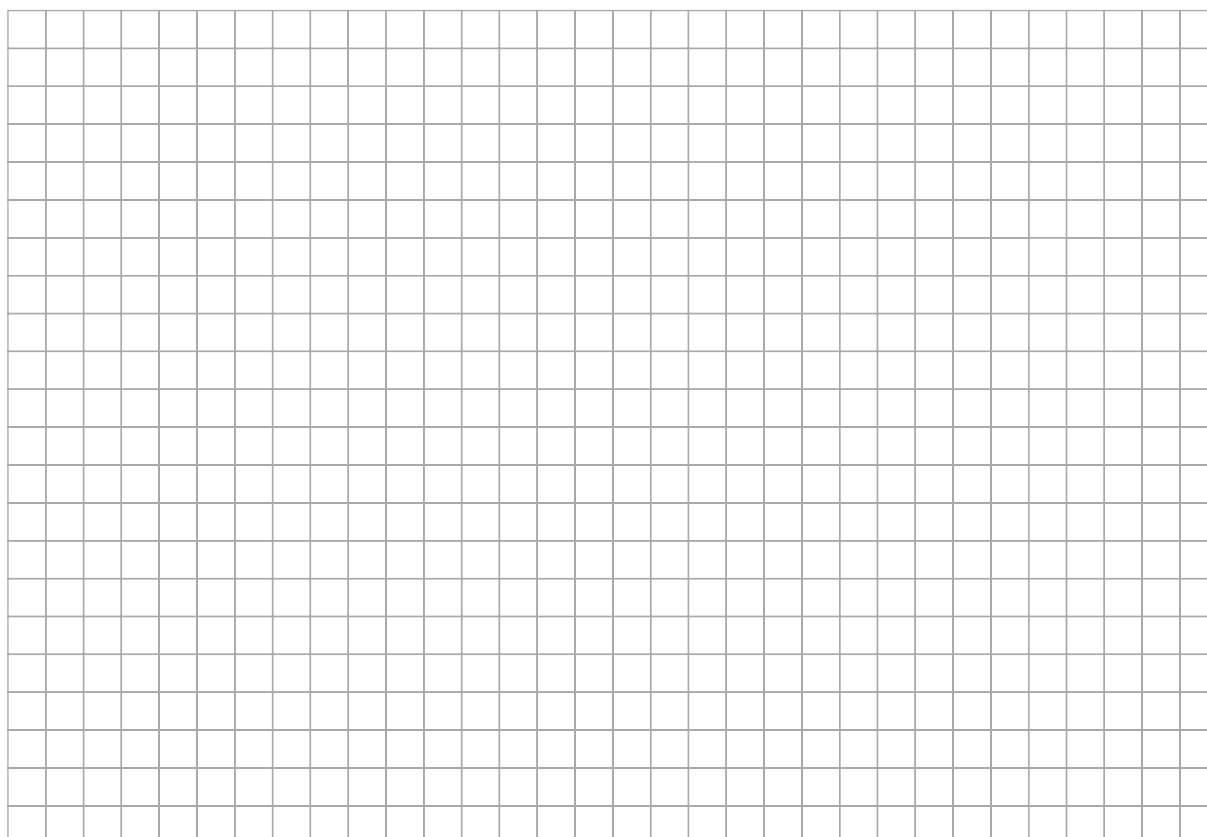
Answer **all six** questions from this section.

Question 1**(25 marks)**

- (a) Find the points on the x -axis that are equidistant from:
- $$k: 3x - 4y + 5 = 0$$
- $$l: 5x - 12y - 1 = 0$$

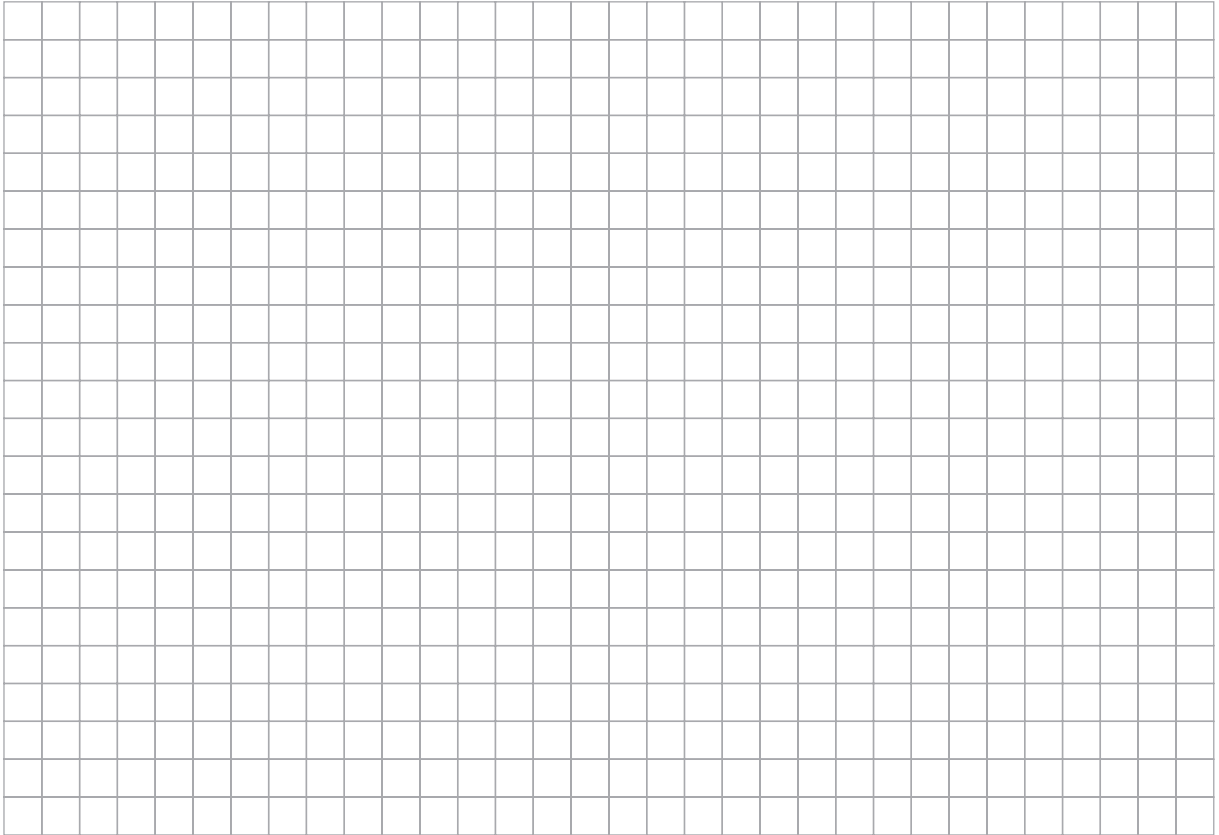


- (b) Find t if $tx - 10y - 5 = 0$ and $2x + y - 3 = 0$ are equally inclined to $3x + 4y - 5 = 0$.

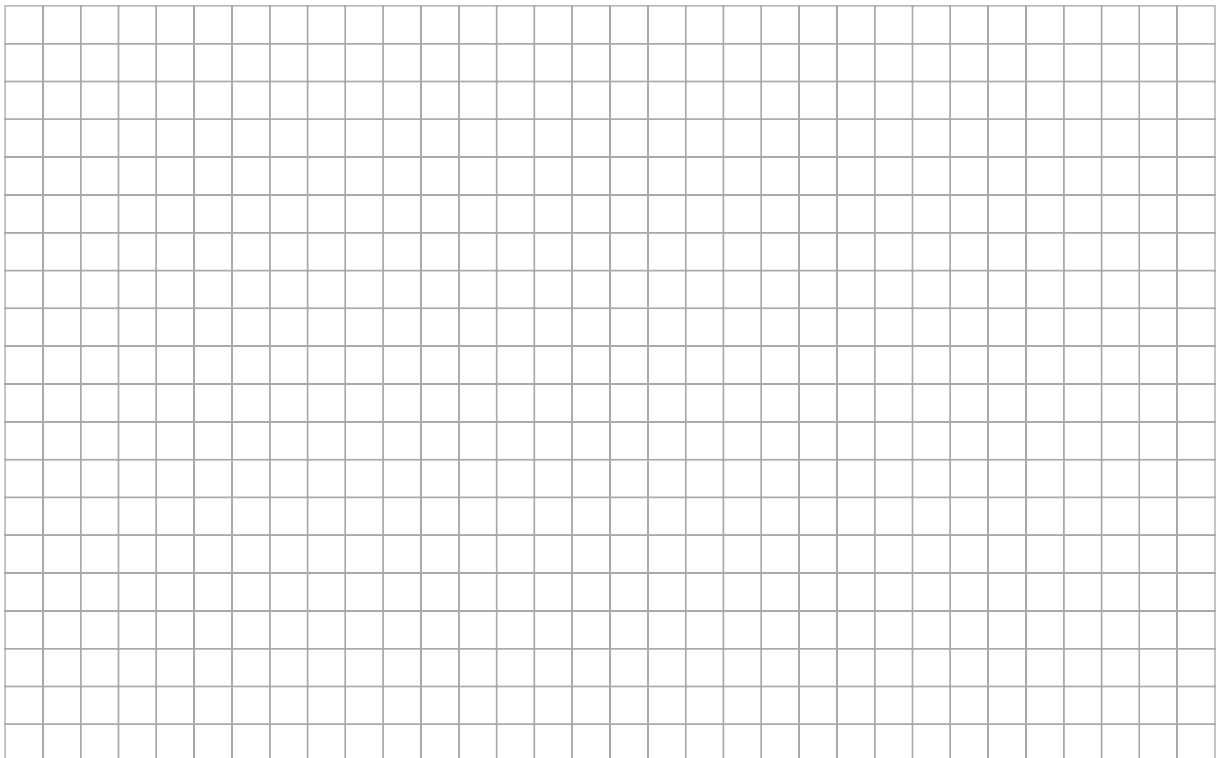


Question 2**(25 marks)**

- (a) A circle s has equation $x^2 + y^2 + 2x - 8y - 8 = 0$. Tangents t_1 and t_2 to s are perpendicular to the line $3x + 4y + 1 = 0$. Find the equations of t_1 and t_2 .



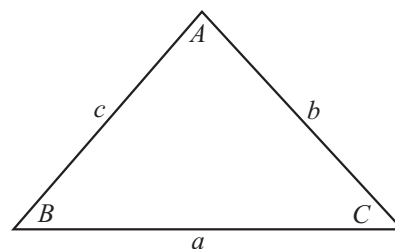
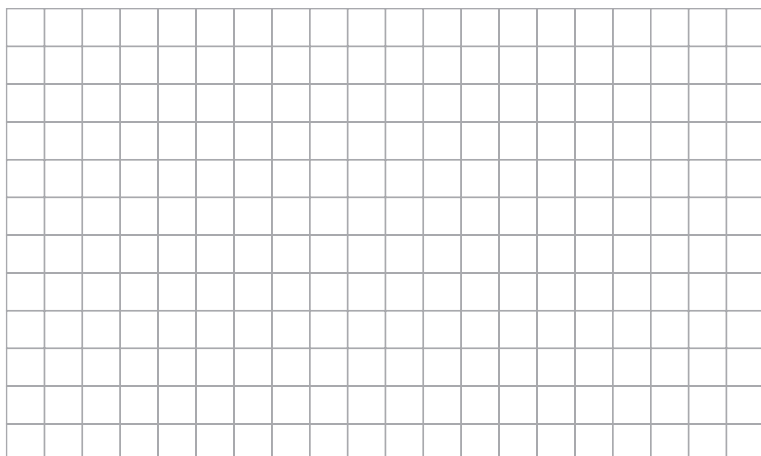
- (b) Find the equations of the lines parallel to $3x + 4y + 1 = 0$ that together with this line and the tangents form a square.



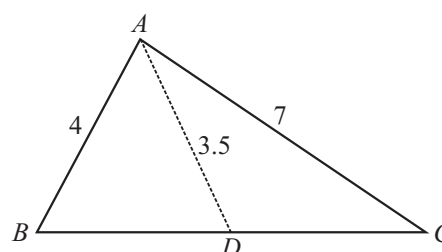
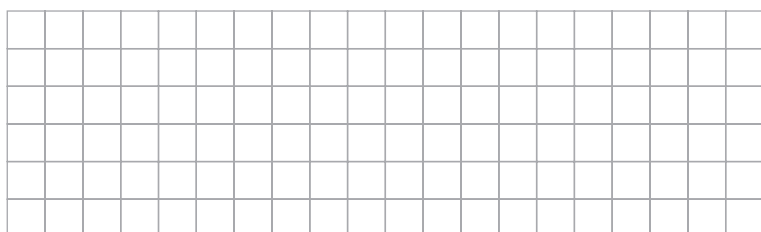
Question 3

(25 marks)

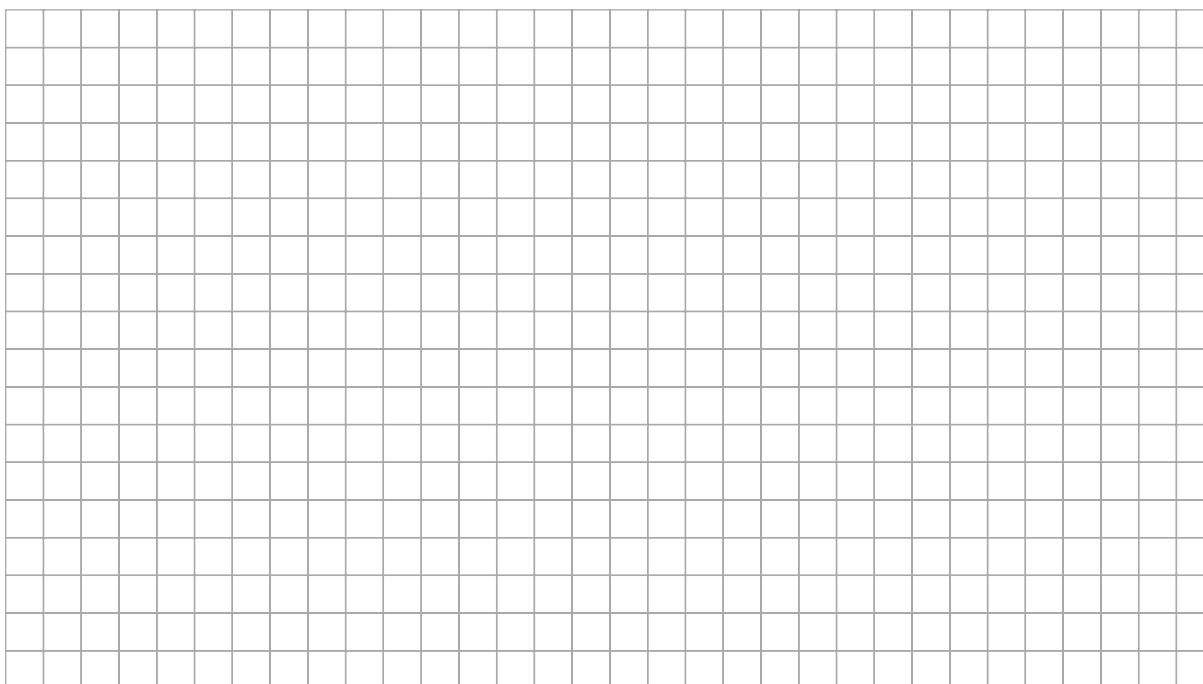
- (a) Write down the three versions of the Cosine rule based for the triangle shown.



- (b) If AD is the median of triangle ABC , what can you conclude about $|BD|$ and $|DC|$?



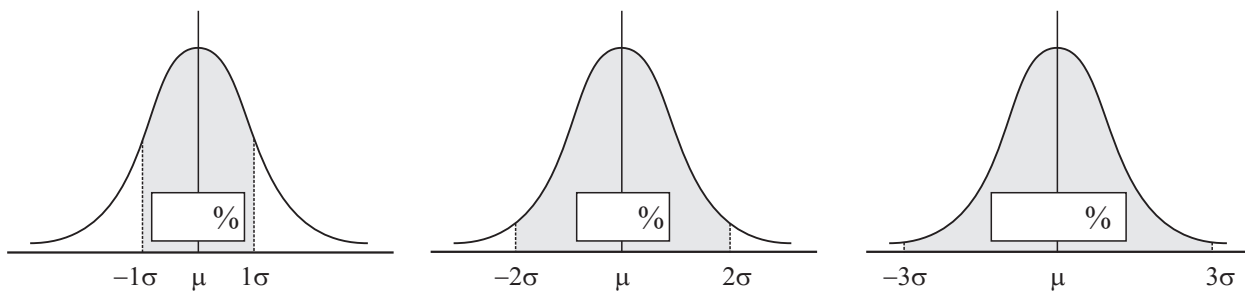
- (c) Use the Cosine rule for triangles ABD and ABC to find $|BC|$.



Question 4

(25 marks)

- (a) Illustrate the Empirical rule by filling in percentages in the shaded areas on the diagrams below.



- (b) In a bank, the ages of all new employees hired over the last 10 years were normally distributed. 95% of the ages centred about the mean were between 24.8 years and 36.4 years. Find the mean and standard deviation.



- (c) In **part (b)**, what proportion had ages greater than 30 years?

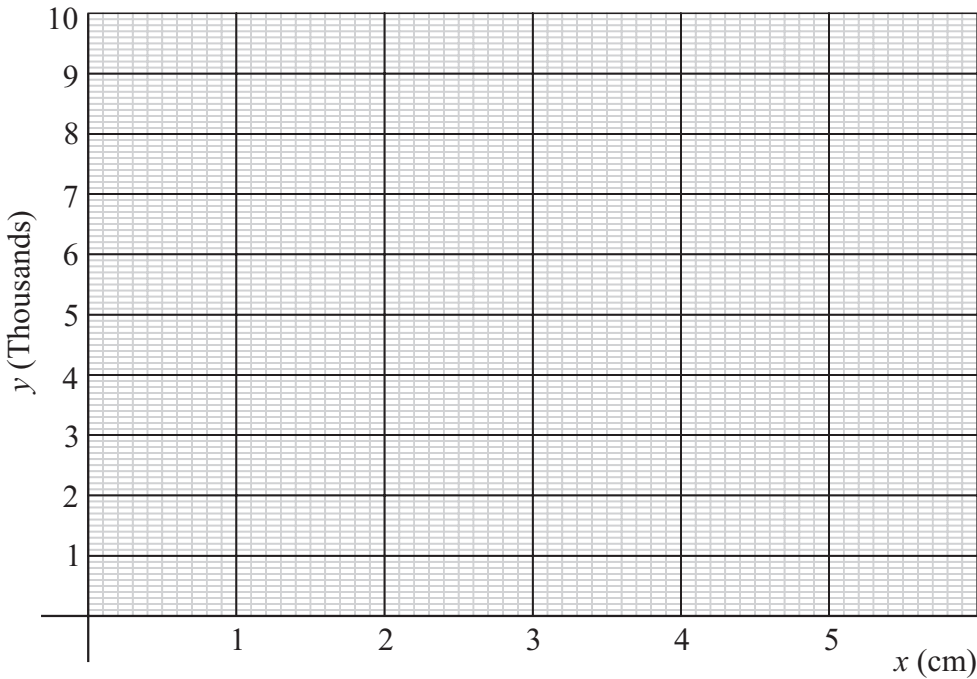


Question 5

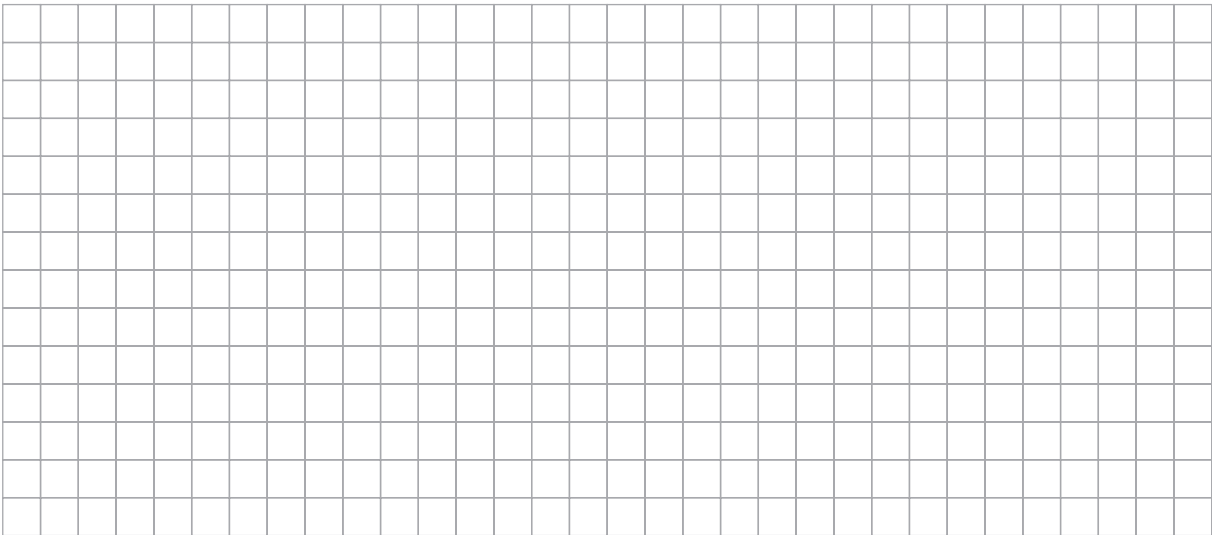
(25 marks)

The following table shows the weekly rainfall (x cm) and the number of tourists (y thousands) visiting a certain tourist attraction for nine successive weeks.

Rainfall (x cm)	4.4	3.0	5.2	5.0	2.1	0	0	1.1	3.2
Number of tourists (y thousands)	5.1	7.9	0.9	4.0	4.7	7.3	9.5	8.7	2.6



- (a) Draw a scatter plot for this data on the grid above.
- (b) Plot the point (\bar{x}, \bar{y}) , where \bar{x} is the mean rainfall and \bar{y} is the mean number of tourists.



- (c) Draw the line of best fit passing through (\bar{x}, \bar{y}) .

- (d) A student who drew the line of best fit found that his line cut the y -axis at $(0, 9000)$. Find the slope of his line of best fit, to the nearest whole number, using the y -intercept and (\bar{x}, \bar{y}) .

[illegible]

- (e) Interpret his slope in the context of rainfall and the number of tourists.

[illegible]

- (f) Find his equation of the line of best fit.

A large rectangular area filled with a uniform grid of small squares, typical of graph paper. The grid consists of 20 columns and 15 rows of squares.

- (g) (i) On the tenth week, there was 3.8 cm of rainfall. Use your line of best fit to estimate the number of tourists that had visited the tourist attraction in the tenth week.

NUMBER OF TOURISTS:

- (ii) Use the student's equation to find the number of tourists for a rainfall of 3.8 cm. How does it compare with your result?

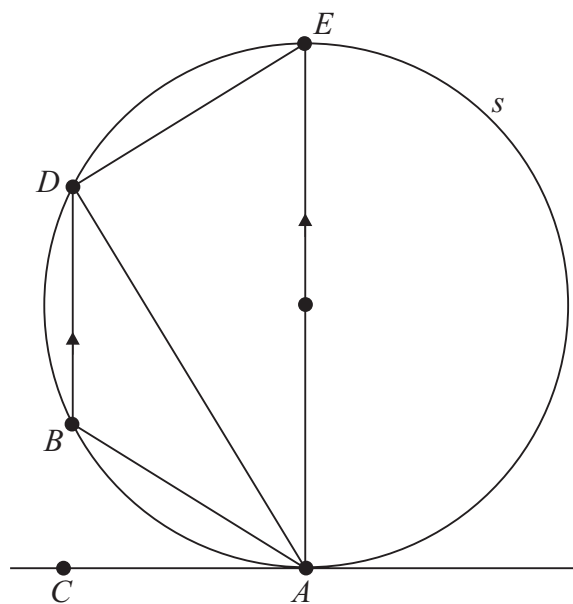
[illegible]

Question 6

(25 marks)

s is circle at A with tangent CA . $ABDE$ is a cyclic quadrilateral with $BD \parallel AE$, where AE is a diameter at A .

Prove $|\angle BAC| = |\angle DAE| = |\angle ADB|$.



150 marks

Question 7

(50 marks)

A histogram showing the distribution of percentage success rates at the free-throw line for 100 players. The x-axis is labeled 'Percentage success rate at the free-throw line' and ranges from 70 to 94. The y-axis is labeled 'Number of players' and ranges from 0 to 40. The distribution is roughly bell-shaped, centered around 80%.

Percentage success rate at the free-throw line	Number of players
70-74	6
74-78	18
78-82	38
82-86	18
86-90	18
90-94	2

- | Percentage success | Frequency f | Mid-interval value x | fx |
|--------------------|---------------|------------------------|------|
| 70–74 | | | |
| 74–78 | | | |
| 78–82 | | | |
| 82–86 | | | |
| 86–90 | | | |
| 90–94 | | | |
| | | | |

[illegible]

- (b)** Fill in the cumulative frequency table and use it to find the median, to one decimal place, from the original histogram.

Percentage success	Cumulative frequency
<74	
<78	
<82	
<86	
<90	
<94	

This image shows a full page of blank graph paper. The grid consists of small, uniform squares formed by thin, light gray lines. There are no margins, text, or other markings on the page.

- (c) (i) Find the percentage difference between the median and the mean as a percentage of the mean, to two decimal places.

[illegible]

- (ii)** You can assume from **(c) (i)** that the distribution is approximately normal. Why?

[illegible]

- (iii)** Use your calculator to find the standard deviation σ of the distribution, to two decimal places.

STANDARD DEVIATION σ

<i>page</i>	<i>running</i>
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- (d)** Using your values for the mean and standard deviation, find:

- (i) the 90th. percentile success rate, to one decimal place,

A large grid of graph paper with 20 columns and 10 rows. The grid is composed of small squares, with a slightly larger margin on the left side for writing.

- (ii) the percentage of free-throwers whose success rate was less than 85%, to one decimal place.

- (e) Write down three conditions for a Bernoulli trial.

CONDITION 1

CONDITION 2

CONDITION 3

- (f) Jamal Crawford of the Portland Trailblazers had the highest success rate at the free-throw line of 92.7% in the 2011–2012 season. In five free-throws, find the probability as a percentage to one decimal place that:

- (i) he gets all five,

[illegible]

- (ii) he only gets three out of five,

[illegible]

- (iii) he get his third free-throw on the fifth and final throw.

[illegible]

Question 8

(30 marks)

- (a)** Explain what a 95% confidence interval means.

Why does a 99% confidence level give a wider confidence interval than a 95% confidence level?

[illegible]

- (b) In a survey of whether the Junior Certificate Exam should be abolished, 200 out of 300 fifth years said it should. Construct a confidence interval at the 95% confidence level for this survey and state what this means.

This image shows a full page of blank graph paper. The grid consists of small, uniform squares formed by thin, light gray lines. There are no margins, text, or other markings on the page.

- (c) The heights of students at a university are assumed to have a normal distribution with a standard deviation of 10 cm.
A random sample of 50 students was taken. It gave a mean of 173 cm.
Construct a 95% confidence interval for the population mean and state what it means.

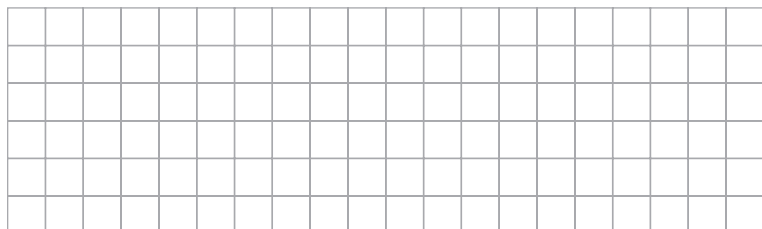
[illegible]

Question 9

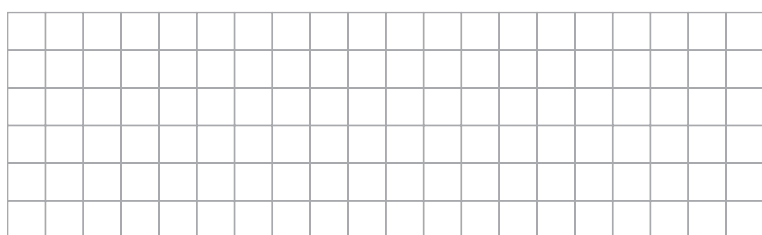
(70 marks)

- (a) A jewellery designer wants to design a brooch consisting of two circular rings with radii 3 cm and 5 cm respectively, with a distance of 10 cm between the centres. He wants to have a silver bar joining them that is tangential to each ring.

- (i) If $a = |DF|$ and $b = |FE|$, show that $a + b = 2$ cm.



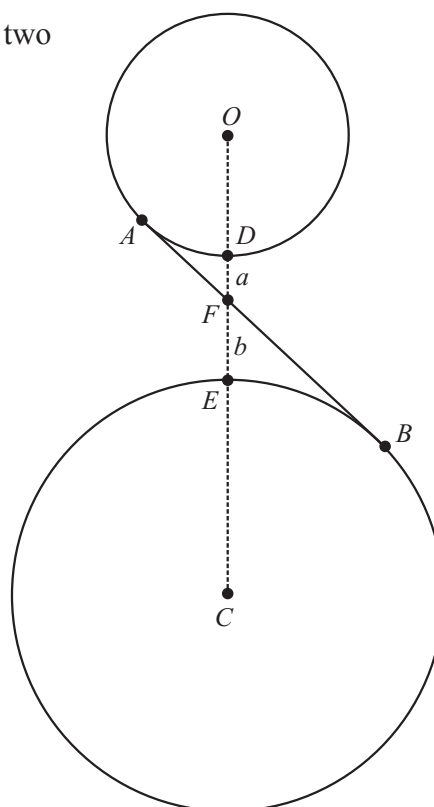
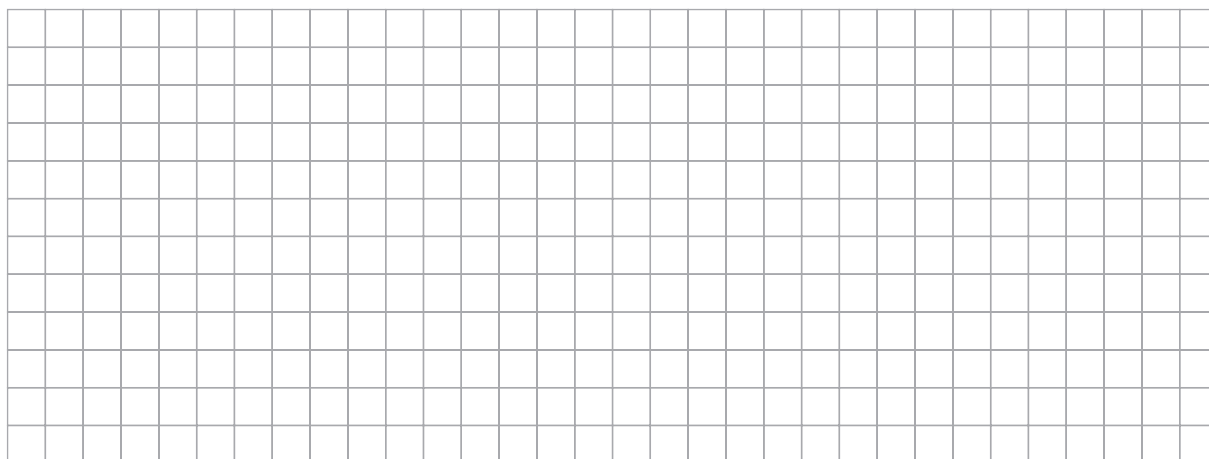
- (ii) Prove that triangles OAF and CBF are similar triangles.



- (iii) Hence, by equating the ratio of corresponding sides from similar triangles, find the values of a and b .



- (iv) Find $|AB|$, the length of the silver bar.



- (b)** The designer decides to check his calculations by using his knowledge of co-ordinate geometry. He calls the rings c_1 and c_2 and the silver bar forms the tangent t . The centre of c_2 is the origin $(0, 0)$.

- (i) One unit on this Cartesian system corresponds to 1 cm. Write the coordinates of the points positioned on the y -axis, as shown on the diagram.

$$C = (0, 0)$$

$$E = (\quad , \quad)$$

$$F = \left(\begin{array}{c} \\ , \\ \end{array} \right)$$

$$D = \left(\begin{array}{c} \\ \end{array} \right)$$

$$O = (\quad , \quad)$$

- (ii) Write down the equations of circles c_1 and c_2 .

Equation of c_1 :

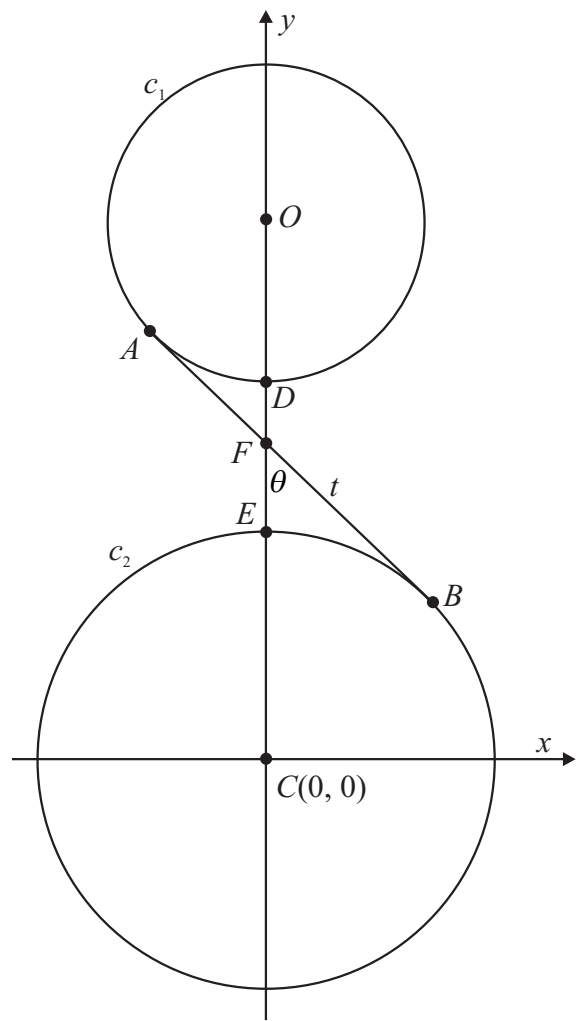
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Equation of c_2 :

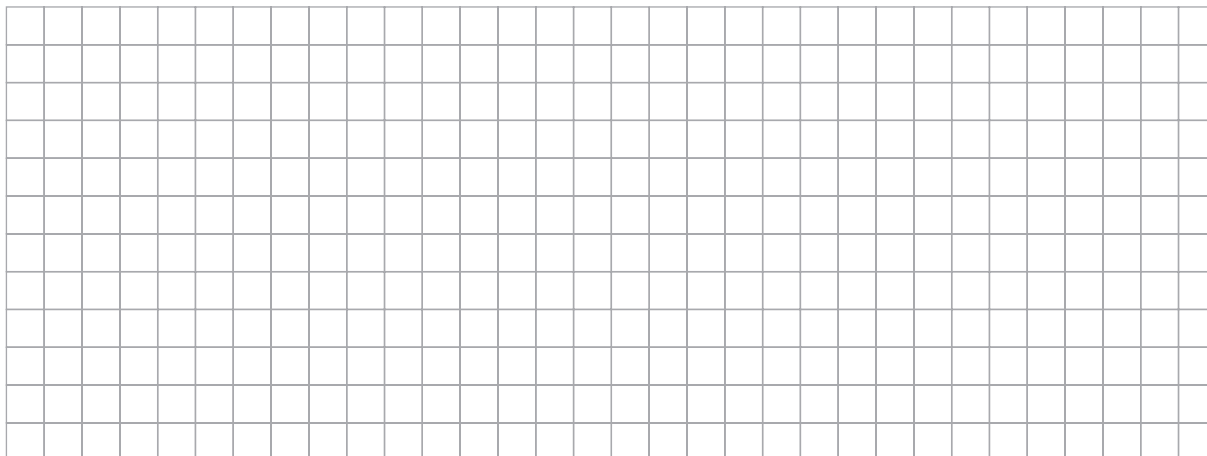
- (iii) Find $\tan \theta$, where $\theta = |\angle BFC|$.

[illegible]

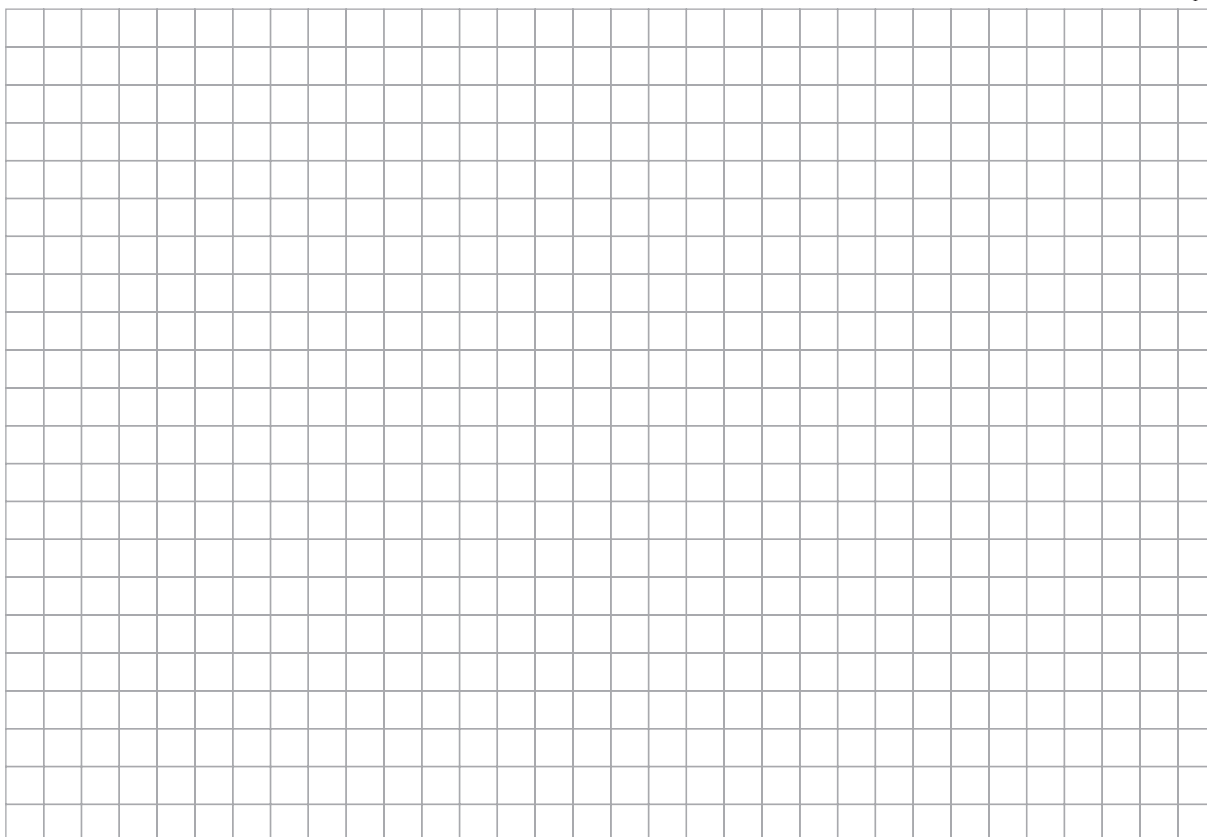
- (iv) Show that θ is also the angle BC makes with the positive x -axis. Hence, find the coordinates of B , the point of intersection of the tangent t with the circle c_2 .



(v) Write down the equation of the tangent t .



(vi) Work out the co-ordinates of A , the point of intersection of the tangent t with the circle c_1 .



(vii) Finally, use the distance formula to find $|AB|$. Does it agree with the answer in part (a)?

