



Coimisiún na Scrúduithe Stáit
State Examinations Commission

Leaving Certificate Examination, 2012

Mathematics (Project Maths – Phase 3)

Paper 2

Ordinary Level

Monday 11 June Morning 9:30 – 12:00

300 marks

Examination number

Centre stamp

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

Answer **all eight** questions, as follows:

In Section A, answer:

Questions 1 to 5 and
either Question 6A **or** Question 6B.

In Section B, answer Questions 7 and 8.

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 on the back cover 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.

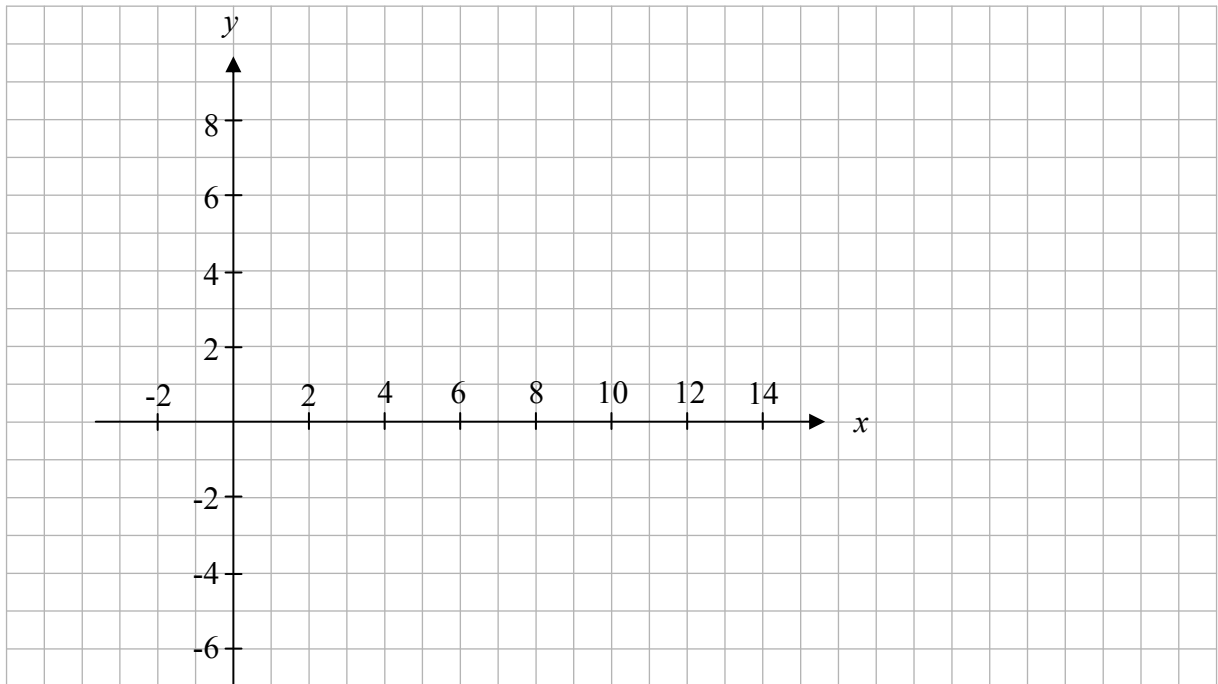
Write the make and model of your calculator(s) here:

Question 3

(25 marks)

$A(6, -1)$, $B(12, -3)$, $C(8, 5)$ and $D(2, 7)$ are four points.

(a) Plot the four points on the diagram below.



(b) Describe two different ways of showing, using co-ordinate geometry techniques, that the points form a parallelogram $ABCD$.

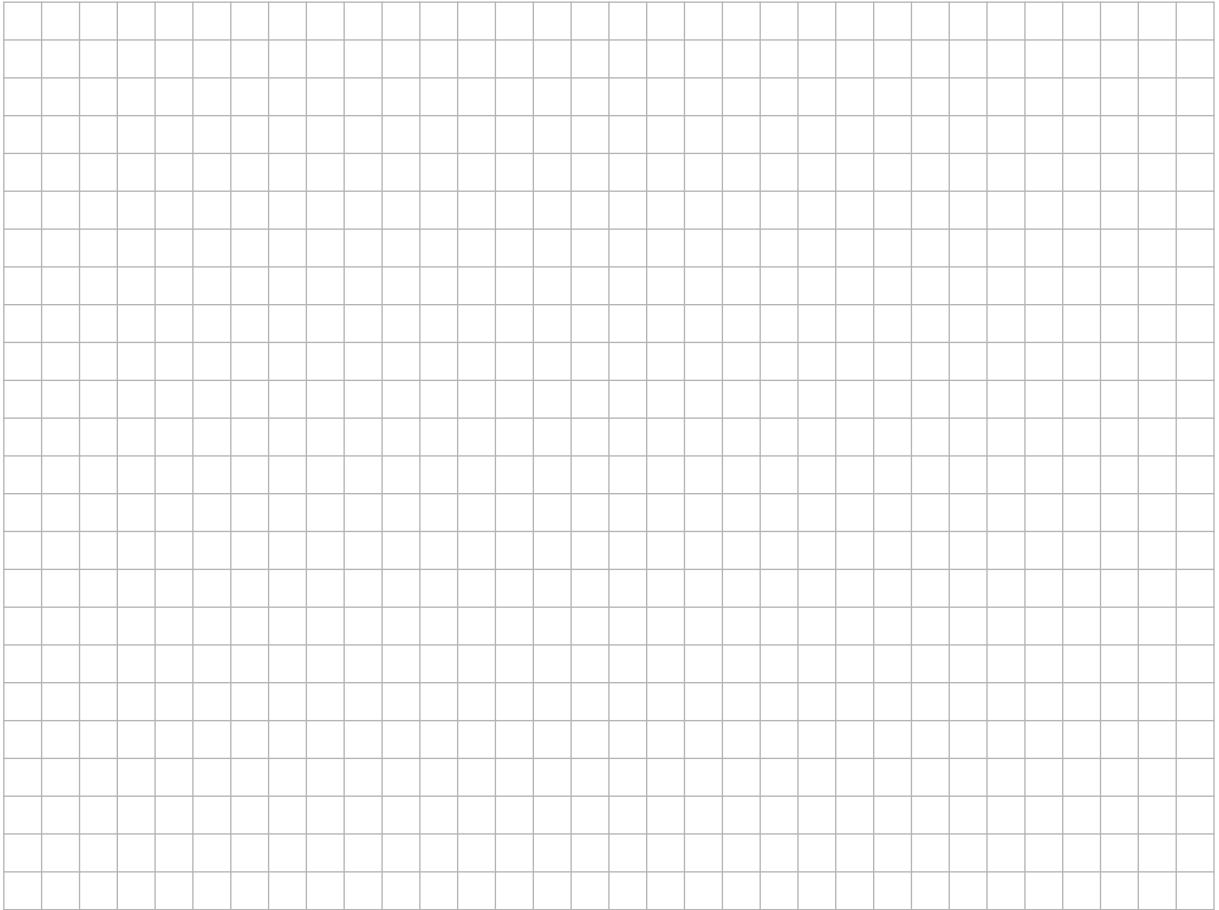
First method:

Second method:

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(c) Use one of the ways you have described to show that $ABCD$ is a parallelogram.

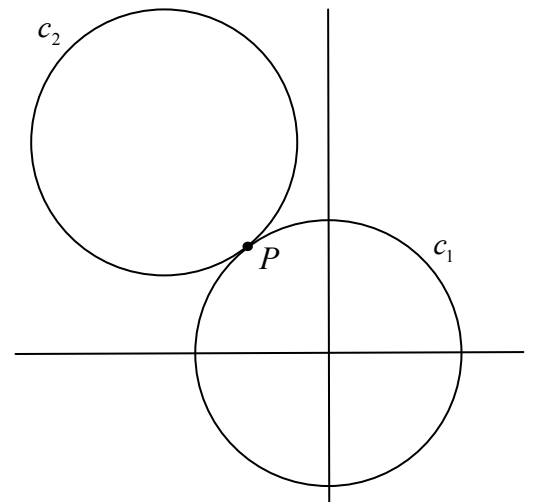
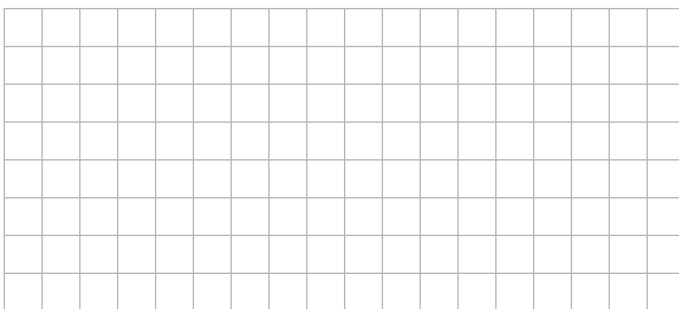


Question 4

(25 marks)

The diagram shows two circles c_1 and c_2 of equal radius.
 c_1 has centre $(0, 0)$ and it cuts the x -axis at $(5, 0)$.

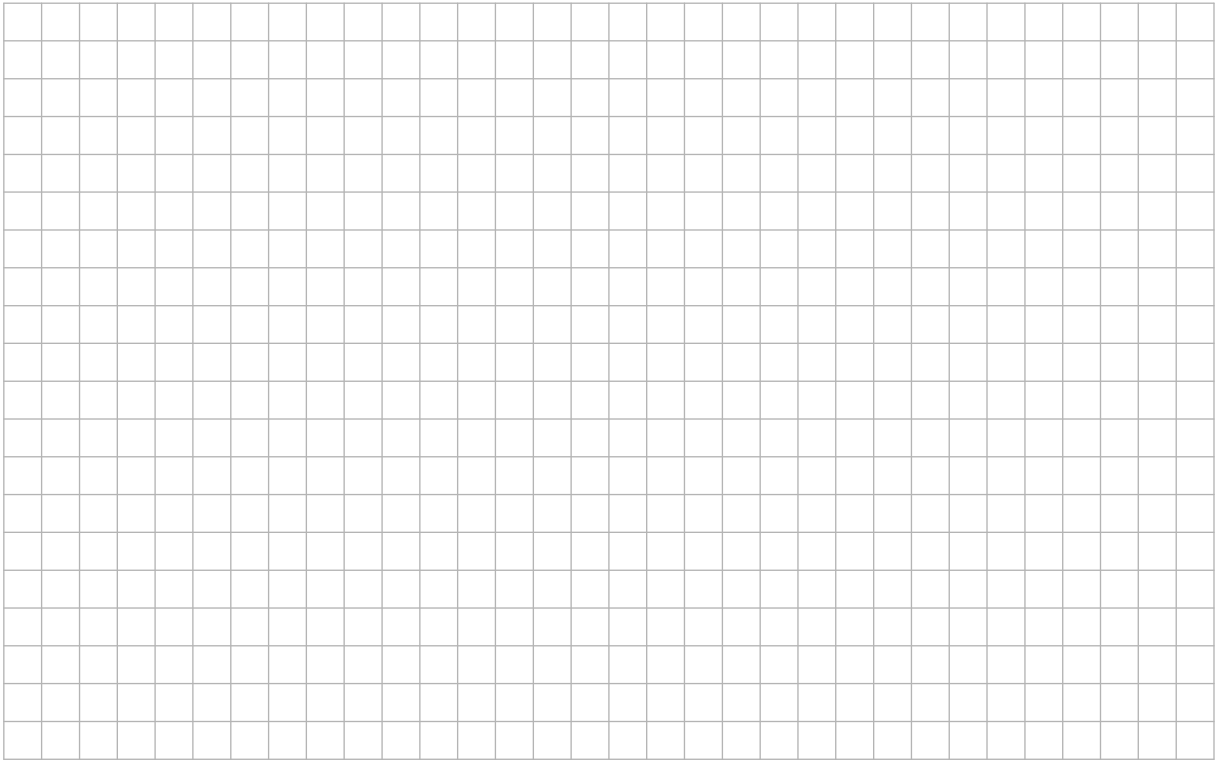
(a) Find the equation of c_1 .



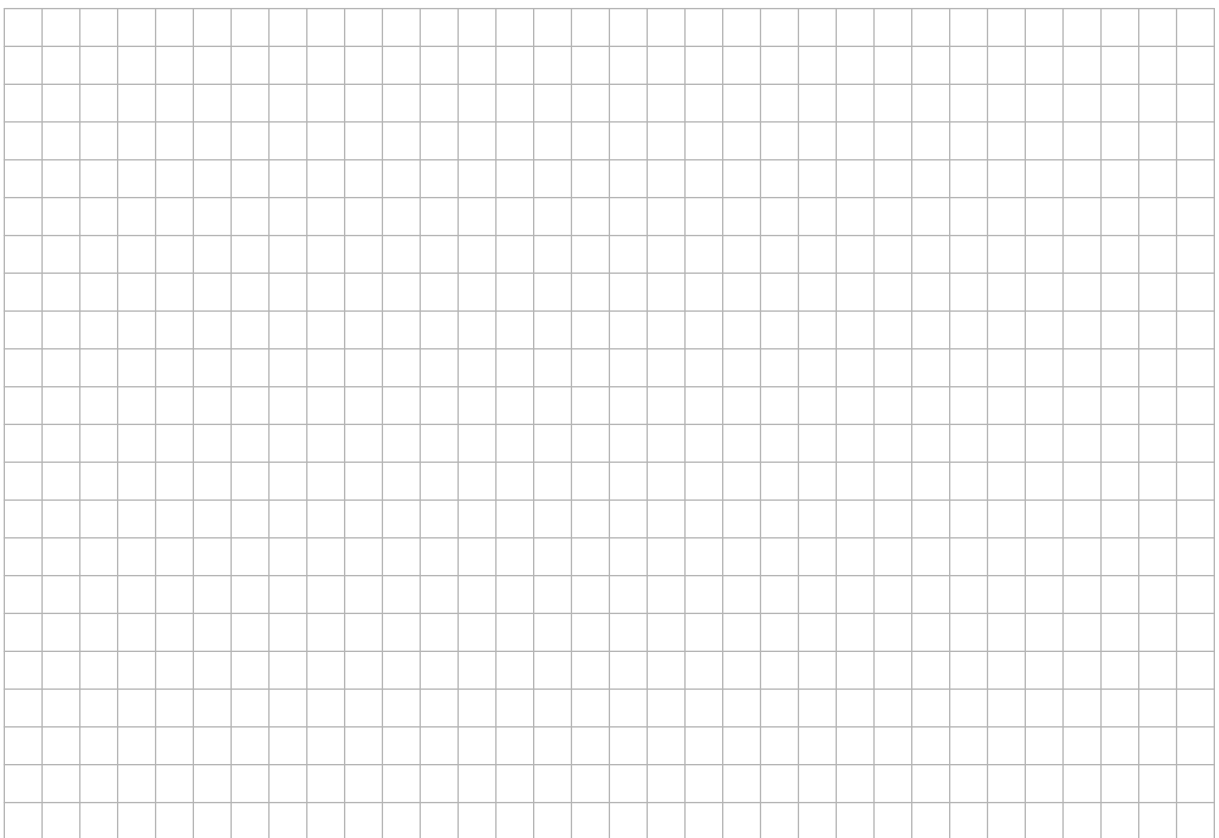
(b) Show that the point $P(-3, 4)$ is on c_1 .



- (c) The two circles touch at $P(-3, 4)$.
 P is on the line joining the two centres.
Find the equation of c_2 .



- (d) Find the equation of the common tangent at P .

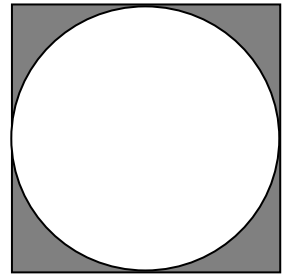


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Question 5

(25 marks)

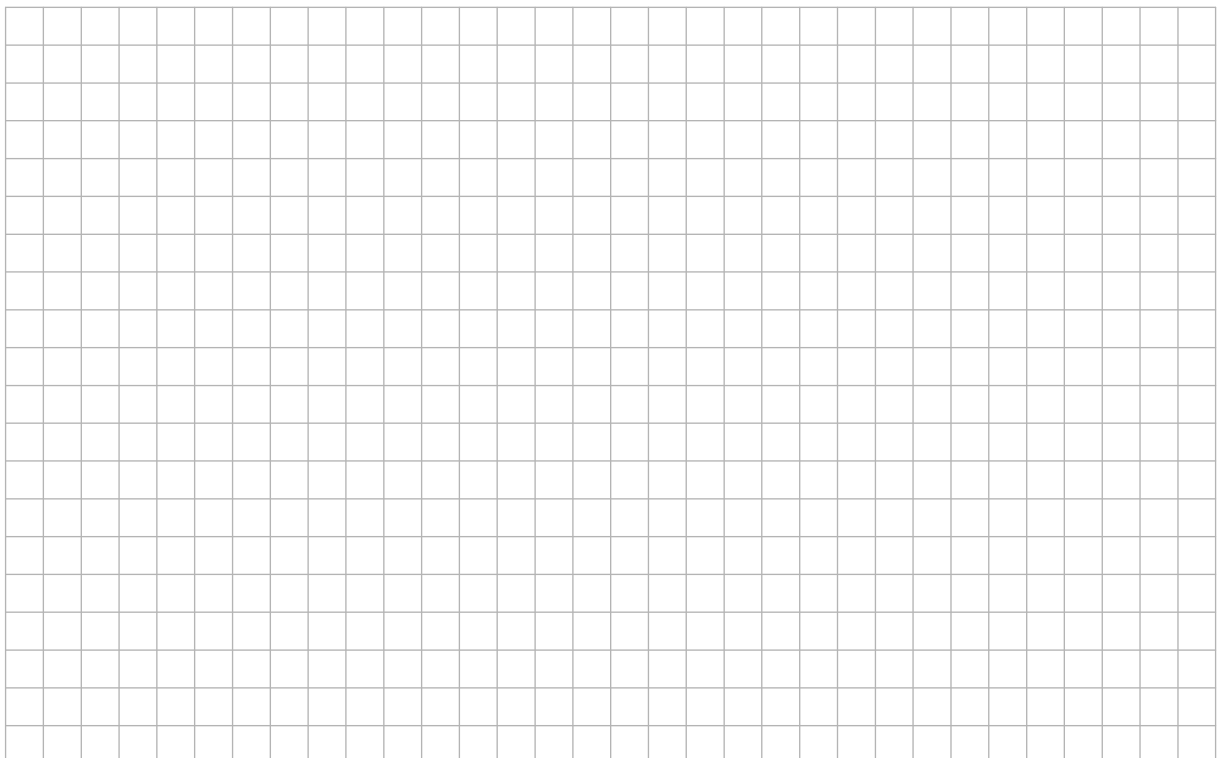
- (a) The diagram shows a circle inscribed in a square.
The area of the square is 16 cm^2 .



- (i) Find the radius length of the circle.



- (ii) Find the area of the shaded region, in cm^2 , correct to one decimal place.



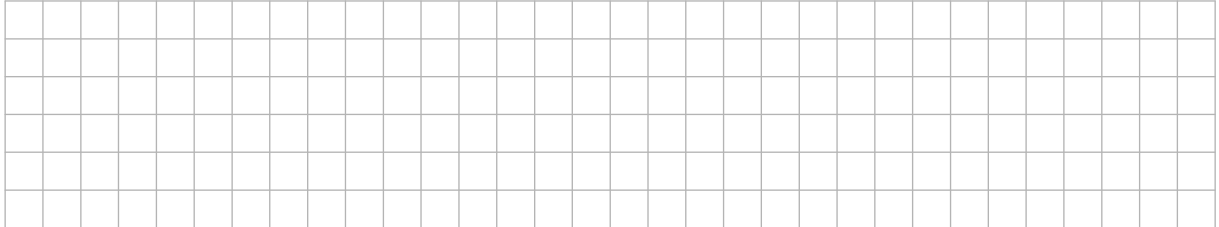
Question 6

(25 marks)

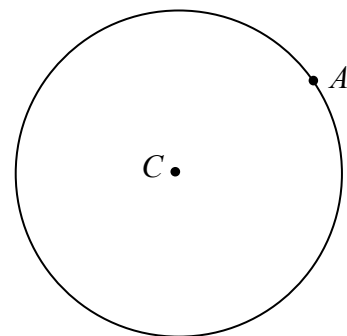
Answer **either** 6A **or** 6B.

Question 6A

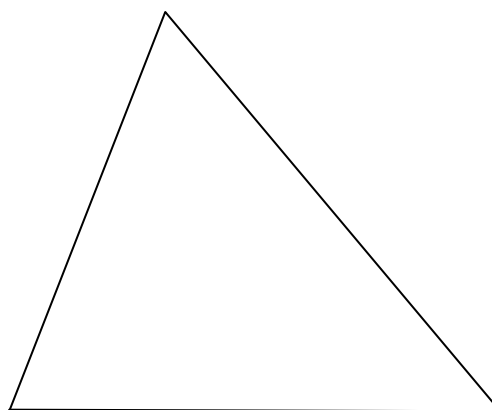
- (a) (i) Write down a geometrical result that can be used to construct a tangent to a circle at a point.



- (ii) On the diagram shown, construct the tangent to the circle at A .



- (b) Construct the circumcentre and circumcircle of the triangle below, using only a straight edge and compass. Show all construction marks clearly.



OR

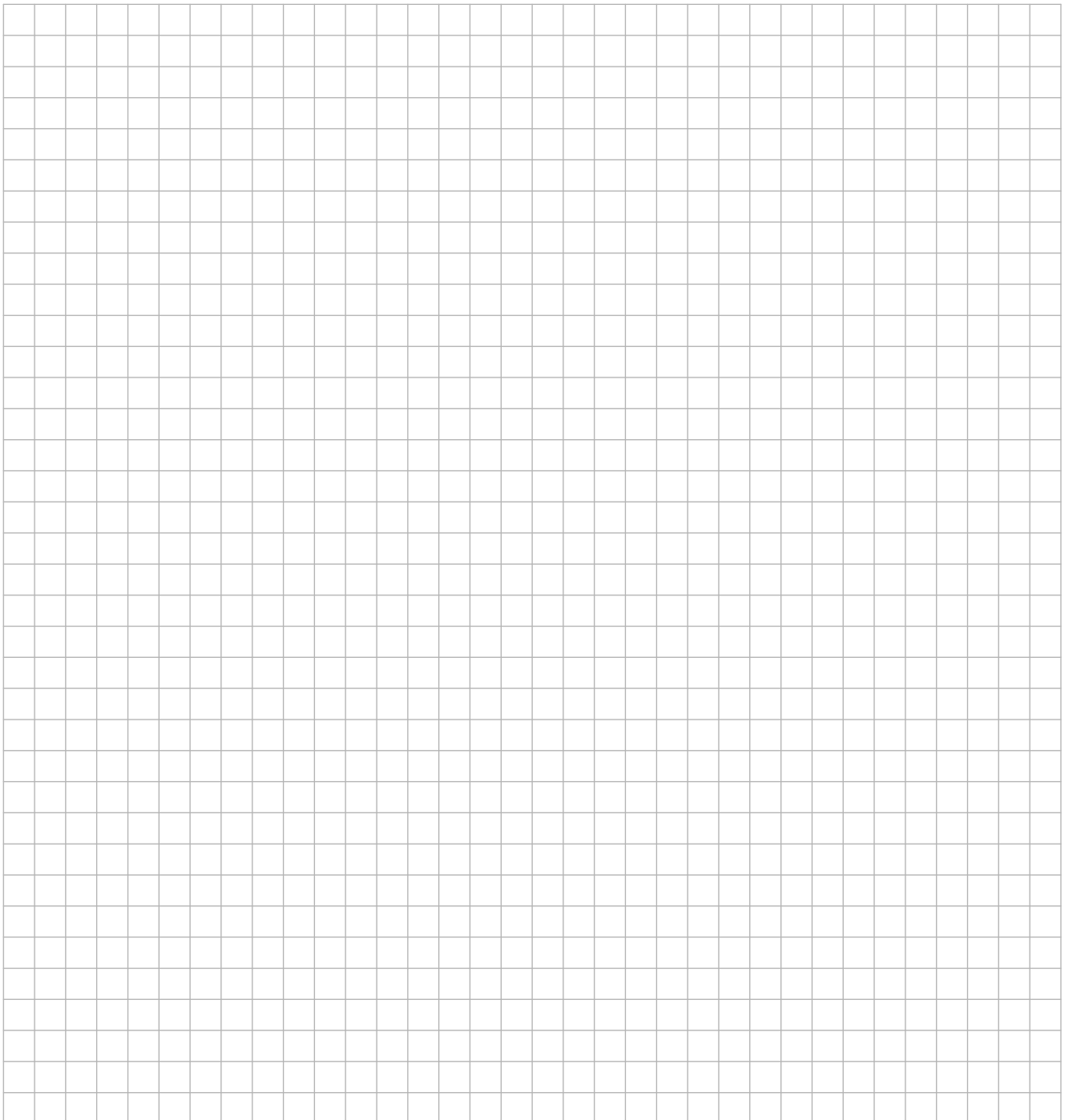
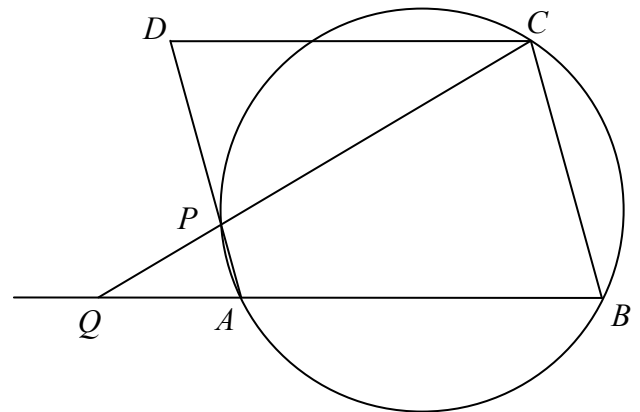
Question 6B

$ABCD$ is a parallelogram.

The points A , B and C lie on the circle which cuts $[AD]$ at P .

The line CP meets the line BA at Q .

Prove that $|CD| = |CP|$.



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Answer Question 7 and Question 8.

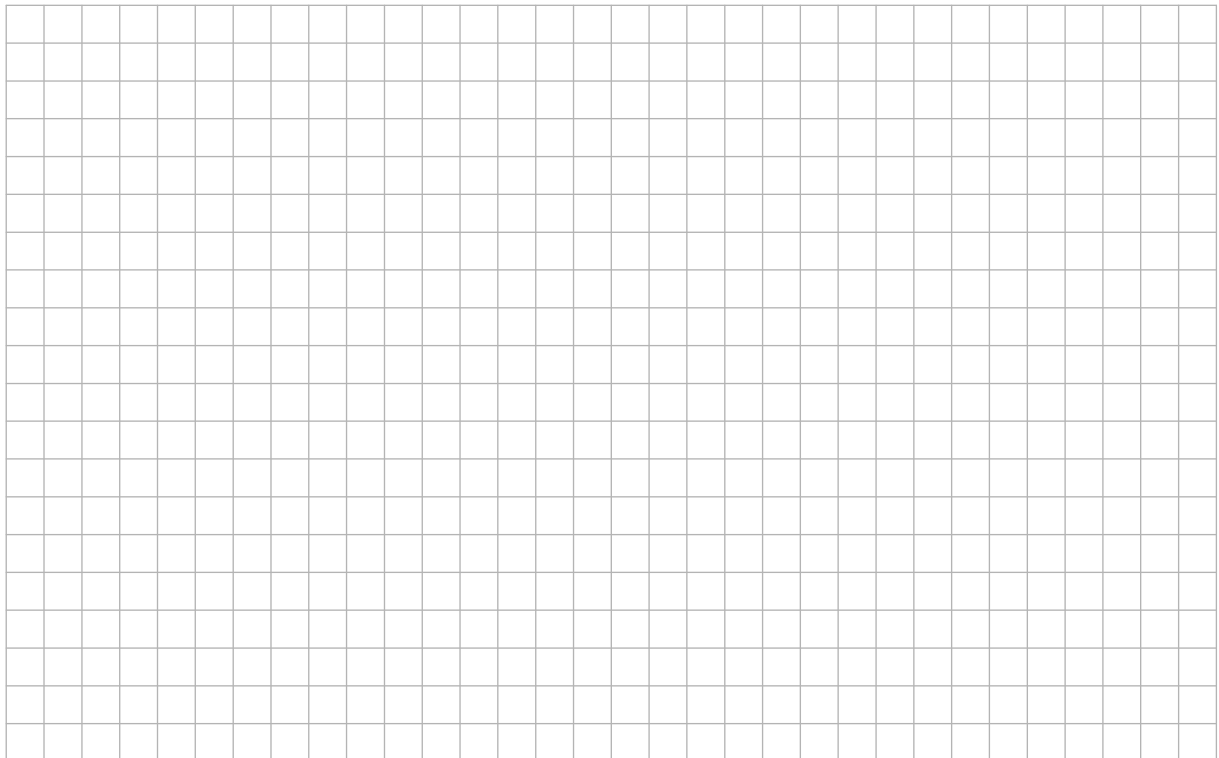
Question 7**(75 marks)**

The following table gives data on new private cars sold in Ireland in each quarter of each year from 2006 to 2011.

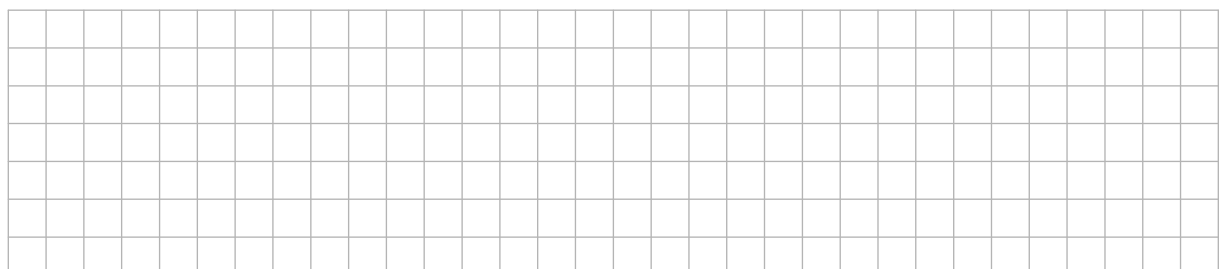
New private cars sales								
Year	Number of cars sold					Engine type of cars sold		
	January to March	April to June	July to Sept.	October to Dec.	Annual Total	Petrol	Diesel	Other
2006	75 769	54 572	32 873	10 059	173 273	128 634	44 010	629
2007	81 750	57 124	32 418	9 462	180 754	128 346	50 560	1 848
2008	77 441	37 128	27 361	4 540	146 470	92 298	50 283	3 889
2009	27 140	15 225	9 049	3 018	54 432	22 802	30 645	985
2010	34 555	26 806	17 011	6 535	84 907	27 124	53 998	3 785
2011	39 484	29 770	13 467	4 211	86 932	23 246	61 730	1 956

(Source: Central Statistics Office, <http://www.cso.ie>)

- (a) (i) Show the *annual total* sales of cars over the six years, using a suitable chart.



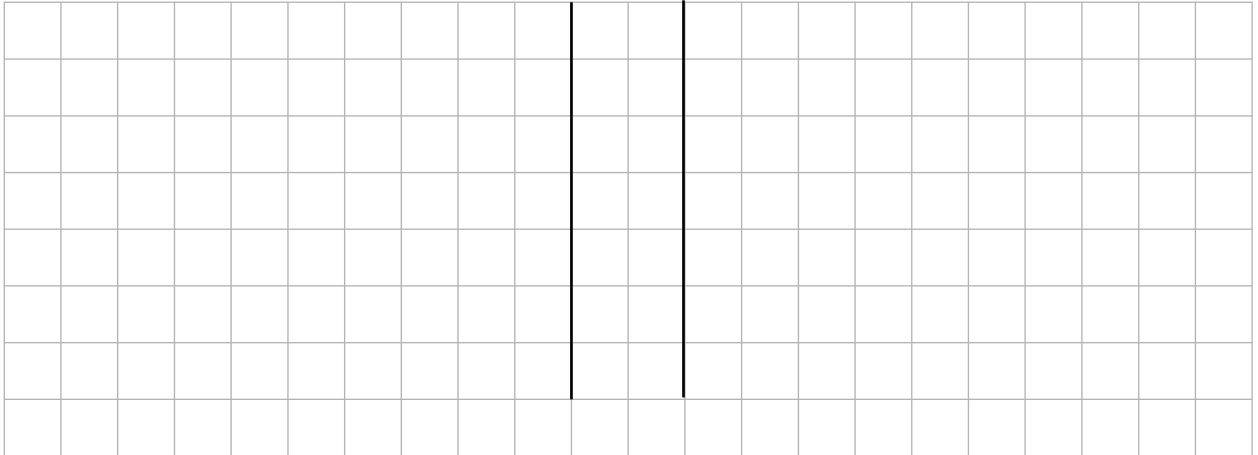
- (ii) Find the mean number of cars sold per year over the six years.



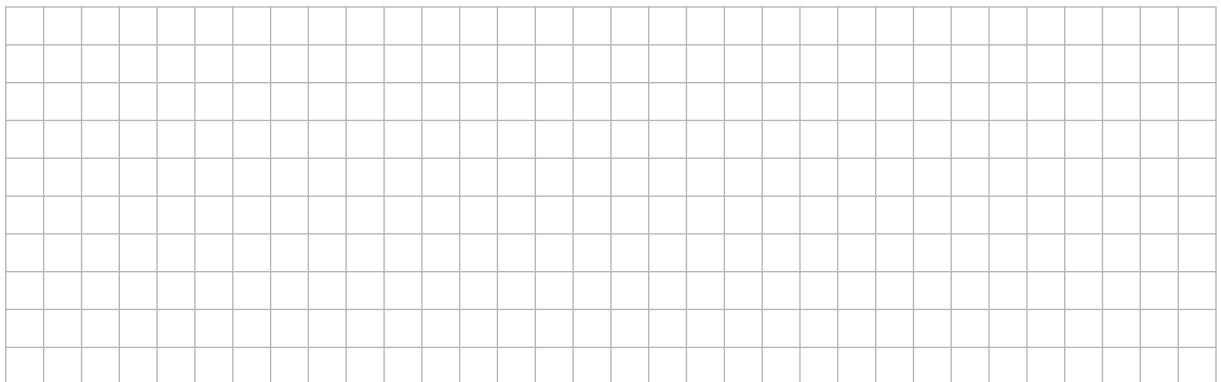
- (d) A survey of some of the most popular models of private cars sold in 2011 examined the CO₂ emissions in g/km from diesel engines and petrol engines. The data are as follows:

Diesel engines	Petrol engines
117, 125, 120, 125, 134, 110, 118, 114, 119, 119, 116, 107.	139, 133, 150, 157, 138, 159, 129, 138, 134, 129, 129, 136.

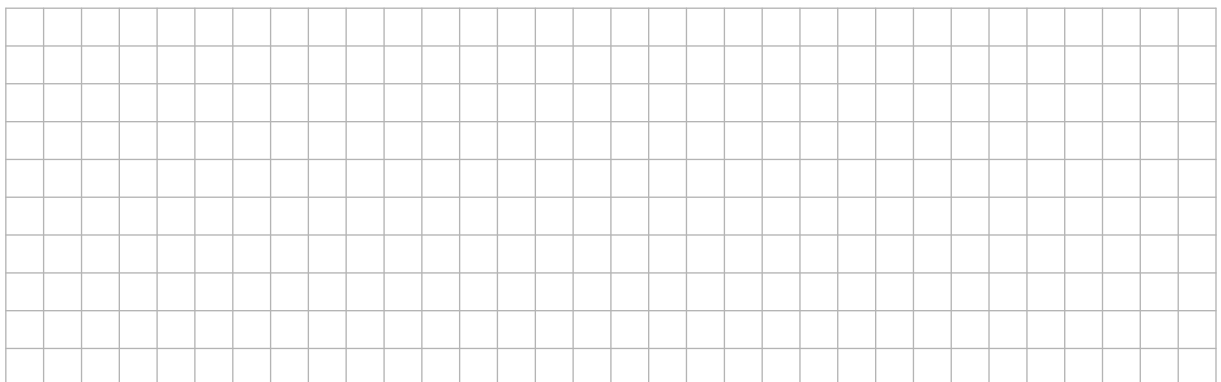
- (i) Construct a back-to-back stem-and-leaf plot of the above data.



- (ii) Does the information suggest that diesel engines produce lower CO₂ emissions than petrol engines? In your answer you should refer to the stem-and-leaf plot and to an appropriate measure of central tendency.



- (iii) Does the information suggest that there is a greater variation in the CO₂ emissions of diesel engines than petrol engines? In your answer you should refer to the stem-and-leaf plot and an appropriate measure of variability.



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Question 8

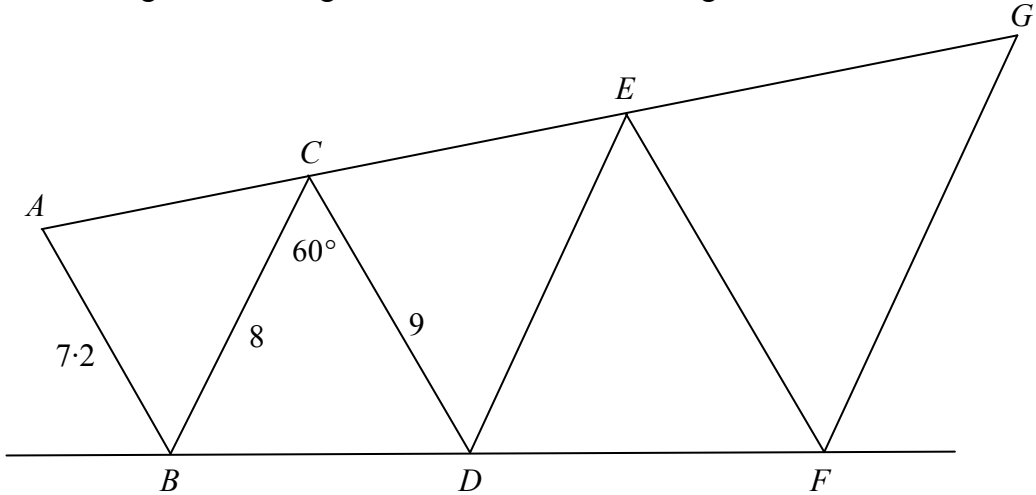
(75 marks)

- (a) The planned supports for the roof of a building form scalene triangles of different sizes.



- (i) Explain what is meant by a **scalene triangle**.

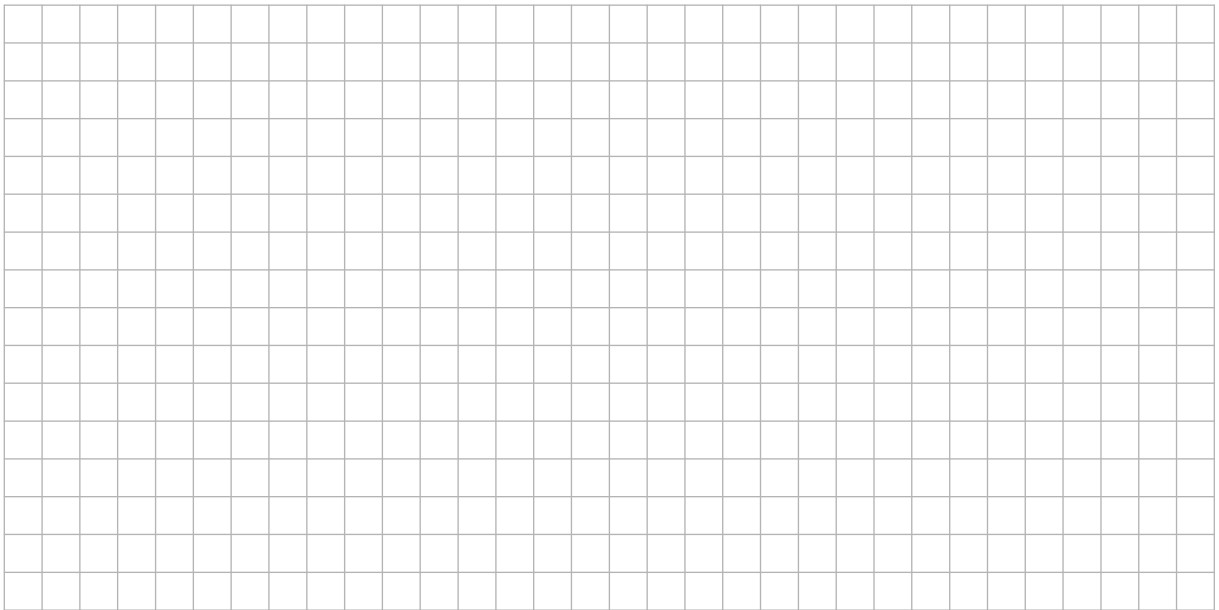
The triangle EFG is the image of the triangle CDE under an enlargement and the triangle CDE is the image of the triangle ABC under the same enlargement.



The proposed dimensions for the structure are $|AB| = 7.2$ m, $|BC| = 8$ m, $|CD| = 9$ m and $|\angle DCB| = 60^\circ$.

- (ii) Find the length of $[FG]$.

- (iii) Find the length of $[BD]$, correct to three decimal places.



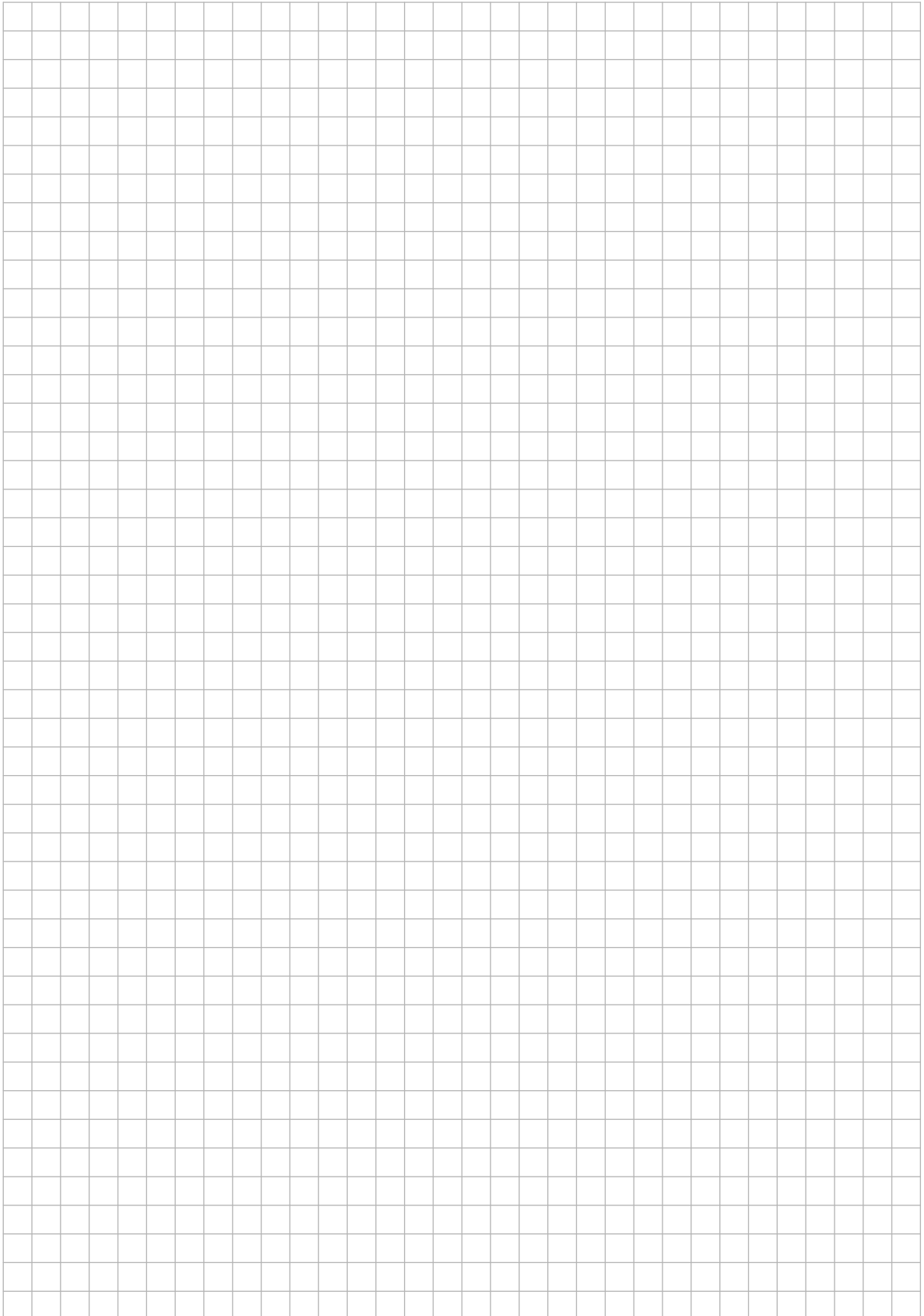
(iv) The centre of the enlargement is O . Find the distance from O to the point B .



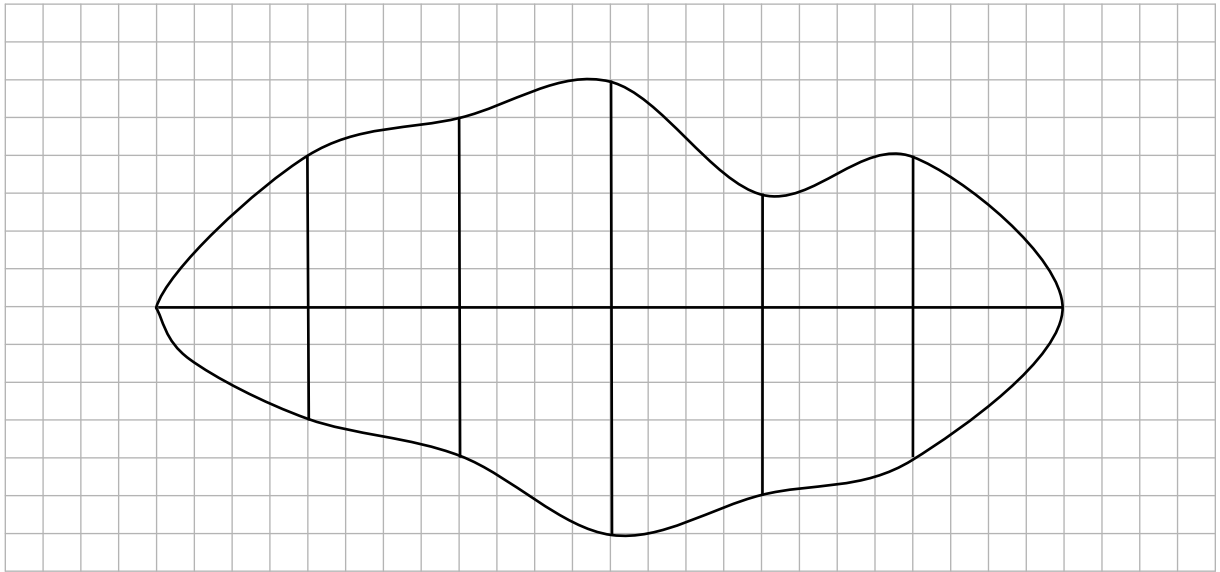
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- (v) A condition of the planning is that the height of the point G above the horizontal line BF cannot exceed 11.6 m.

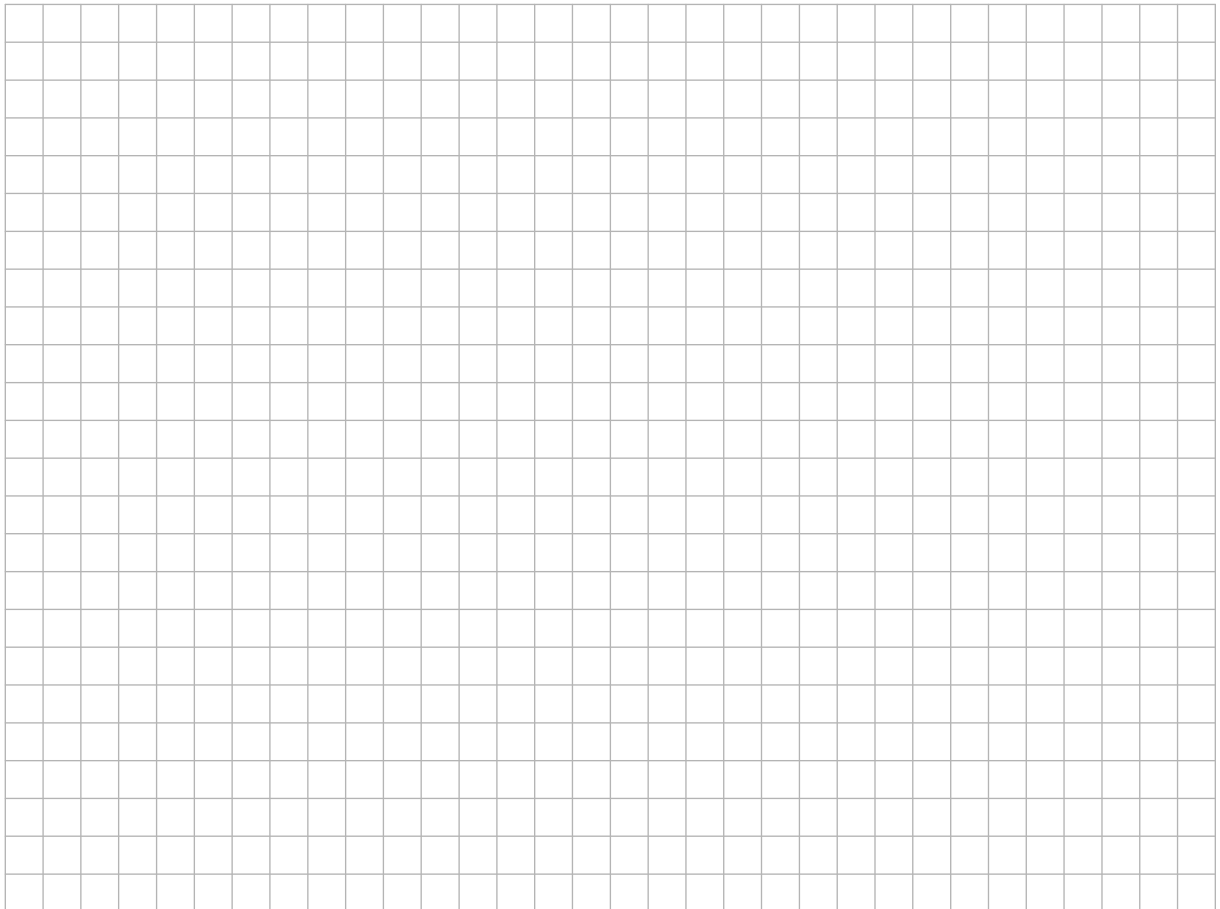
Does the plan meet this condition? Justify your answer by calculation.

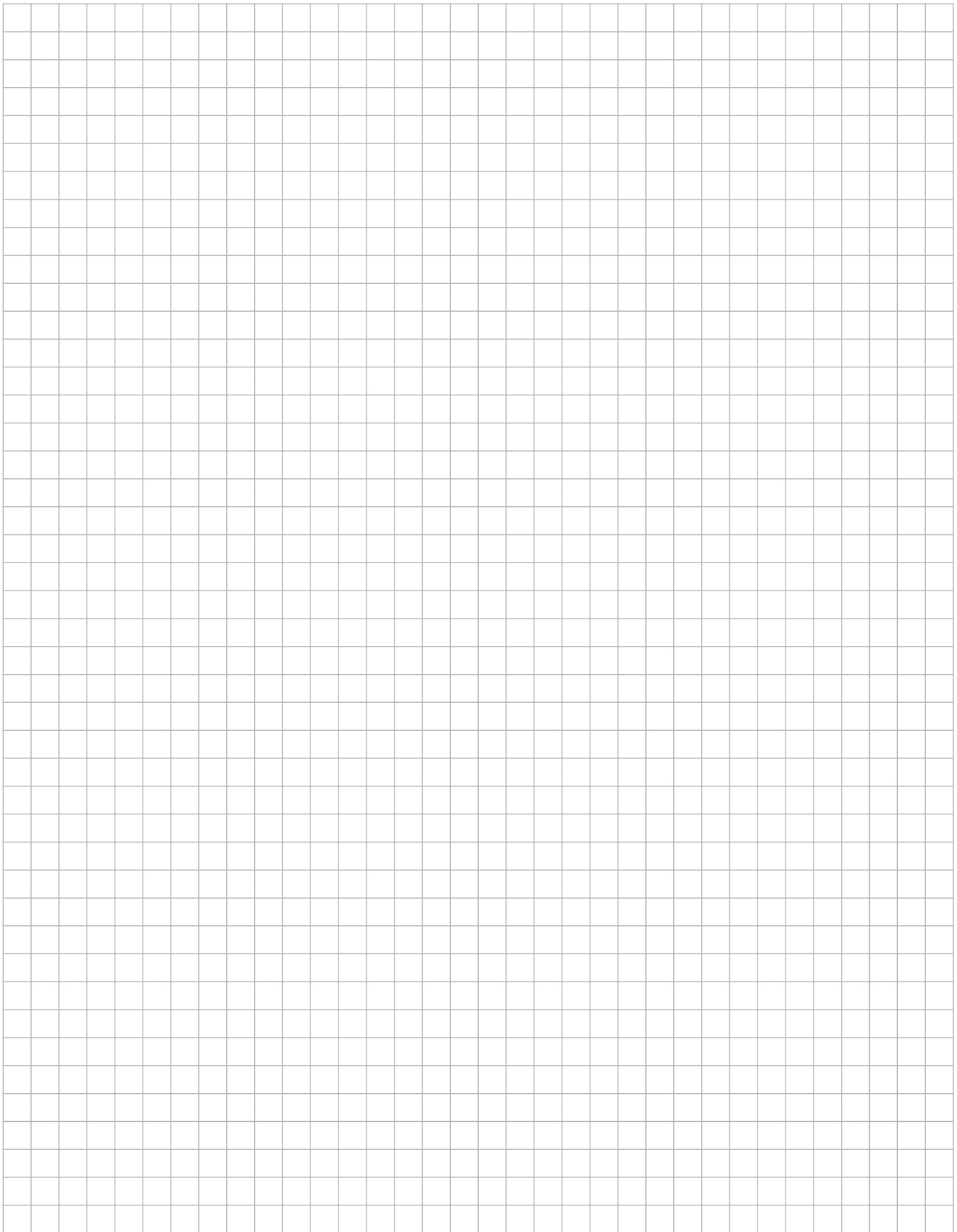


- (b) In order to estimate the area of the irregular shape shown below, a horizontal line was drawn across the widest part of the shape and five offsets (perpendicular lines) were drawn at equal intervals along this line.



- (i) Find the lengths of the horizontal line and the offsets, taking each grid unit as 5 mm, and record the lengths on the diagram.
- (ii) Use the trapezoidal rule to estimate the area of the shape.





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