



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

Grade
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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	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:



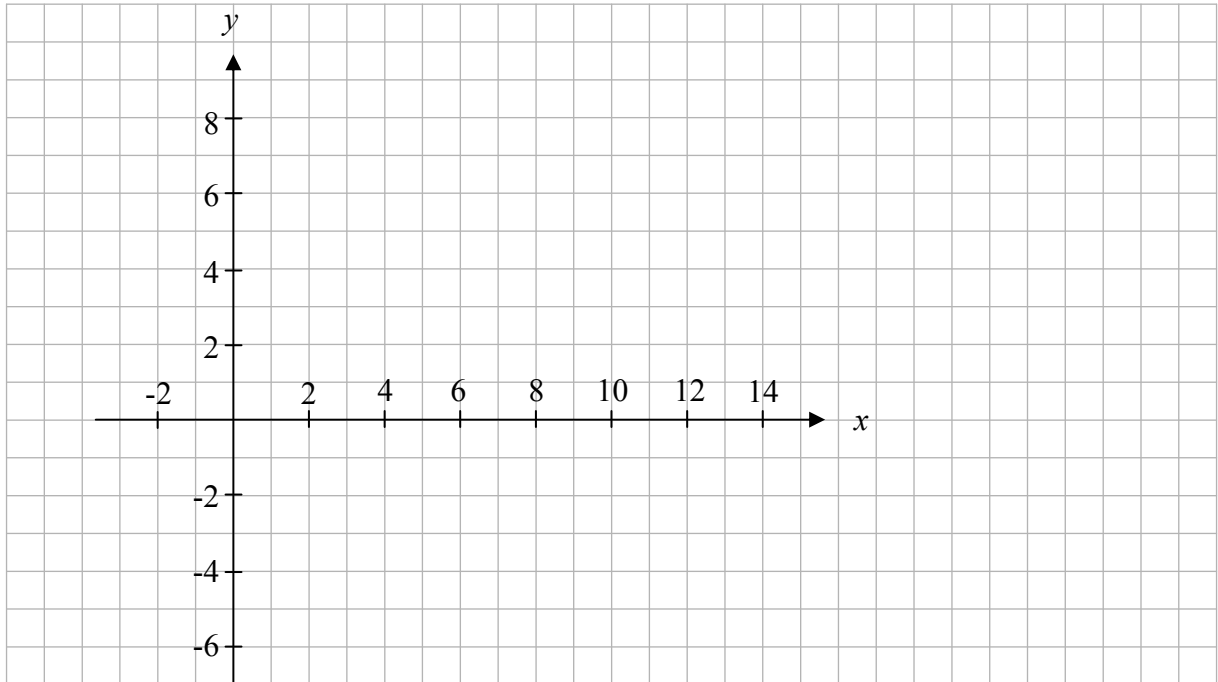


**Question 3**

**(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  $ABCD$ .

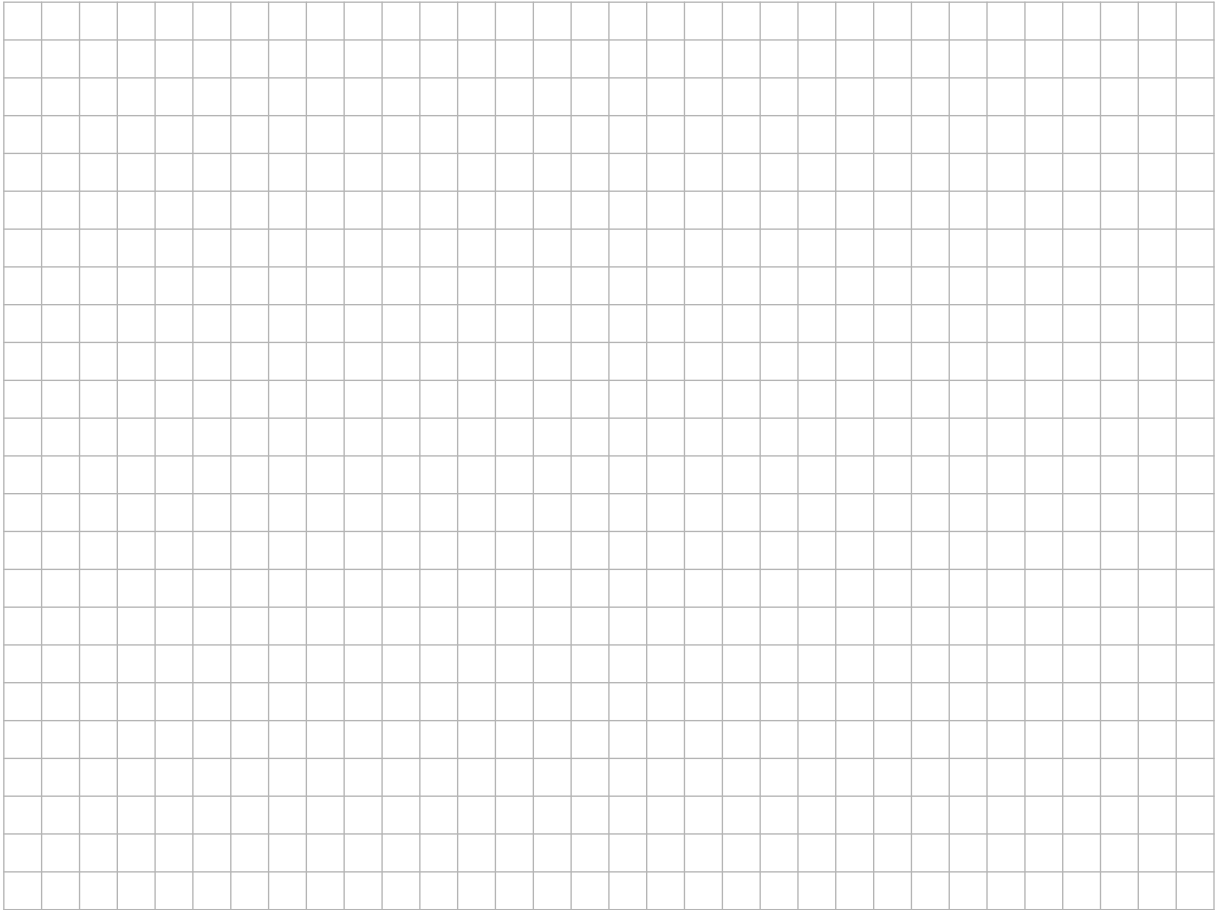
First method:

Second method:

*This question continues on the next page.*

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

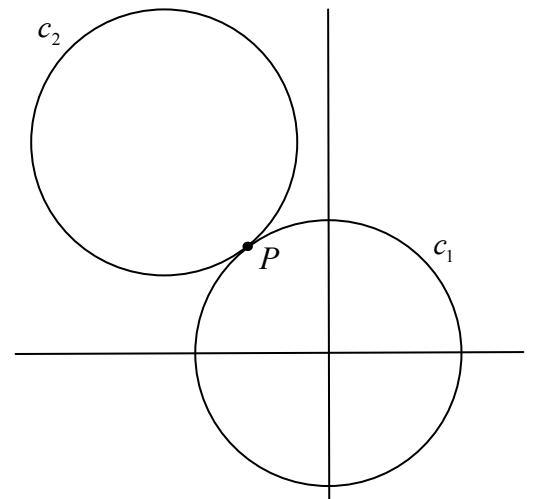
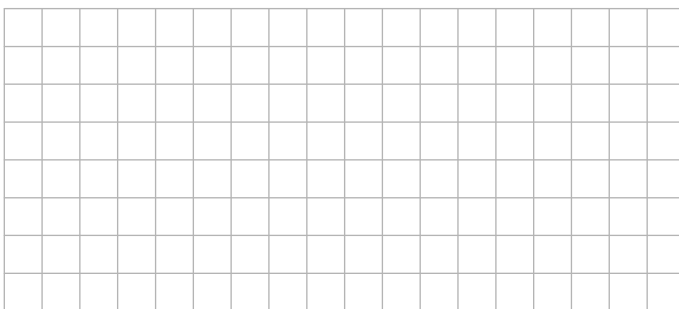


**Question 4**

**(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  $(5, 0)$ .

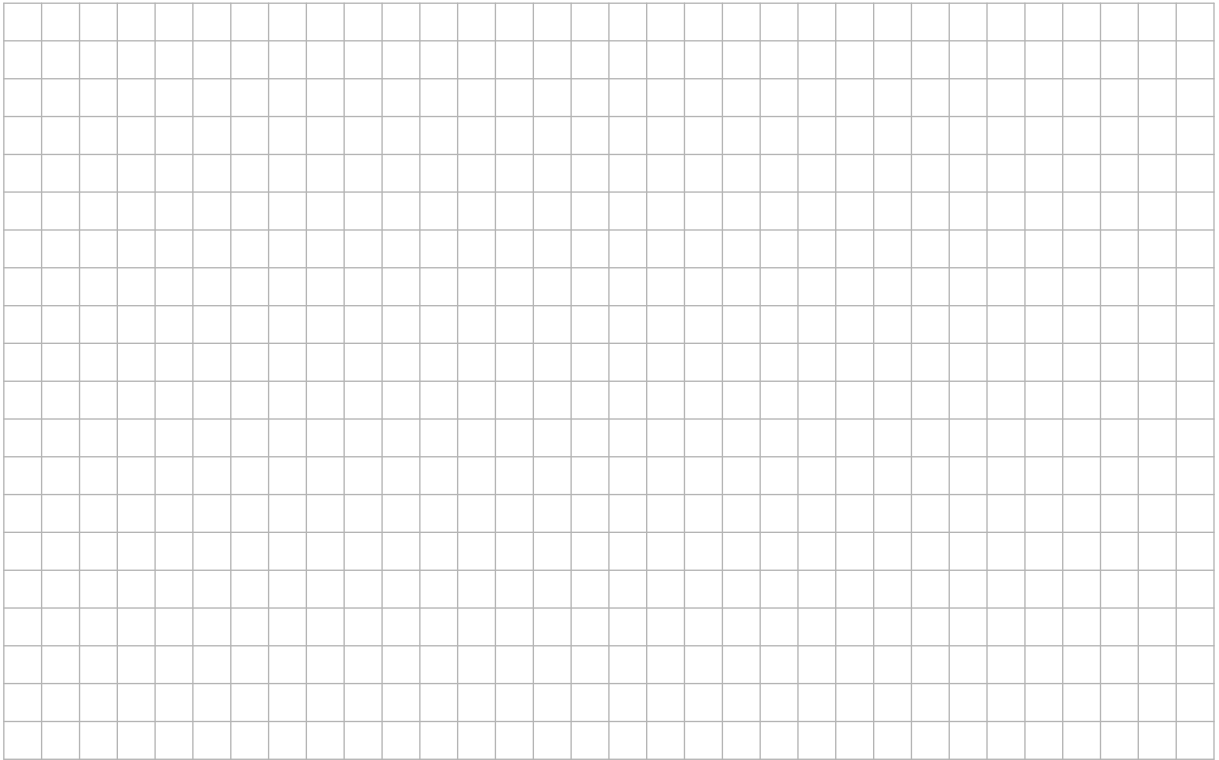
- (a) Find the equation of  $c_1$ .



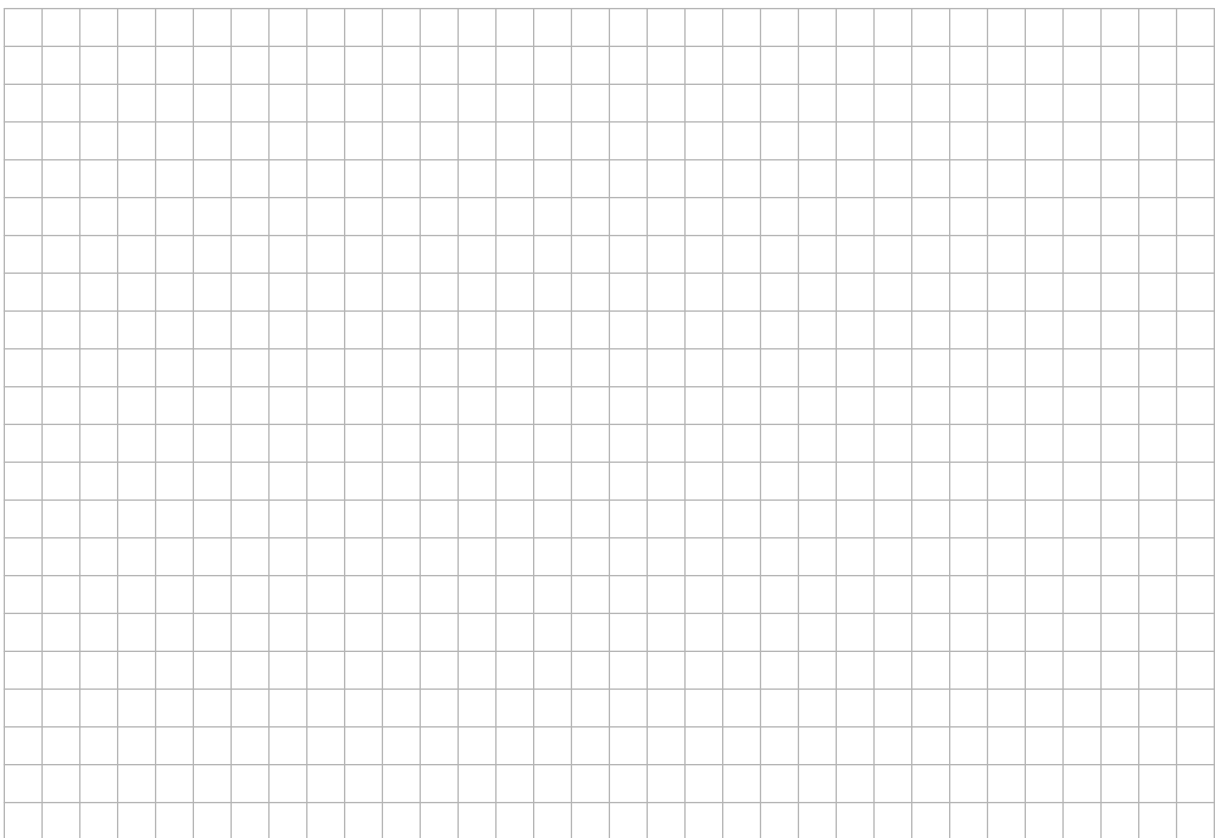
- (b) Show that the point  $P(-3, 4)$  is on  $c_1$ .



- (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  $P$ .

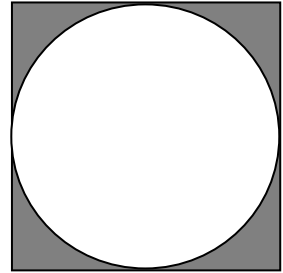


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**Question 5**

**(25 marks)**

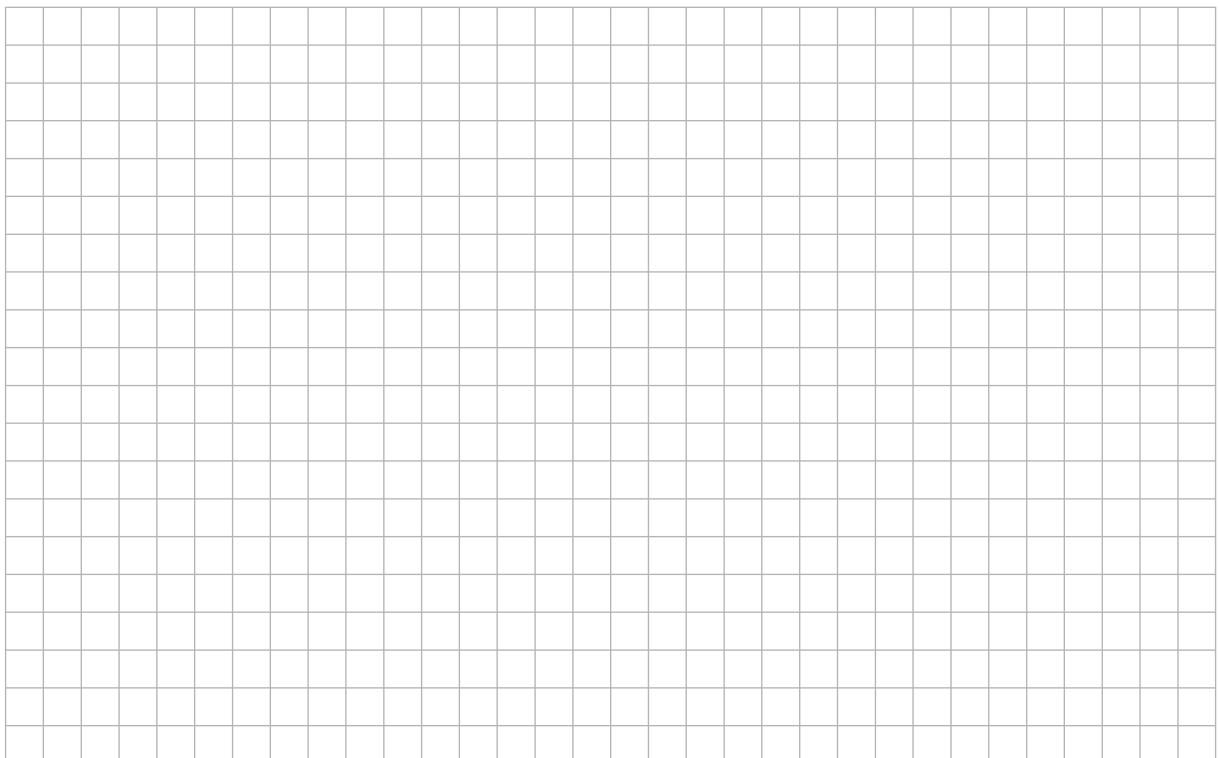
- (a) The diagram shows a circle inscribed in a square.  
The area of the square is  $16 \text{ cm}^2$ .



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



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







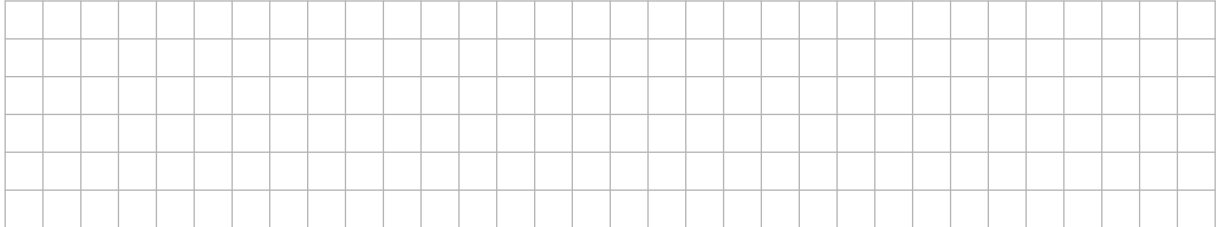
**Question 6**

**(25 marks)**

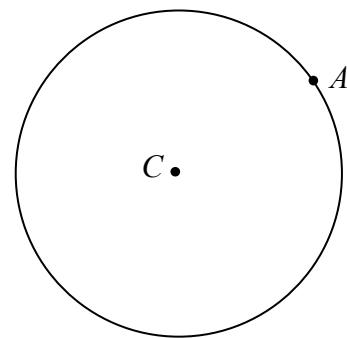
Answer **either** 6A **or** 6B.

**Question 6A**

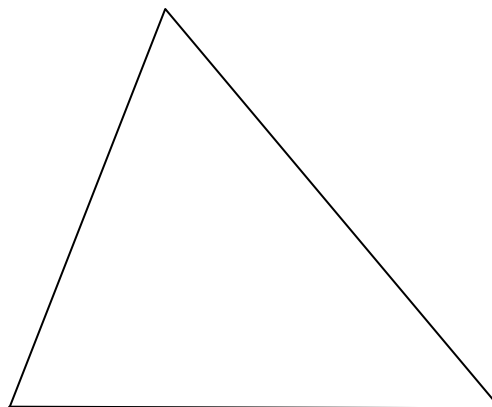
- (a) (i) Write down a geometrical result that can be used to construct a tangent to a circle at a point.



- (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.







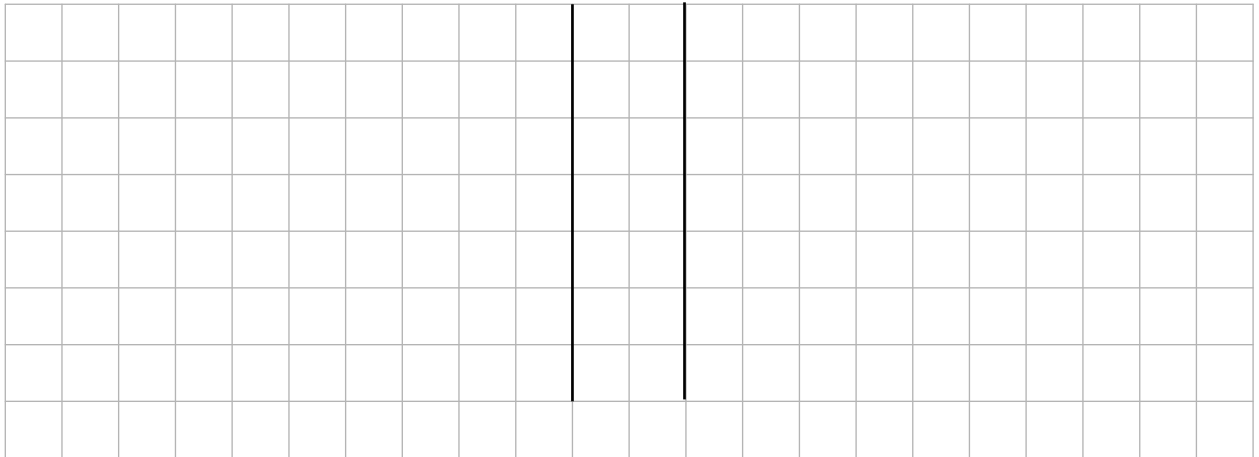




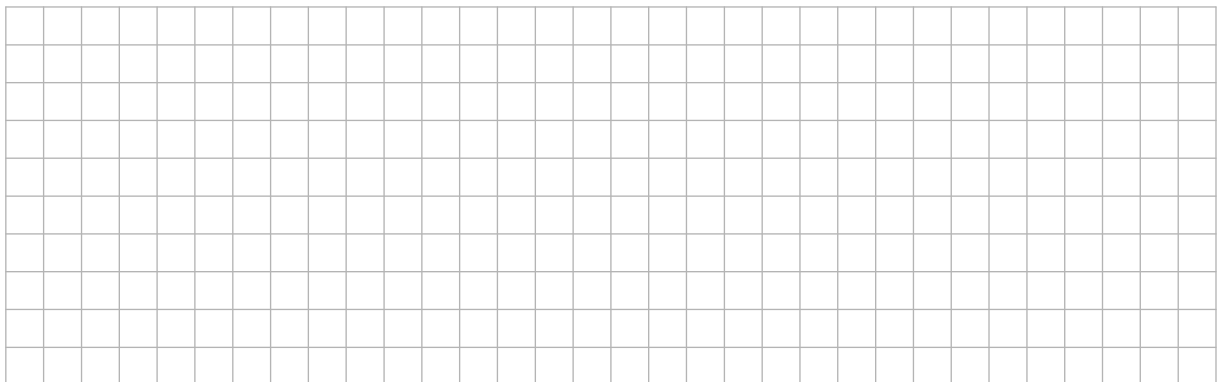
- (d) A survey of some of the most popular models of private cars sold in 2011 examined the CO<sub>2</sub> emissions in g/km from diesel engines and petrol engines. The data are as follows:

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

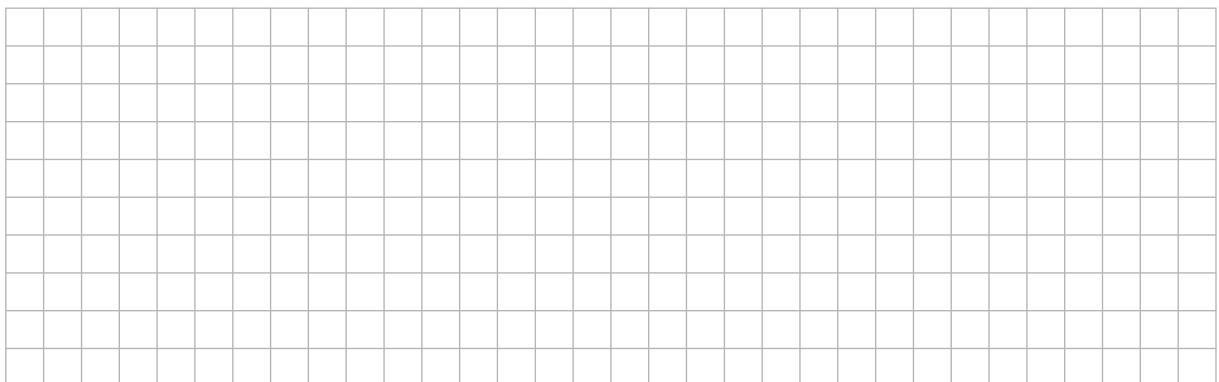
- (i) Construct a back-to-back stem-and-leaf plot of the above data.



- (ii) Does the information suggest that diesel engines produce lower CO<sub>2</sub> emissions than petrol engines? In your answer you should refer to the stem-and-leaf plot and to an appropriate measure of central tendency.



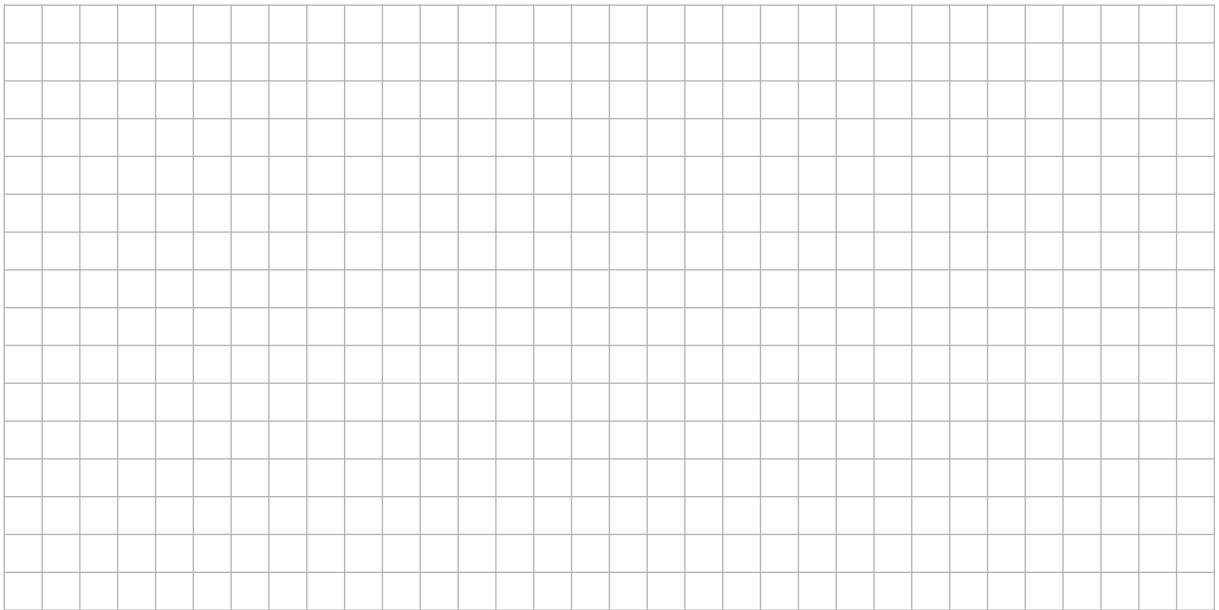
- (iii) Does the information suggest that there is a greater variation in the CO<sub>2</sub> emissions of diesel engines than petrol engines? In your answer you should refer to the stem-and-leaf plot and an appropriate measure of variability.



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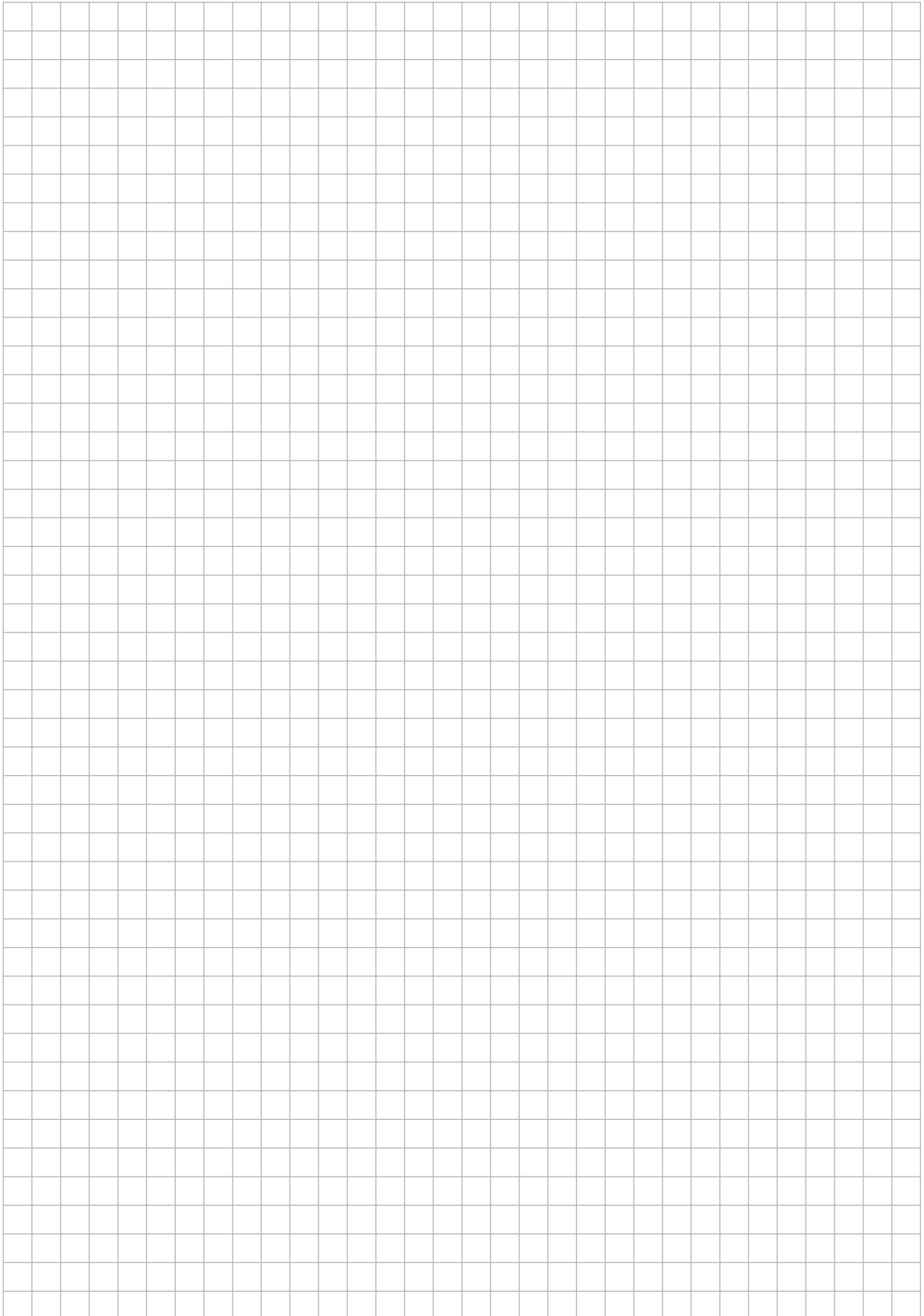
(iv) The centre of the enlargement is  $O$ . Find the distance from  $O$  to the point  $B$ .



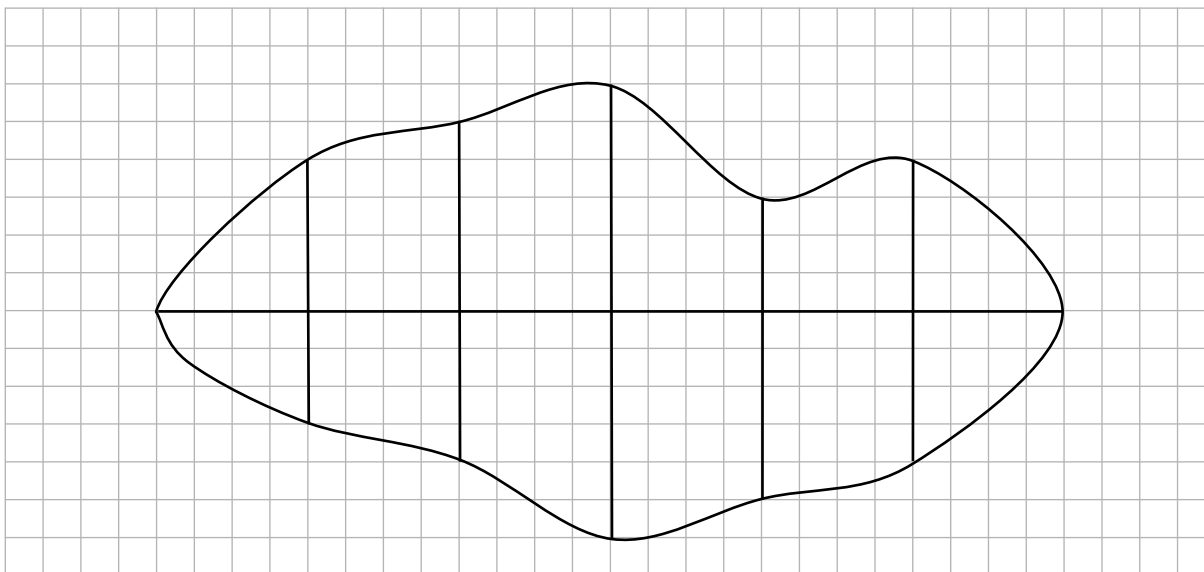
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- (v) A condition of the planning is that the height of the point  $G$  above the horizontal line  $BF$  cannot exceed 11.6 m.

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

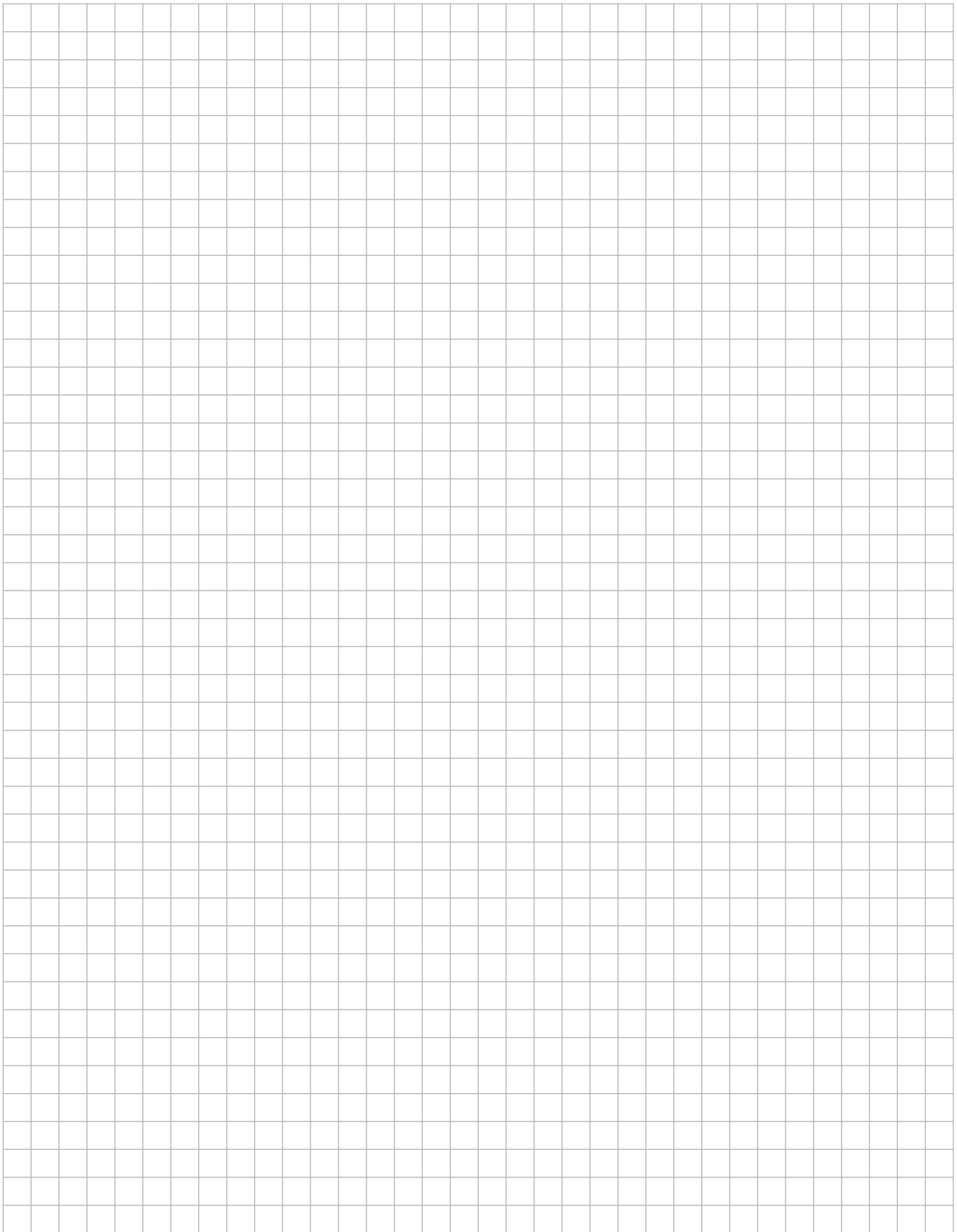


- (b) In order to estimate the area of the irregular shape shown below, a horizontal line was drawn across the widest part of the shape and five offsets (perpendicular lines) were drawn at equal intervals along this line.



- (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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