



Coimisiún na Scrúduithe Stáit
State Examinations Commission

Leaving Certificate Examination 2013

Mathematics
(Project Maths – Phase 2)

Paper 2

Higher Level

Monday 10 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	
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, as follows:

In Section A, answer

Questions 1 to 5 and

either Question 6A **or** Question 6B.

In Section B, answer Questions 7 to 9.

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

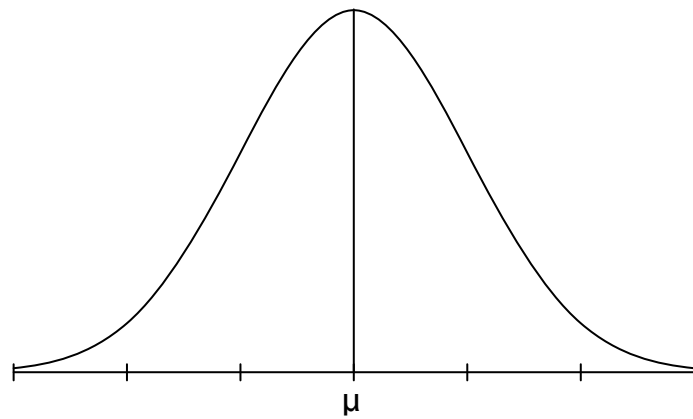
Answers should be given in simplest form, where relevant.

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

Hormone A

The effect of hormone A was to increase the height of all of the plants.

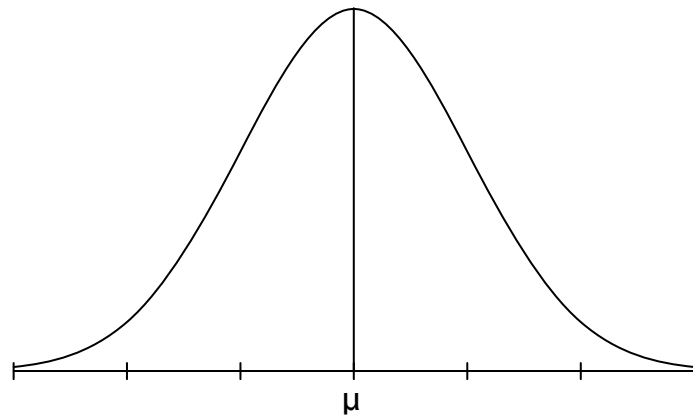
Diagram A



Hormone B

The effect of hormone B was to reduce the number of really small plants and the number of really tall plants. The mean was unchanged.

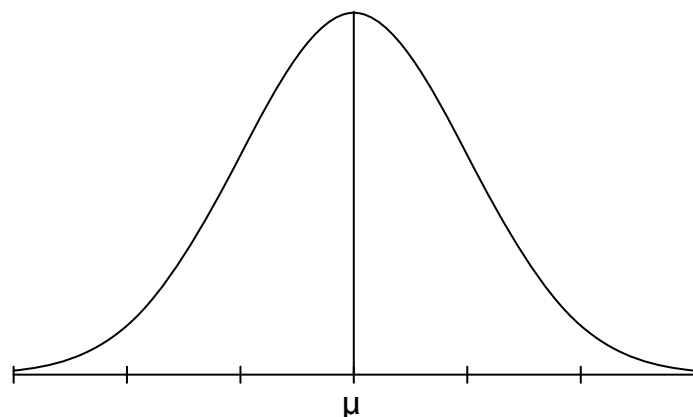
Diagram B



Hormone C

The effect of hormone C was to increase the number of small plants and the number of tall plants. The mean was unchanged.

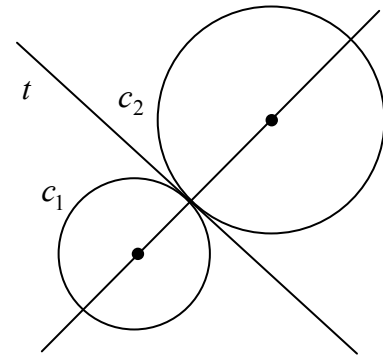
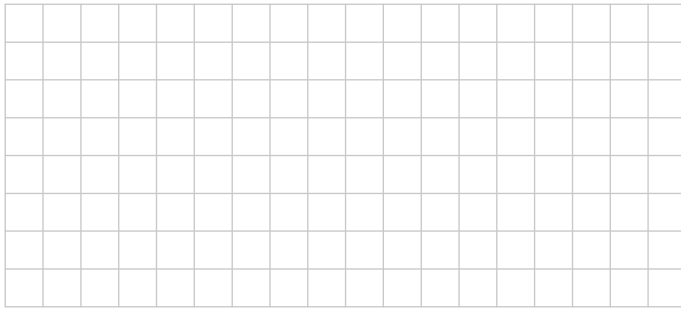
Diagram C



Question 4

(25 marks)

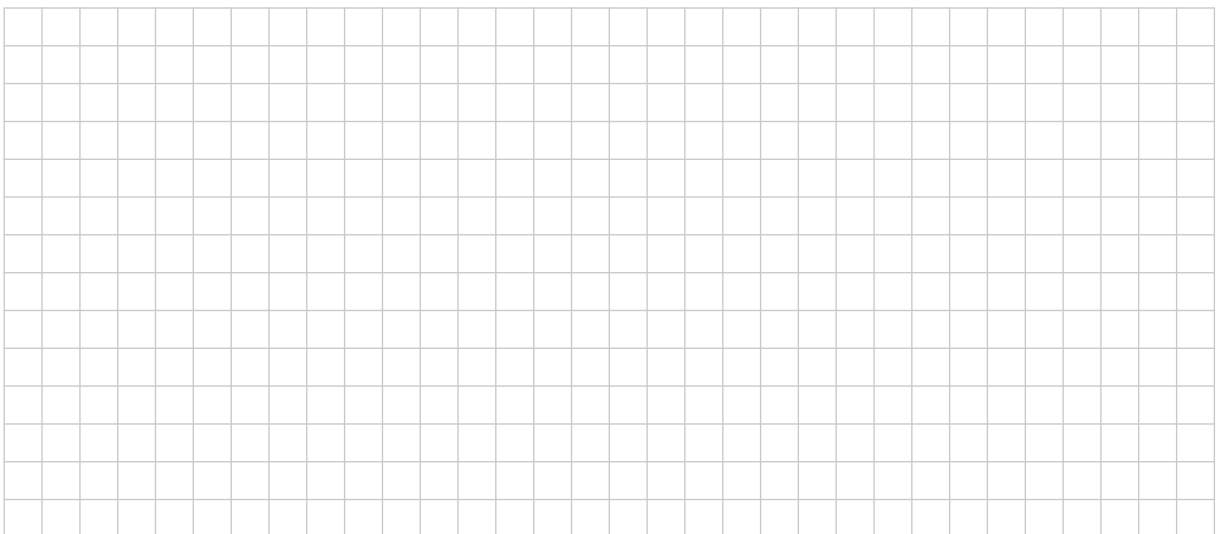
The circles c_1 and c_2 touch externally as shown.



(a) Complete the following table:

Circle	Centre	Radius	Equation
c_1	$(-3, -2)$	2	
c_2			$x^2 + y^2 - 2x - 2y - 7 = 0$

(b) (i) Find the co-ordinates of the point of contact of c_1 and c_2 .



(ii) Hence, or otherwise, find the equation of the tangent, t , common to c_1 and c_2 .

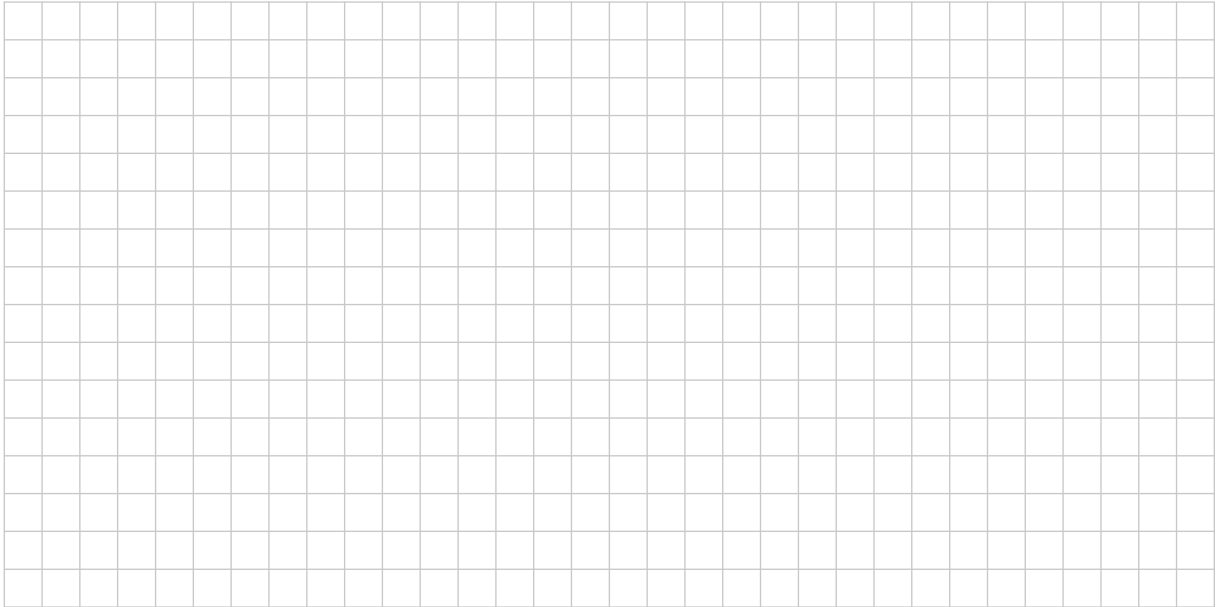


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Question 5**(25 marks)**

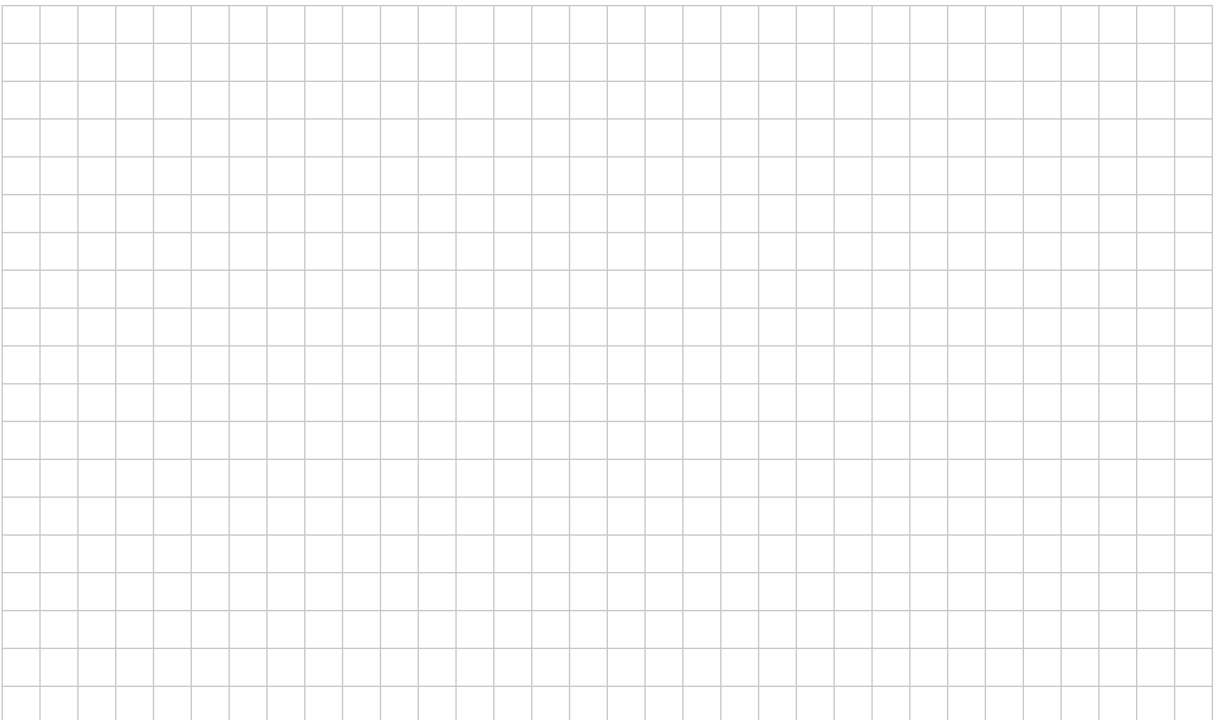
- (a) In a triangle ABC , the lengths of the sides are a , b and c . Using a formula for the area of a triangle, or otherwise, prove that

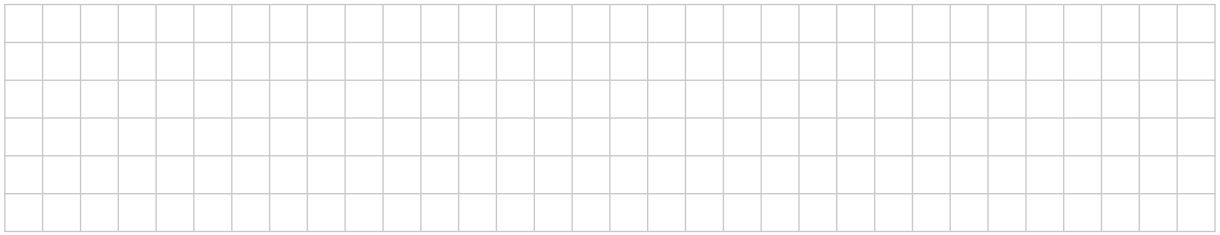
$$\frac{a}{\sin \angle A} = \frac{b}{\sin \angle B} = \frac{c}{\sin \angle C}.$$



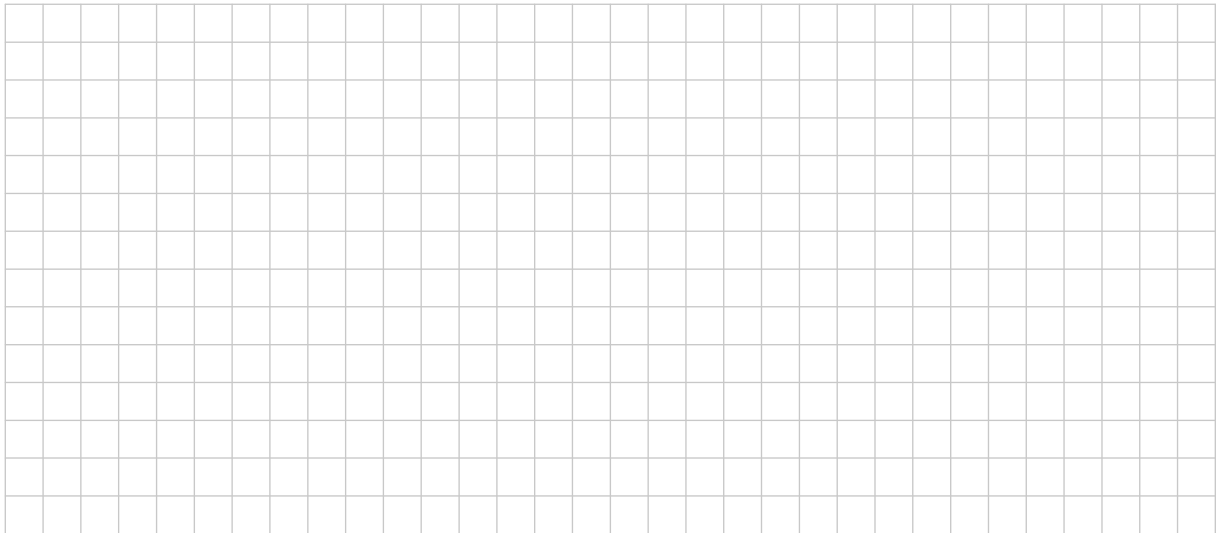
- (b) In a triangle XYZ , $|XY| = 5$ cm, $|XZ| = 3$ cm and $|\angle XYZ| = 27^\circ$.

- (i) Find the two possible values of $|\angle XZY|$. Give your answers correct to the nearest degree.





(ii) Draw a sketch of the triangle XYZ , showing the two possible positions of the point Z .



(c) In the case that $|\angle XZY| < 90^\circ$, write down $|\angle ZXY|$, and hence find the area of the triangle XYZ , correct to the nearest integer.

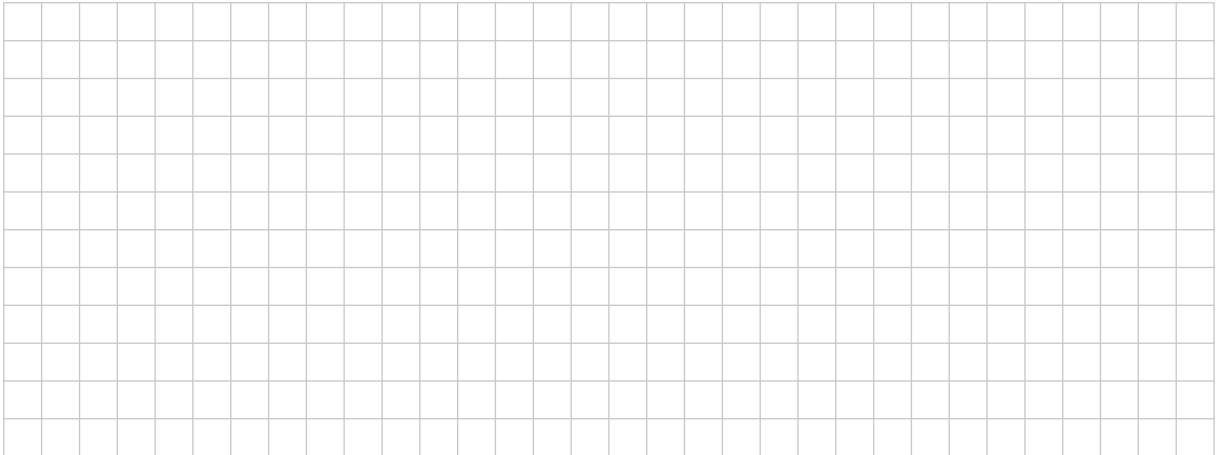
$|\angle ZXY| =$ _____

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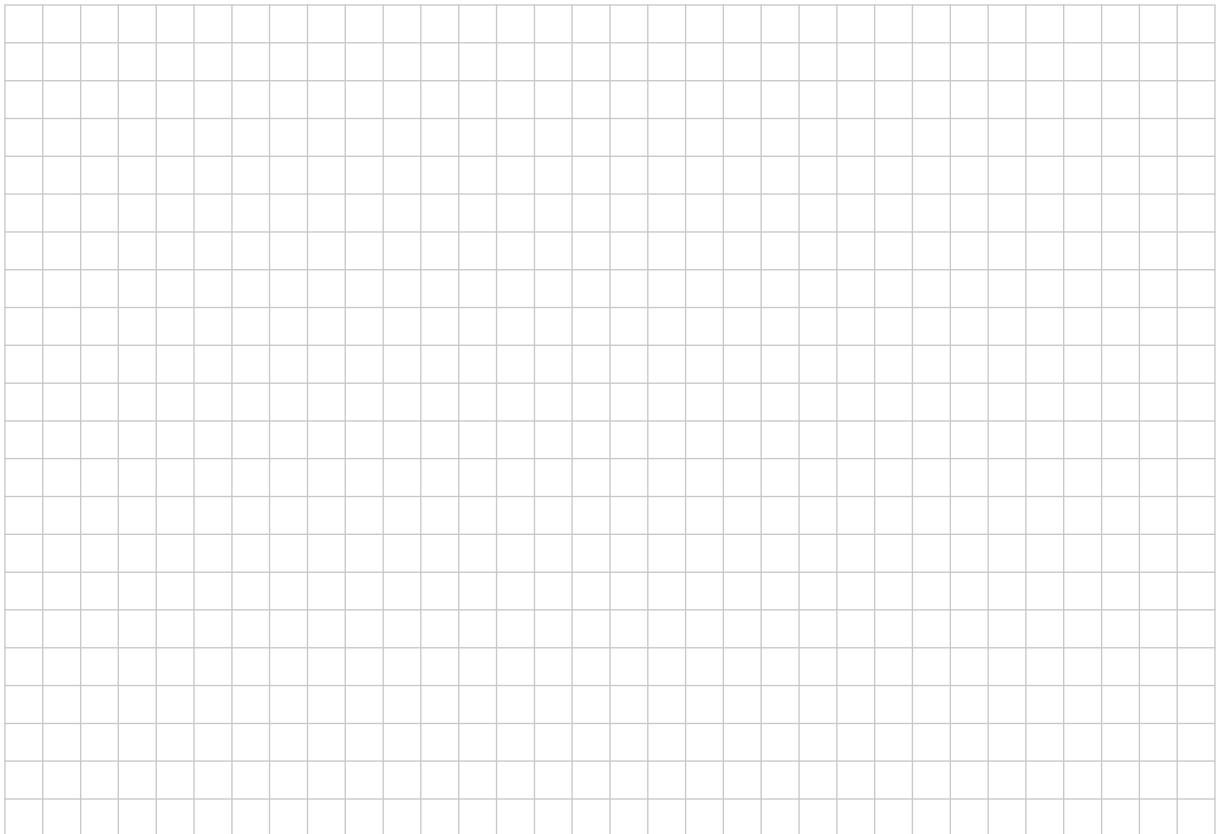
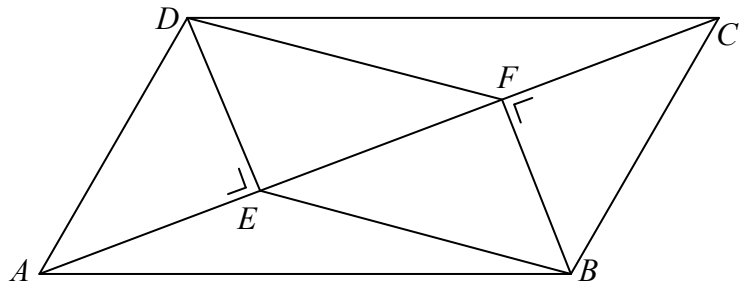
OR

Question 6B

- (a) A quadrilateral (four sided figure) has two sides which are parallel and equal in length.
Prove that the quadrilateral is a parallelogram.



- (b) In the parallelogram $ABCD$,
 DE is perpendicular to AC .
 BF is perpendicular to AC .
Prove that $EBFD$ is a parallelogram.



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- (f) The responses of ten individual passengers to the questions on age and in-flight spend are given below.

Age (years)	46	29	37	18	25	75	52	35	40	31
In-flight spend (euro)	30	15	20	0	10	45	25	20	20	30

- (i) Draw a scatter plot of the data.



- (ii) Calculate the correlation coefficient between passenger age and in-flight spend.

Answer: _____

- (iii) What can you conclude from the completed scatter plot and the correlation coefficient?

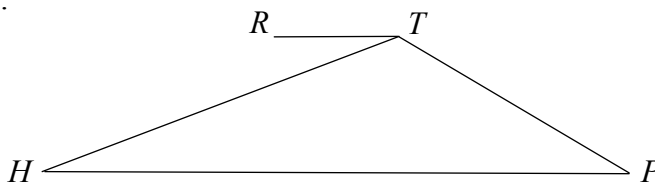


- (iv) Sketch the line of best fit in the completed scatter plot above.

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- (b) The point T is directly east of the point R .
 $|HT| = 110$ km and $|TP| = 80$ km.

Find $|RT|$.

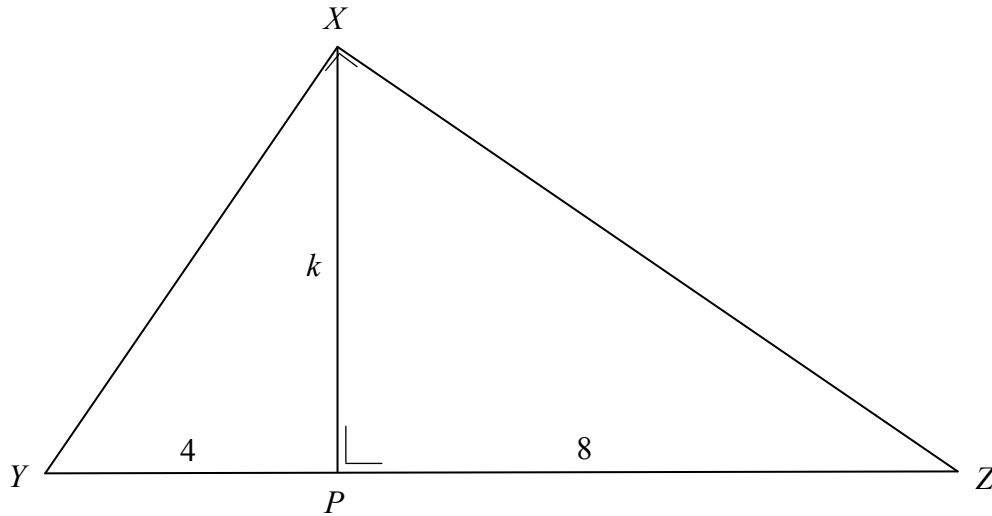


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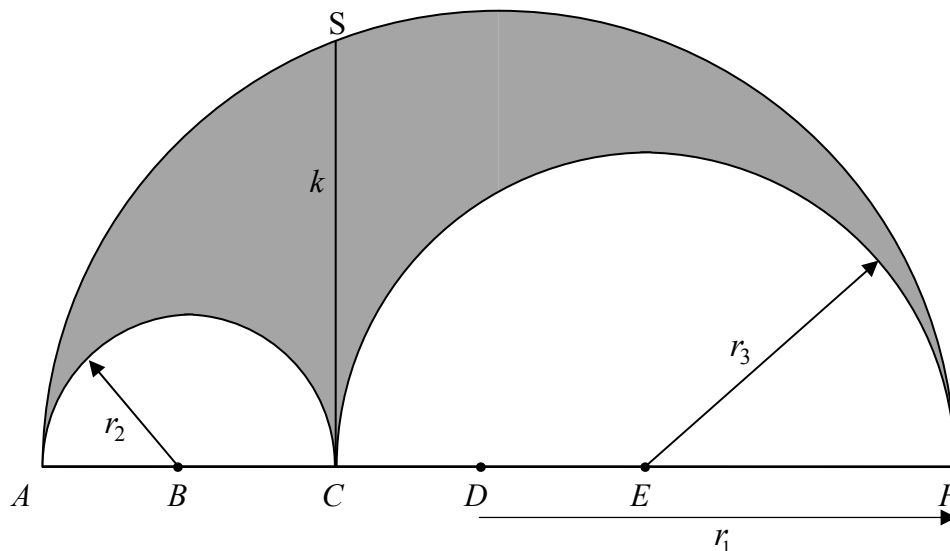
Question 9

(45 marks)

- (a) The triangle XYZ is right-angled at X and XP is perpendicular to YZ .
 $|YP| = 4$, $|PZ| = 8$ and $|PX| = k$. Find the value of k .



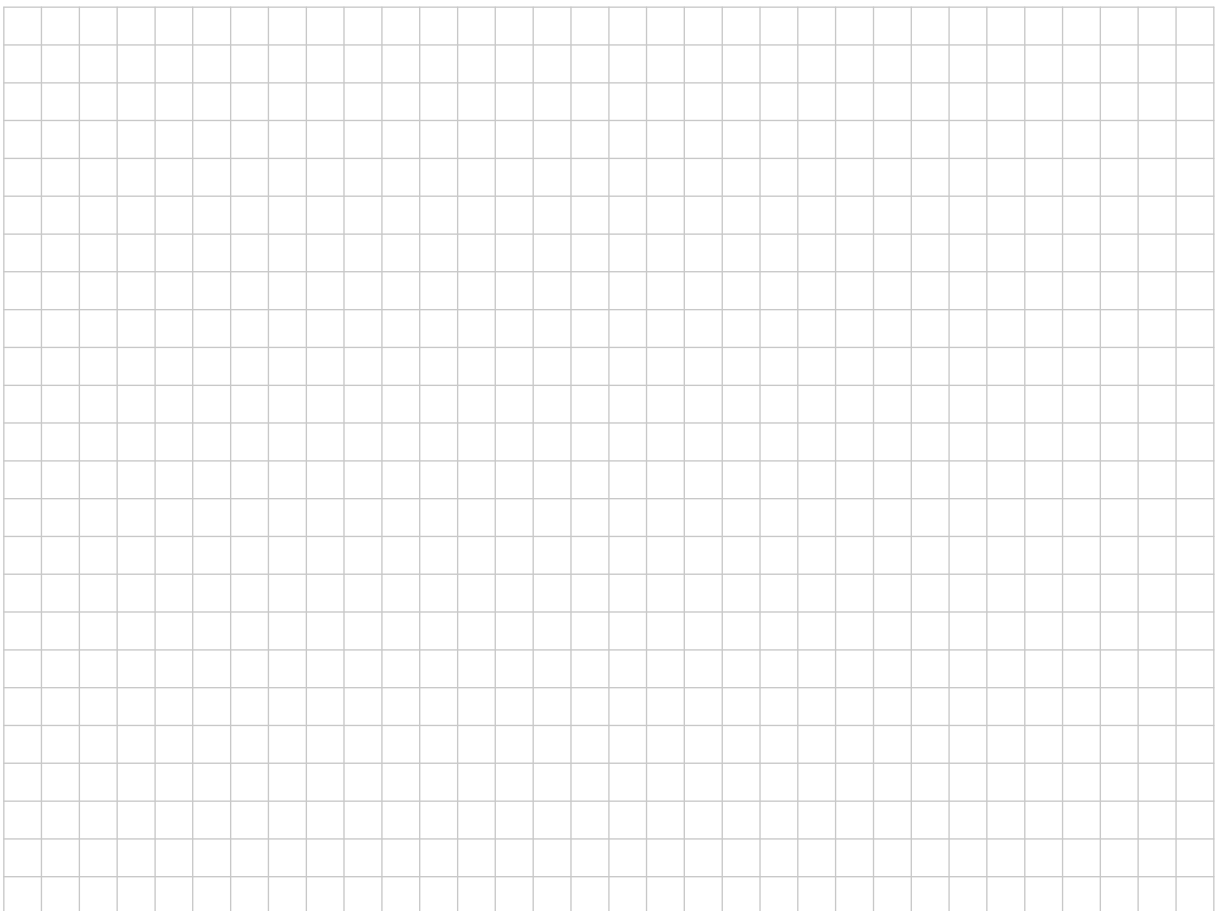
- (b) The shaded region in the diagram below is called an **arbelos**. It is a plane semicircular region of radius r_1 from which semicircles of radius r_2 and r_3 are removed, as shown. In the diagram $SC \perp AF$ and $|SC| = k$.



- (i) Show that, for fixed r_1 , the perimeter of the arbelos is independent of the values of r_2 and r_3 .

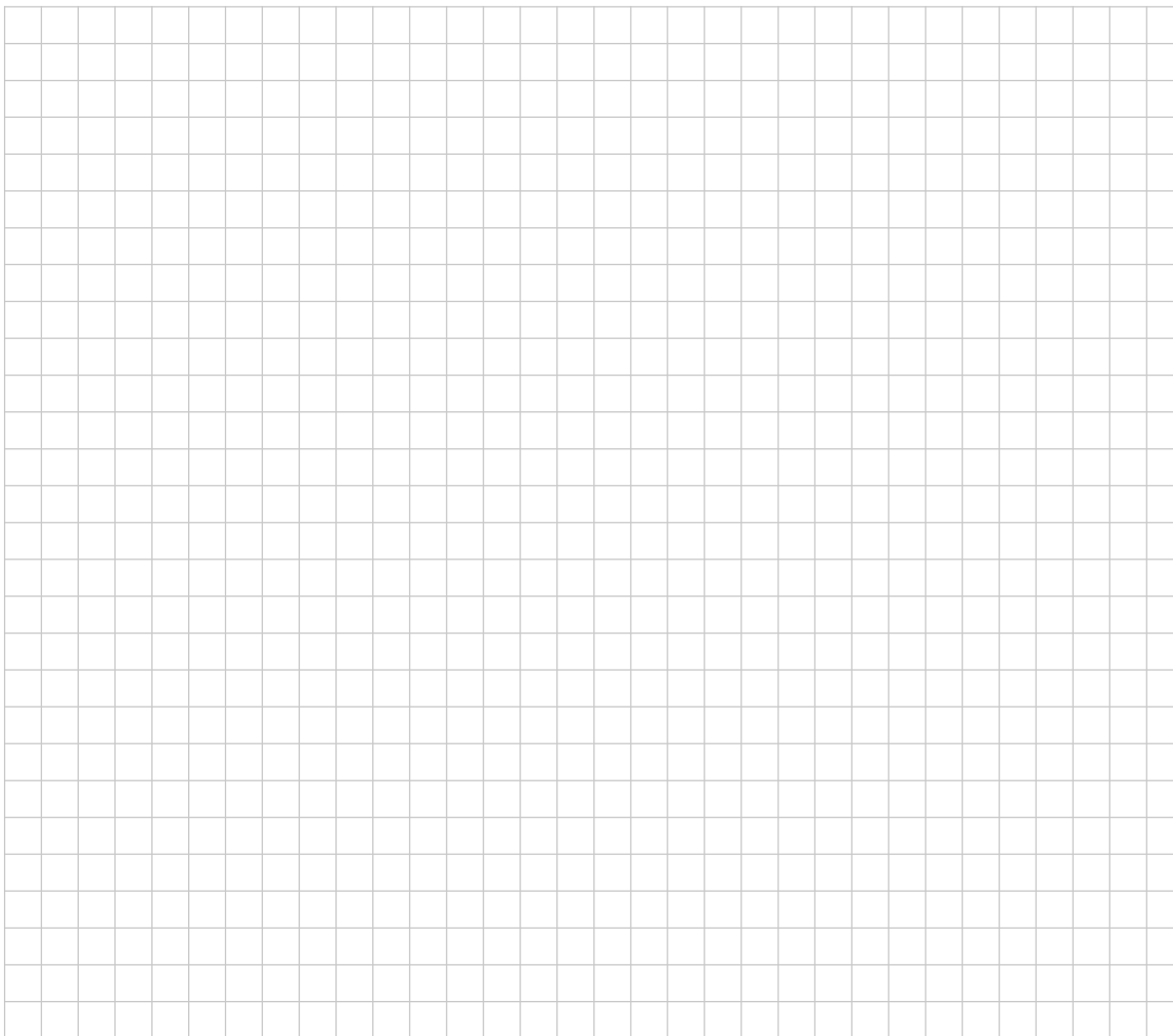
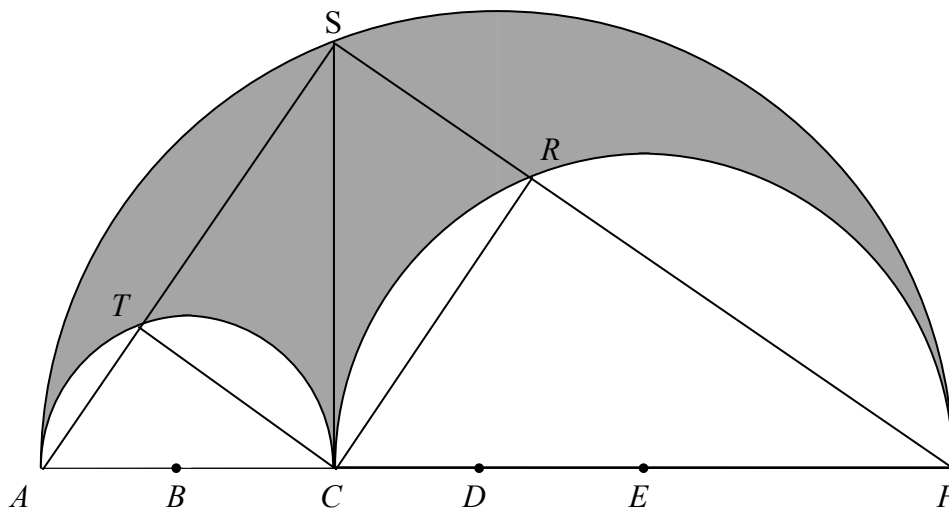


- (ii) If $r_2 = 2$ and $r_3 = 4$, show that the area of the arbelos is the same as the area of the circle of diameter k .



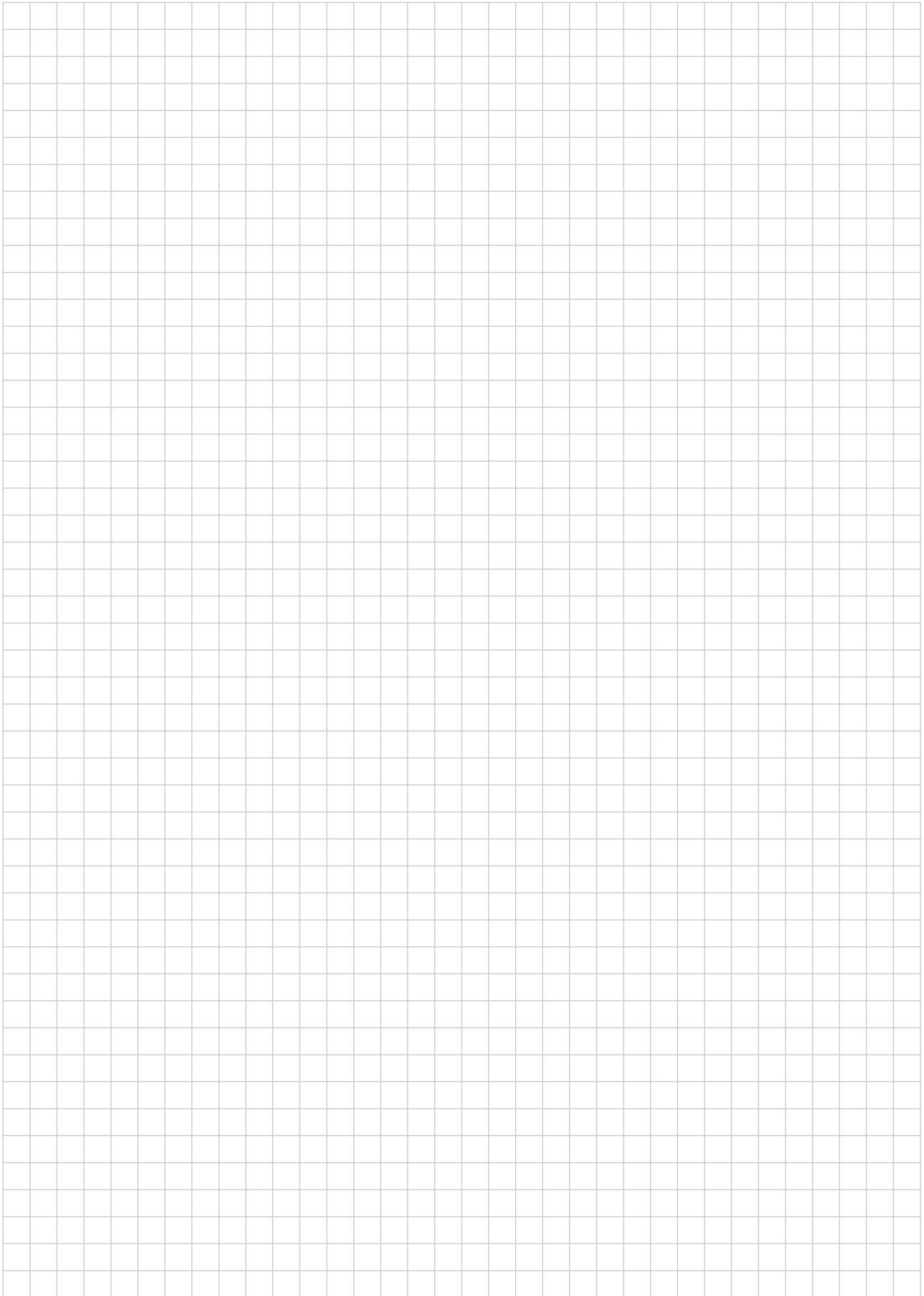
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- (d) AS and FS cut the two smaller semicircles at T and R respectively.
 Prove that $RSTC$ is a rectangle.

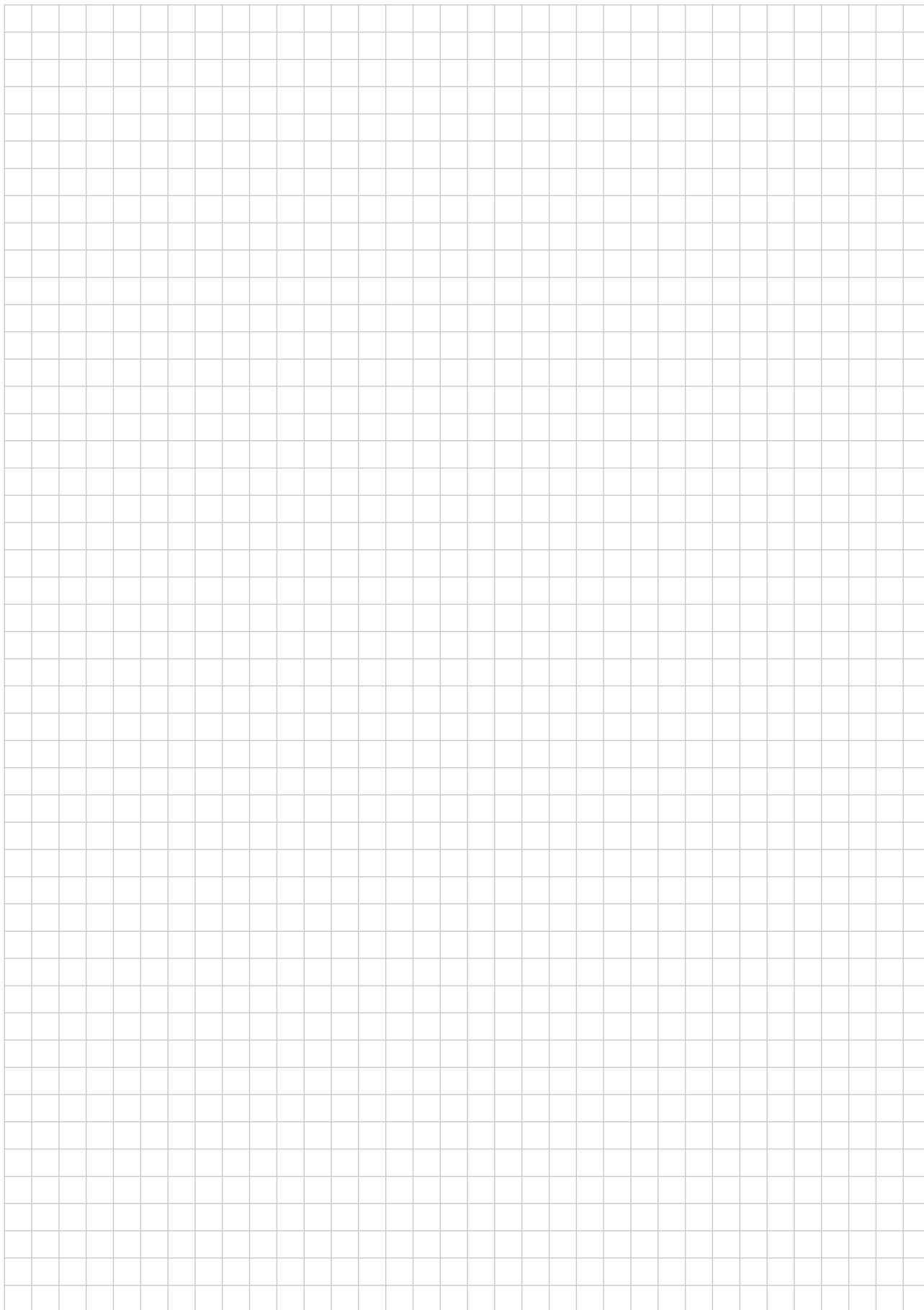


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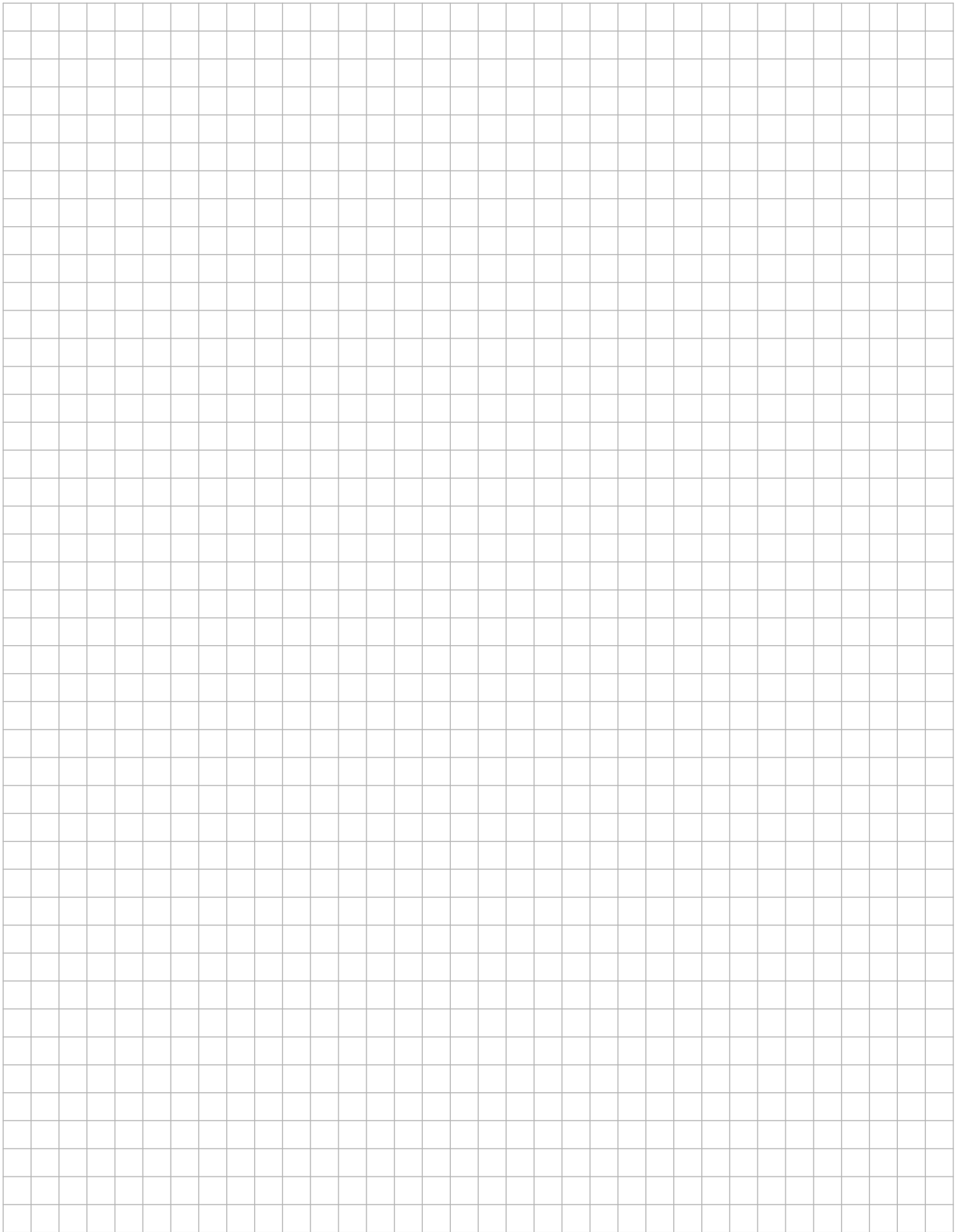
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