



Coimisiún na Scrúduithe Stáit
State Examinations Commission

Leaving Certificate Examination 2016

Mathematics

Paper 1

Ordinary Level

Friday 10 June Afternoon 2:00 – 4:30

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 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.

You will lose marks if you do not show all necessary work.

You may lose marks if you do not include appropriate units of measurement, where relevant.

You may lose marks if you do not give your answers in simplest form, where relevant.

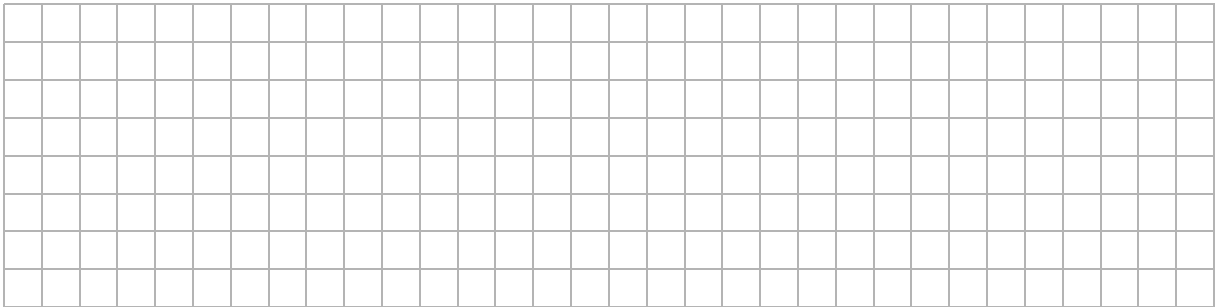
Write the make and model of your calculator(s) here:

Question 2

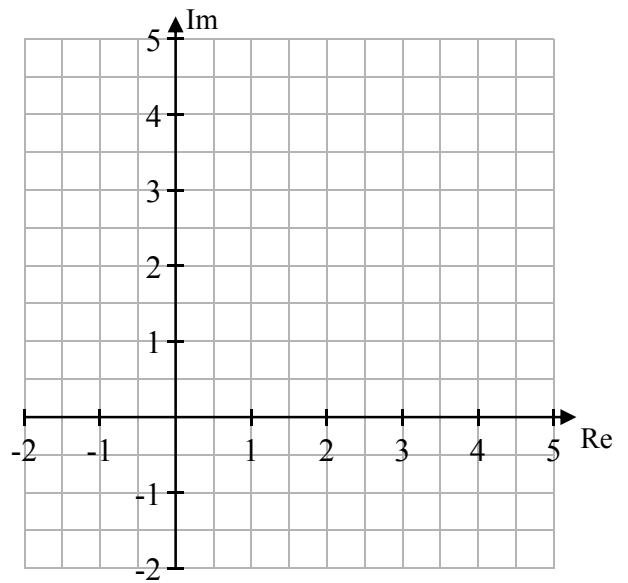
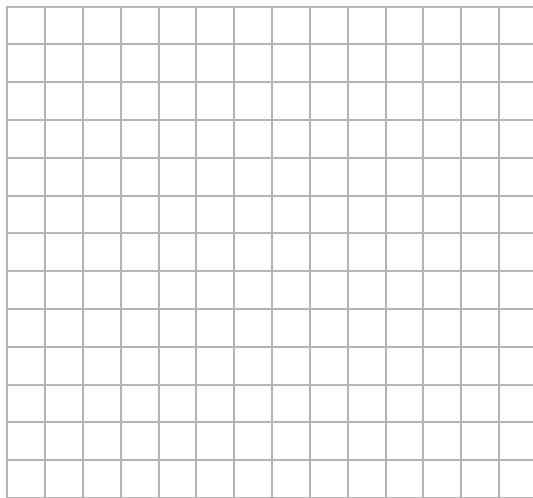
(25 marks)

$z_1 = 1 + 3i$ and $z_2 = 2 - i$, where $i^2 = -1$, are two complex numbers.

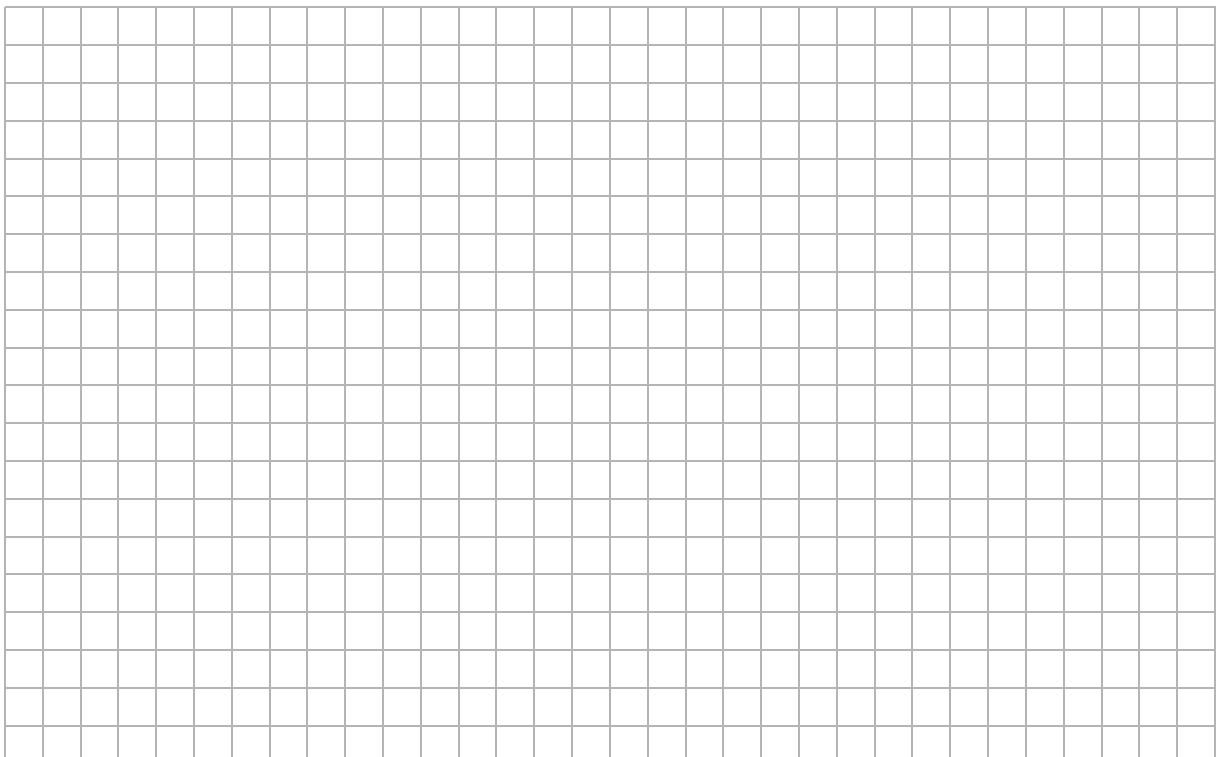
- (a) Let $z_3 = z_1 + 2z_2$. Find z_3 in the form $a + bi$ where $a, b \in \mathbb{Z}$.



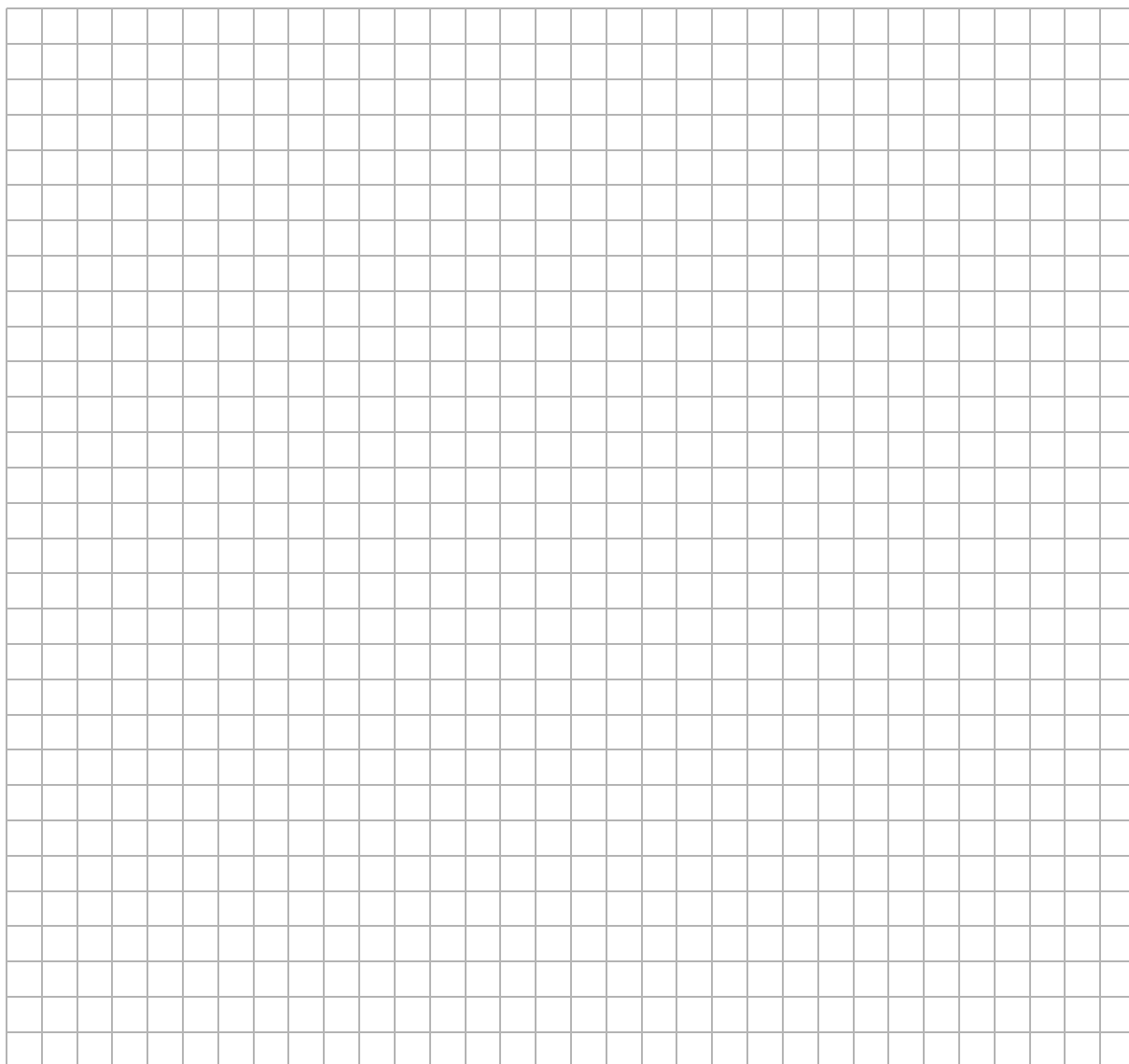
- (b) Plot z_1, z_2 , and z_3 on the given Argand diagram and label each point clearly.



- (c) Investigate if $|z_2 - z_3| = |z_1 + z_2|$.



- (d) Find the complex number w , such that $w = \frac{z_1}{z_2}$.
Give your answer in the form $a + bi$, where $a, b \in \mathbb{R}$.

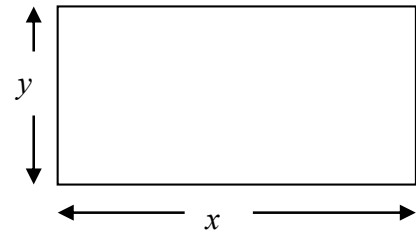


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Question 8

(50 marks)

Kieran has 21 metres of fencing. He wants to enclose a vegetable garden in a rectangular shape as shown.



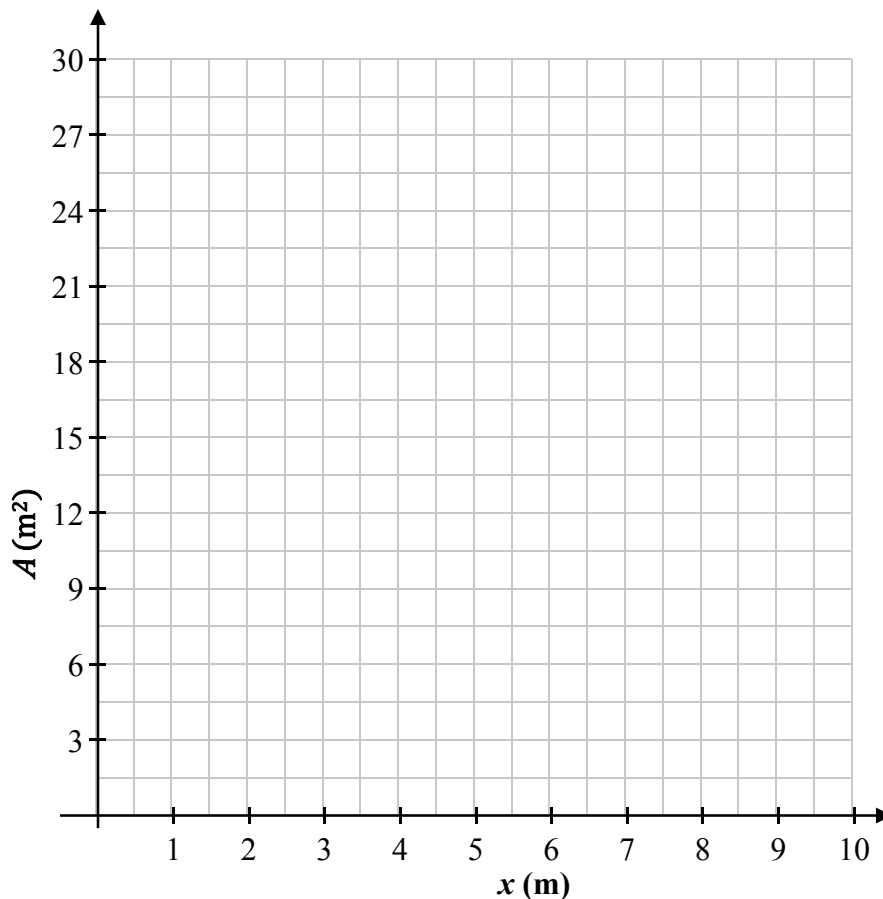
- (a) By writing an expression for the perimeter of the vegetable garden in terms of x (length in metres) and y (width in metres), show that $y = 10.5 - x$.



- (b) (i) Complete the table below to show the values of y and A (the area of the garden) for each given value of x .

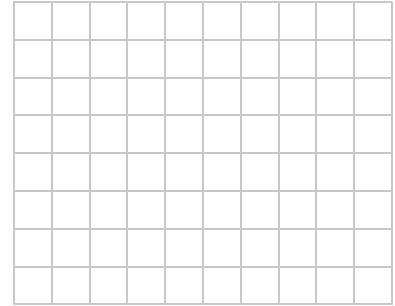
x (m)	0	1	2	3	4	5	6	7	8	9	10
y (m)					6.5						
A (m ²)					26						

- (ii) Use the values of x and A from the table to plot the graph of A on the grid below.

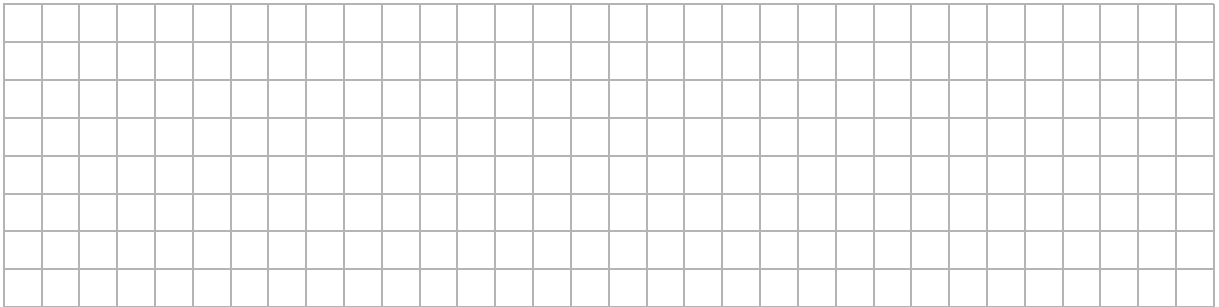


- (c) Use your graph to estimate the maximum value of A and write the corresponding length and width.

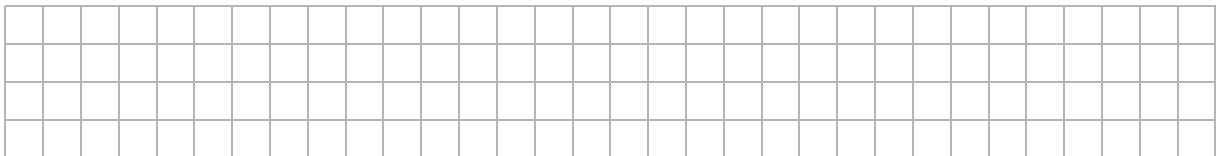
A: Maximum area (m^2)	
Length (m)	
Width (m)	



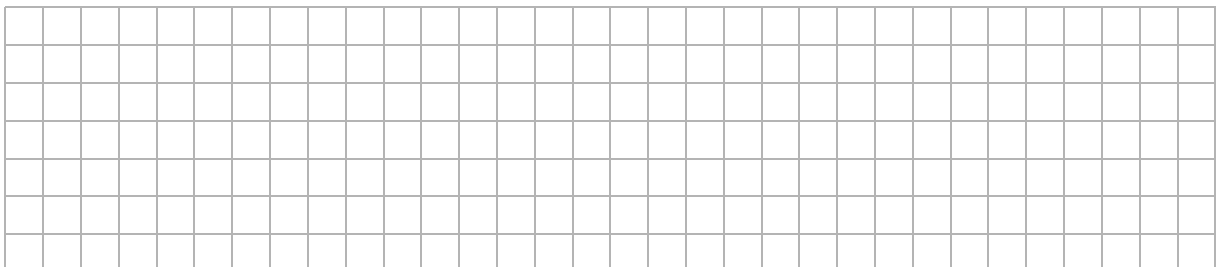
- (d) (i) Show that the area of the rectangle can be written as $A = 10 \cdot 5x - x^2$.



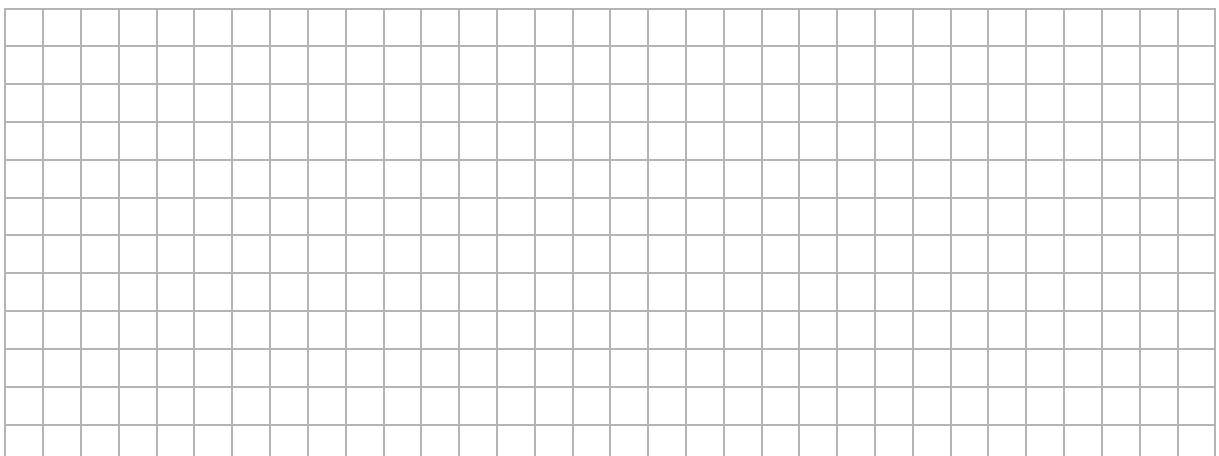
- (ii) Find $\frac{dA}{dx}$.



- (iii) Hence, find the value of x which will give the maximum area.



- (iv) Find this maximum area.



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Question 9

(45 marks)

Company A uses the following formula to charge a customer for a job:

$$A(h) = 30 + 9.5h,$$

where $A(h)$ is the cost of the job, in euro, and h is the length of time that the job takes in hours.

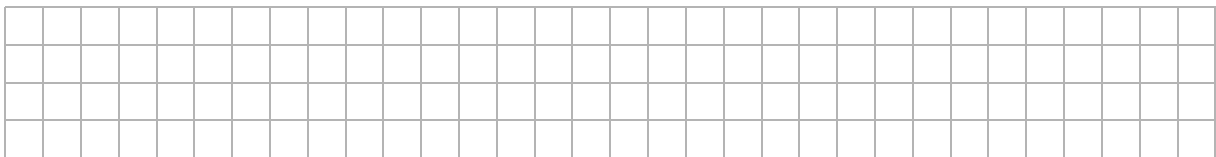
Company B uses the following formula to charge a customer for the same job:

$$B(h) = 10(1.74)^h$$

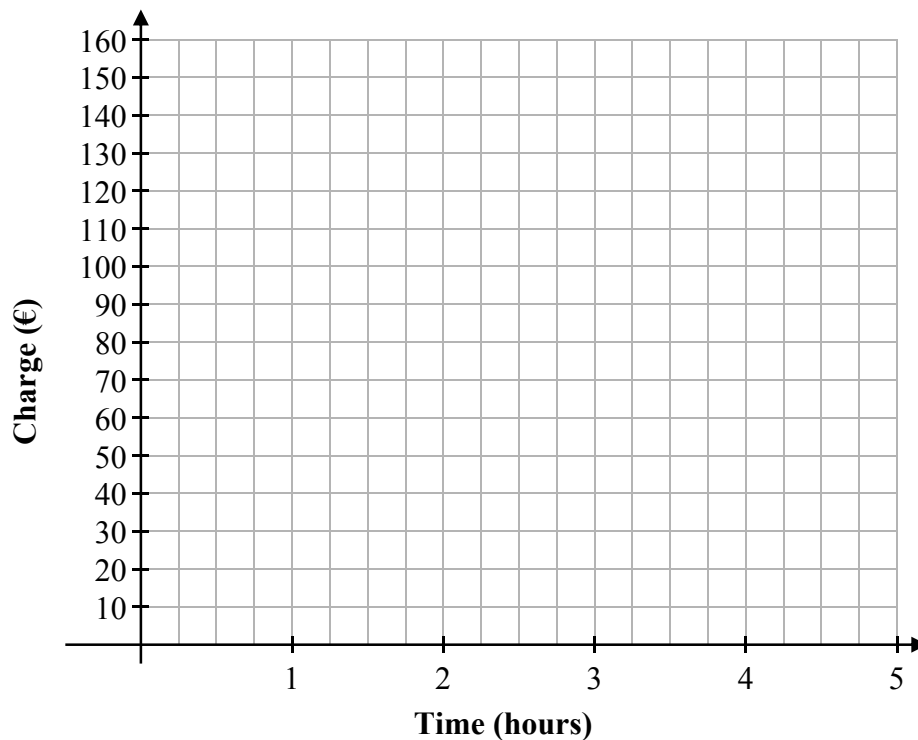
where $B(h)$ is the cost of the job, in euro, and h is again the length of time that the job takes in hours.

- (a) (i) Complete the table below to show what Company A charges and what Company B charges for jobs that take up to 5 hours. Where necessary give the charge correct to the nearest cent.

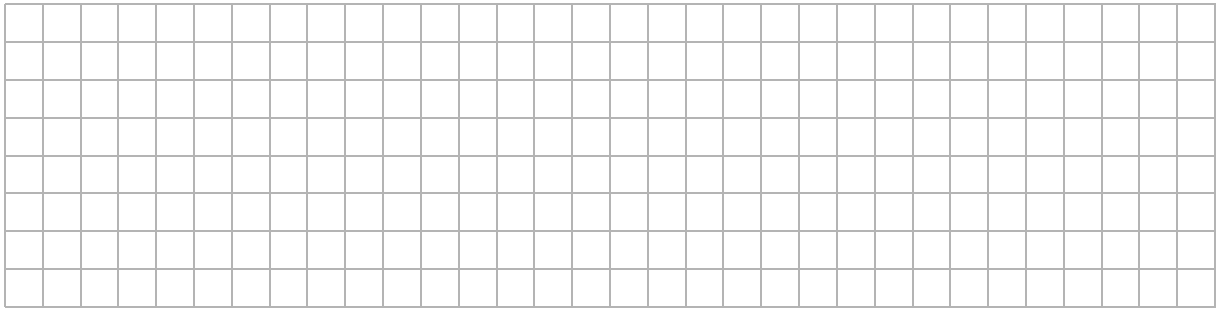
Time (hours)	0	1	2	3	4	5
$A(h)$ (€)					68	
$B(h)$ (€)					91.66	



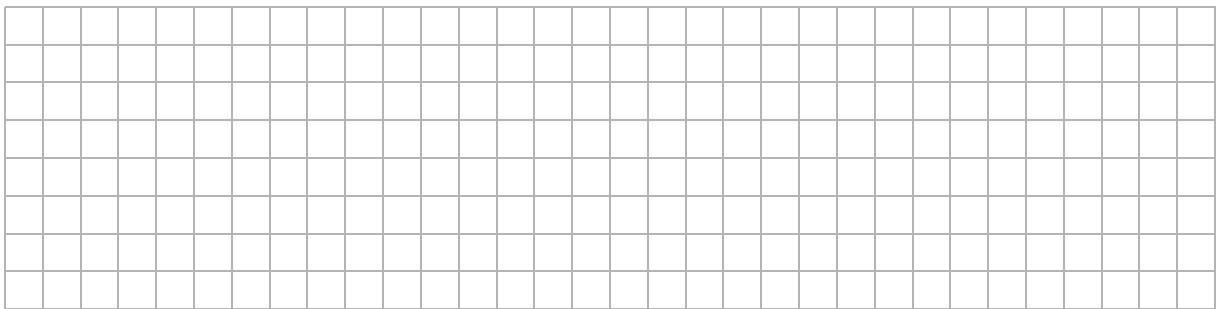
- (ii) On the grid below draw separate graphs to show the charge for Company A and the charge for Company B. Label each graph clearly.



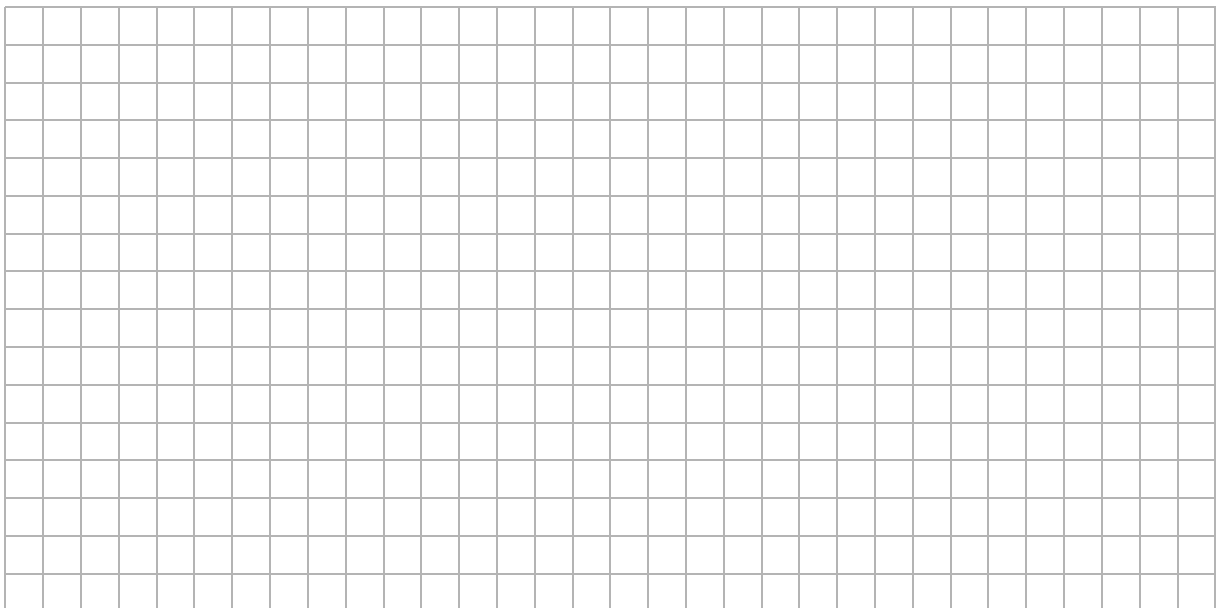
- (b) Which company would charge least for a job that takes $2\frac{1}{2}$ hours to complete?
Give a reason for your answer.



- (c) Use your graphs to estimate the value of h for which the charge is the same for both companies.

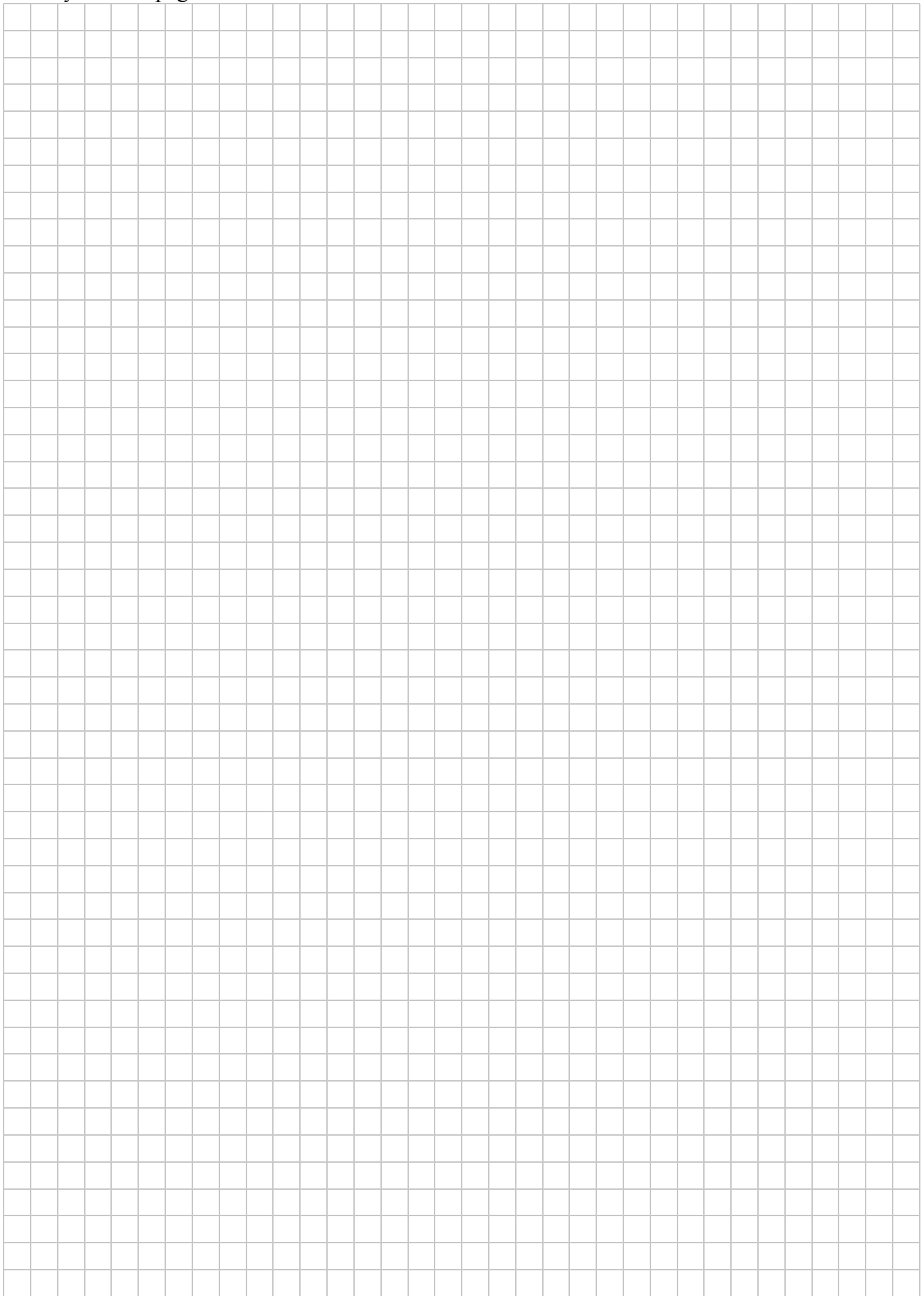


- (d) Find the difference in cost for a job that takes 6 hours to complete.

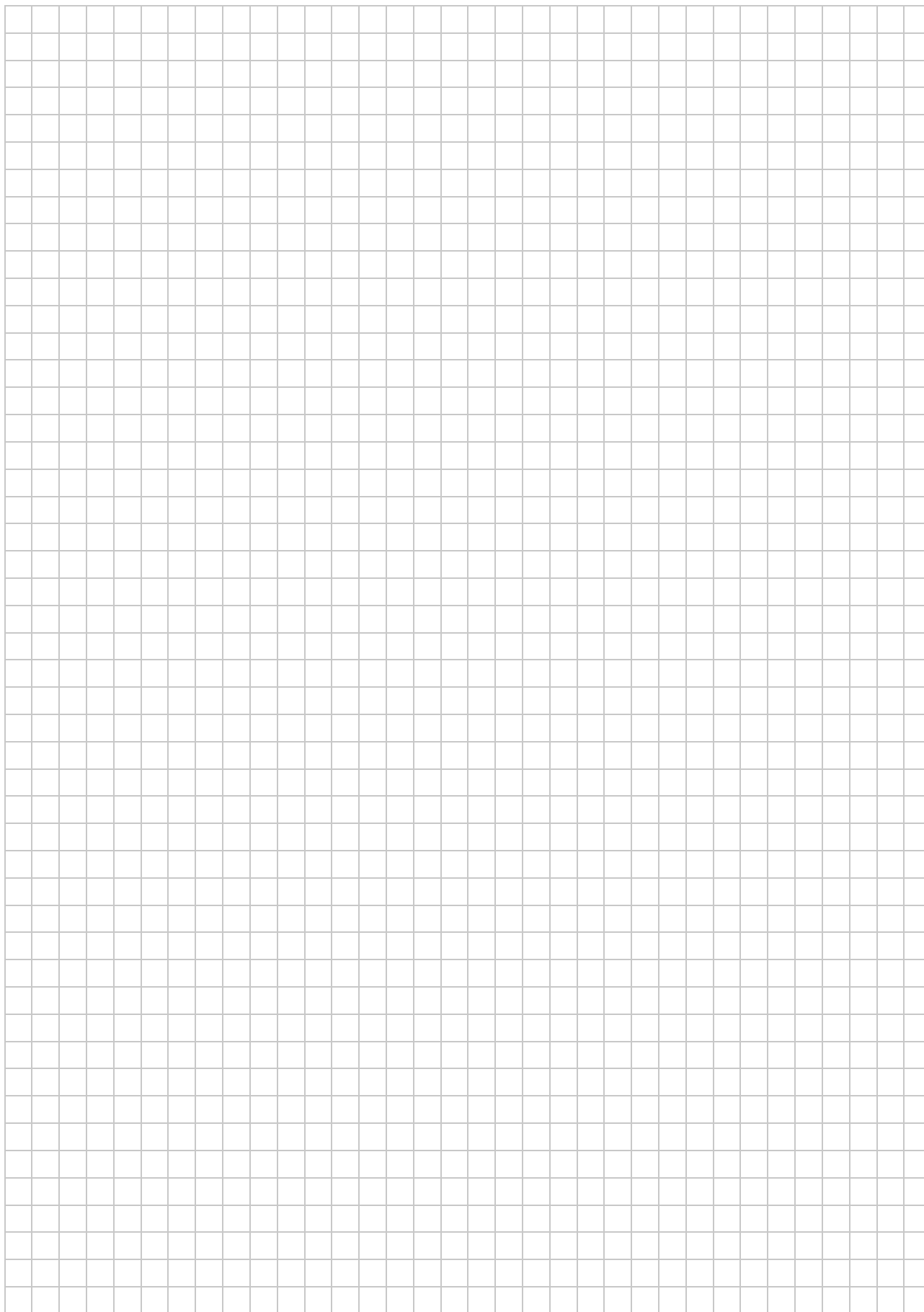


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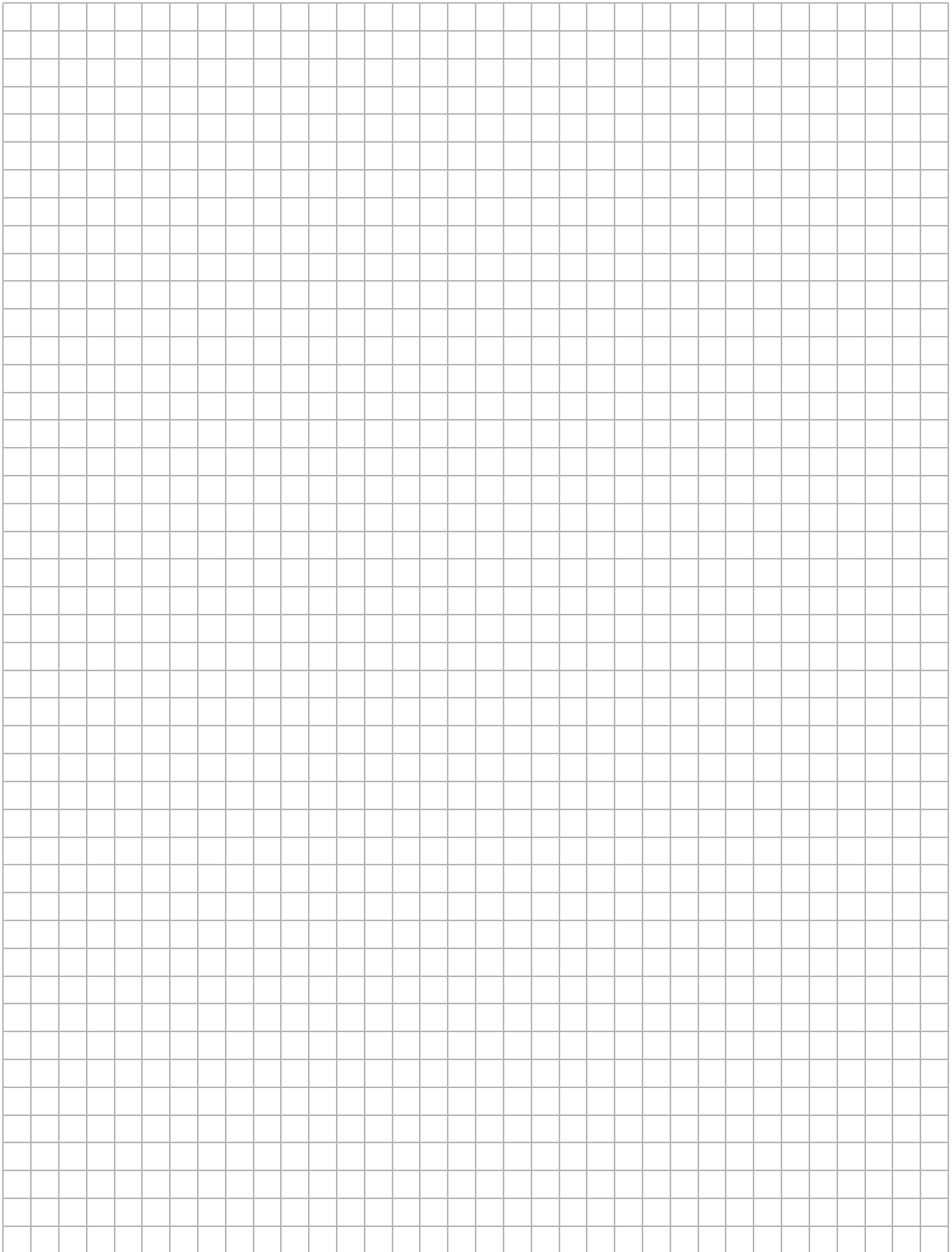
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