






NAME 

SCHOOL 

TEACHER 

Pre-Leaving Certificate Examination, 2014

Mathematics (Project Maths – Phase 3)

Paper 1

Ordinary Level

Time: 2 hours, 30 minutes

300 marks

School 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.

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:

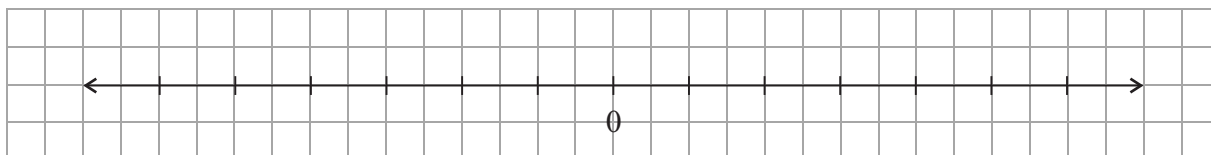
Question 3

(25 marks)

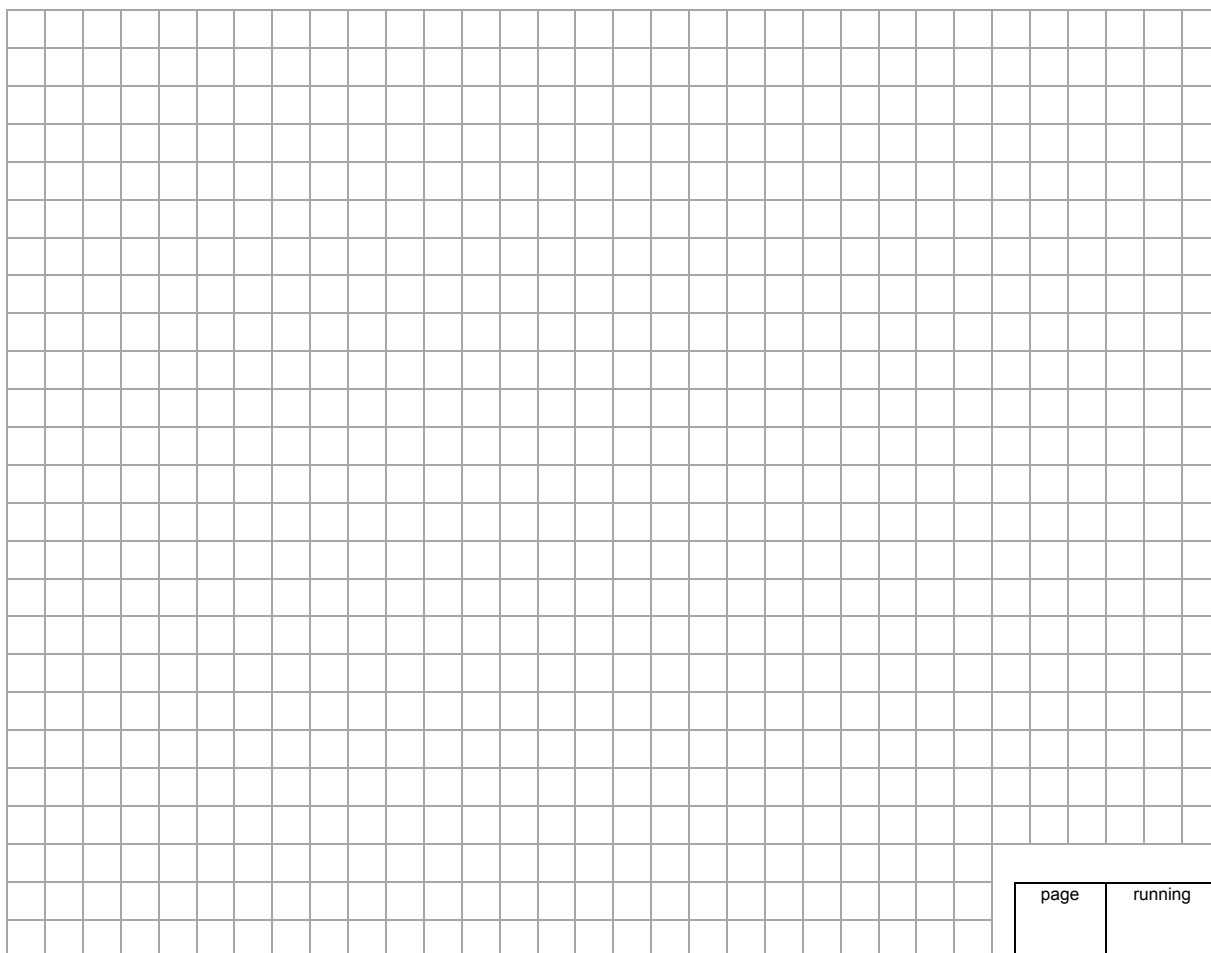
(a) (i) Solve the inequality $4(x + 1) \geq 7(x - 2) + 3$, where $x \in \mathbb{R}$.



(ii) Show your solution set on the number line below.



(b) Solve the equation $\frac{3}{2x + 1} - \frac{1}{3x + 2} = 2$, giving your answer correct to two decimal places.

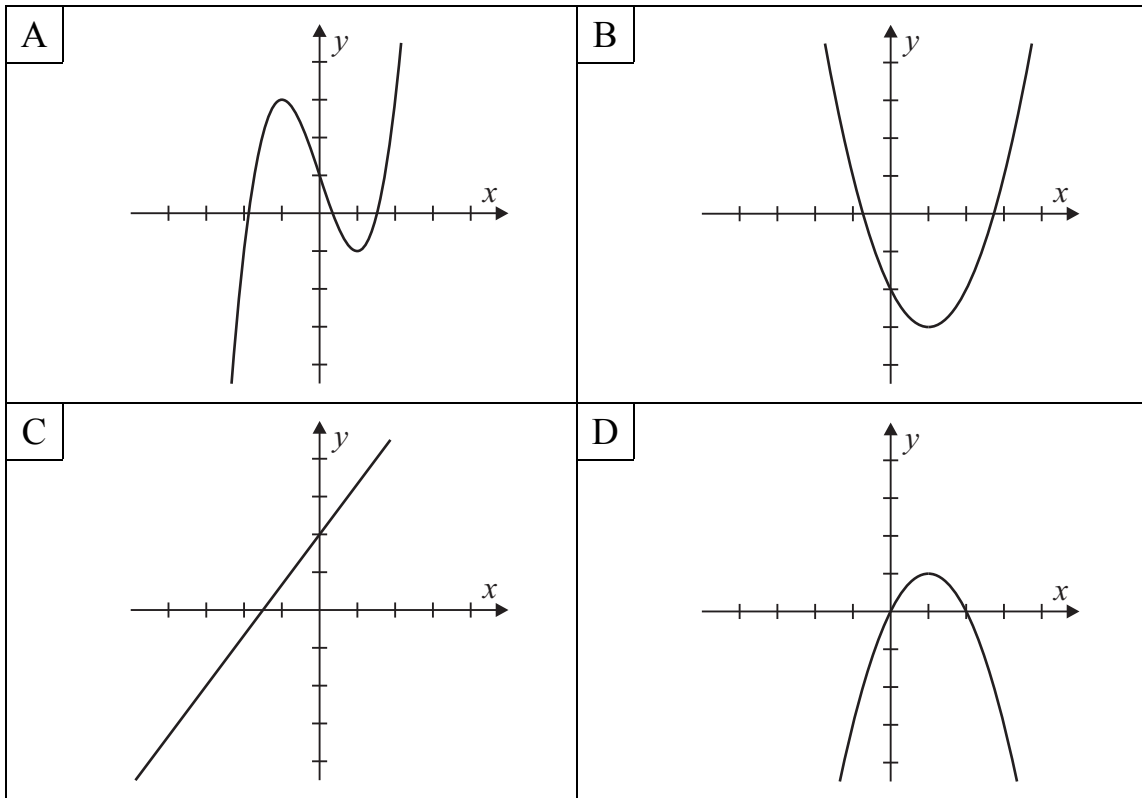


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Question 4

(25 marks)

The graphs of four functions are shown below. The graphs are labelled A, B, C and D. The four functions are listed in the table beneath the graphs.

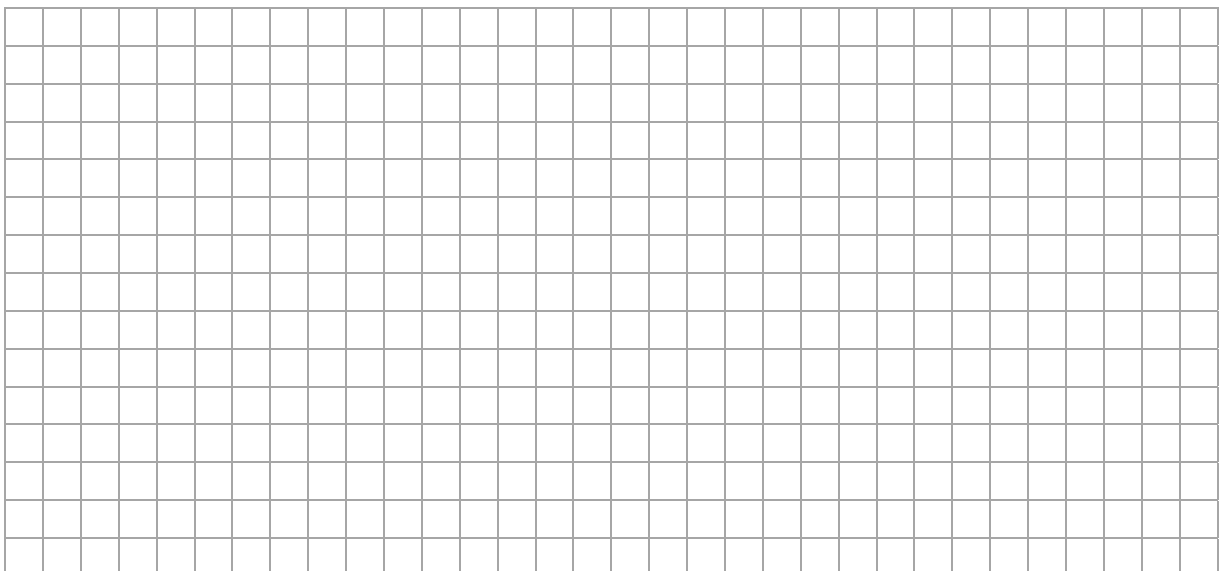


(a) (i) Match the graphs to the functions, by putting the correct letter beside each one in the table.

Function	Graph	Function	Graph
$f(x) = x^2 - 2x - 2$		$h(x) = x^3 - 3x + 1$	
$g(x) = 2x - x^2$		$j(x) = 3x + 2$	

(ii) Sketch the graph of the derivative of each of the functions shown in the above diagrams.

(b) Find the equation of the tangent to the curve $y = f(x)$ shown above at the point where $x = -1$.



Question 5

(25 marks)

(a) Write 8 and 8^3 in the form 2^n , where $n \in \mathbb{N}$.

$8 =$	$8^3 =$

(b) Hence, or otherwise, solve for x the equation $8^{3x} = \sqrt{64}$.

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(c) Earth and Mars follow two separate orbits around the sun. When they reach their nearest point, the two planets are only 54.6 million kilometres apart.

(i) Write this distance as a whole number in metres and then, in the form $a \times 10^n$, where $1 \leq a \leq 10$ and $n \in \mathbb{Z}$, correct to two significant figures.

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(ii) To determine the distance between the two planets, a light beam is aimed at Mars and the time it takes for the light to travel to Mars and be reflected back is measured.

Given that the speed of light is 3×10^8 metres per second, find the minimum time it would take for a light beam to travel to Mars and back again, correct to the nearest second.

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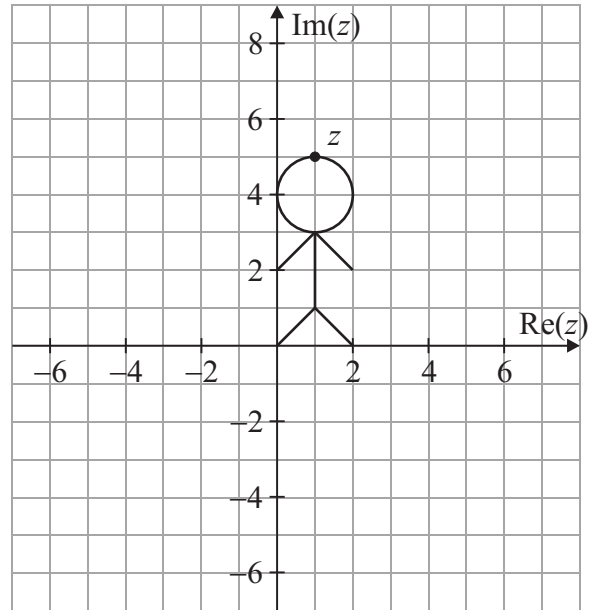
Answer **all three** questions from this section.

Question 7

(60 marks)

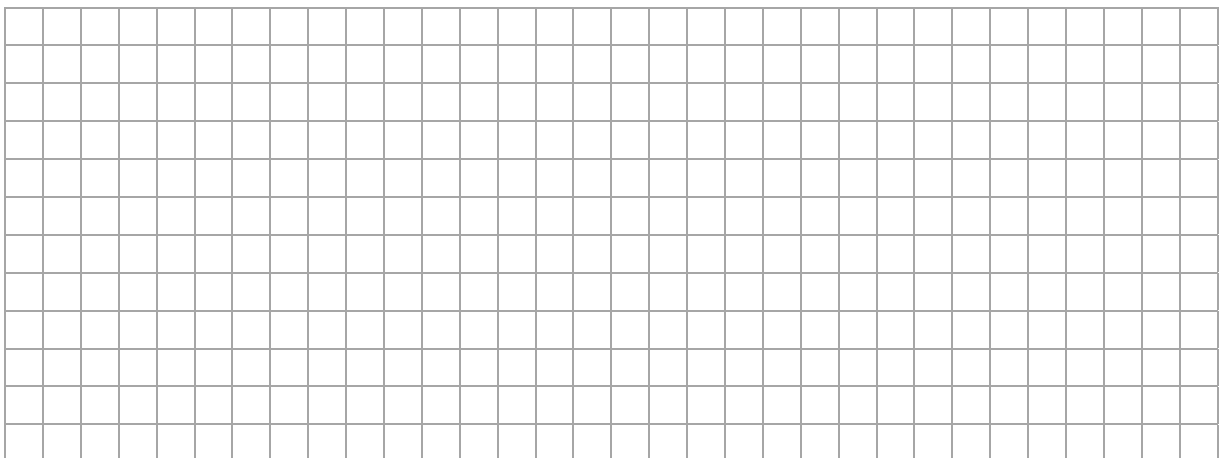
Complex numbers are used to describe the size and position of animated fictional characters and objects in computer games.

In one interactive simulation game, the main character needs to change size and position in different ways.



- (a) By evaluating the following transformations to the complex number $z = 1 + 5i$, where $i^2 = -1$, describe what happens to the fictional character in each case. You may assume that every point in the character undergoes the same transformation as z . The first one is done for you.

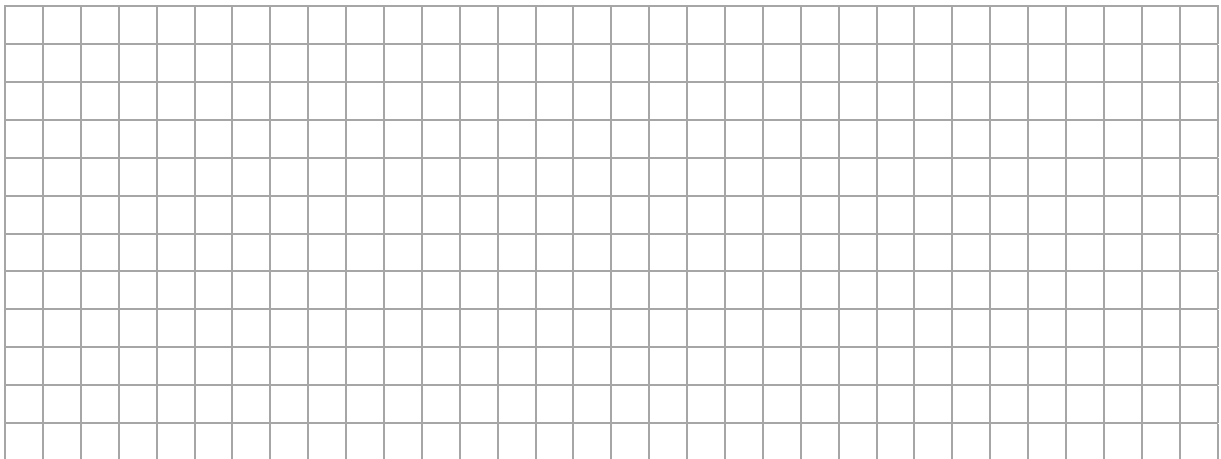
Transformation	Evaluation	Explanation
$z_1 = z + 3$	$4 + 5i$	the character shifts 3 units to the right
$z_2 = -z$		
$z_3 = zi$		



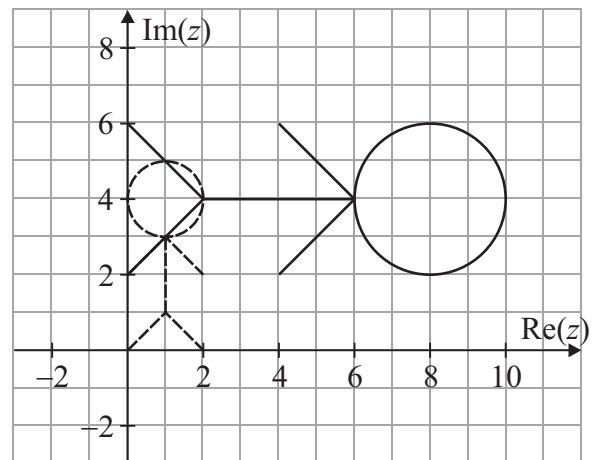
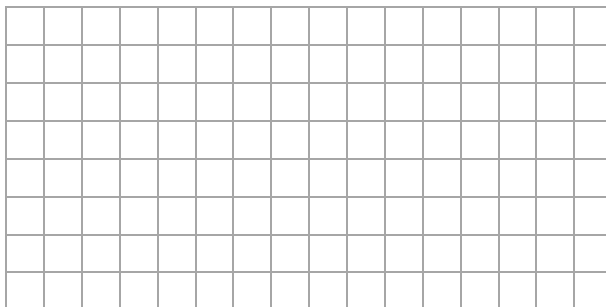
- (b) Show the outline of the fictional character under each of the transformations defined in part (a) on the Argand diagram above.

- (c) Some transformations require the examination of more than one point on the fictional character. By considering z and another point, describe what happens to the character under each of the following transformations.

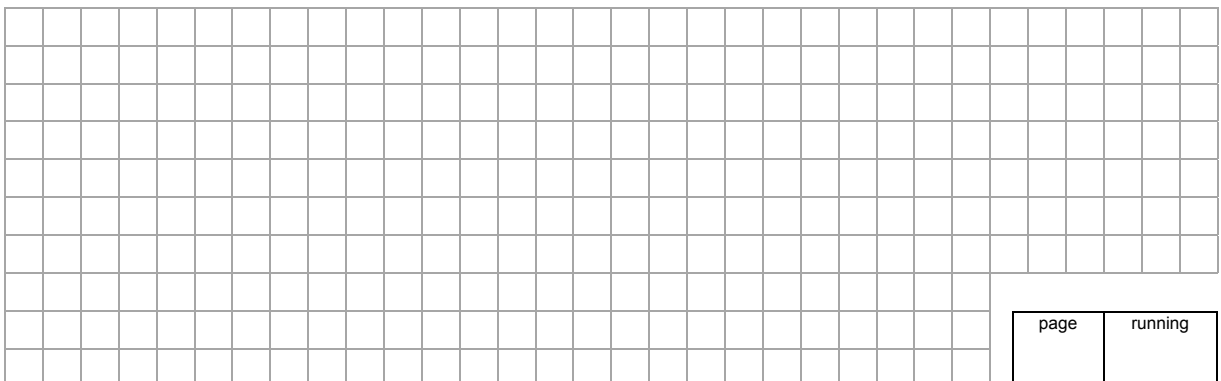
Transformation	Evaluation	2nd Point	Evaluation	Explanation
$z_4 = 3z$				
$z_5 = \bar{z}$				
$z_6 = (2 + 2i)z$				



- (d) Using the fictional character from part (a), describe, in your own words, how the character is transformed to the position and size shown in the diagram.

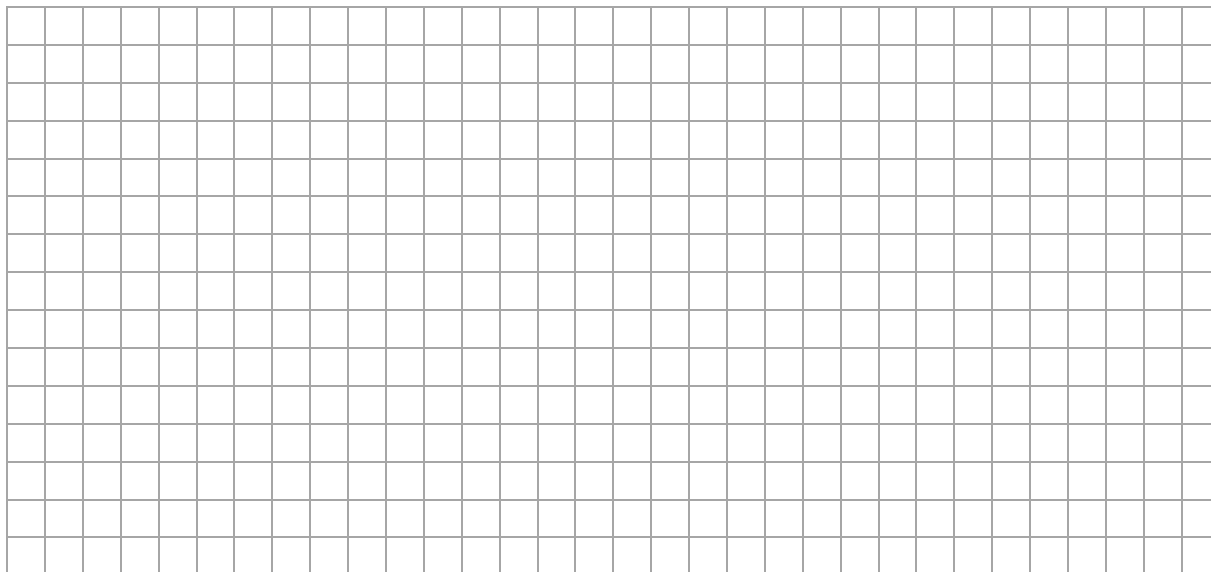


- (e) Write down, in mathematical terms, what calculations need to be performed to transform the fictional character to the position and size shown in the above diagram.

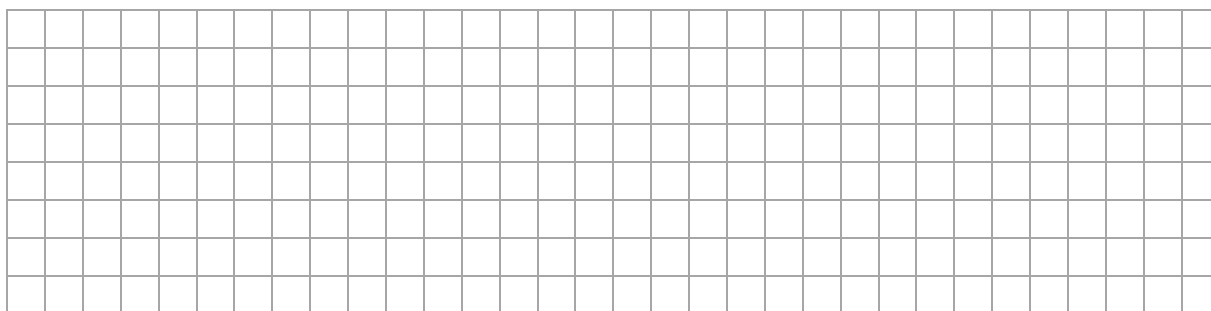


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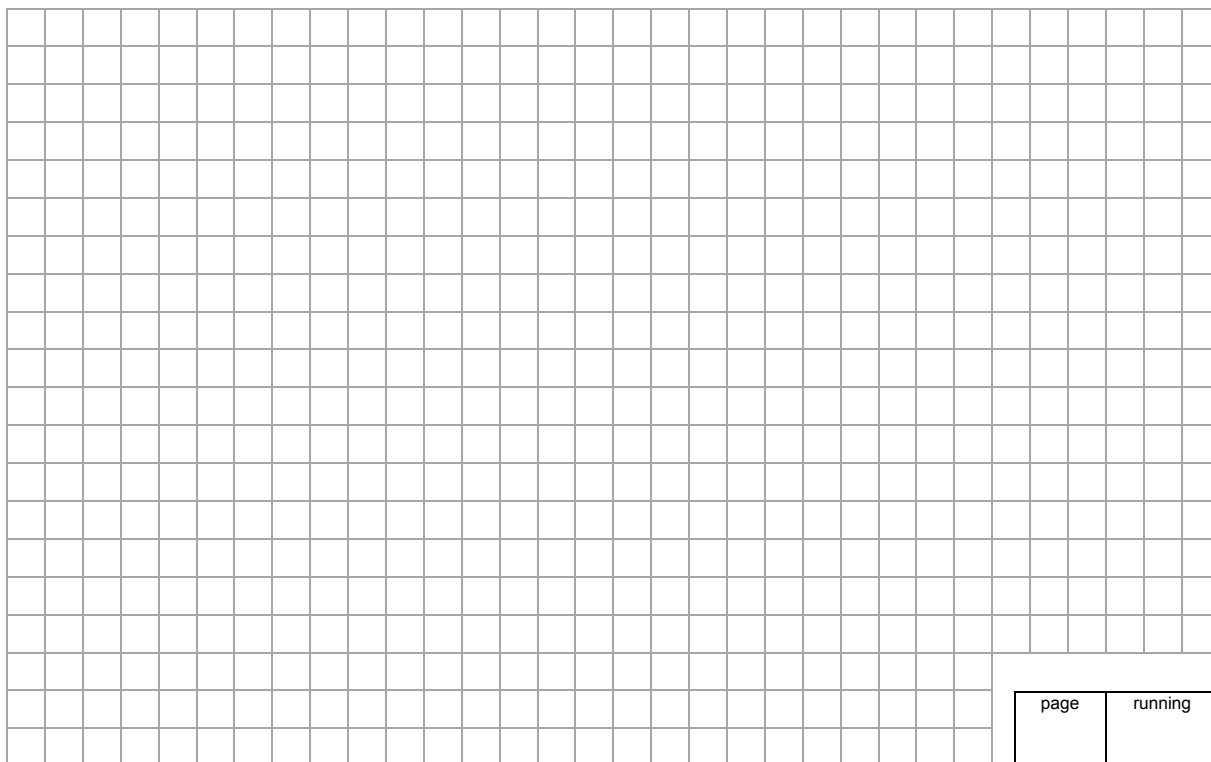
- (c) Find the horizontal distance that the golf ball has travelled when it reaches its maximum height above ground level.



- (d) What is the maximum height that the golf ball reaches above the elevated position from which it is struck?

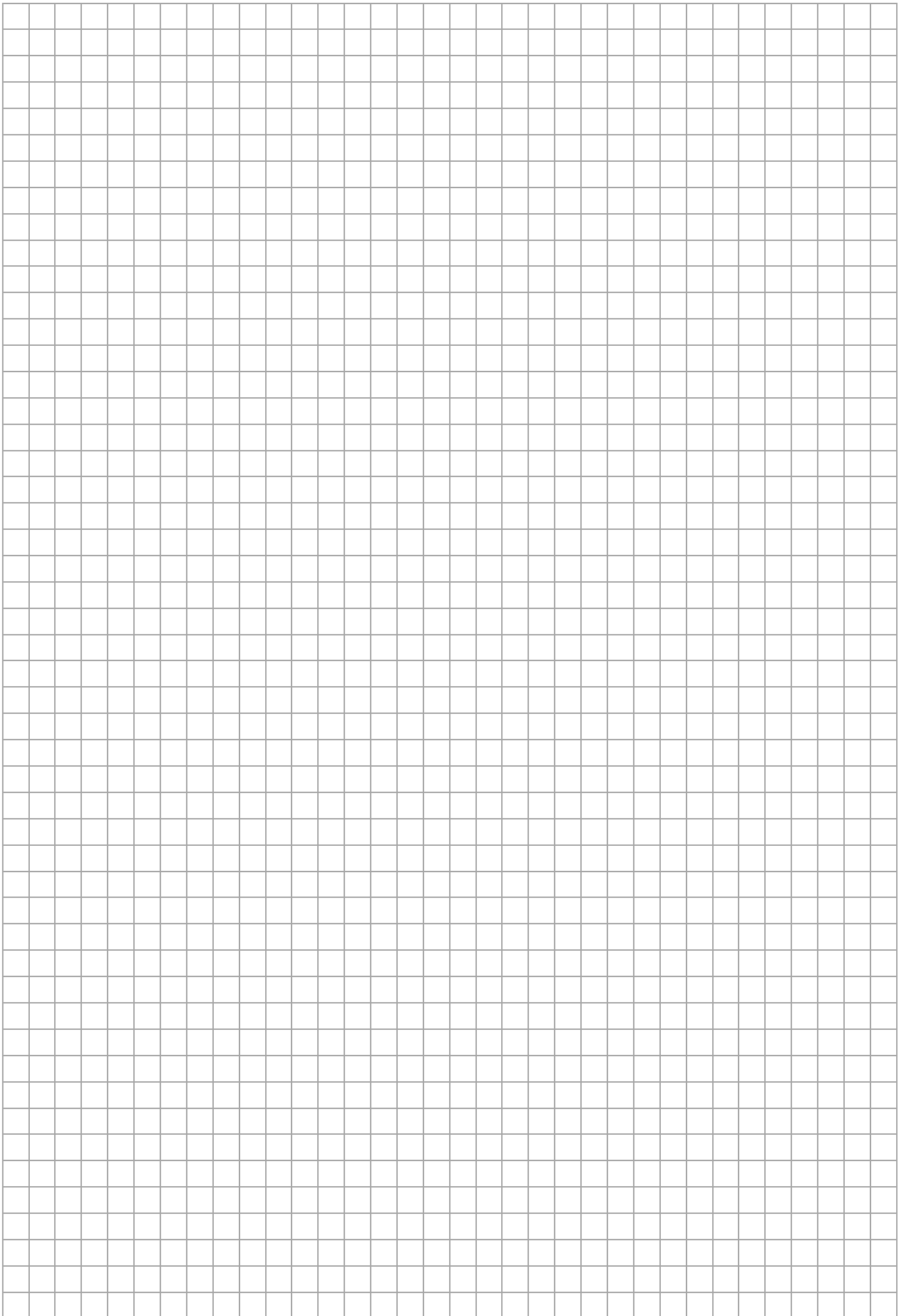


- (e) Find the horizontal distance that the golf ball has travelled when it strikes the ground.

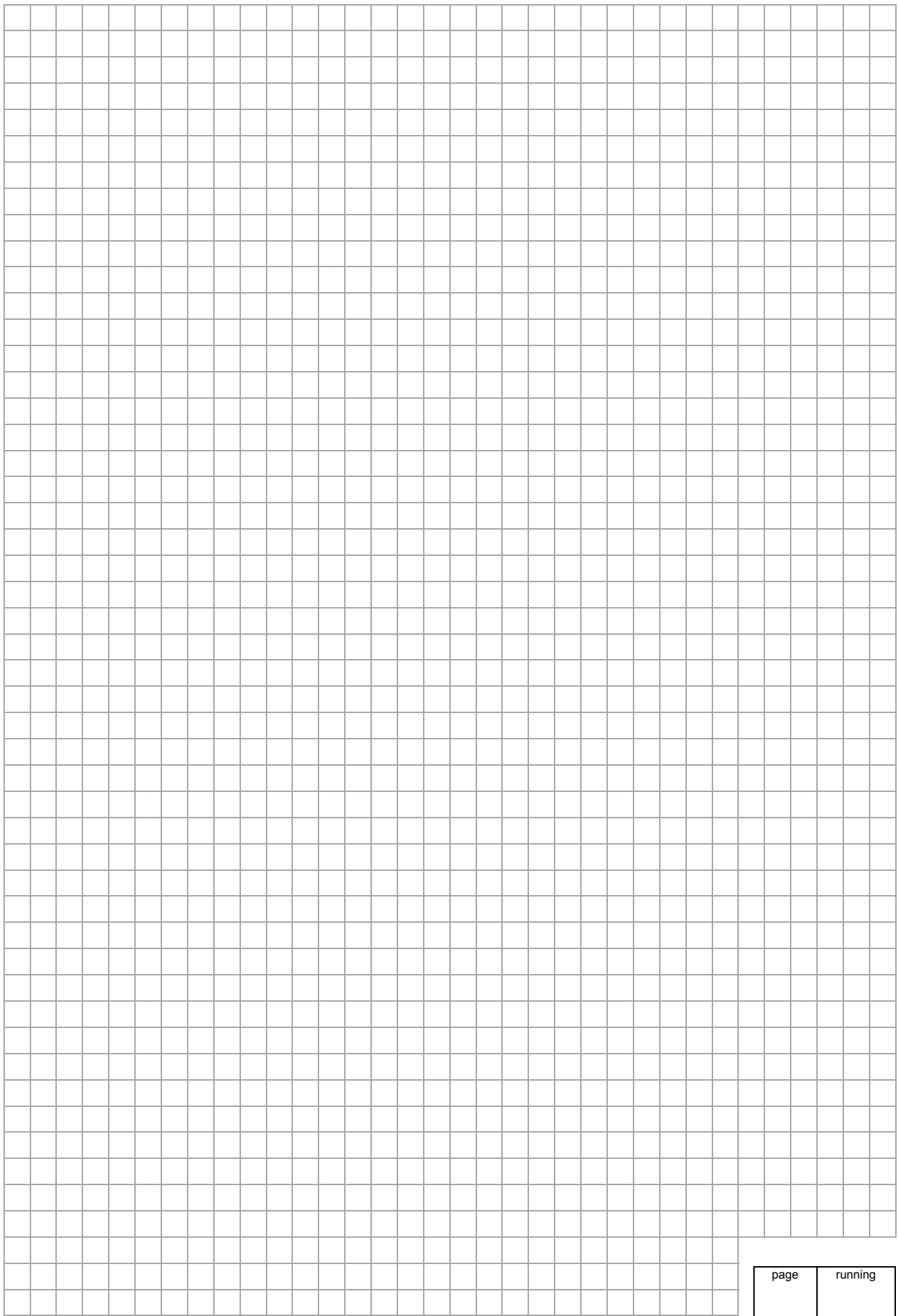


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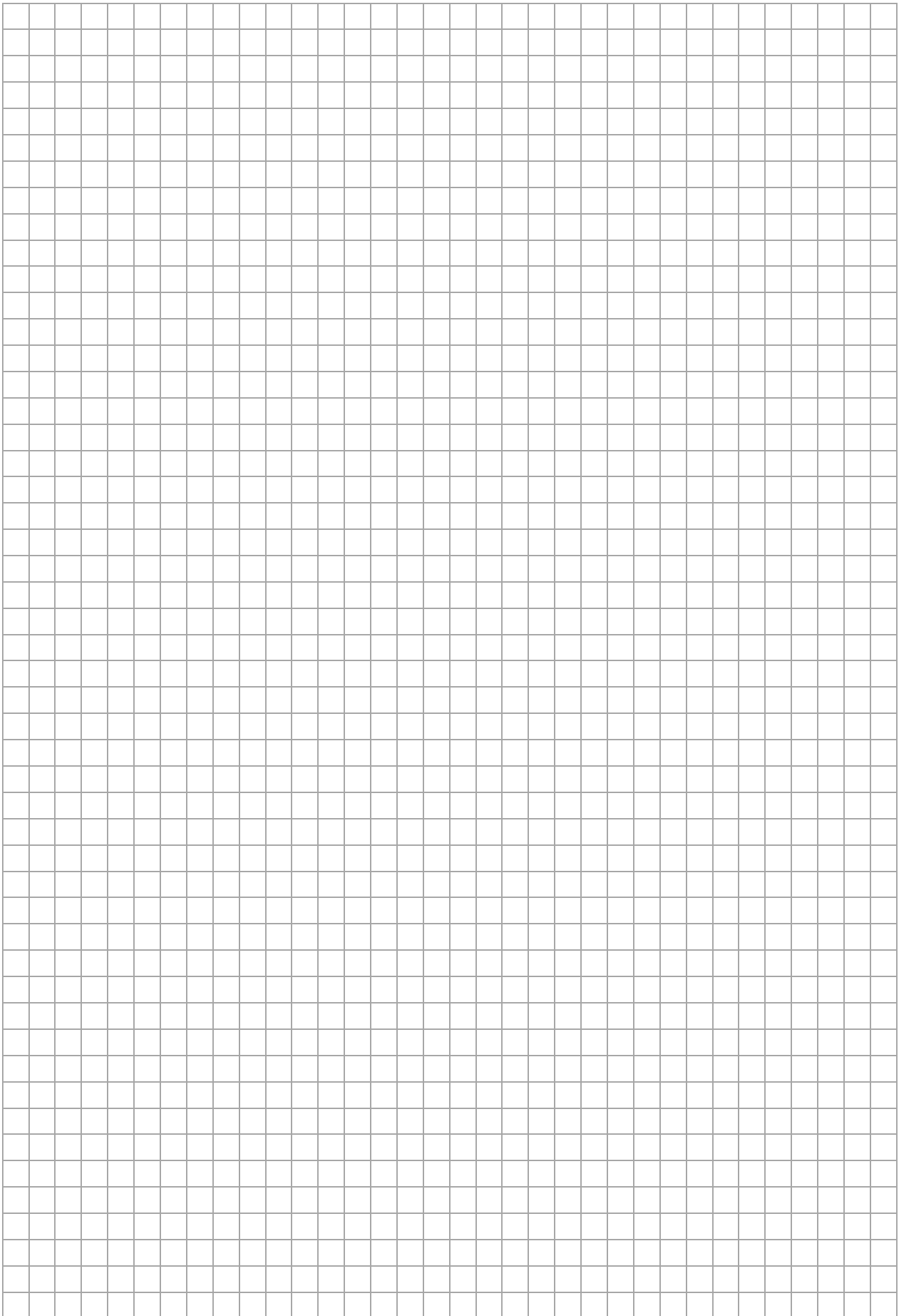


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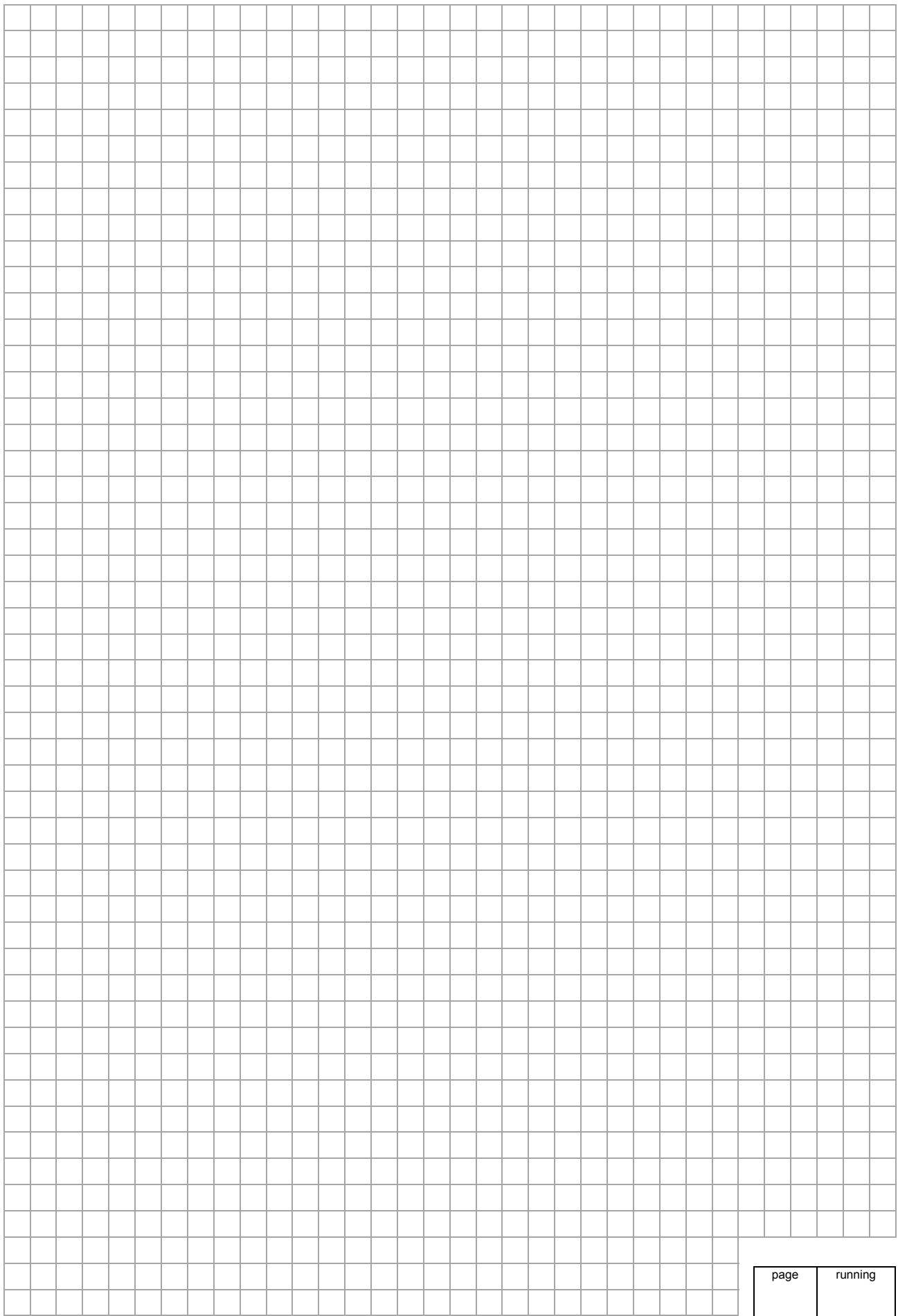


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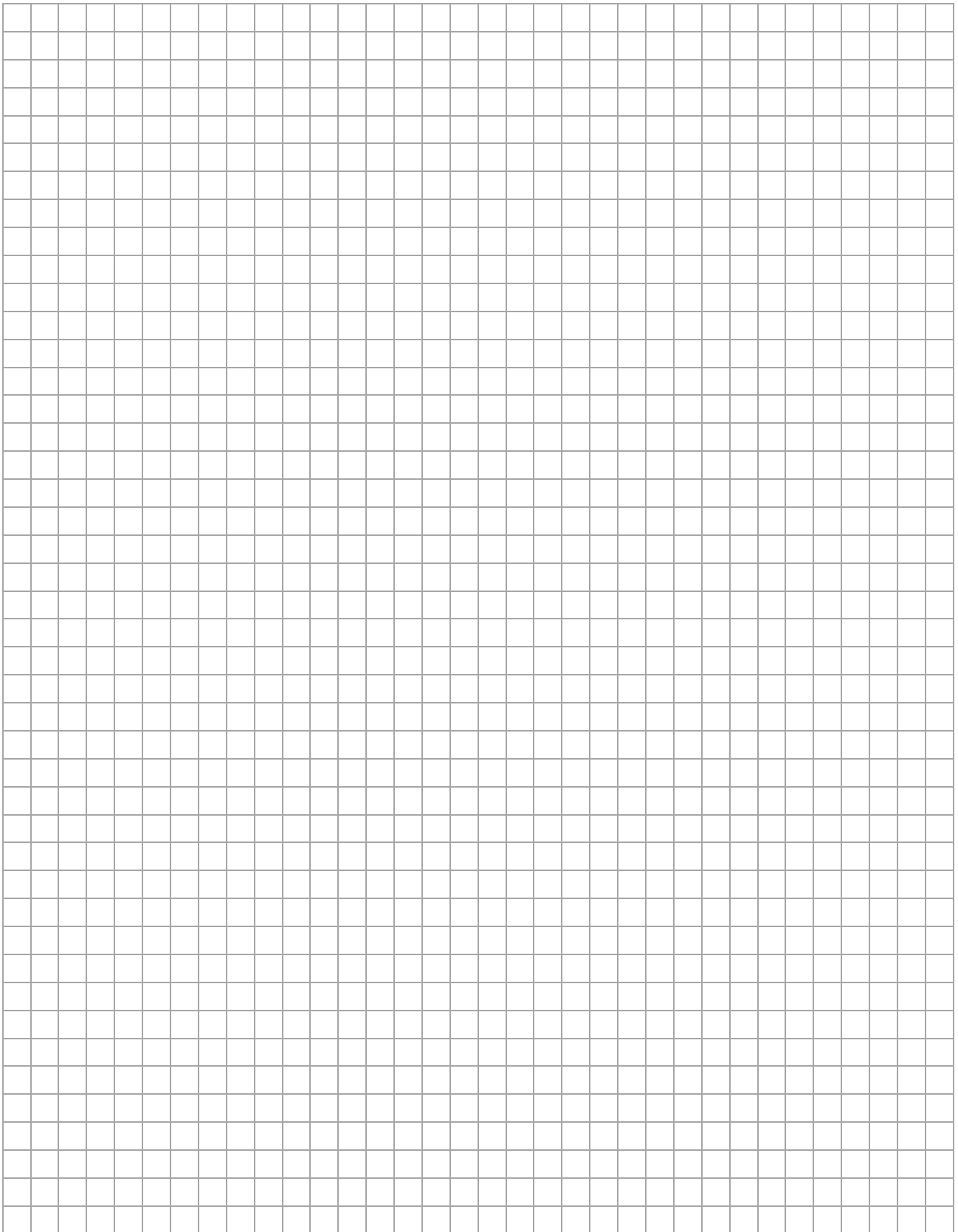
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