



Coimisiún na Scrúduithe Stáit  
State Examinations Commission

Leaving Certificate Examination 2013  
Sample Paper

Mathematics  
(Project Maths – Phase 2)

Paper 1

Ordinary Level

Time: 2 hours, 30 minutes

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	
9	
Total	

Grade
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## Instructions

There are **three** sections in this examination paper:

Section A	Concepts and Skills	100 marks	4 questions
Section B	Contexts and Applications	100 marks	2 questions
Section C	Functions and Calculus (old syllabus)	100 marks	2 questions

Answer all eight 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 booklet of *Formulae and Tables*. 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:

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

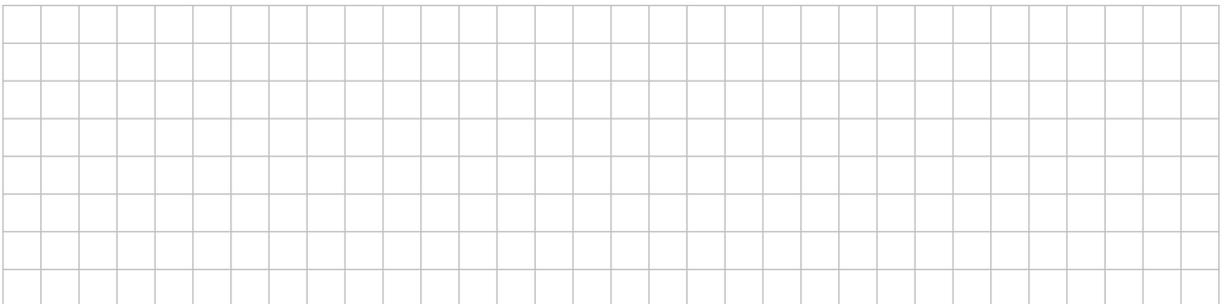
**Question 1****(25 marks)**

- (a) The same number can be represented in different ways. Write two more representations of each of the numbers in the table below, by choosing only from the following list.

Note: some of the representations may be approximations.

$-36$ ,	$9\%$ ,	$\frac{1}{9}$ ,	$\frac{1}{62}$ ,	$\frac{1}{81}$ ,
$16^5$ ,	$(\sqrt{3})^4$ ,	$2^4 \times 2^5$ ,	$(0.25)^{-10}$ ,	$2.8\%$ ,
$36\%$ ,	$900\%$ ,	$0.02\dot{7}$ ,	$1.05 \times 10^6$ ,	$1.05 \times 10^{-5}$ .

$6^{-2}$		
$81^{\frac{1}{2}}$		
$2^{20}$		



- (b) Giving the number line below an appropriate scale, mark the following numbers on it:

$$\sqrt{82}, 3\pi, 8.9, 9, \frac{37}{4}, 9.3 \times 10^0.$$



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**Question 3****(25 marks)**

(a) Write each of the following complex numbers in the form  $a + bi$ , where  $i^2 = -1$ .

$$z_1 = (3 + 2i)(2 - 5i) =$$

$$z_2 = (5 + 4i)(17 - 13i) - (5 + 3i)(17 - 13i) =$$

$$z_3 = \left(\frac{5}{2} + \frac{7}{2}i\right)^2 - \left(\frac{5}{2} + \frac{1}{2}i\right)^2 =$$

$$z_4 = 1 + i + i^2 + i^3 =$$

(b) Which of  $z_1$  and  $z_2$  above is farther from 0 on an Argand diagram?

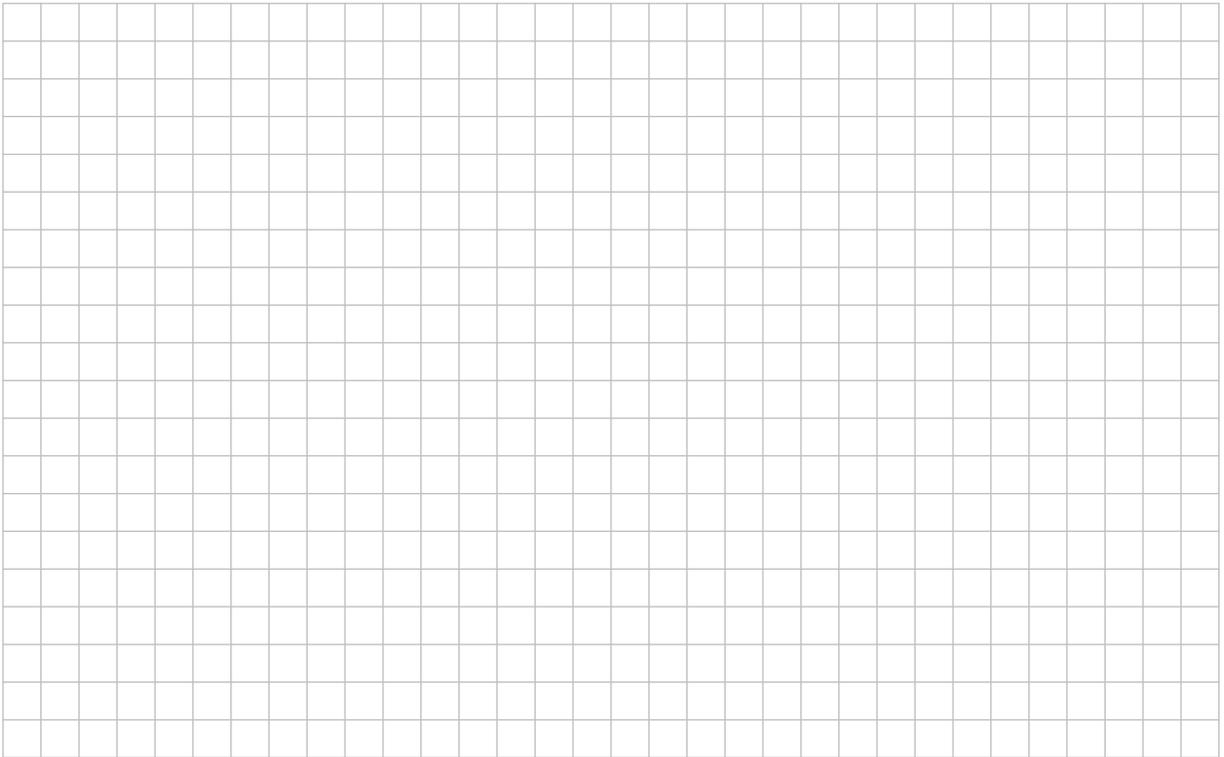
Justify your answer.

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**Question 4**

**(25 marks)**

- (a) Solve the equation  $x^2 - 6x - 23 = 0$ , giving your answer in the form  $a \pm b\sqrt{2}$ , where  $a, b \in \mathbb{Z}$ .



- (b) Solve the simultaneous equations

$$2r - s = 10$$

$$rs - s^2 = 12$$

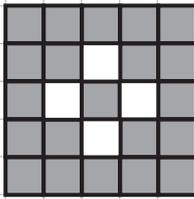


Answer **both** Question 5 **and** Question 6.

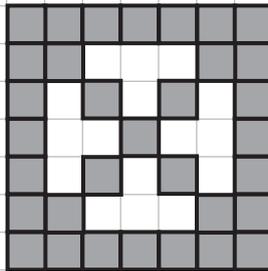
**Question 5****(50 marks)**

Sile is investigating the number of square grey tiles needed to make patterns in a sequence. The first three patterns are shown below, and the sequence continues in the same way. In each pattern, the tiles form a square and its two diagonals. There are no tiles in the white areas in the patterns – there are only the grey tiles.

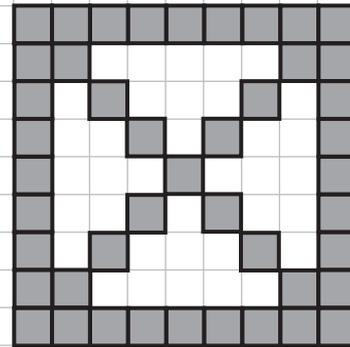
*(Questions start overleaf.)*



1st pattern



2nd pattern



3rd pattern

- (a) In the table below, write the number of tiles needed for each of the first five patterns.

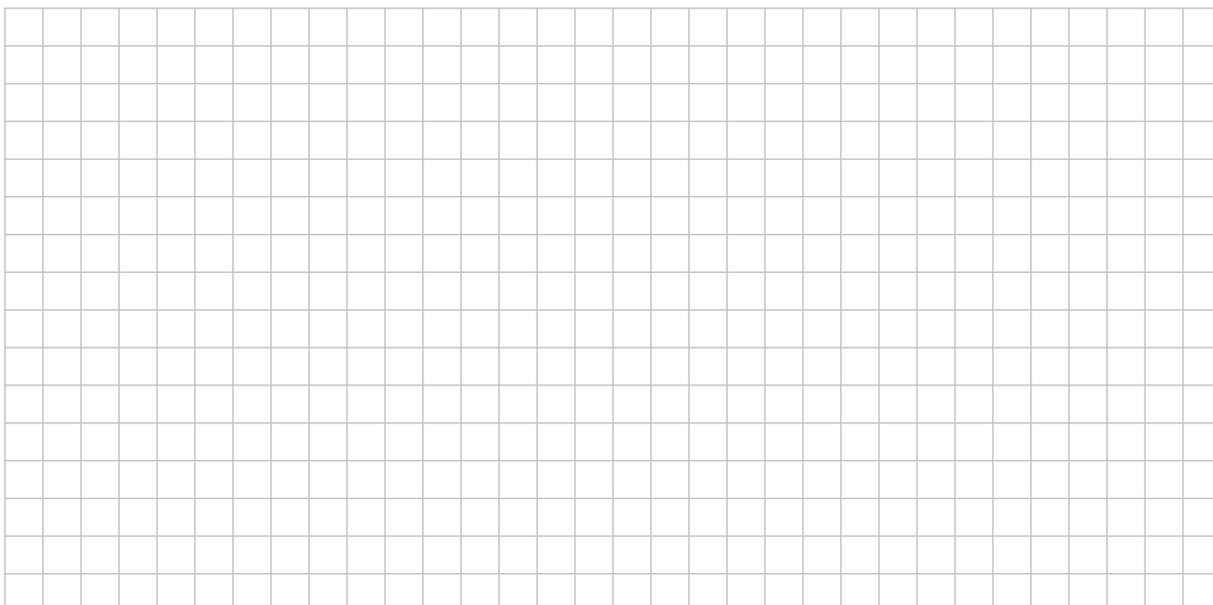
Pattern	1	2	3	4	5
No. of tiles	21	33			

- (b) Find, in terms of  $n$ , a formula that gives the number of tiles needed to make the  $n$ th pattern.

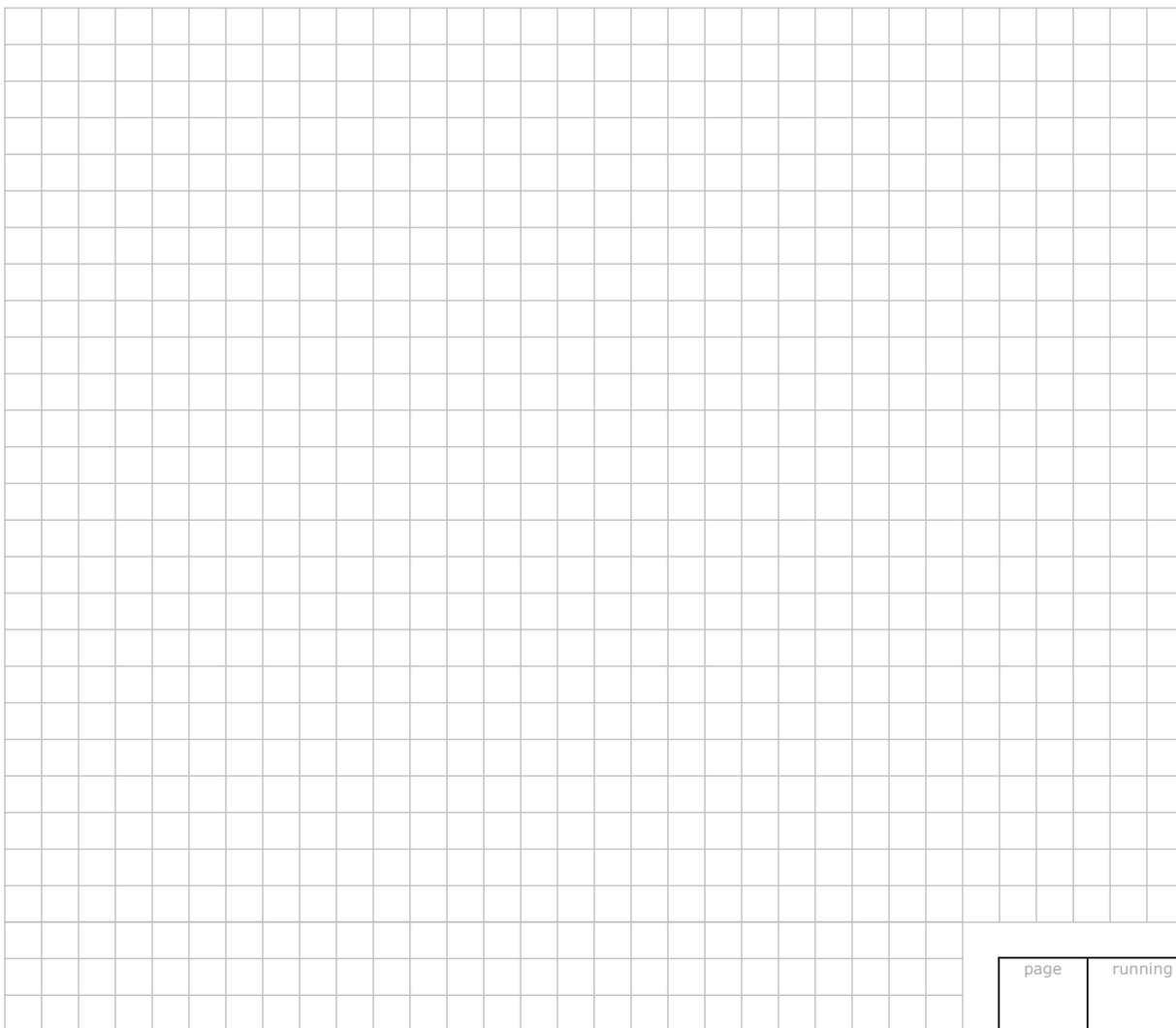
- (c) Using your formula, or otherwise, find the number of tiles in the tenth pattern.

- (d) Síle has 399 tiles. What is the biggest pattern in the sequence that she can make?

- (e) Find, in terms of  $n$ , a formula for the total number of tiles in the first  $n$  patterns.



- (f) Sile starts at the beginning of the sequence and makes as many of the patterns as she can. She does not break up the earlier patterns to make the new ones. For example, after making the first two patterns, she has used up 54 tiles,  $(21 + 33)$ . How many patterns can she make in total with her 399 tiles?

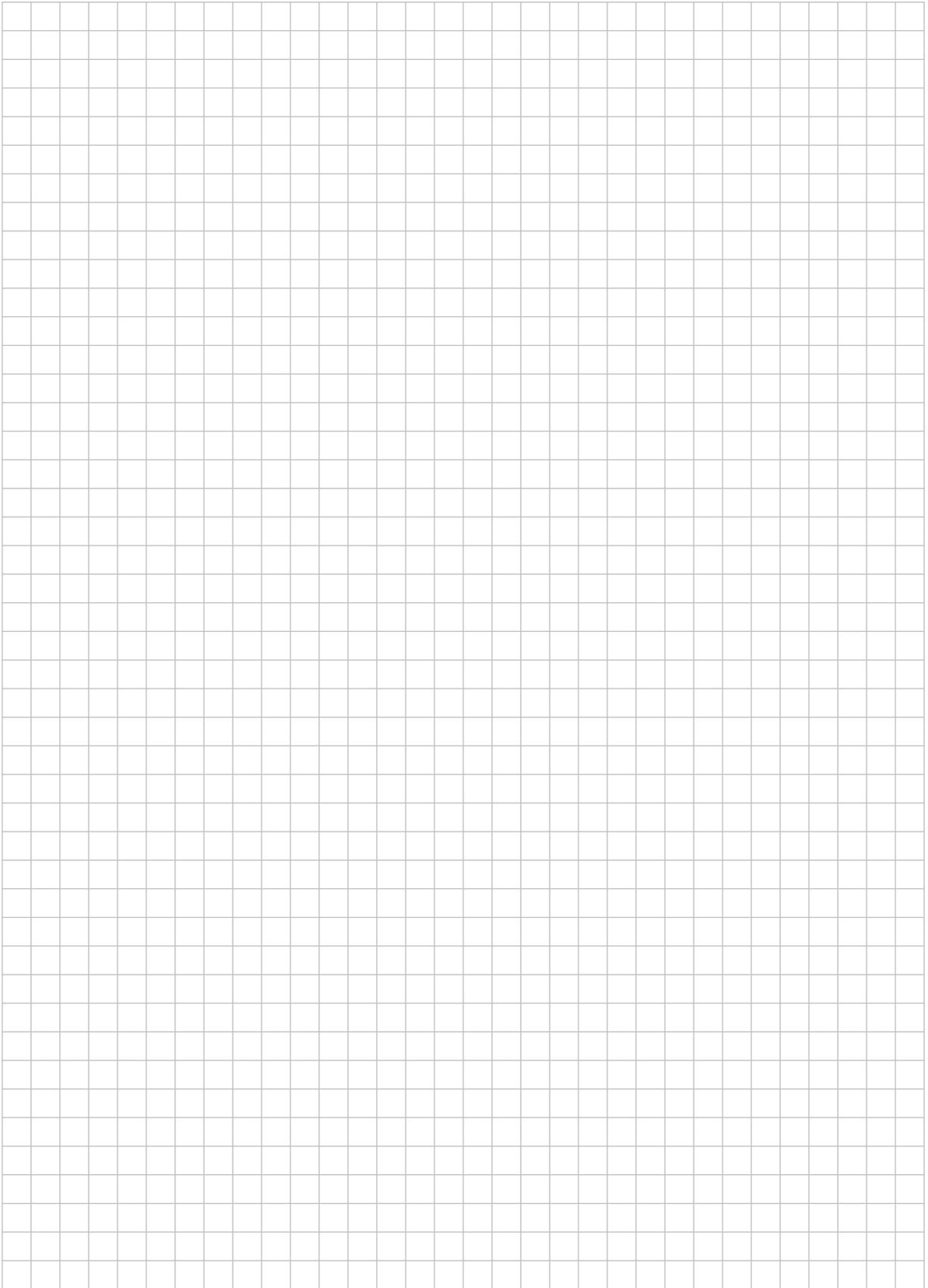


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- (c) John assumes that the plants will continue to grow at the same rates. Draw graphs to represent the heights of the two plants over the first *four weeks*.

*(Questions continue overleaf.)*



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(c) Let  $f(x) = x - \frac{5}{x}$ , where  $x \in \mathbb{R}$  and  $x \neq 0$ .

(i) Find  $f'(x)$ , the derivative of  $f(x)$ .

(ii) Find the co-ordinates of the two points at which the tangent to the curve  $y = f(x)$  is parallel to the line  $y = 6x$ .



(c) The speed,  $v$ , of an object at time  $t$  is given by

$$v = 96 + 40t - 4t^2$$

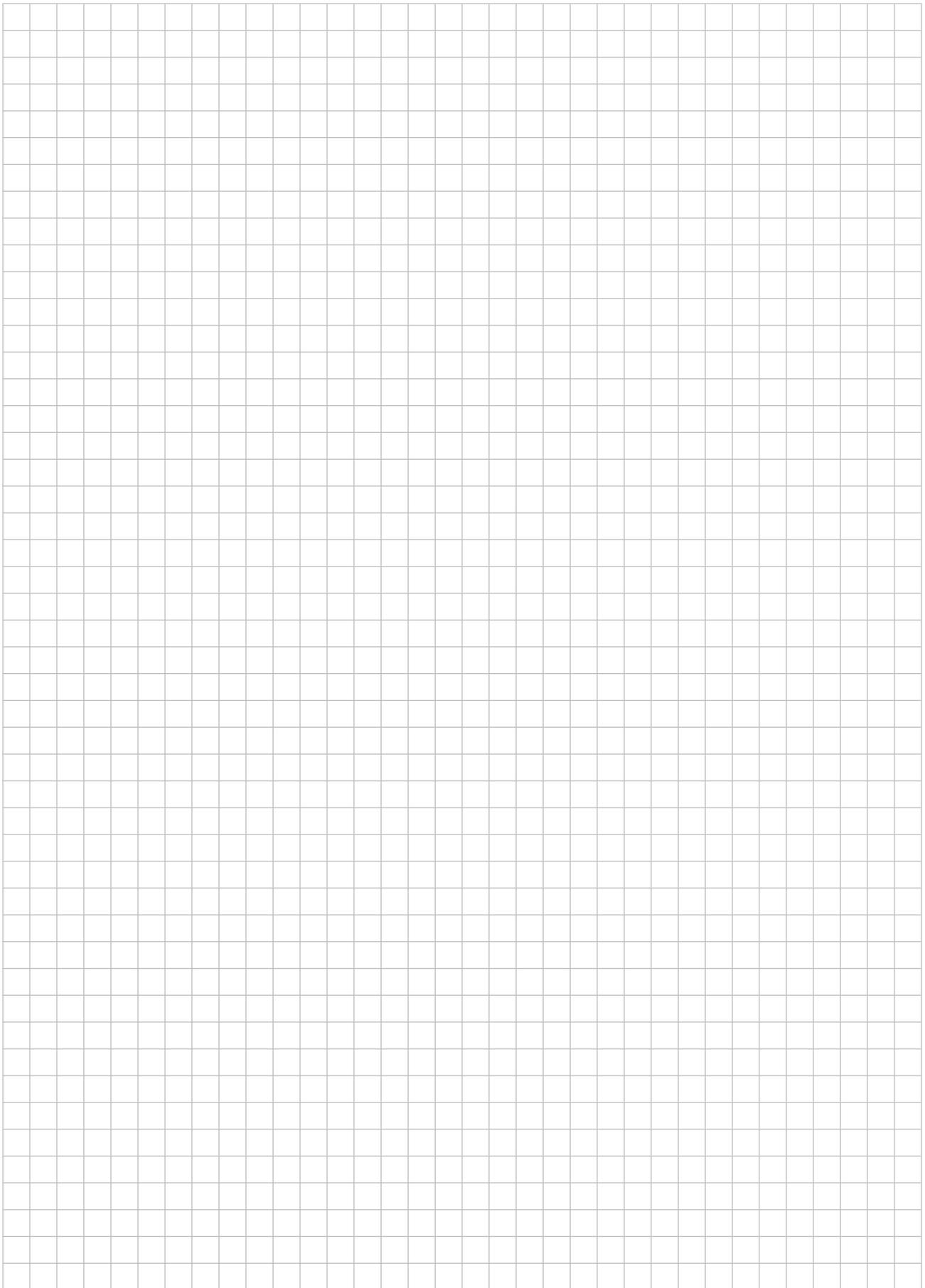
where  $t$  is in seconds and  $v$  is in metres per second.

(i) At what times will the speed of the object be 96 metres per second?

(ii) What will the acceleration of the object be at  $t = 2.5$  seconds?

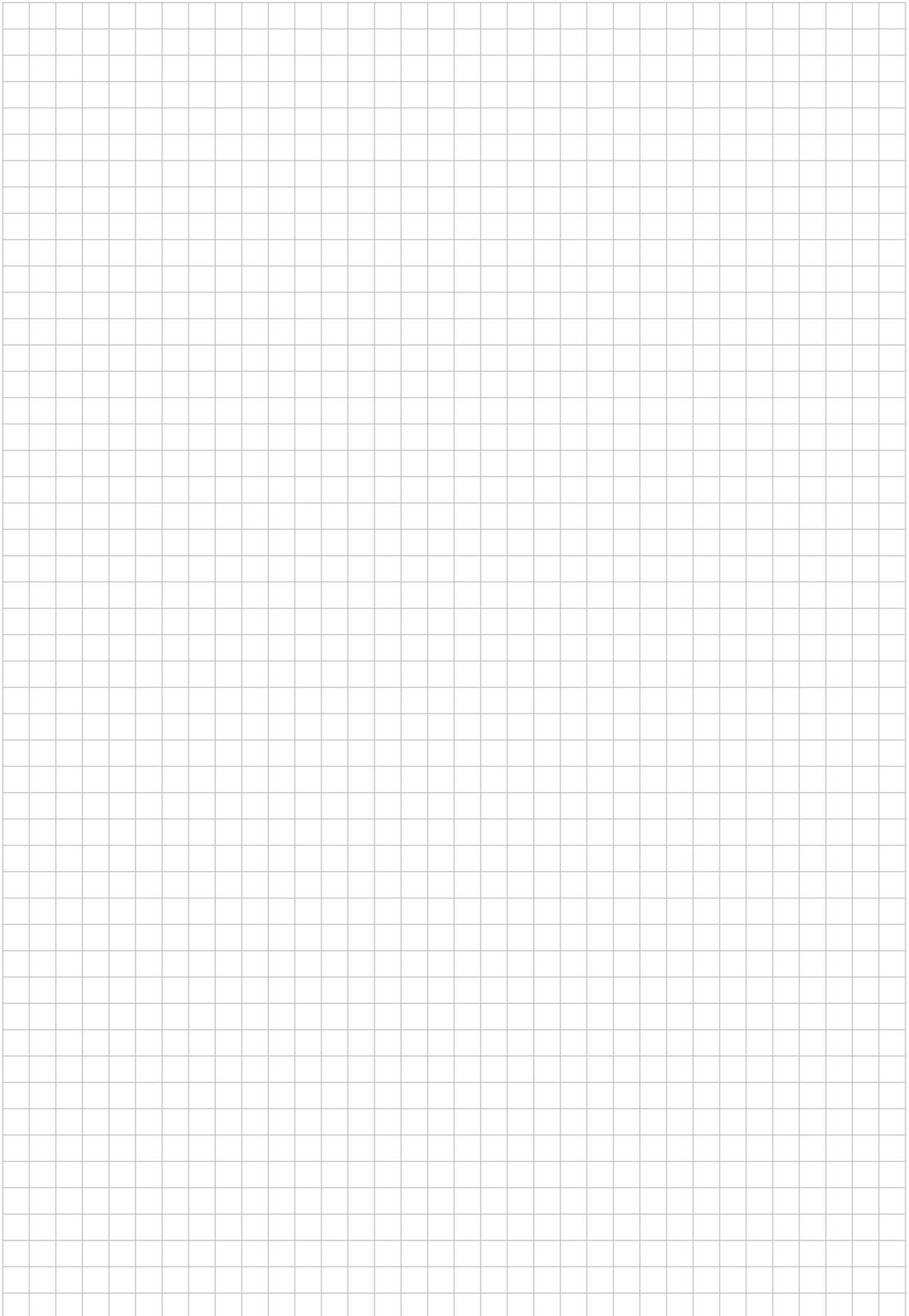
(iii) At what value of  $t$  will the acceleration become negative?

You may use this page for extra work.

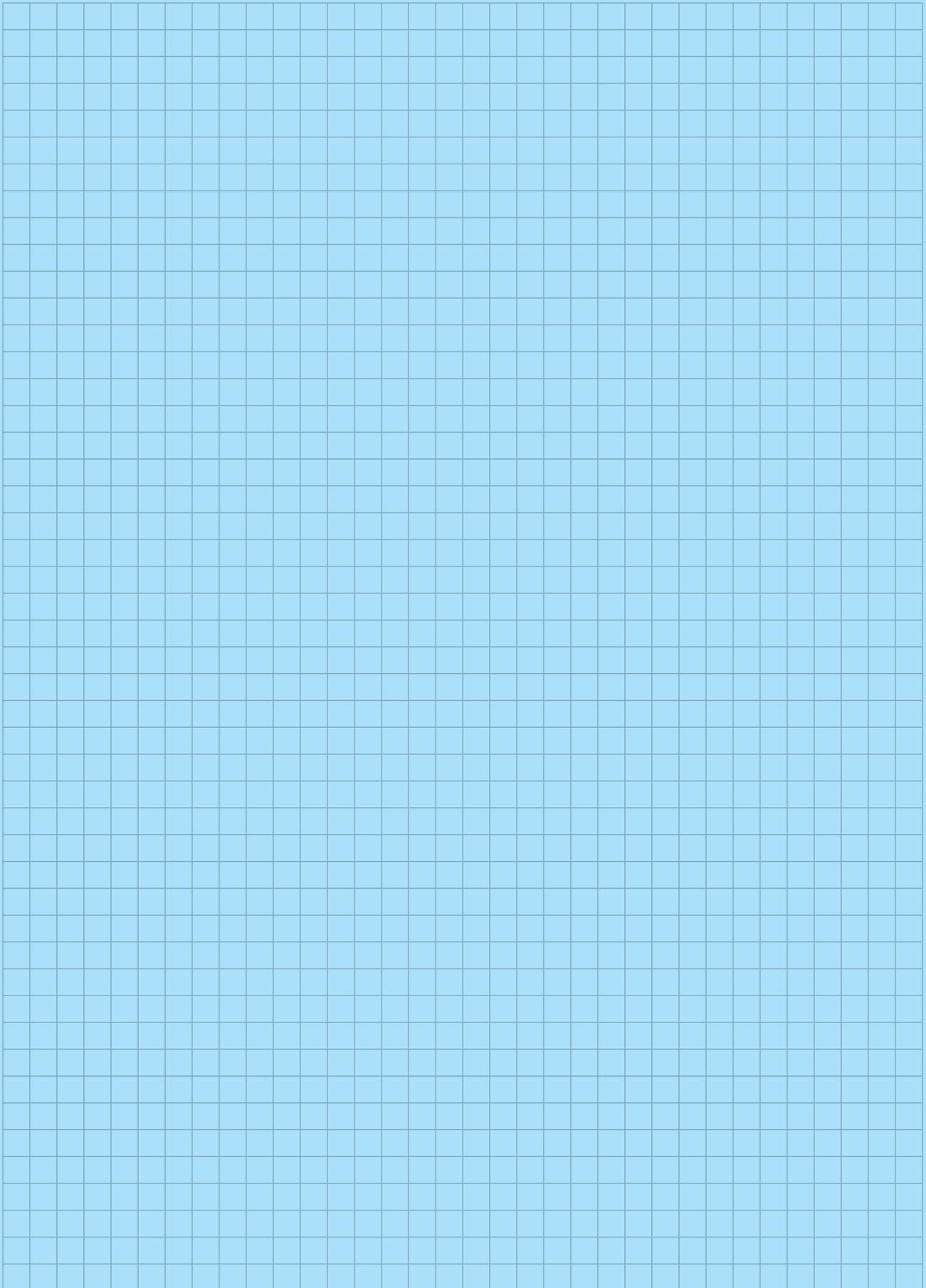


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*Note to readers of this document:*

This sample paper is intended to help teachers and candidates prepare for the June 2013 examination in *Mathematics* under Phase 2 of *Project Maths*. The content and structure do not necessarily reflect the 2014 or subsequent examinations.

In the 2013 examination, Questions 7 and 8 in Section C on Paper 1 will be similar in content and style to those that have appeared as Questions 6, 7, and 8 on the examination in previous years. On this sample paper, two questions from the 2010 examination have been inserted to illustrate.

Leaving Certificate 2013 – Ordinary Level

## Mathematics (Project Maths – Phase 2) – Paper 1

Sample Paper

Time: 2 hours 30 minutes