

Do not write on this page



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	4 questions

Answer questions as follows:

- any **five** questions from Section A – Concepts and Skills
- any **three** questions from Section B – Contexts and Applications.

Write your Name and Individual Details in the grid on the front cover.

Write your answers in blue or black pen. You may use pencil in graphs and diagrams only.

This examination booklet will be scanned and your work will be presented to an examiner on screen. Anything that you write outside of the answer areas may not be seen by the examiner.

Write all answers into this booklet. There is space for extra work at the back of the booklet. If you need to use it, 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.

In general, diagrams are not to scale.

You will lose marks if your solutions do not include relevant supporting work.

You may lose marks if the appropriate units of measurement are not included, where relevant.

You may lose marks if your answers are not given in simplest form, where relevant.

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



Answer **any five questions** from this section.

Question 1

(30 marks)

- (a) Mary is flying home to Dublin from Toronto in Canada.
The flight takes 6 hours, 45 minutes.
Local time in Toronto is 5 hours behind that in Dublin.



- (i) Mary's flight departs Toronto at 14:25.

Work out the local time in Dublin when the flight is expected to arrive.

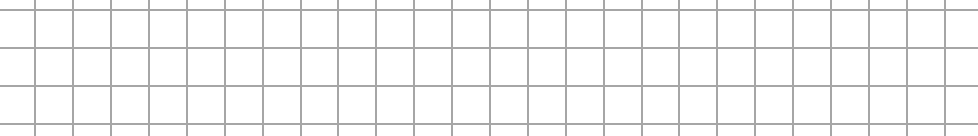
[illegible]

- (ii) The total flight distance from Toronto to Dublin is 3270 miles. 5 miles is approximately 8 kilometres.

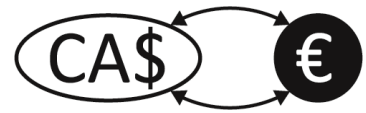
Work out this distance in kilometres.

A large rectangular grid of graph paper, consisting of 20 columns and 10 rows of squares, intended for drawing a picture.

- (iii) Work out the average speed of the flight in km/hour.
Give your answer correct to the nearest whole number.



- (b)** Mary wants to exchange some Canadian dollars for euro. She exchanges 368 Canadian dollars (CA\$) at Dublin Airport. She is charged 1.5% commission on the transaction.



If the exchange rate is €1 = CA\$1.46, work out how much she receives in euro. Give your answer correct to the nearest cent.

A full-page sheet of white graph paper with a light gray grid. The grid consists of small squares, approximately 1 cm by 1 cm each. There are 20 columns and 20 rows of squares, creating a total of 400 small square units. The grid lines are thin and evenly spaced.

(30 marks)

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

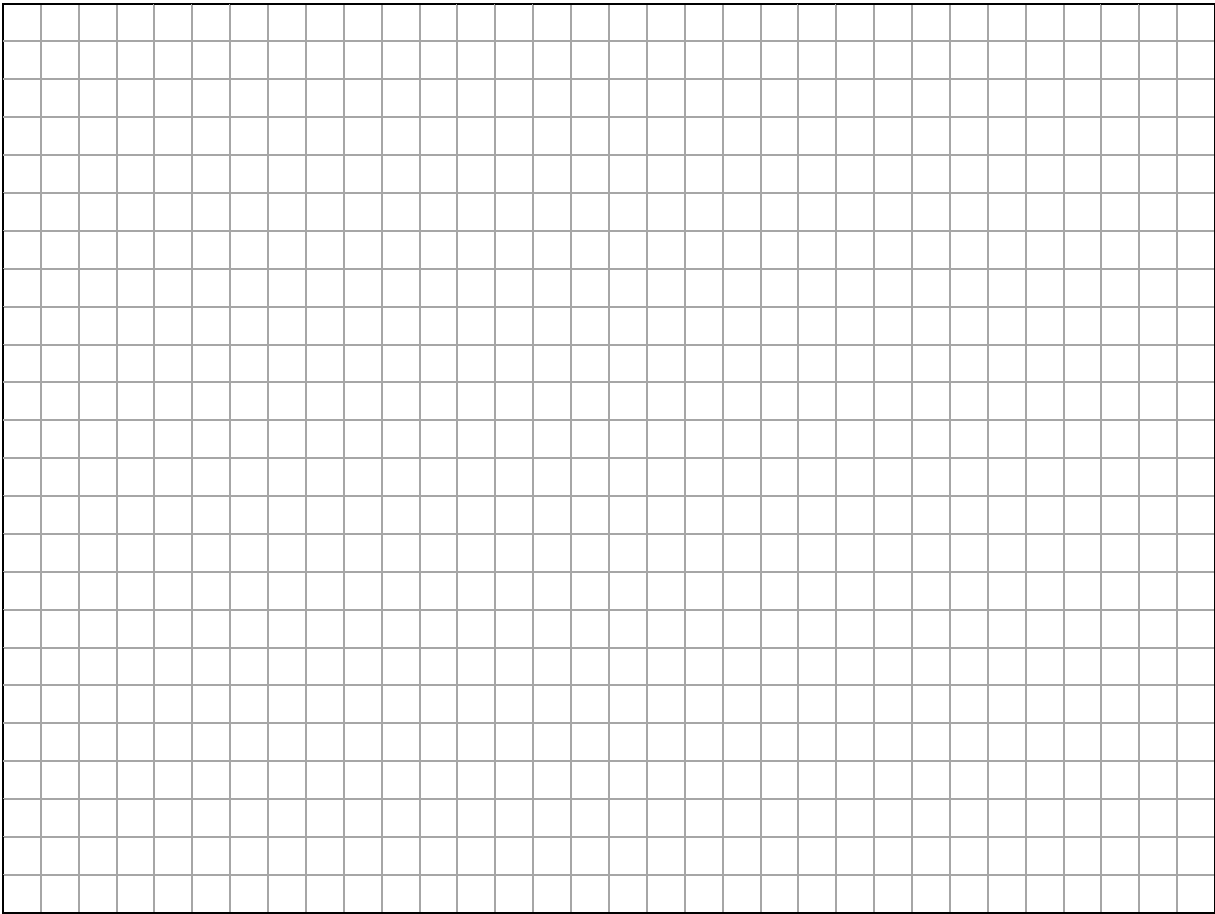
- Write down z_3 in the form $a + bi$, where $a, b \in \mathbb{Z}$.

[illegible]

-

- [illegible]

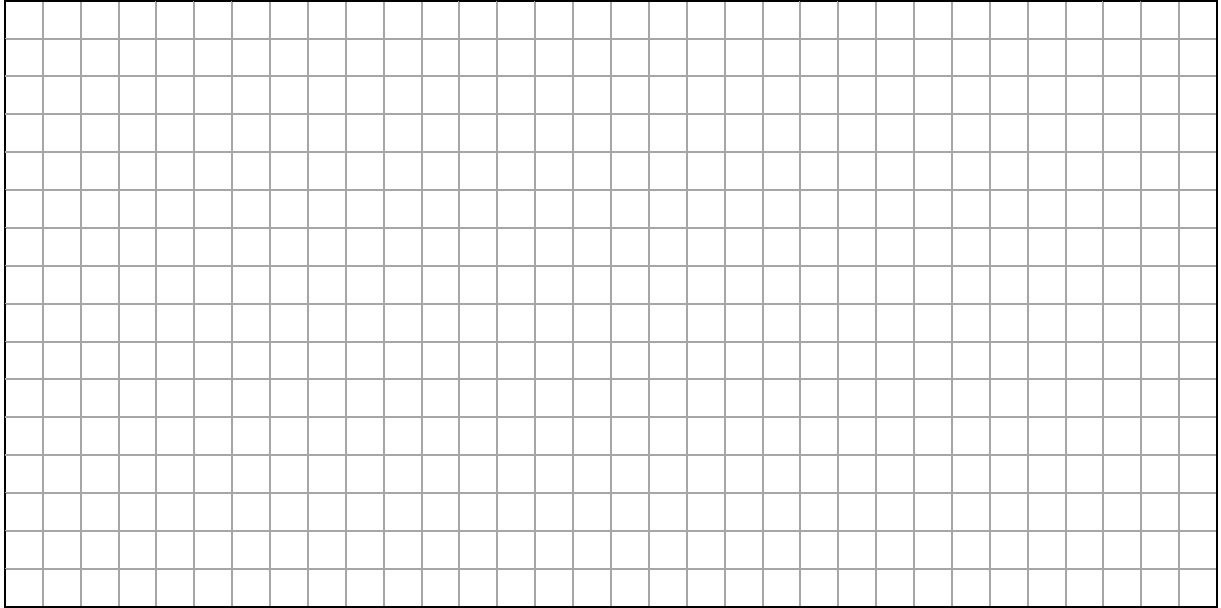
(b) Let $z_4 = \frac{z_2}{z_1}$. Find z_4 in the form $a + bi$, where $a, b \in \mathbb{R}$.



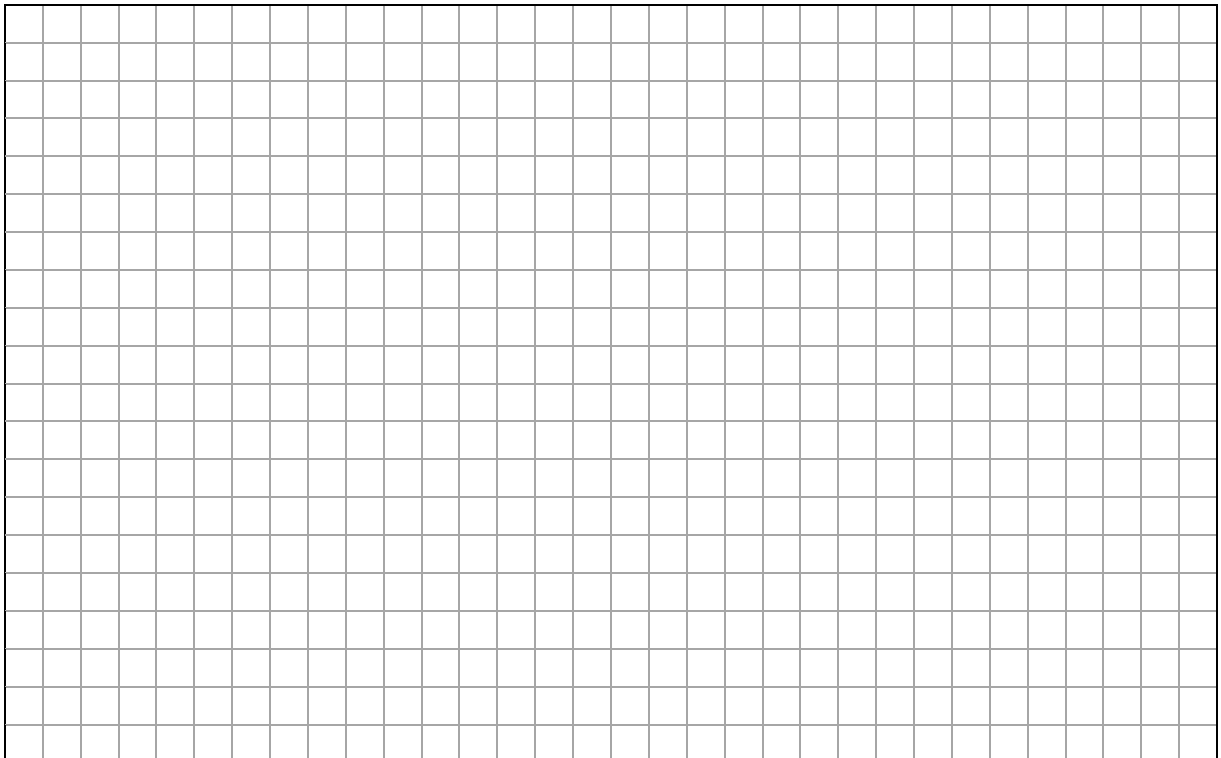
Question 3**(30 marks)**

- (a) Expand and simplify:

$$(2x + 3)^2 - (2x - 3)^2.$$



- (b) Given that $x - 2$ is a factor of $3x^2 + kx - 6$,
find the value of k .

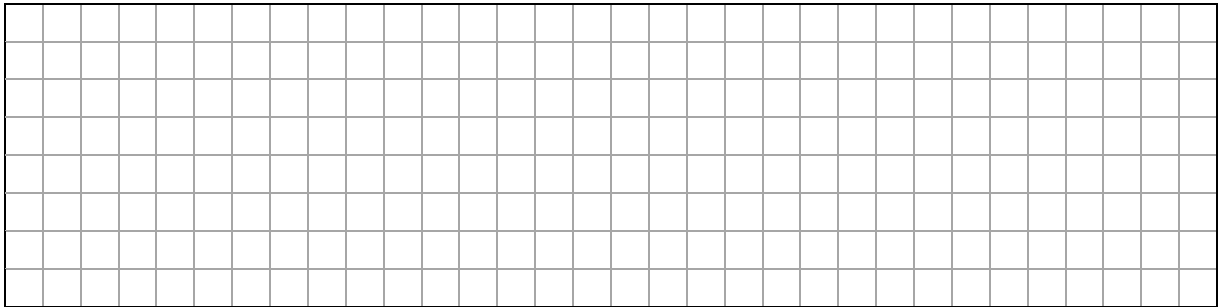


[illegible]

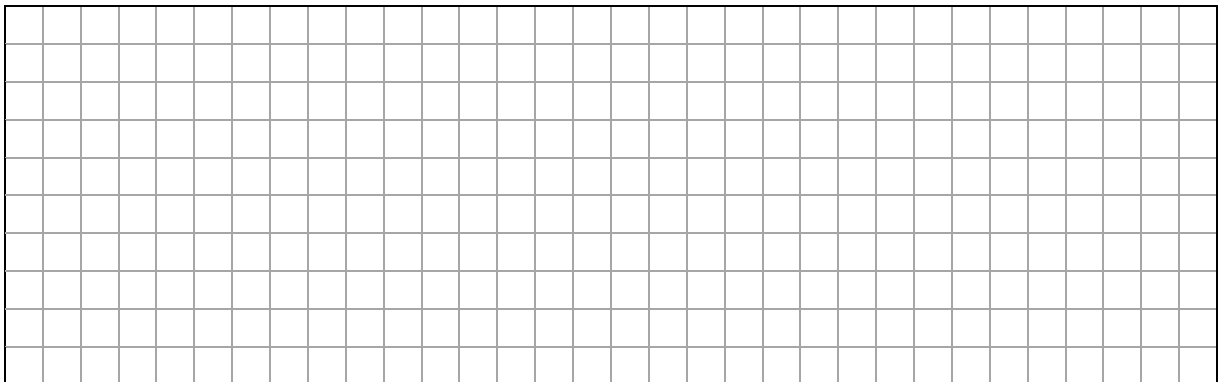
Question 4**(30 marks)**

The function f is defined as $f(x) = x^3 - 3x^2 + 1$, where $x \in \mathbb{R}$.

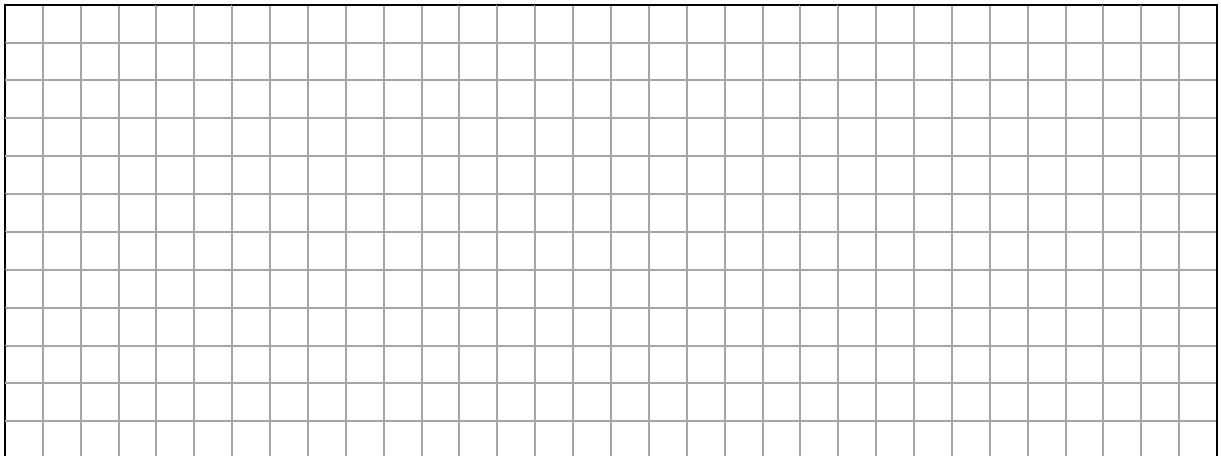
- (a)** Find the co-ordinates of the point at which the graph of $f(x)$ cuts the y -axis.



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

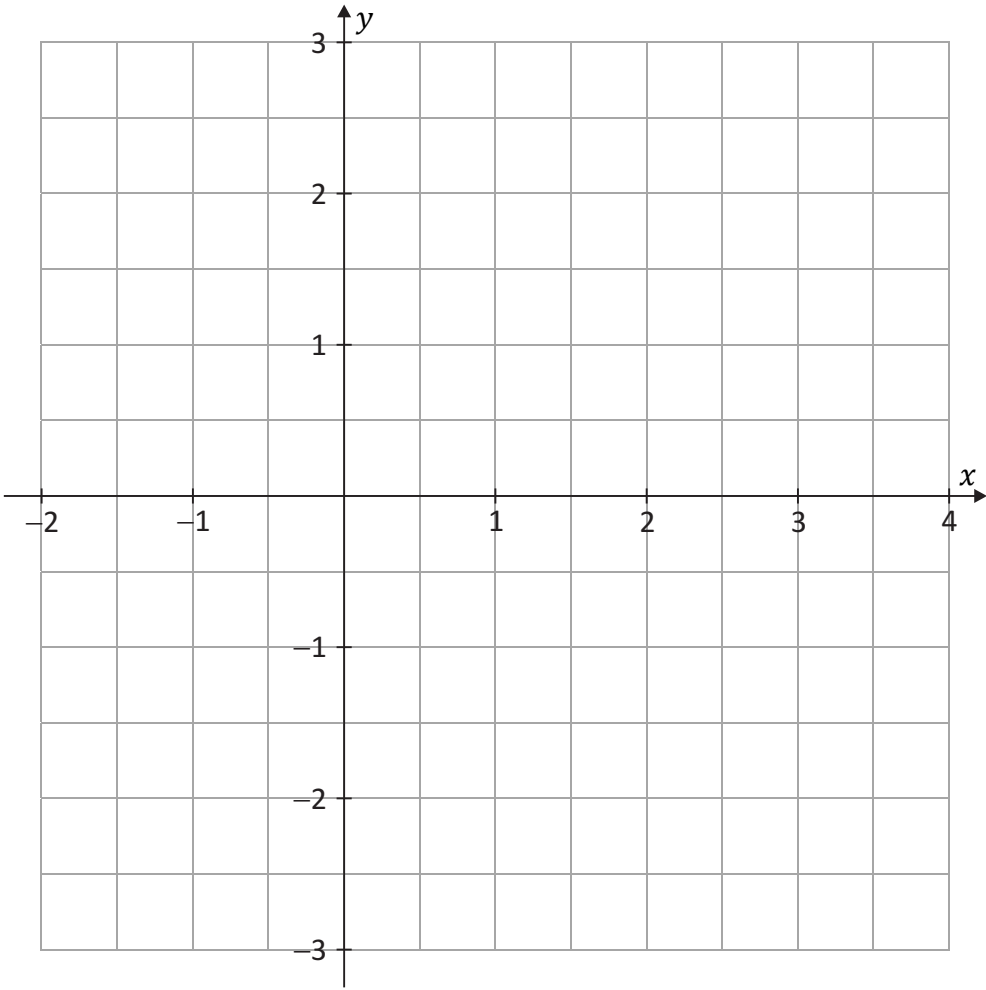
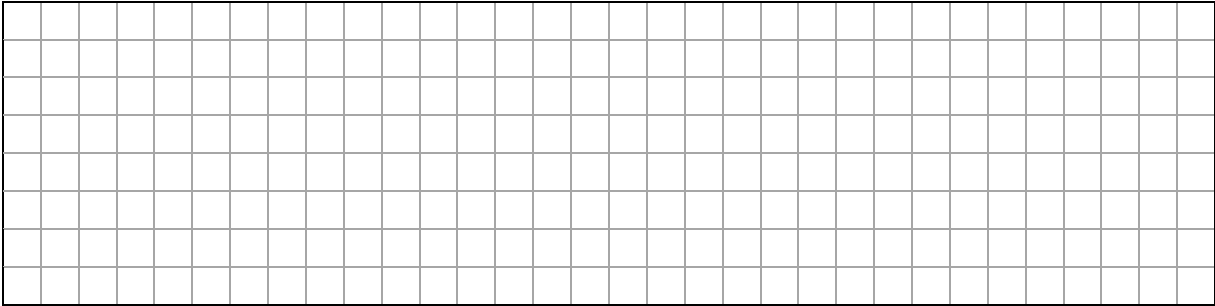


- (ii)** Using your answer to **part (b)(i)** above, find the two values of x for which the slope of the tangent to the graph of $f(x)$ is 0.

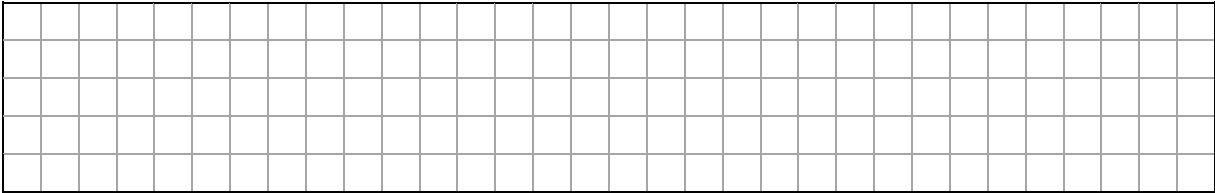


- (c) (i) Fill in the table below to show the values of $f(x)$ for each of the given values of x .
Hence, draw the graph of the function $f(x)$ in the domain $-1 \leq x \leq 3$, where $x \in \mathbb{R}$.

x	-1	0	1	2	3
$f(x)$					



- (ii) Use your graph to estimate the roots of the function $f(x) = 0$.



(30 marks)

- $$2(3 - 4x) - 3 \geq -22, \text{ where } x \in \mathbb{N}.$$

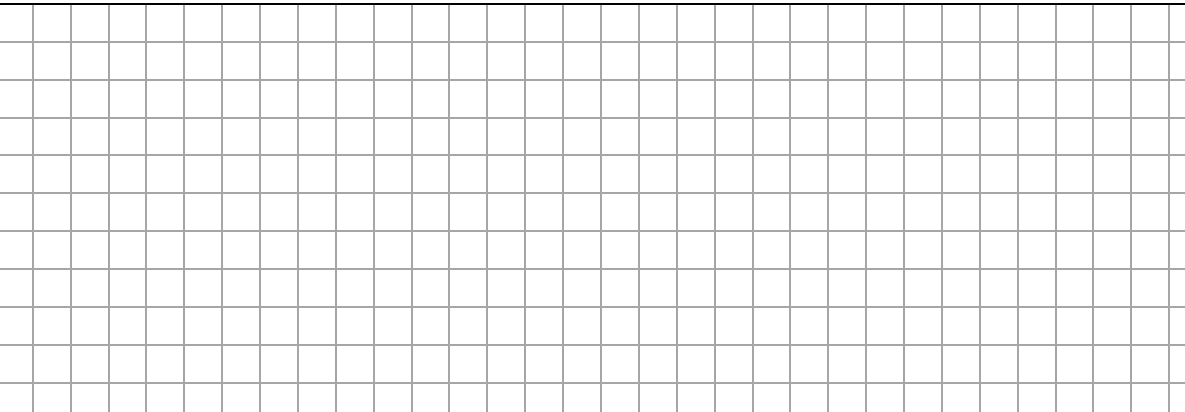
[illegible]

- $$v^2 = u^2 + 2as,$$

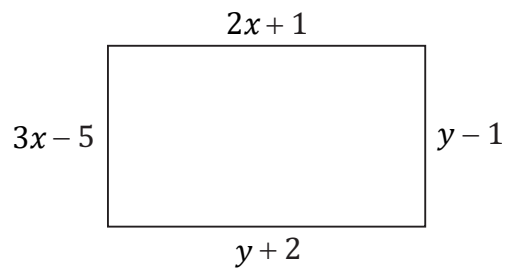
(i) Rearrange the formula to write s in terms of v , u and a .

[illegible]

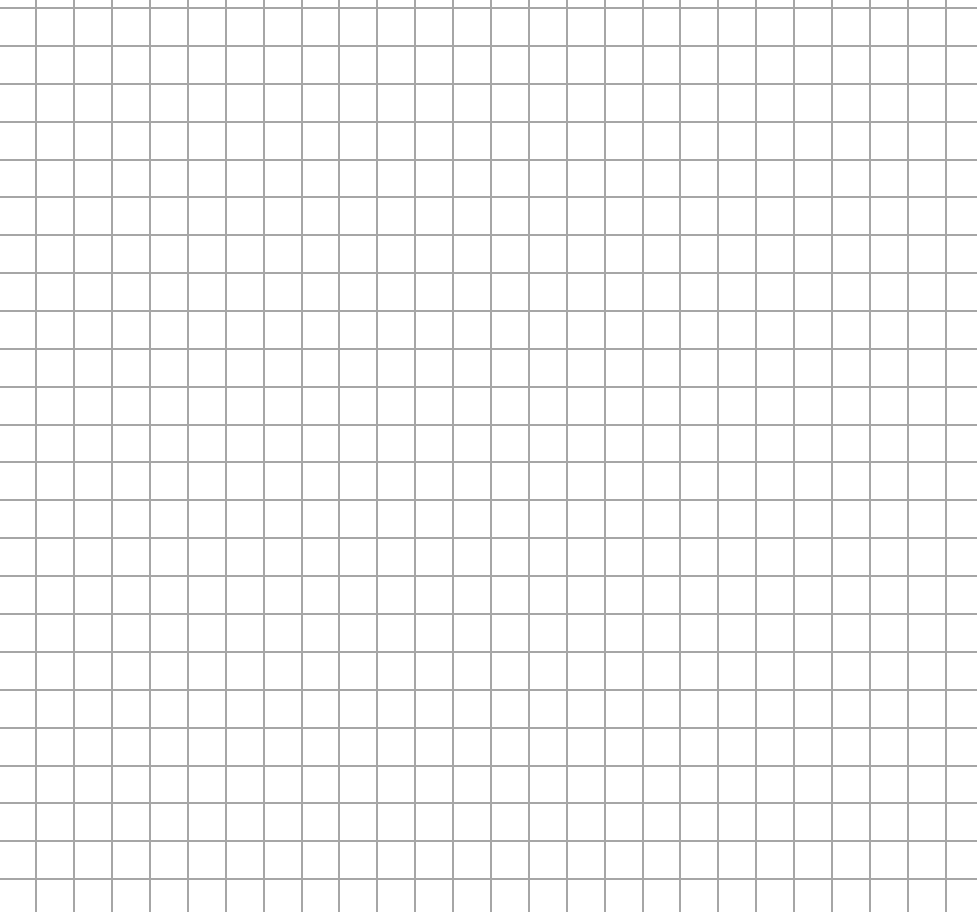
- Find the distance that the car travels before its speed reaches 72 kilometres per hour. Give your answer in metres.

A large grid of graph paper, consisting of 20 columns and 15 rows of squares, intended for drawing a picture.

- (c)** The diagram below (not to scale) shows a rectangle.
The length and width of the rectangle are shown in terms of x and y .



By writing two equations to represent this information, or otherwise, find the length and width of the rectangle.




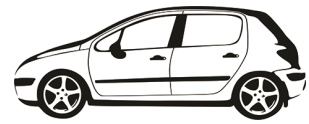
Length = _____

Width = _____

Question 6

(30 marks)

- (a)** Sarah buys a new car which costs €37 500.
The value of the car depreciates (reduces) by 20% per annum.
Using the formula $F = P(1 - i)^t$, or otherwise, find the value of Sarah's car at the end of 3 years.



- (b)** Sean bought a new car 3 years ago.
The value of the car also depreciates by 20% per annum.
It is now worth €23 296.
Work out the cost of Sean's car when he bought it.

[illegible]

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

Question 7

(50 marks)

Paula participated in the javelin event at a track and field competition. The height of the tip of the javelin, $h(t)$, in metres, above level ground after it is thrown can be partially modelled by the function:

$$h(t) = -4.9t^2 + 19.6t + 1.85, \quad t \in \mathbb{R},$$

where t is the time, in seconds, after the javelin is thrown.



- (a) (i)** Work out the height of the tip of the javelin, in metres, above the ground when it is thrown (when $t = 0$).

[illegible]

- (ii)** Solve the function $h(t) = 0$ to find the time it takes for the tip of the javelin to hit the ground.
Give your answer correct to 1 decimal place.

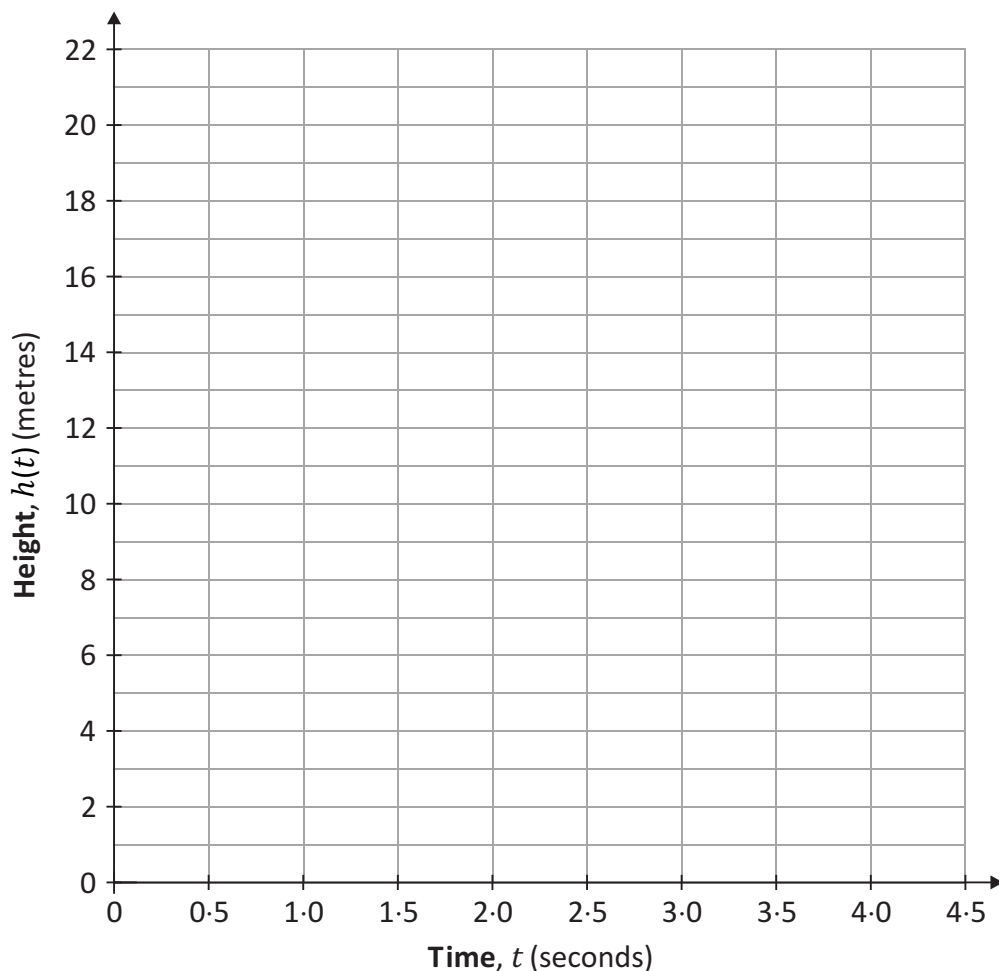
This image shows a full page of blank graph paper. The grid consists of small, uniform squares formed by thin, light gray lines. There are no margins, text, or other markings on the page.

- (b) (i)** Complete the table below to show the values of $h(t)$ for the given values of t . Give each value of $h(t)$ correct to 2 decimal places.

t	0	0.5	1	1.5	2	2.5	3	3.5	4
$h(t)$		10.43					16.55		

[illegible]

- (ii) On the axes below, draw a graph to show the height of the tip of the javelin while it is in the air.



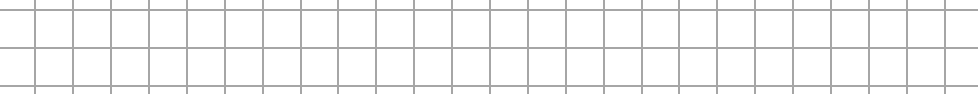
- (iii) Use your graph to estimate the length of time that the tip of the javelin was 15 m, or more, above the ground.

[illegible]

This question continues on the next page.



- (c) (i)** Find $h'(t)$, the derivative of $h(t) = -4.9t^2 + 19.6t + 1.85$.



- (ii) Use your answer from **part (c)(i)** to find the maximum height reached by the tip of the javelin.

[illegible]

- (iii) Find $h'(3.5)$.
Explain your answer in the context of the question.

A full-page sheet of white graph paper with a light gray grid. The grid consists of small squares, approximately 1 cm by 1 cm each. There are 20 columns and 15 rows of squares. A thicker gray border surrounds the entire grid area.

(50 marks)

At a particular time, tank A contains 100 litres of water and is being filled at a constant rate of 15 litres per minute. At the same time, tank B contains 1640 litres of water and is being drained at a constant rate of 20 litres per minute.

- | | |
|----------|----------|
| $A(t) =$ | $B(t) =$ |
|----------|----------|

- [illegible]

- [illegible]

- [illegible]

2025-1116-1-FI-19/32

At a particular time, tank *A* contains 100 litres of water and is being filled at a constant rate of 15 litres per minute. At the same time, tank *B* contains 1640 litres of water and is being drained at a constant rate of 20 litres per minute.

- | t (minutes) | 0 | 10 | 20 | 30 | 40 | 50 | 60 |
|--|------|-----|----|------|----|----|------|
| $A(t)$ (volume of water in Tank A) | 100 | 250 | | | | | 1000 |
| $B(t)$ (volume of water in Tank B) | 1640 | | | 1040 | | | |

[illegible]

-

- (iii) Use your graphs to estimate how long it takes for tank B to empty **and** the volume of water in tank A at that time.
Show your work on the graphs.

Time for tank B to empty = _____	Volume of water in tank A = _____
------------------------------------	-------------------------------------

- (iv) Use your answers from **part (a)(i)** to verify your answers to **part (b)(iii)** above.

--

- (c) A **different** water tank can be completely filled using a certain hosepipe in 75 minutes.
The same tank can be completely filled using a larger hosepipe in 50 minutes.
Work out how long it would take to fill the water tank using both hosepipes together.

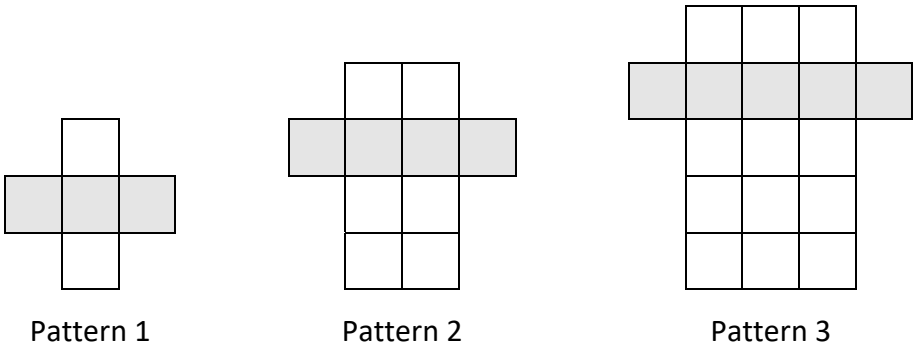
--



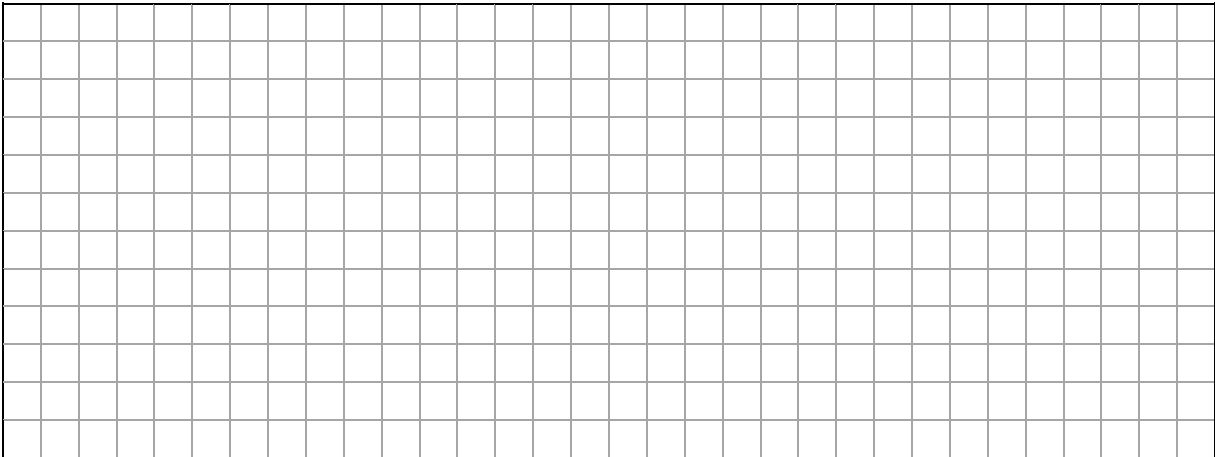
Question 9

(50 marks)

The first three patterns in a sequence of patterns containing grey and white tiles are shown below.



(a) (i) Draw the next pattern in the sequence (in the box below).



(ii) Based on the patterns shown, complete the table below to show the number of **grey tiles** in each of the first five patterns of the sequence.

Pattern number (n)	Number of grey tiles
1	3
2	
3	
4	
5	

- (b) Assuming the pattern continues, the number of **grey tiles** in each pattern forms an arithmetic sequence.

(i) Find a formula, in n , for the number of **grey tiles** in pattern n of the sequence (G_n).

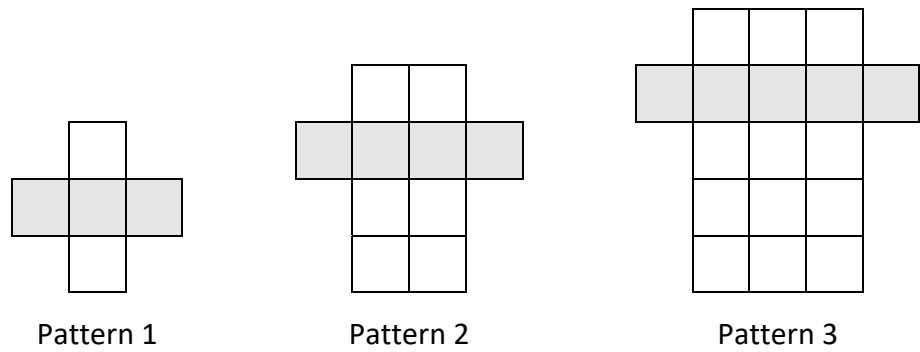
(ii) Work out the number of **grey tiles** in pattern 40 of the sequence.

(iii) Find the total number of **grey tiles** in the first 40 patterns of the sequence.

This question continues on the next page.



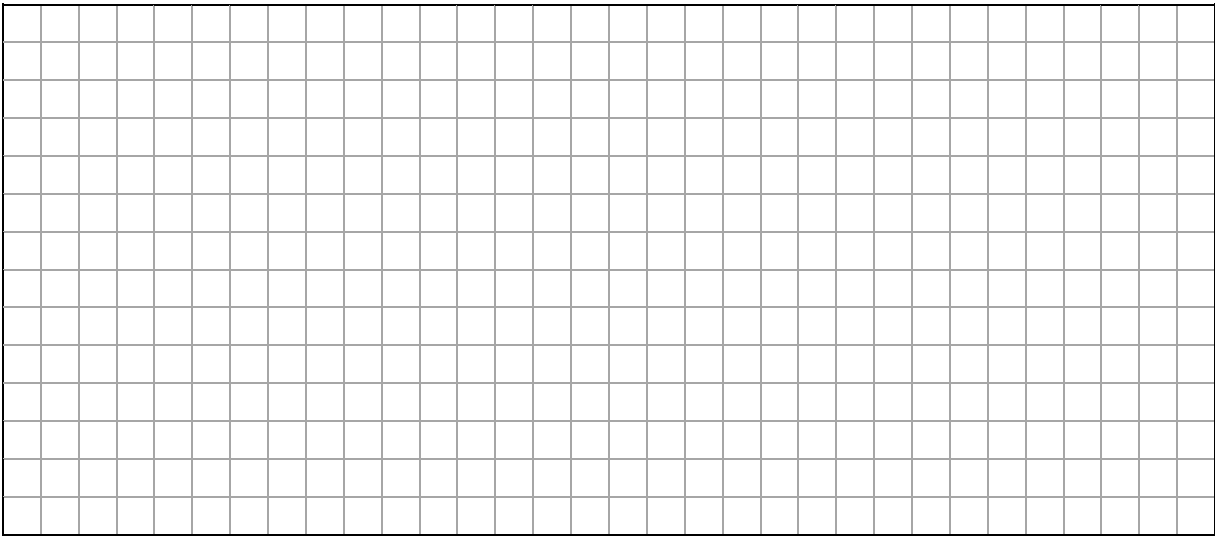
The first three patterns in a sequence of patterns are shown again below.



(c) (i) Based on the patterns shown, complete the table to show the number of **white tiles** in each of the first five patterns of the sequence.

Pattern number (n)	Number of white tiles
1	2
2	6
3	
4	
5	

(ii) Show that the number of **white tiles** in each pattern forms a quadratic sequence.



- (iii) Assuming the pattern continues, the number of **white tiles** in pattern n (W_n) of the sequence is given by the formula:

$$W_n = n^2 + bn + c, \text{ where } b, c \in \mathbb{Z}.$$

Find the value of b and the value of c .

[illegible]

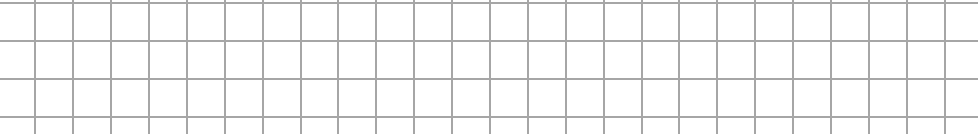
- (iv) The **total** number of tiles (**grey and white**) in the k th pattern is 226.
Using your answers from **parts (b)(i) and (c)(iii)**, or otherwise, find the value of k .

A full-page sheet of white graph paper with a light gray grid. The grid consists of small squares, approximately 1 cm by 1 cm each. There are 20 columns and 20 rows of squares, creating a total of 400 small squares. The grid lines are thin and evenly spaced. The entire page is framed by a thin black border.

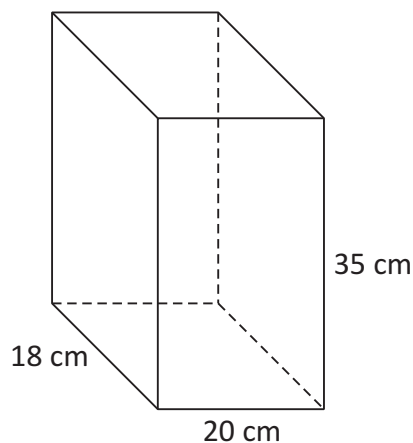
Question 10

(50 marks)

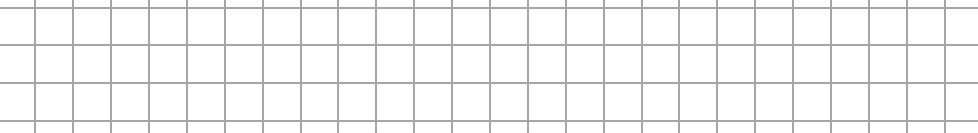
- (a)** A vending machine dispenses different fruit juice drinks in a school cafeteria. In one such drink, the ratio of orange juice to apple juice to mango juice is 15:9:4.
- (i)** Work out how much orange juice is needed if the fruit juice drink contains 1.8 litres of apple juice.



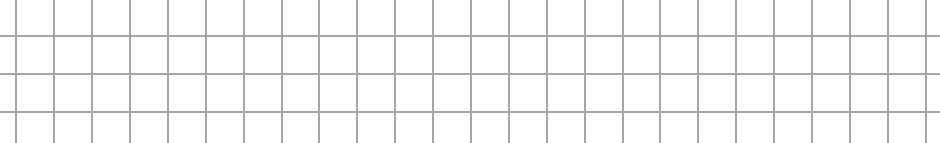
The container which holds the fruit juice in the vending machine is in the shape of a rectangular box with internal dimensions as shown in the diagram below (not to scale).



- (ii) Work out the capacity (volume) of the container.
Give your answer in litres. [Note: $1000 \text{ cm}^3 = 1 \text{ litre}$.]



- (iii) How many litres of mango juice are needed to fill the container completely with the fruit juice drink?

A large rectangular area filled with a grid of small squares, intended for drawing a picture. The grid is 20 squares wide and 10 squares high.

- (iv) Orange juice costs €2 per litre, apple juice costs €2.40 per litre and mango juice costs €7 per litre.

Find the cost to fill the container in the vending machine.

A large grid of graph paper with 20 columns and 10 rows. The grid is composed of small squares, with a slightly larger margin on the left side for writing.

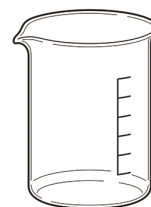
- (v) The fruit juice drink is sold at a mark-up (profit as a percentage of cost price) of 85%. Work out the selling price of 1 litre of the fruit juice drink, correct to the nearest cent.

A large grid of graph paper with 20 columns and 15 rows. The grid is composed of small squares, with a thicker border around the perimeter.

This question continues on the next page.



- (b)** A solution of acid marked 5% has 5 cm³ of acid per 100 cm³ of solution. The solution is made up by measuring 5 cm³ of acid, adding it to water, and then adding more water until the volume of the solution is 100 cm³.



- (i) The solution is placed in a glass beaker in the shape of a cylinder. The beaker has a radius of 4 cm and a height of 12 cm.

Find the capacity (volume) of the beaker.

Give your answer correct to the nearest cm^3 .

[illegible]

- (ii)** The beaker is filled to its capacity with the acidic solution.

Work out the volume of acid **and** the volume of water in the beaker.

Give your answers correct to the nearest cm^3 .

Volume of acid = _____

Volume of water = _____

- (iii) A student needs exactly 35 cm^3 of acid for an experiment. Work out how much of the acidic solution is required.

[illegible]

You may use this page for extra work.

Label any extra work clearly with the question number and part.

[illegible]

You may use this page for extra work.

Label any extra work clearly with the question number and part.

[illegible]

You may use this page for extra work.

Label any extra work clearly with the question number and part.

[illegible]

Do not write on this page

Copyright notice

This examination paper may contain text or images for which DEB Exams is not the copyright owner, and which may have been adapted, for the purpose of assessment, without the authors' prior consent. This examination paper has been prepared in accordance with Section 53(5) of the *Copyright and Related Rights Act, 2000*. Any subsequent use for a purpose other than the intended purpose is not authorised. DEB Exams does not accept liability for any infringement of third-party rights arising from unauthorised distribution or use of this examination paper.

Pre-Leaving Certificate Examination, 2025

Mathematics – Ordinary Level – Paper 1

Time: 2 hours, 30 minutes

