2025.M27K
(deferred exam)

2025L003G1EK

Coimisiún na Scrúduithe Stáit
State Examinations Commission

Leaving Certificate Examination

Mathematics

Paper 1

Ordinary Level

2 hours 30 minutes

300 marks

Examination number					

Centre stamp

For the Examiner only					
			Section	Question	Mark
Disallowed			A	1	
A				2	
B				3	
Total Disall.				4	
				5	
				6	
			B	7	
Cumulative Check				8	
Running Total				9	
− Total Disall.				10	
= Total		↔		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	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 Examination Number in the box on the front cover.

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

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: | |

Section A — Concepts and Skills — 150 marks

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

Question 1 **(30 marks)**

(a) Solve the following equation, where $x \in \mathbb{R}$:

$$4(x-2)+10=3x$$

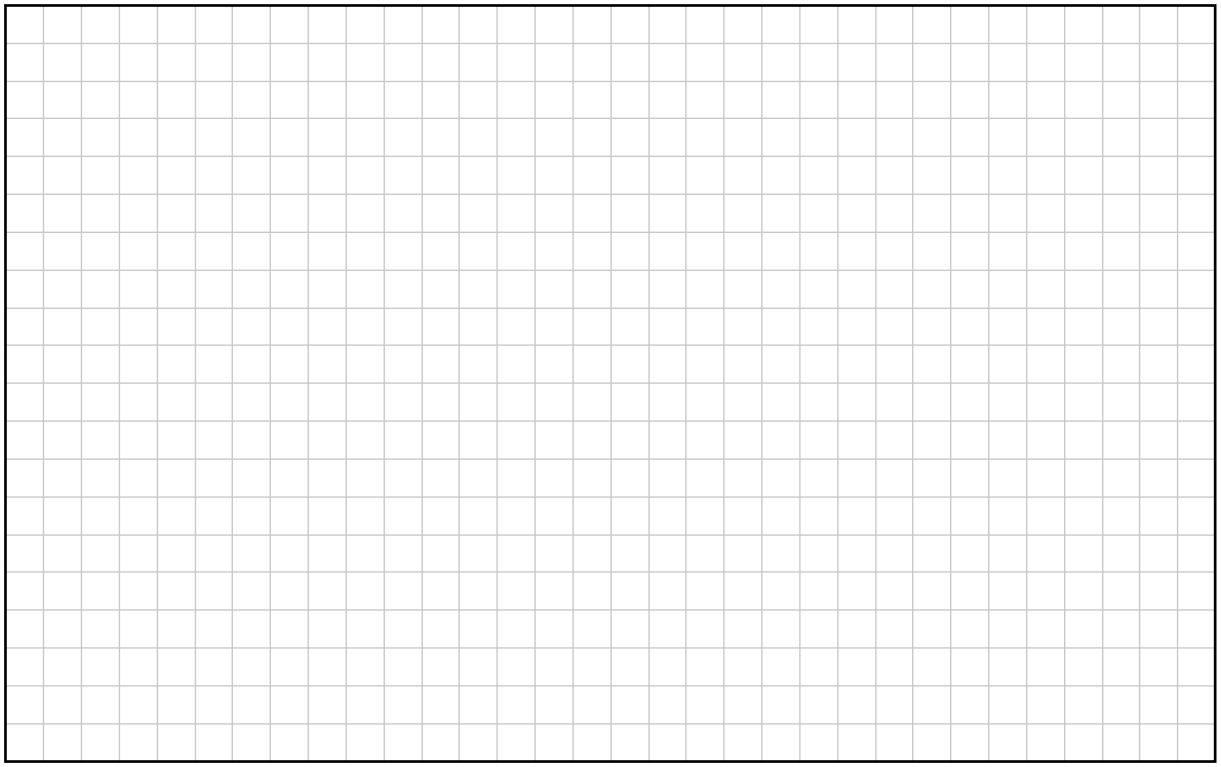
(b) Solve the following equation in x:

$$2x^2-4x-13=0$$

Give each answer correct to 2 decimal places.

(c) Express as a single fraction in its simplest form:

$$\frac{3x-1}{2} - \frac{2x+2}{5}$$

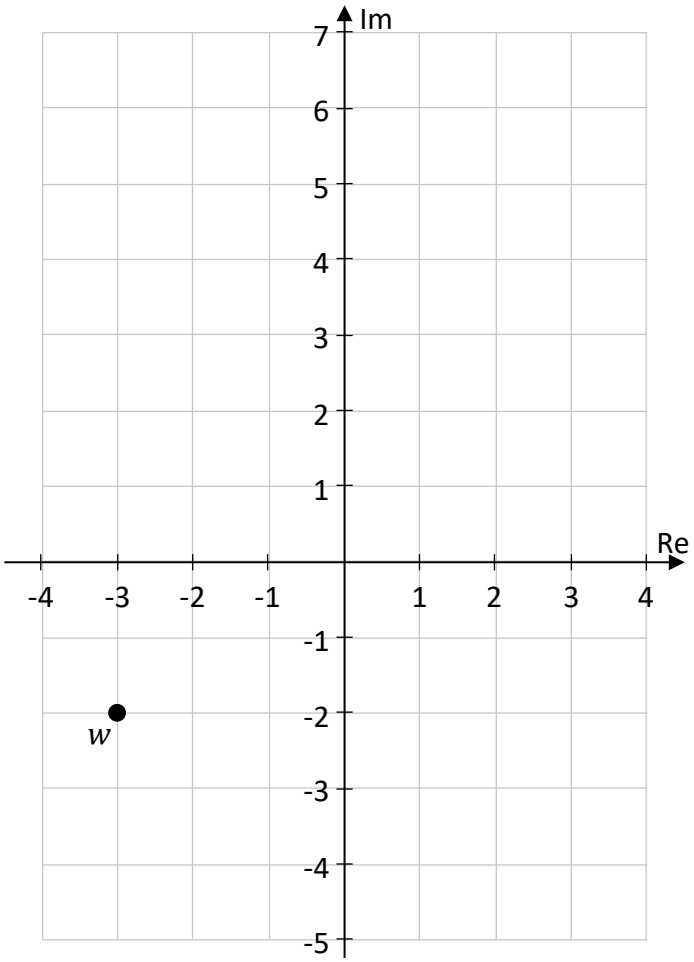


Question 2 **(30 marks)**

In this question, $i^2 = -1$.

$z_1 = 4 + 3i$ and $z_2 = 2 - i$ are complex numbers.

(a) **(i)** **Plot** and **label** the two complex numbers z_1 and z_2 on the Argand diagram below.



(ii) The complex number w is shown on the Argand diagram.

Write w in the form $p + qi$, where $p, q \in \mathbb{R}$.

$w =$

(b) $z_3 = z_1 - 3z_2$

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

(c) $z_4 = \dfrac{z_1}{z_2}$

Write z_4 in the form $c + di$, where $c, d \in \mathbb{Z}$.

Question 3 **(30 marks)**

(a) $f(x) = x^2 - x - 2$, where $x \in \mathbb{R}$.

(i) Find $f(5)$ and $f(-3)$.

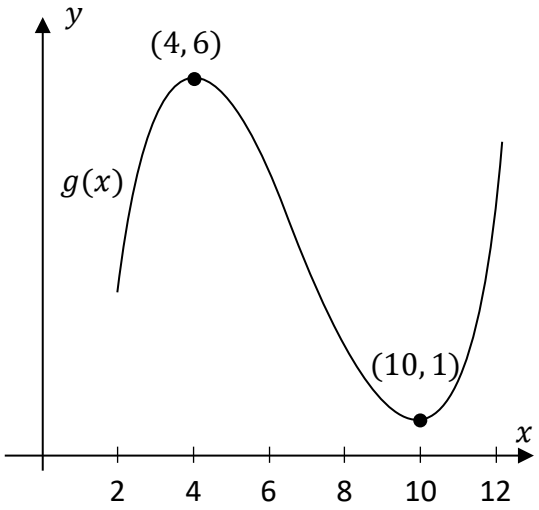
$f(5) =$ $f(-3) =$

(ii) Find the co-ordinates of the points where $f(x)$ crosses the x-axis.

(That is, where $f(x) = 0$.)

Answer: (,) and (,)

(b) Part of the graph of the function $g(x)$ is shown in the diagram below.



(i) Write down two values of x for which $g'(x) = 0$,
where $g'(x)$ is the derivative of $g(x)$.

$x =$ _____ and $x =$ _____

(ii) Is $g'(11)$ positive or negative?

Give a reason for your answer. You may include work on the diagram.

Is $g'(11)$ positive or negative?	Positive	Negative
(Tick (✓) **one** box only)	☐	☐

Reason:

Question 4 **(30 marks)**

$f(x) = x^3 + 2x^2 - 5$.

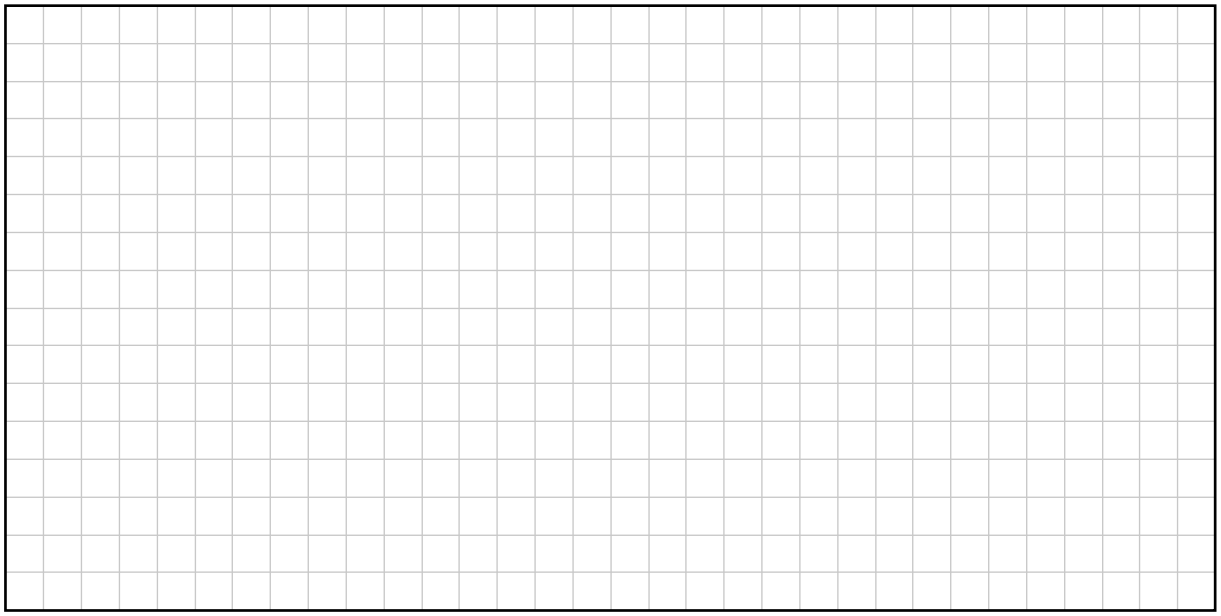
(a) Find $f'(x)$, where $f'(x)$ is the derivative of $f(x)$.

(b) Show that $f'(1) = 7$.

(c) Hence, find the equation of the tangent to $f(x)$ when $x = 1$.

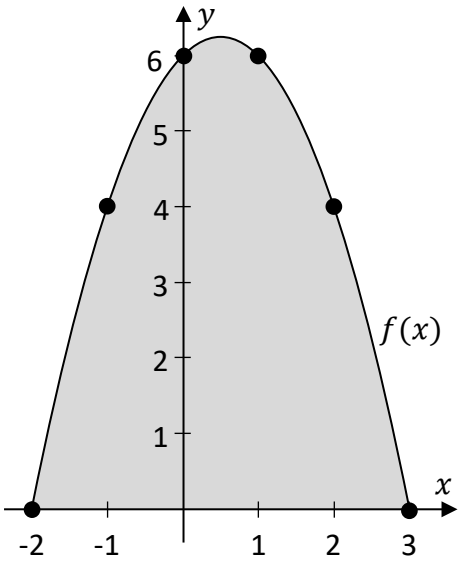
(d) $g(x) = x + 11$.

Find $g\big(f(x)\big)$ in terms of x.



Question 5 **(30 marks)**

(a) The graph of the function $f(x)$ in the domain $-2 \leq x \leq 3$, where $x \in \mathbb{R}$, is shown in the diagram on the right.



This graph is symmetrical.

(i) Use the points shown on the graph to complete the table below.

x	-2	-1	0	1	2	3
$f(x)$	0		6		4	

(ii) Use the **Trapezoidal Rule** to estimate the area between the graph and the x-axis.

(Use the values of $f(x)$ from your table as your heights.)

(b) **(i)** Express 16 **and** 32 in the form 2^k, where $k \in \mathbb{N}$.

$16 = 2^{\square}$ $\qquad$ $32 = 2^{\square}$

(ii) Hence, or otherwise, find the value of x for which $16^x = 32$, where $x \in \mathbb{R}$.

Question 6 **(30 marks)**

(a) John invested €3400 for 2 years.
The interest rate was 4% for year 1 and 5% for year 2.

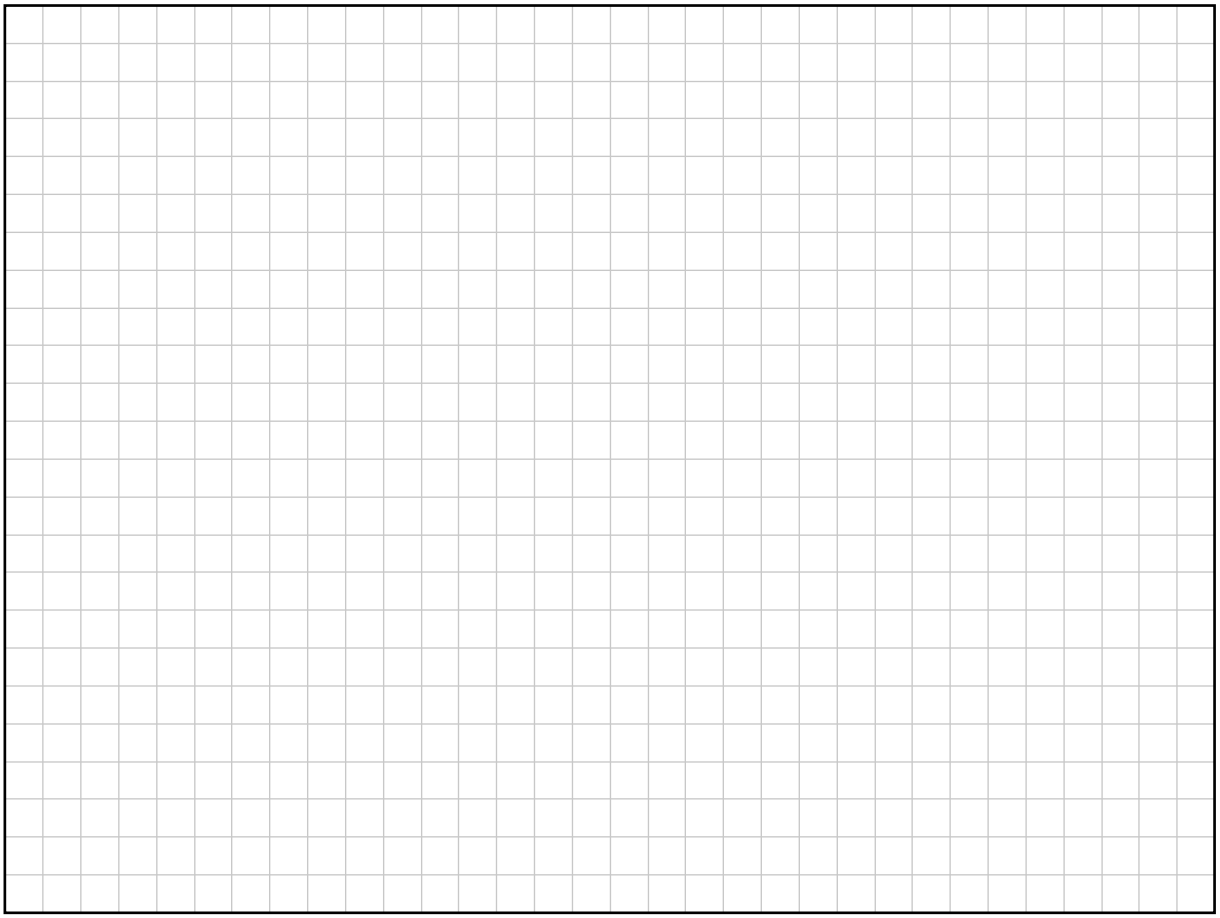
Find the amount of the investment at the end of year 2.

(b) John's car was valued at €25 000 one year ago.
Today it has a value of €21 250.

Find the percentage decrease in the value of the car over the course of the year.

(c) Mary bought a painting 3 years ago.
The value of the painting increased by 20% during each year for the last 3 years.
The painting is **now** worth $€8640$.

Find the value of the painting when Mary bought it.



Section B — Contexts and Applications — 150 marks

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

Question 7 **(50 marks)**

(a) Anna and Ross are saving to buy a house.

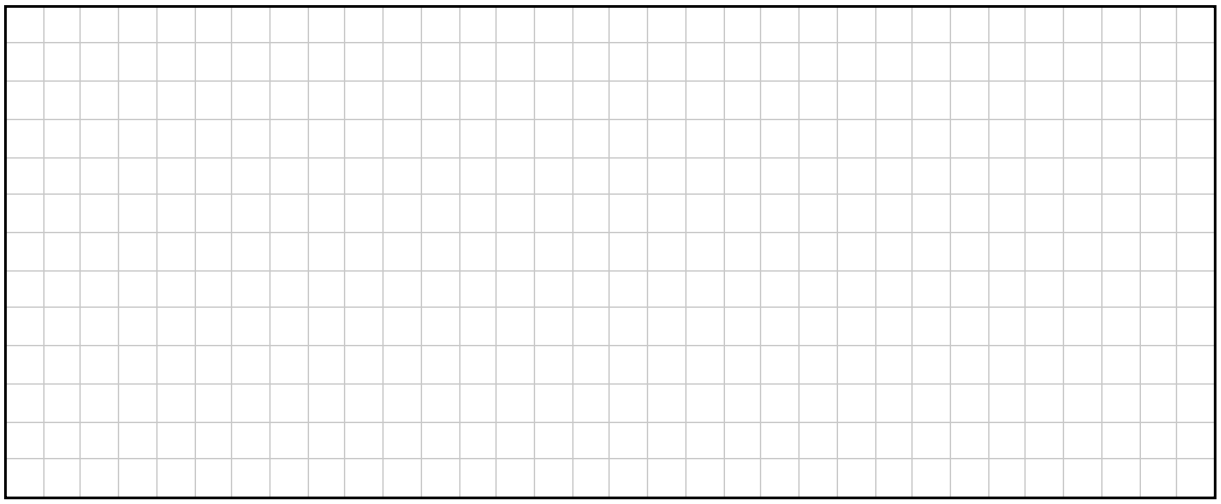
Anna's gross annual salary is €50 800 and Ross's gross annual salary is €48 500.
The maximum that they can borrow is 4 times their gross combined salaries.

(i) What is the maximum amount of money that they can borrow?

(ii) They are interested in buying a house that costs €395 000.
In order to qualify for a mortgage they must have a deposit of at least 12·5% of the price of a house.

How much of a deposit do they need to have in order to qualify for a mortgage for this house?

(iii) The builder expects to make a profit of 15% when this house is sold for €$395\,000$.
Find the cost of building this house.
Give your answer correct to the nearest euro.



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(b) Mary earns €55 000 per year.
She pays €10 100 tax on her income.
She also pays €1561·42 in U.S.C. (Universal Social Charge).

Find her net income **and** write it as a percentage of her gross income.
Give your second answer correct to 1 decimal place.

Net Income:

Percentage:

(c) John earns €49 572 per year.

(i) The table on the right shows the rates at which U.S.C. is charged.

Find how much U.S.C. John pays per annum.

First €12,012	0·5%
Next €10,908	2%
Next €47,124	4%
Balance	8%

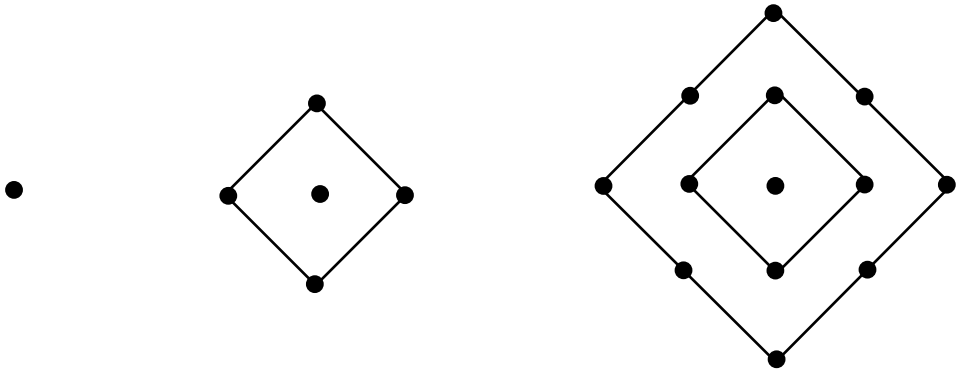
(ii) John gets a pay rise.
He pays tax at 40% and U.S.C. at 4% on this extra income.
His net salary increases by €1400 per year after tax and U.S.C. are deducted.

Find his gross pay rise.

Question 8 **(50 marks)**

(a) The diagram below shows the first three patterns of a sequence of patterns of dots and lines.

Pattern 1 **Pattern 2** **Pattern 3**



(i) Draw pattern 4 of the sequence in the box below.

(ii) Complete the table below showing the number of dots in each pattern.

Pattern	1	2	3	4	5
Number of dots	1	5			

(iii) T_n is the number of dots in pattern n of the sequence, where $n \in \mathbb{N}$.

T_n is given by:

$$T_n = 2n^2 + bn + c$$

where $b, c \in \mathbb{Z}$ are constants.
$T_1 = 1$ and $T_2 = 5$.
Show that this means that:

$$b + c = -1$$

$$2b + c = -3$$

$b + c = -1$

$2b + c = -3$

(iv) Solve these simultaneous equations to find the value of b and the value of c:

$$b + c = -1$$

$$2b + c = -3$$

$b =$ $c =$

This question continues on the next page.

(b) The total distance Dan has driven, in km, is shown on the dashboard of his car.

The table below shows the readings on the dashboard at the start of each week for 4 weeks, where $p, q \in \mathbb{N}$.

Dashboard reading (km)			
Week 1	**Week 2**	**Week 3**	**Week 4**
$100\,000$	p	q	$104\,500$

Dan drives the **same total distance** each week.
Hence, find the value of p and the value of q.

$p =$ $q =$

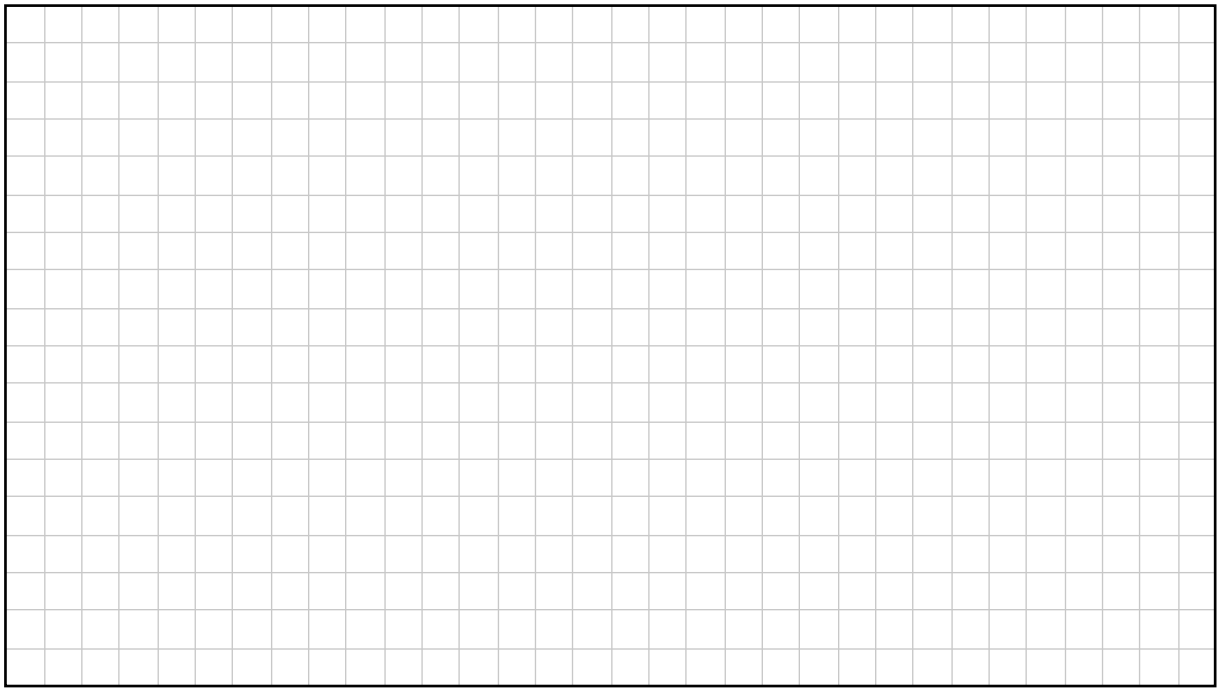
(c) The sequence of colours and timings of a set of traffic lights is shown in the table below. This sequence repeats as the lights change during the day.

Colour	**Time**
Green	13 seconds
Amber	2 seconds
Red	20 seconds

(i) Dan is walking along the road and notices that the lights change from amber to red. He continues to look at the lights.

How long will it be, from the time the light first changes to red, until Dan sees it change **to amber** for the third time?
Give your answer in seconds.

(ii) What colour will the lights be exactly 25 minutes from the time Dan notices the first change from amber to red?
Show any calculations you make to arrive at your answer.



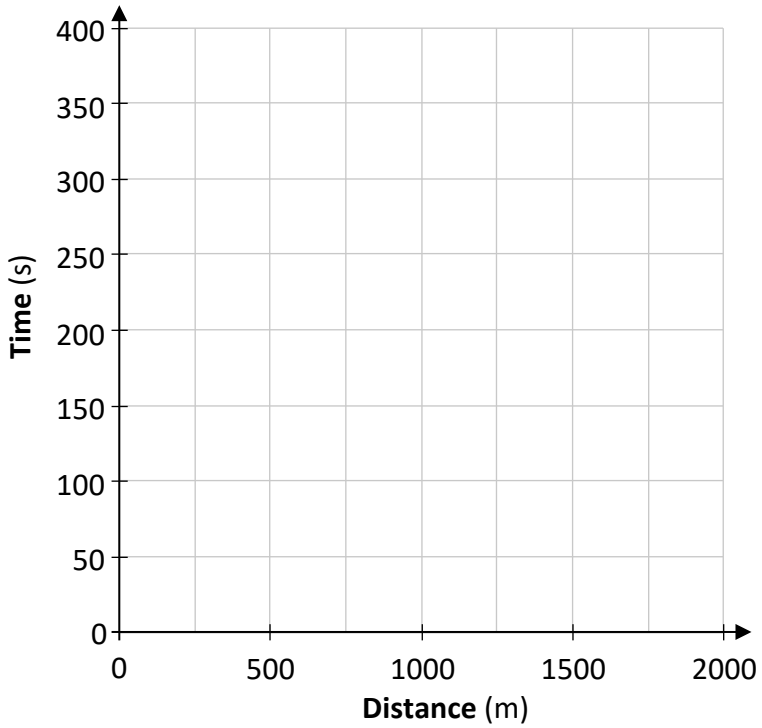
Question 9 **(50 marks)**

(a) Paul O'Donovan and Fintan McCarthy are Irish rowers.
They won a gold medal in the 2020 Olympic Games.
The course they raced on was 2000 m in length.

The following table shows their time since the start of the race as they pass various markers at set distances along the course. Their time is in seconds and the distances are measured in metres.

Distance (m)	0	500	1000	1500	2000
Time (s)	0	78·6	182·4	261·6	366·43

(i) Draw a graph of their progress in the race on the grid below.
You may assume that their rate of rowing was constant in between the markers.



Use your graph to answer part **(a)(ii)** and part **(a)(iii)**. Show your work clearly on the graph.

(ii) Estimate how much time had passed when they had travelled 750 m from the start.

(iii) How far did they travel during minute 5 of the race (between 240 and 300 seconds)?

(b) **(i)** Paul and Fintan finished the race in a time of $366{\cdot}43$ seconds.

Find their average speed.
Give your answer, in metres per second (m/s), correct to 2 decimal places.

(ii) Paul and Fintan also won gold at the 2022 world championships over the same distance (2000 m).
In that race, they rowed at an average speed of $5{\cdot}31$ m/s.

How long did it take them to finish that race?
Give your answer in minutes and seconds, correct to the nearest second.

This question continues on the next page.

(c) **(i)** Two different rowers, A and B, compete in a race.
As they row, their bodies burn calories.
They burn calories in the ratio A : B $= 10: 11$.

During the race they burned a total of $53{\cdot}55$ calories between them.
Find how many calories each rower burned during the race.

Rower A $=$ Rower B $=$

(ii) The two rowers, A and B, compete in a different race.
In this race they burn calories in the ratio A : B $= 1: R$, where $R \in \mathbb{R}$ is a constant.
At the end of the race they have burned a total of $57{\cdot}5$ calories between them.

Rower A has burned 25 calories.
Find the value of R in the ratio.

Question 10 **(50 marks)**

Functions can be used to model wind speed as it changes over time.

(a) The function:

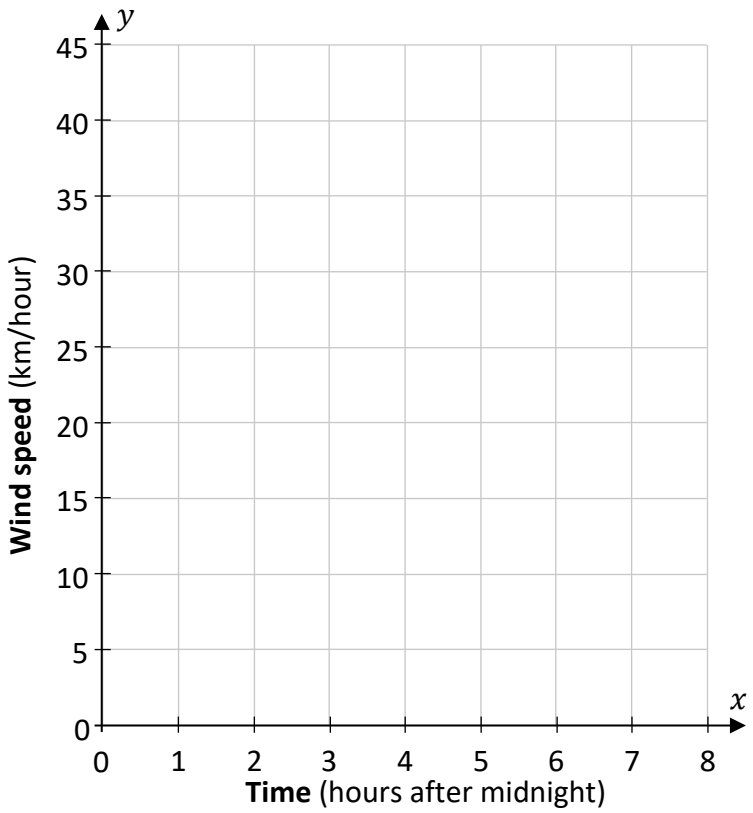
$$f(x) = x^3 - 12x^2 + 36x + 10$$

where $0 \leq x \leq 8$ and $x \in \mathbb{R}$, was used to model wind speed on a certain night at a particular location over an eight-hour period between midnight and 8 a.m.
The wind speed was measured in km/hour and x is the time, in hours, after midnight.

(i) Complete the table, to show the values of $f(x)$ for the given values of x.

x	0	1	2	3	4	5	6	7	8
$f(x)$			42					17	

(ii) Draw the graph of $f(x)$ on the axes below for $0 \leq x \leq 8$, where $x \in \mathbb{R}$.



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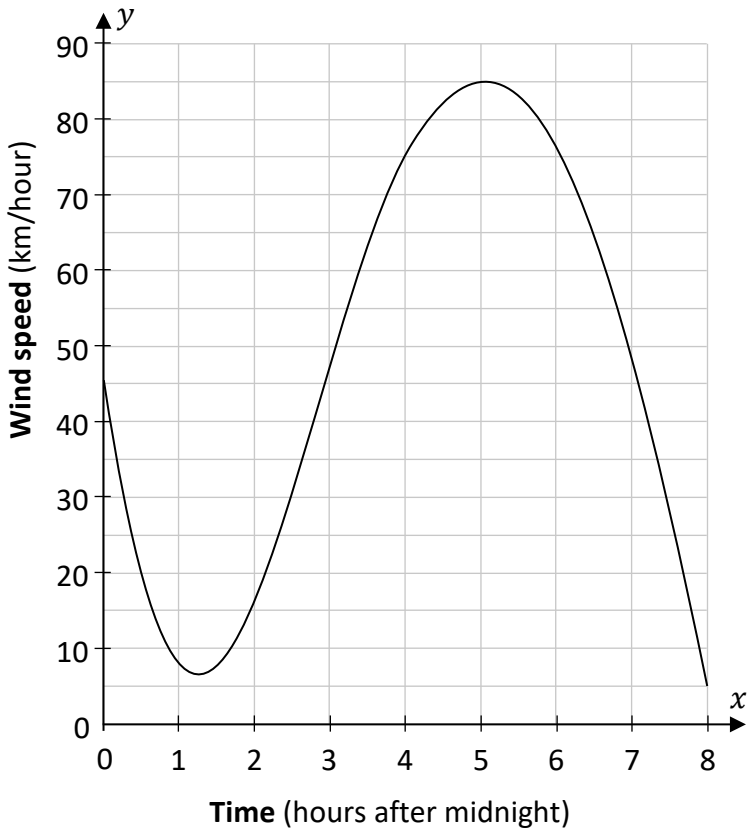
(b) The diagram below shows the graph of a model for the wind speed, in km/hour, on a different night at the same location over the eight-hour period between midnight and 8 a.m.



In the case of parts **(b)(i)** and **(b)(ii)** below, show your work on the graph.
(Remember that, on the graph, 1 on the x-axis represents 1 a.m., and so on.)

(i) What was the wind speed at 3 a.m.?

Give your answer in km/hour.

(ii) On the Beaufort Wind Scale, winds between 75 km/hour and 88 km/hour are referred to as Strong Gale Force winds. Use the graph to complete the sentence below.

On that night, Strong Gale Force winds were blowing

between _____ a.m. and _____ a.m.

(c) On a third night the quadratic function:

$$g(x) = -x^2 + 8x + 9$$

where $0 \leq x \leq 8$ and $x \in \mathbb{R}$, was used to model the wind speed, in km/hour, at the same location over the eight hour period between midnight and 8 a.m.

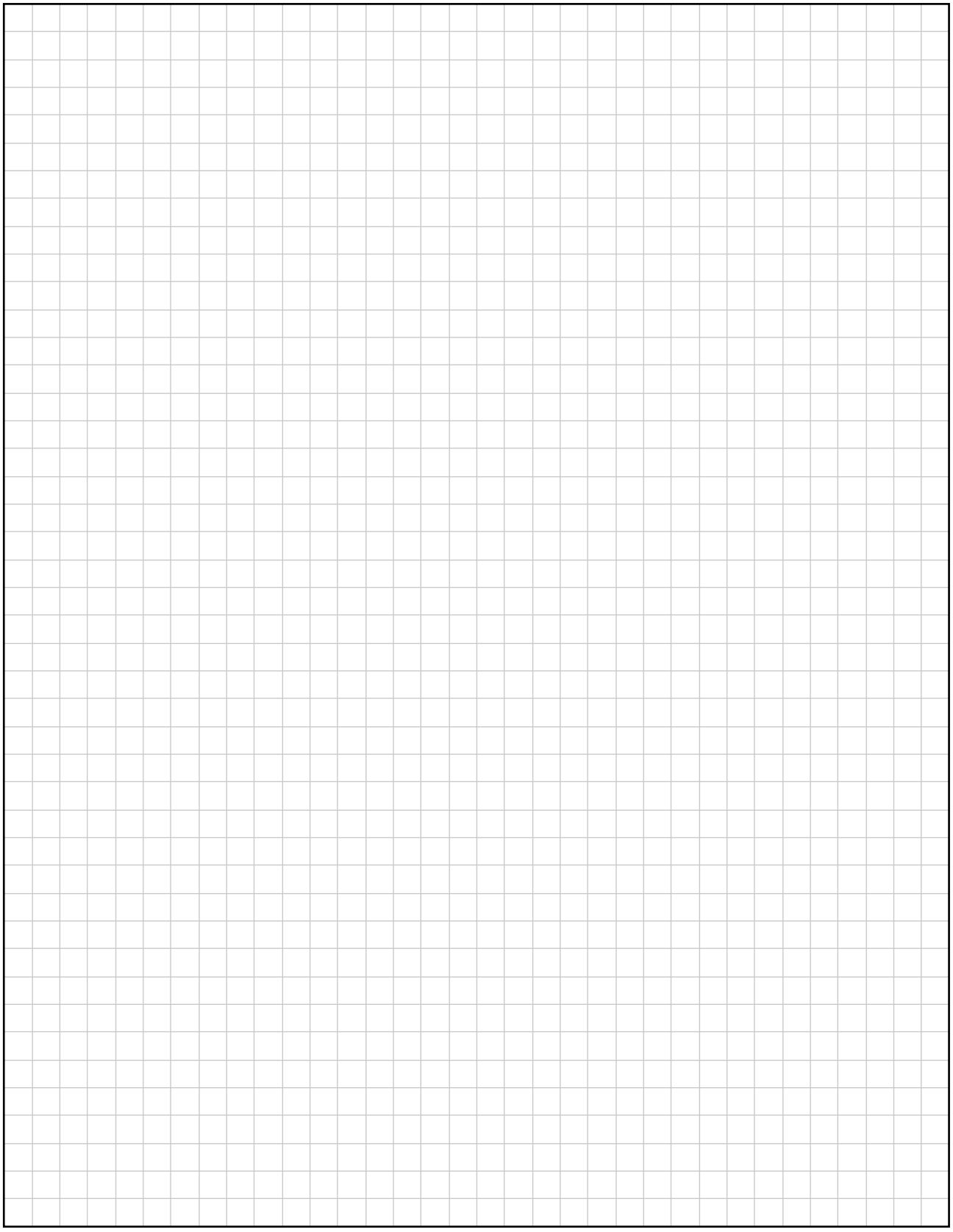
(i) Solve a quadratic equation to find the two times when the wind speed was exactly 24 km/hour, according to $g(x)$.

Answer: _____ a.m. and _____ a.m.

(ii) Use differentiation to find the **time** when the wind speed was at its maximum **and** find this maximum wind speed, according to $g(x)$.

Time: Maximum wind speed:

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



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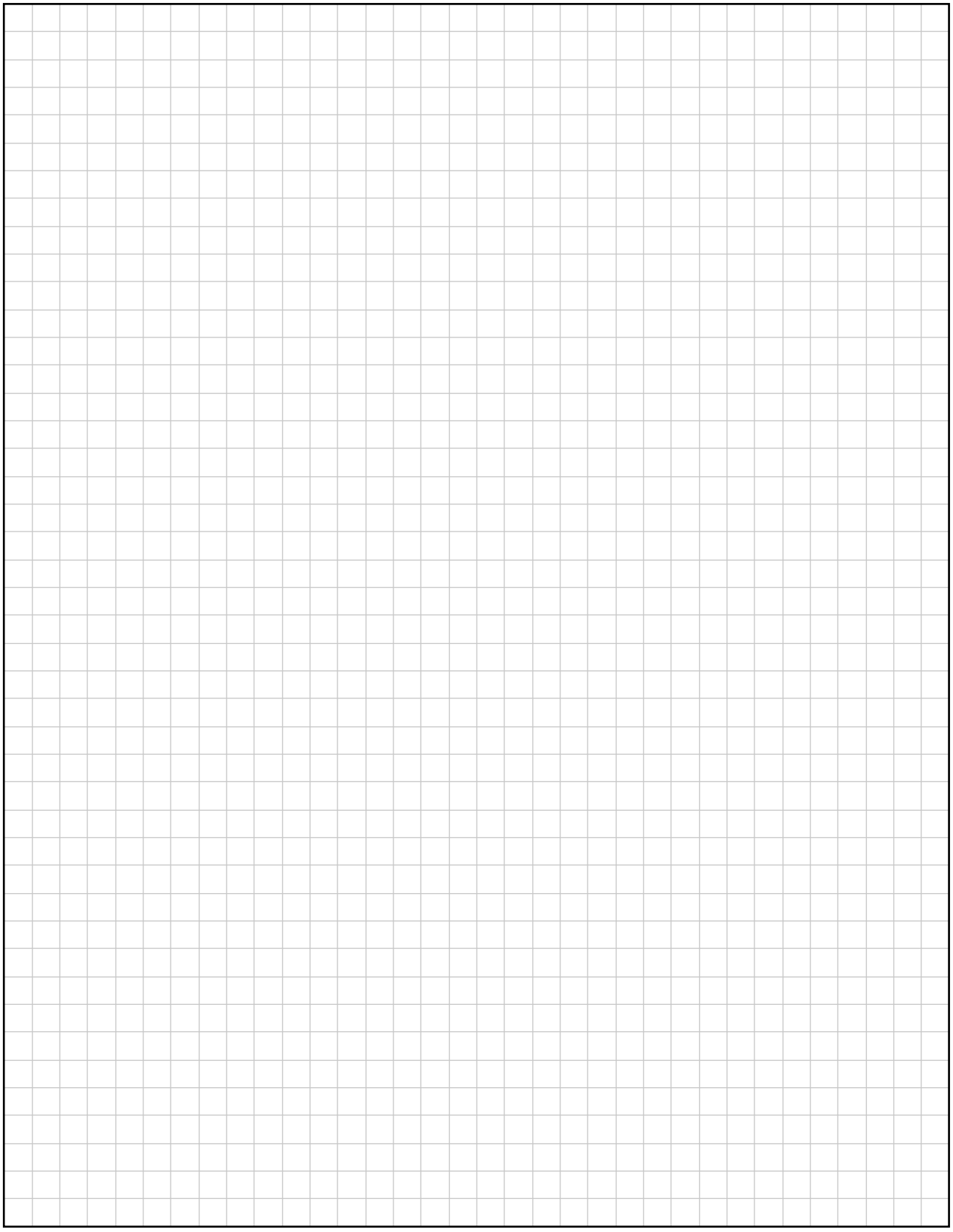

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Leaving Certificate – Ordinary Level

Mathematics Paper 1

2 hours 30 minutes