Diploma Programme
Programme du diplôme
Programa del Diploma

Mathematics: analysis and approaches
Standard level
Paper 1

10 November 2025

Zone A afternoon | **Zone B** afternoon | **Zone C** afternoon

Candidate session number

1 hour 30 minutes

Instructions to candidates

- Write your session number in the boxes above.
- Do not open this examination paper until instructed to do so.
- You are not permitted access to any calculator for this paper.
- Section A: answer all questions. Answers must be written within the answer boxes provided.
- Section B: answer all questions in the answer booklet provided. Fill in your session number on the front of the answer booklet, and attach it to this examination paper and your cover sheet using the tag provided.
- Unless otherwise stated in the question, all numerical answers should be given exactly or correct to three significant figures.
- A clean copy of the **mathematics: analysis and approaches SL formula booklet** is required for this paper.
- The maximum mark for this examination paper is **[80 marks]**.

8825 – 7109

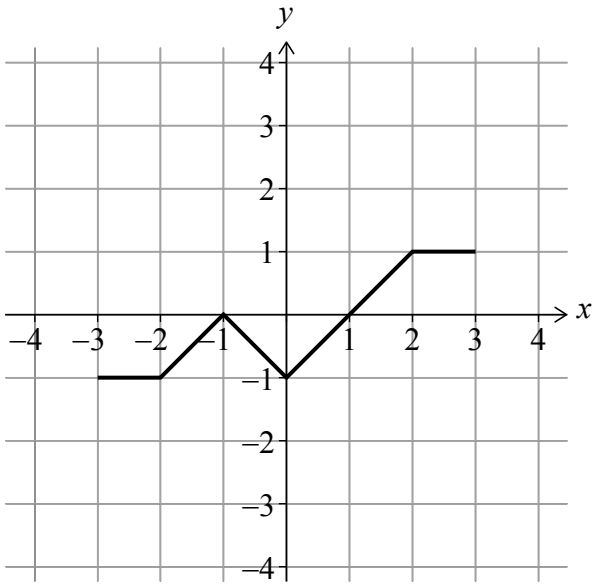
Full marks are not necessarily awarded for a correct answer with no working. Answers must be supported by working and/or explanations. Where an answer is incorrect, some marks may be given for a correct method, provided this is shown by written working. You are therefore advised to show all working.

Section A

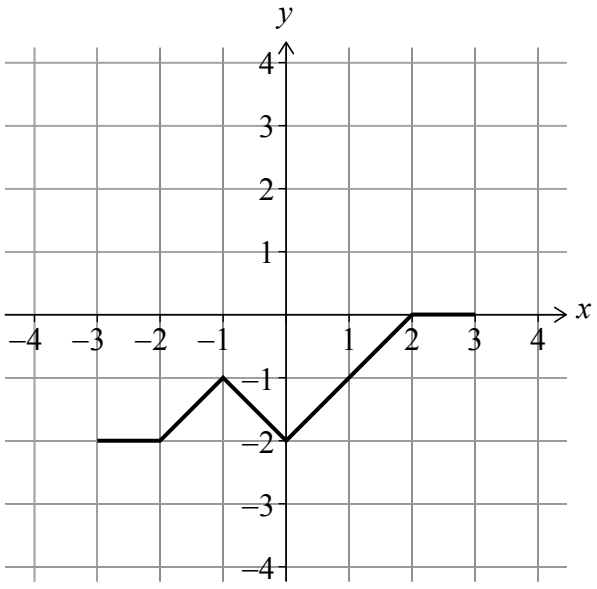
Answer **all** questions. Answers must be written within the answer boxes provided. Working may be continued below the lines, if necessary.

1. [Maximum mark: 4]

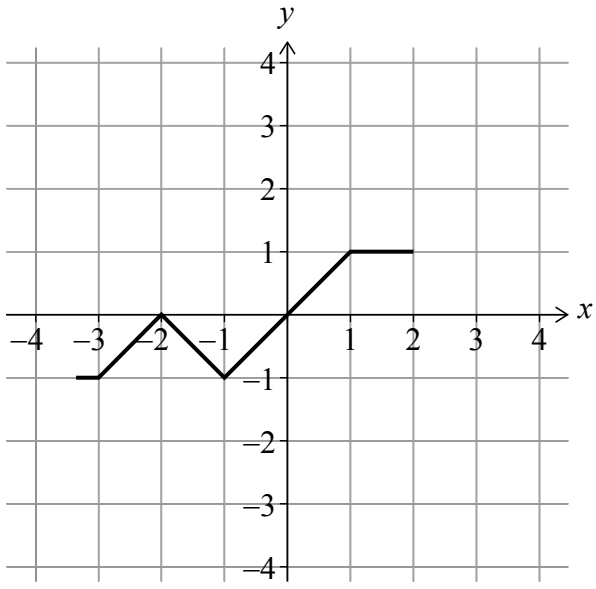
The graph of a function f for $-3 \leq x \leq 3$ is shown in the following diagram.



The following graphs are transformations of the graph of $y = f(x)$.



(A)



(B)

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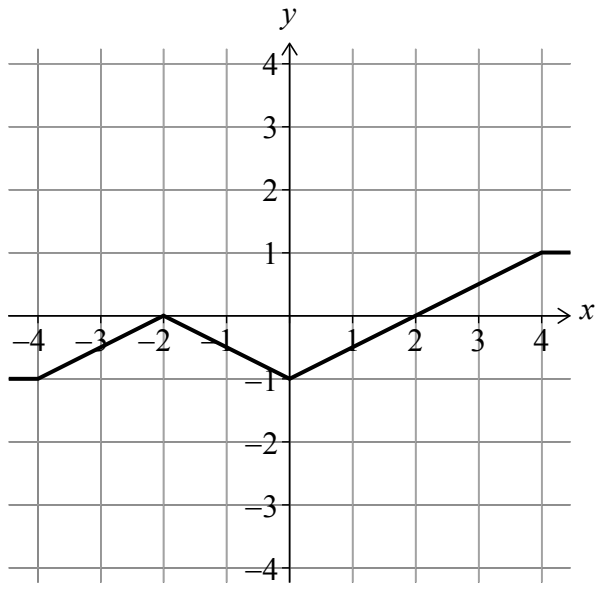
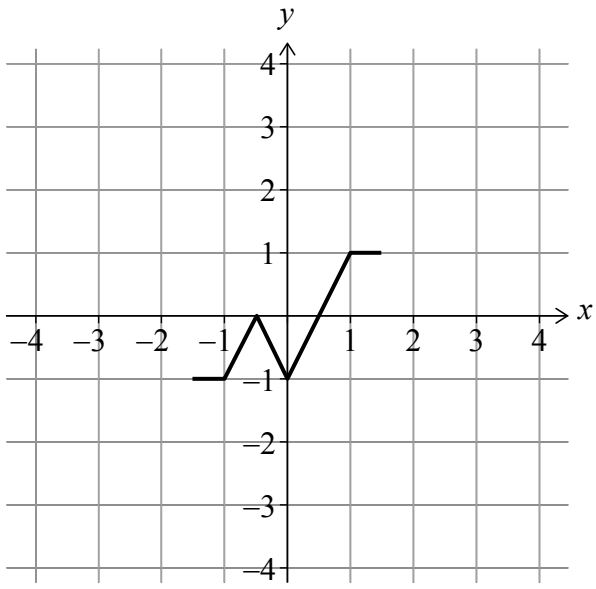
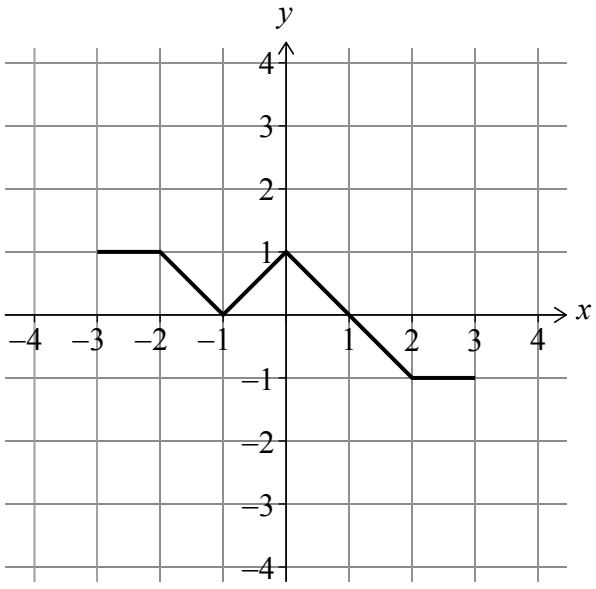
(Question 1 continued)



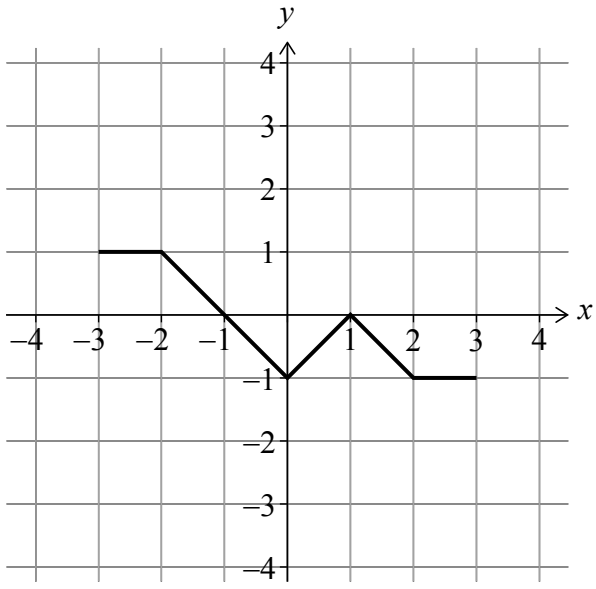
(C)



(D)



(E)



(F)

Consider the following table of transformations of $y = f(x)$.

Next to each transformed function, write down the letter that corresponds to its graph.

Function	Letter
$y = f(x + 1)$	
$y = f(x) - 1$	
$y = f(-x)$	
$y = f(2x)$	

2. [Maximum mark: 6]

The 1st and 5th terms of an arithmetic sequence are 36 and 12 respectively.

(a) Find the 13th term of this arithmetic sequence. [4]

The sum of the first n terms of this arithmetic sequence is zero.

(b) Find the value of n. [2]

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3. [Maximum mark: 6]

Two events A and B are such that $\mathrm{P}(A) = 0.5$, $\mathrm{P}(B) = 0.6$ and $\mathrm{P}(A \cap B) = 0.4$.

(a) Find $\mathrm{P}(A \cup B)$. [2]

(b) Show that A and B are **not** independent. [1]

(c) Find $\mathrm{P}(A \mid B')$. [3]

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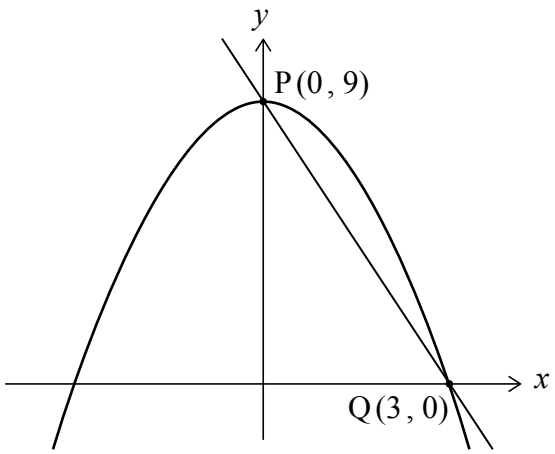
4. [Maximum mark: 7]

A line with equation $y = -3x + 9$ intersects the axes at the points $\mathrm{P}(0, 9)$ and $\mathrm{Q}(3, 0)$.

A parabola of the form $y = ax^2 + c$, where $a, c \in \mathbb{Z}$, also passes through the points P and Q.

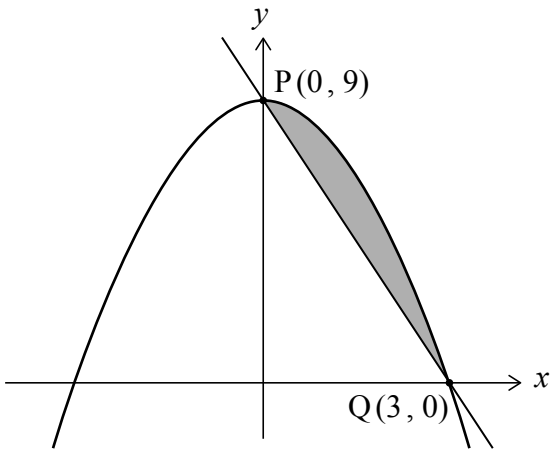
This is shown in the following diagram.



(a) (i) Write down the value of c.

(ii) Find the value of a. [3]

The region enclosed by the line and the parabola is shaded in the following diagram.



(b) Find the area of the shaded region. [4]

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(Question 4 continued)

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5. [Maximum mark: 6]

(a) Given that $x > 7$, show that $\frac{x}{x^2-8x+7} \times \frac{x^2-1}{x+1} = \frac{x}{x-7}$. [2]

(b) Hence, or otherwise, solve $\log_2[x(x^2-1)] - 1 = \log_2[(x^2-8x+7)(x+1)]$. [4]

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6. [Maximum mark: 8]

For $x \in \mathbb{R}$, the functions f and g are defined by

$$f(x) = -x^2 + 4x + p \text{ and}$$

$$g(x) = x^2 + qx - 1,$$

where p and q are non-zero constants.

The graph of $y = f(x)$ has a vertex at A and the graph of $y = g(x)$ has a vertex at B.

Points A and B both lie on the line $y = 2x - 1$.

(a) Show that $p = -1$. [3]

(b) Find the value of q. [5]

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Do **not** write solutions on this page.

Section B

Answer **all** questions in the answer booklet provided. Please start each question on a new page.

7. [Maximum mark: 14]

Consider the function $f(x) = 2x + 3$ where $x \in \mathbb{R}$.

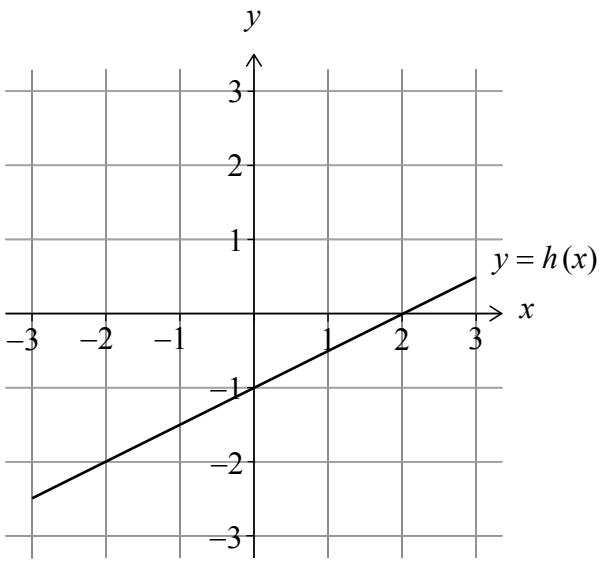
(a) Find

(i) $f(2)$;

(ii) $f^{-1}(x)$. [3]

The following diagram shows part of the graph of a linear function h.

The graph has x-intercept 2 and y-intercept -1.



(b) Write down an expression for $h(x)$. [2]

(c) Solve the equation $h^{-1}(x) = -2$. [2]

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(Question 7 continued)

Consider the function $g(x) = mx + c$, where $x \in \mathbb{R}$ and $m, c \in \mathbb{Q}$.

(d) Given that $h(x) = (f^{-1} \circ g)(x)$, find the value of m and the value of c. [4]

A function k exists such that $h\big(k(x)\big) = x$.

(e) Find an expression for $k(x)$. [2]

(f) State the single transformation that maps the graph of $y = k(x)$ onto the graph of $y = h(x)$. [1]

Do **not** write solutions on this page.

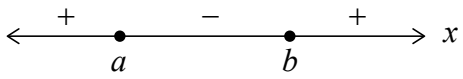
8. [Maximum mark: 14]

The function f has a derivative given by $f'(x) = 3x^2 + 12x - 15$.

The graph of $y = f(x)$ has horizontal tangents at the points where $x = a$ and $x = b$, $a < b$.

(a) Find the value of a and the value of b. [3]

The following diagram shows three intervals along the x-axis defined by a and b. The sign of the **first derivative** of f is shown in each interval.

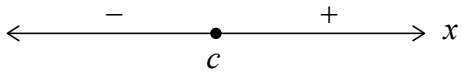


(b) State, with a reason, whether there is a local maximum point or a local minimum point on the graph of $y = f(x)$ at $x = a$. [2]

The second derivative $f''(x)$ is zero at $x = c$.

(c) Find the value of c. [3]

The following diagram shows two intervals along the x-axis defined by c. The sign of the **second derivative** is shown in each interval.



(d) State, with a reason, whether there is a point of inflexion on the graph of $y = f(x)$ at $x = c$. [2]

(e) Given that $f(-2) = 36$, find $f(x)$. [4]

Do **not** write solutions on this page.

9. [Maximum mark: 15]

(a) Show that $\frac{2\tan\theta}{1+\tan^2\theta}$ can be expressed as $\sin 2\theta$. [3]

(b) Hence, solve the equation $\frac{2\tan\theta}{1+\tan^2\theta}=\frac{1}{2}$ for $0° \le \theta \le 180°$. [5]

Let $x=\tan\left(22\frac{1}{2}^{\circ}\right)$.

(c) Use the result from part (a) to show that $x^2-2\sqrt{2}x+1=0$. [4]

(d) Hence, find the exact value of $\tan\left(22\frac{1}{2}^{\circ}\right)$. [3]

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