

© International Baccalaureate Organization 2025

All rights reserved. No part of this product may be reproduced in any form or by any electronic or mechanical means, including information storage and retrieval systems, without the prior written permission from the IB. Additionally, the license tied with this product prohibits use of any selected files or extracts from this product. Use by third parties, including but not limited to publishers, private teachers, tutoring or study services, preparatory schools, vendors operating curriculum mapping services or teacher resource digital platforms and app developers, whether fee-covered or not, is prohibited and is a criminal offense.

More information on how to request written permission in the form of a license can be obtained from <https://ibo.org/become-an-ib-school/ib-publishing/licensing/applying-for-a-license/>.

© Organisation du Baccalauréat International 2025

Tous droits réservés. Aucune partie de ce produit ne peut être reproduite sous quelque forme ni par quelque moyen que ce soit, électronique ou mécanique, y compris des systèmes de stockage et de récupération d'informations, sans l'autorisation écrite préalable de l'IB. De plus, la licence associée à ce produit interdit toute utilisation de tout fichier ou extrait sélectionné dans ce produit. L'utilisation par des tiers, y compris, sans toutefois s'y limiter, des éditeurs, des professeurs particuliers, des services de tutorat ou d'aide aux études, des établissements de préparation à l'enseignement supérieur, des fournisseurs de services de planification des programmes d'études, des gestionnaires de plateformes pédagogiques en ligne, et des développeurs d'applications, moyennant paiement ou non, est interdite et constitue une infraction pénale.

Pour plus d'informations sur la procédure à suivre pour obtenir une autorisation écrite sous la forme d'une licence, rendez-vous à l'adresse <https://ibo.org/become-an-ib-school/ib-publishing/licensing/applying-for-a-license/>.

© Organización del Bachillerato Internacional, 2025

Todos los derechos reservados. No se podrá reproducir ninguna parte de este producto de ninguna forma ni por ningún medio electrónico o mecánico, incluidos los sistemas de almacenamiento y recuperación de información, sin la previa autorización por escrito del IB. Además, la licencia vinculada a este producto prohíbe el uso de todo archivo o fragmento seleccionado de este producto. El uso por parte de terceros —lo que incluye, a título enunciativo, editoriales, profesores particulares, servicios de apoyo académico o ayuda para el estudio, colegios preparatorios, desarrolladores de aplicaciones y entidades que presten servicios de planificación curricular u ofrezcan recursos para docentes mediante plataformas digitales—, ya sea incluido en tasas o no, está prohibido y constituye un delito.

En este enlace encontrará más información sobre cómo solicitar una autorización por escrito en forma de licencia: <https://ibo.org/become-an-ib-school/ib-publishing/licensing/applying-for-a-license/>.

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]**.



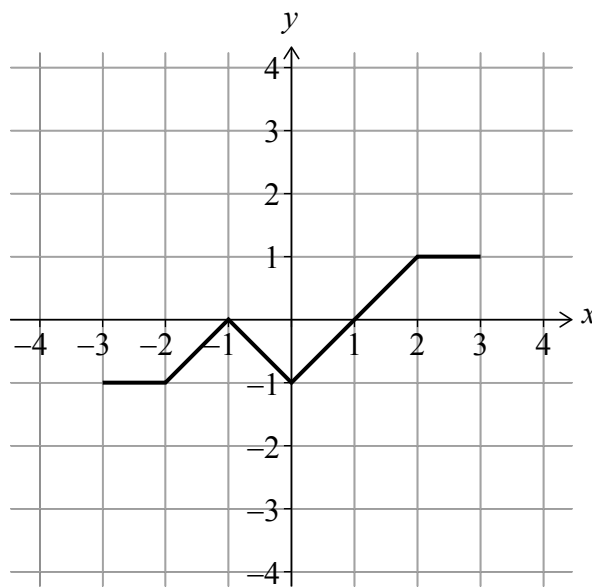
Full marks are not necessarily awarded for a correct answer with no working. Answers must be supported by working and/or explanations. Where an answer is incorrect, some marks may be given for a correct method, provided this is shown by written working. You are therefore advised to show all working.

Section A

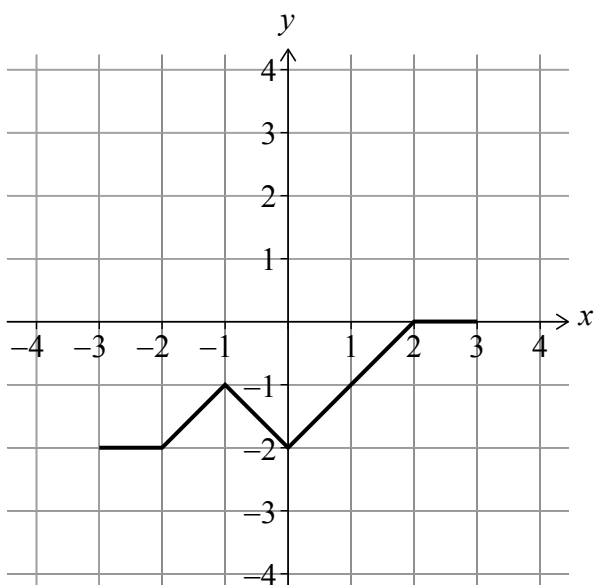
Answer **all** questions. Answers must be written within the answer boxes provided. Working may be continued below the lines, if necessary.

1. [Maximum mark: 4]

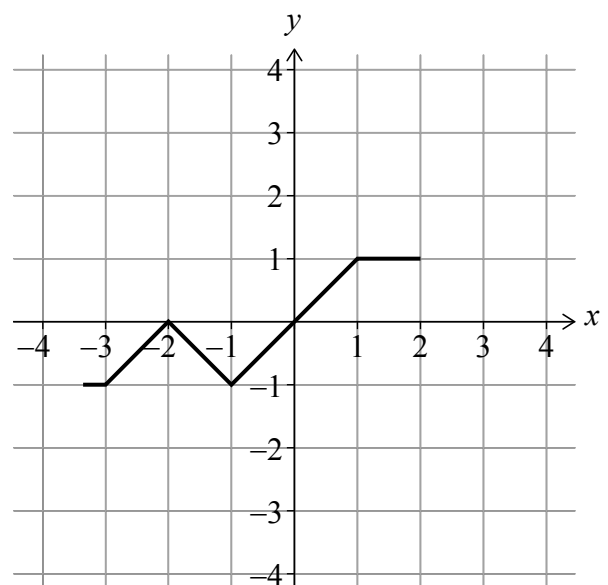
The graph of a function f for $-3 \leq x \leq 3$ is shown in the following diagram.



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



(A)

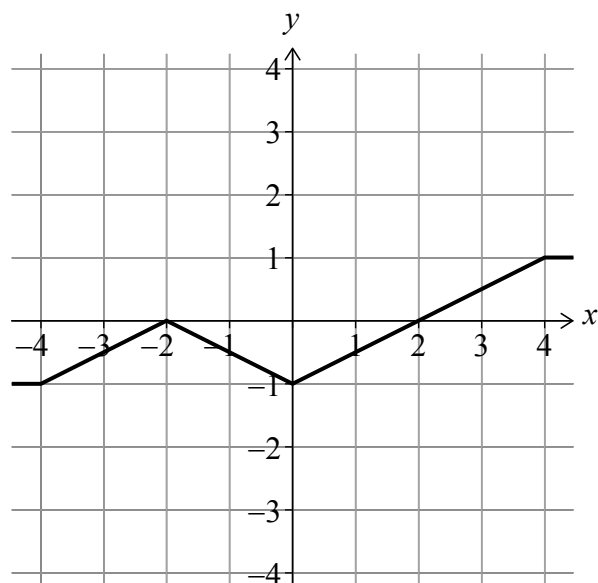


(B)

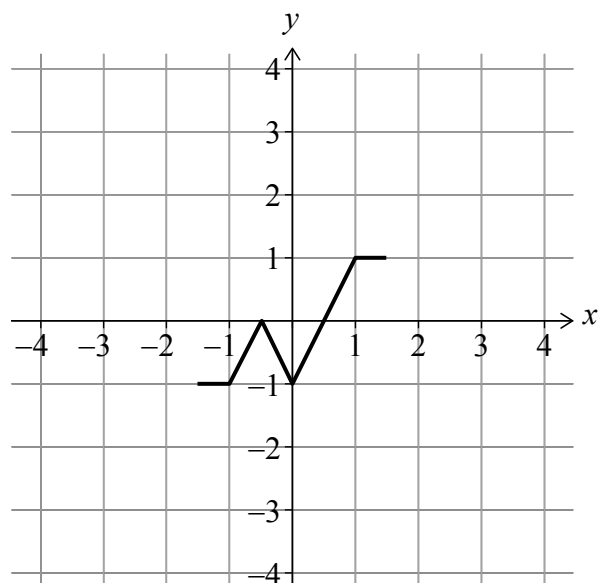
(This question continues on the following page)



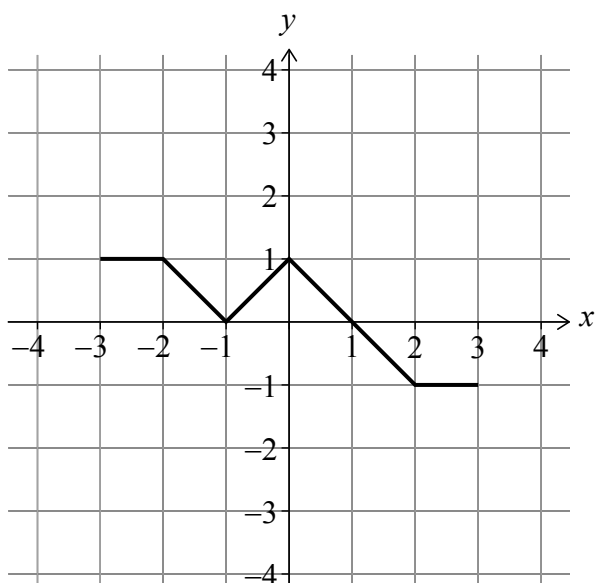
(Question 1 continued)



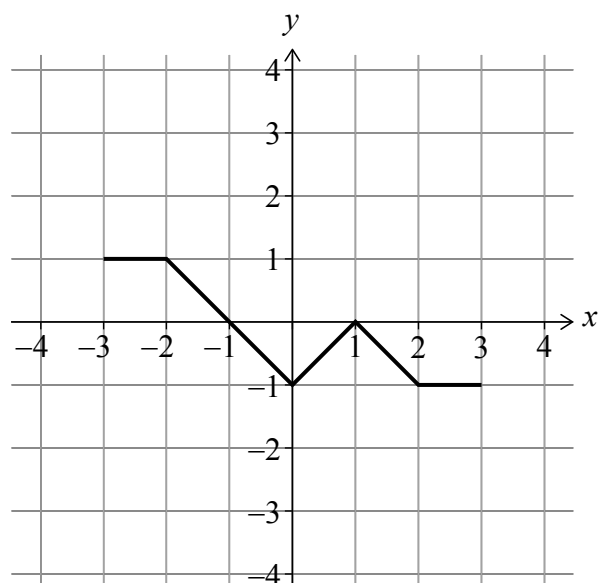
(C)



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

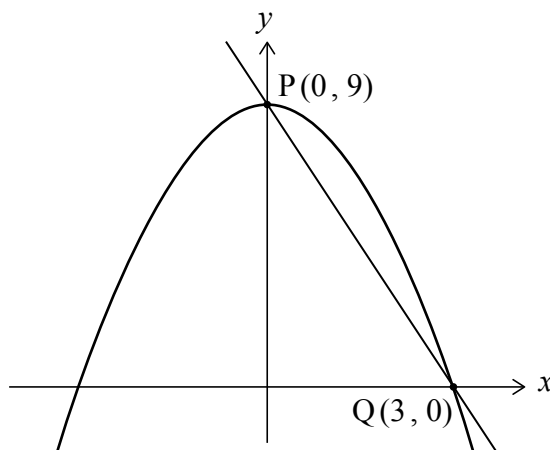


4. [Maximum mark: 7]

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

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.

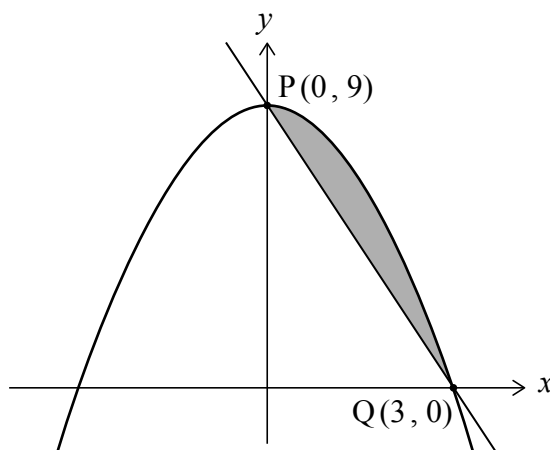


(a) (i) Write down the value of c .

(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]

(This question continues on the following page)



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

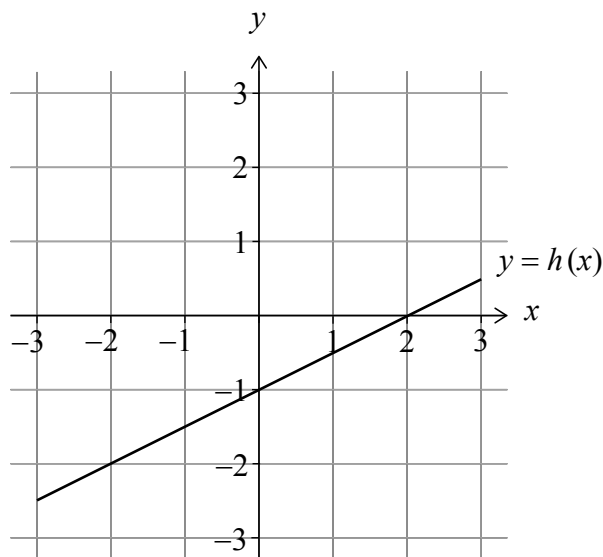
(i) $f(2)$;

(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]

(This question continues on the following page)



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

(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 $h(k(x)) = x$.

(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.

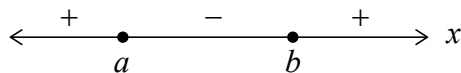
8. [Maximum mark: 14]

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.

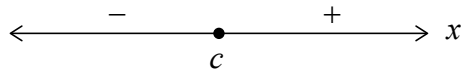


(b) State, with a reason, whether there is a local maximum point or a local minimum point on the graph of $y = f(x)$ at $x = a$. [2]

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 $0^\circ \leq \theta \leq 180^\circ$. [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]



Please **do not** write on this page.

Answers written on this page
will not be marked.



16EP14

Please **do not** write on this page.

Answers written on this page
will not be marked.



16EP15

Please **do not** write on this page.

Answers written on this page
will not be marked.



16EP16