

© 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

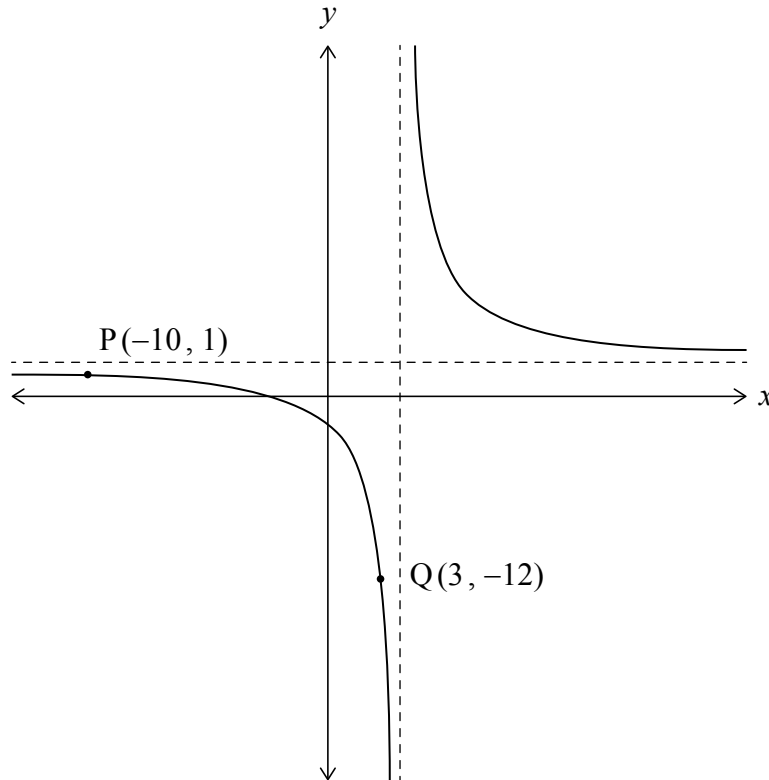
- Write your session number in the boxes above.
- Do not open this examination paper until instructed to do so.
- You are not permitted access to any calculator for this paper.
- Section A: answer all questions. Answers must be written within the answer boxes provided.
- Section B: answer all questions 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]**.



5. [Maximum mark: 8]

The following diagram shows the graph of $y = \frac{Ax + B}{x - 4}$, where $x \in \mathbb{R}, x \neq 4$ and $A, B \in \mathbb{Z}$.

The graph passes through the points $P(-10, 1)$ and $Q(3, -12)$.



(a) Determine the value of A and the value of B . [3]

(b) Describe a sequence of transformations that would map the graph of $y = \frac{1}{x}$ onto the graph of $y = \frac{Ax + B}{x - 4}$. [5]

.....

.....

.....

.....

.....

.....

.....

.....

.....



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

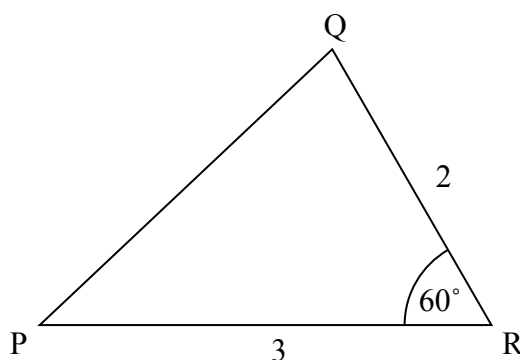
Section B

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

7. [Maximum mark: 14]

Consider a triangle PQR where $PR = 3$, $QR = 2$ and $\hat{P}RQ = 60^\circ$.

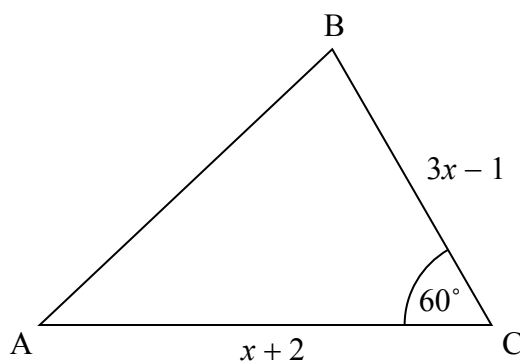
diagram not to scale



(a) Find PQ.

[3]

Now consider a general triangle ABC where $AC = x + 2$, $BC = 3x - 1$ and $\hat{A}CB = 60^\circ$.



(b) Show that $AB = \sqrt{7x^2 - 7x + 7}$.

[5]

(c) Given that $AB = 7$,

(i) find the value of x ;

(ii) find the area of triangle ABC.

[6]



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

8. [Maximum mark: 15]

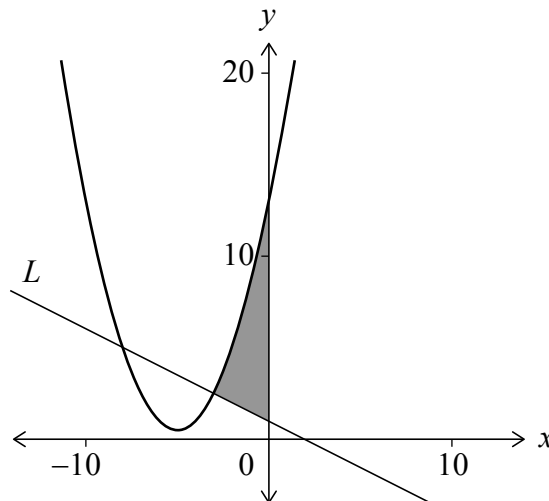
Consider the function defined by $f(x) = \frac{1}{2}x^2 + kx + 13$, where $x \in \mathbb{R}$ and $k \in \mathbb{Z}^+$.

(a) Given that the equation $f(x) = 0$ has no real roots, show that the greatest possible value of k is 5. [2]

For the remainder of this question, consider the case $k = 5$.

- (b) (i) Write down the equation of the axis of symmetry of the graph of f .
- (ii) Hence, or otherwise, determine the coordinates of the minimum point on the graph of f . [3]

The following diagram shows the graph of f and a line L which is normal to the curve at $x = -3$. The shaded area shown is bounded by the curve, the line L and the y -axis.



(c) Show that the equation of L is given by $y = -\frac{1}{2}x + 1$. [5]

(d) Hence, find the shaded area. [5]

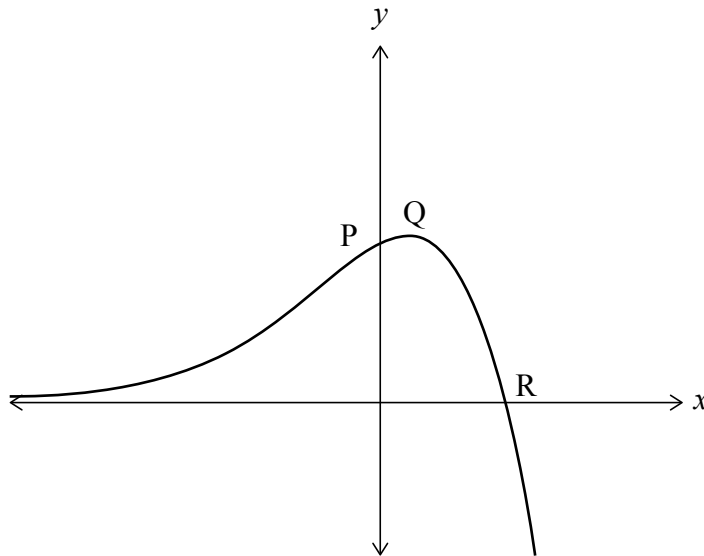


Do **not** write solutions on this page.

9. [Maximum mark: 16]

The function f is defined by $f(x) = \frac{5e^x - e^{2x}}{e^x + 1}$. The following diagram shows part of the graph of f . The graph intersects the y -axis at point P and intersects the x -axis at point R.

Point Q is a local maximum point with coordinates $(q, 7 - 2\sqrt{6})$.



- (a) (i) Find the coordinates of point P.
- (ii) Find the coordinates of point R. [6]
- (b) State the range of f . [1]
- (c) Show that $f'(x) = \frac{-e^{3x} - 2e^{2x} + 5e^x}{(e^x + 1)^2}$. [3]
- (d) Hence, show that $q = \ln(\sqrt{6} - 1)$. [6]



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

Answers written on this page
will not be marked.



12EP11

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

Answers written on this page
will not be marked.



12EP12