

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: 6]

The discrete random variable X has the following probability distribution:

x	1	2	3	4
$P(X = x)$	0.2	0.3	k	0.1

- (a) Find the value of k . [2]
- (b) Find $P(X > 1.5)$. [2]
- (c) Find $E(X)$. [2]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....



2. [Maximum mark: 5]

The gradient of a curve is given by $\frac{dy}{dx} = 4 \cos x - \sin x$. The curve passes through the point $(\pi, 3)$. Find the equation of the curve.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....



3. [Maximum mark: 5]

The 7th term of an arithmetic sequence is 6.

The sum of the 6th term and the 12th term is 24.

Find the first term and the common difference.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....



4. [Maximum mark: 6]

Events A and B are such that $P(A) = \frac{1}{2}$, $P(B) = \frac{1}{3}$ and $P(A|B) = \frac{1}{4}$.

(a) Find the probability that both events A and B occur. [2]

(b) Find $P(A|B')$. [4]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

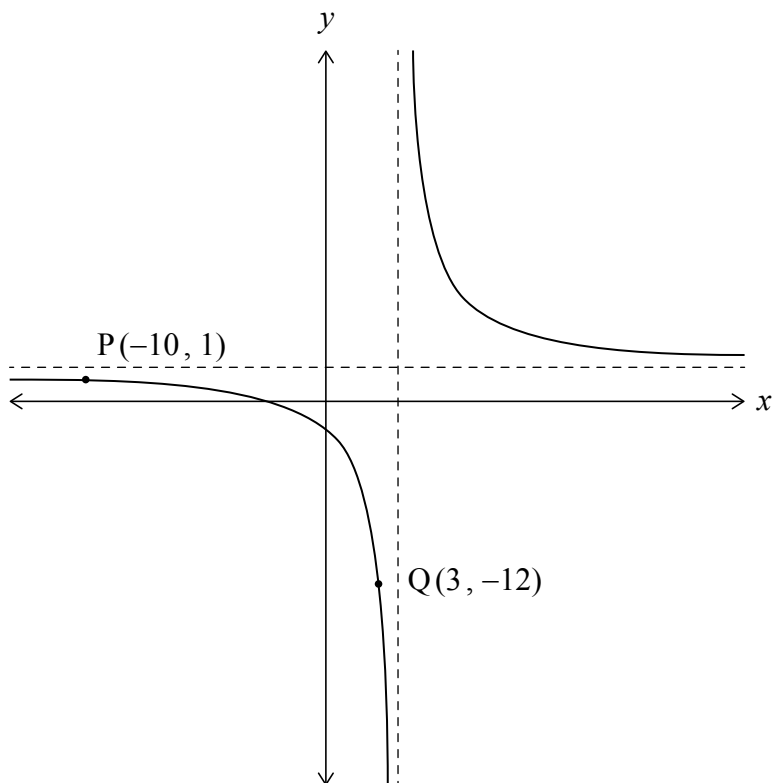
.....



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]

.....

.....

.....

.....

.....

.....

.....

.....



6. [Maximum mark: 5]

Solve the equation $3\log_8 10x - \log_4 x = 1$ for $x > 0$.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....



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

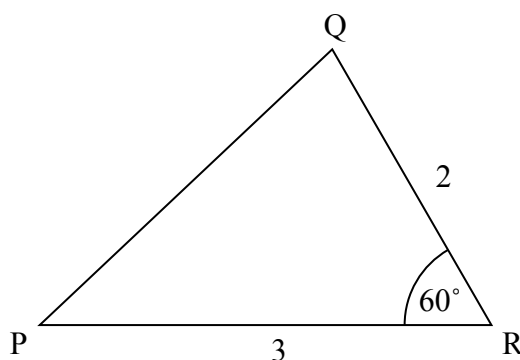
Section B

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 $\hat{P}RQ = 60^\circ$.

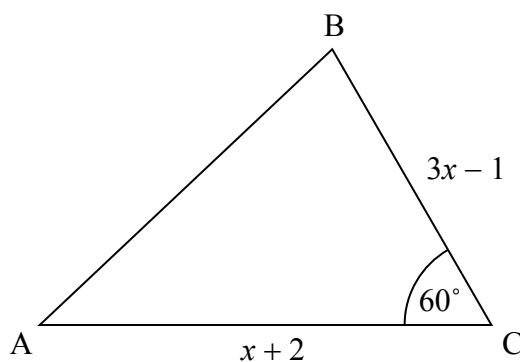
diagram not to scale



(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]

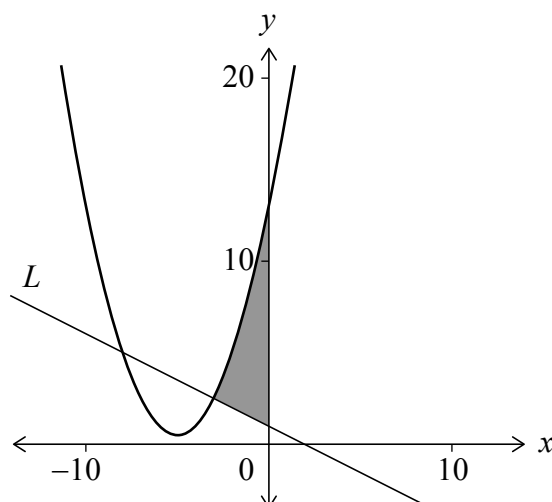
Consider the function defined by $f(x) = \frac{1}{2}x^2 + kx + 13$, where $x \in \mathbb{R}$ and $k \in \mathbb{Z}^+$.

- (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]

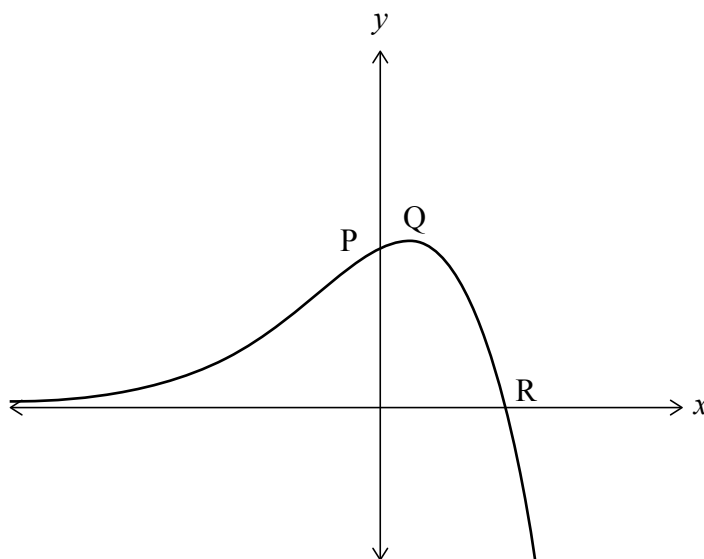


Do **not** write solutions on this page.

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