



Rewarding Learning

ADVANCED
General Certificate of Education
2025

Centre Number

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Candidate Number

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Mathematics

Assessment Unit A2 1

assessing

Pure Mathematics

MV18

[AMT11]

THURSDAY 29 MAY, MORNING

Time

2 hours 30 minutes, plus your additional time allowance.

Instructions to Candidates

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.

You must answer **all twelve** questions in the spaces provided.

Do not write on blank pages or tracing paper.

Complete in black ink only. **Do not write with a gel pen.**

Questions which require drawing or sketching should be completed using an HB pencil.

Show clearly the full development of your answers.

Answers without working may not gain full credit.

Answers should be given to three significant figures unless otherwise stated.

You are permitted to use a graphic or scientific calculator in this paper.

Information for Candidates

The total mark for this paper is 150

Figures in brackets printed at the end of each question indicate the marks awarded to each question or part question.

A copy of the **Mathematical Formulae and Tables booklet** is provided.

Throughout the paper the logarithmic notation used is $\ln z$ where it is noted that $\ln z \equiv \log_e z$.

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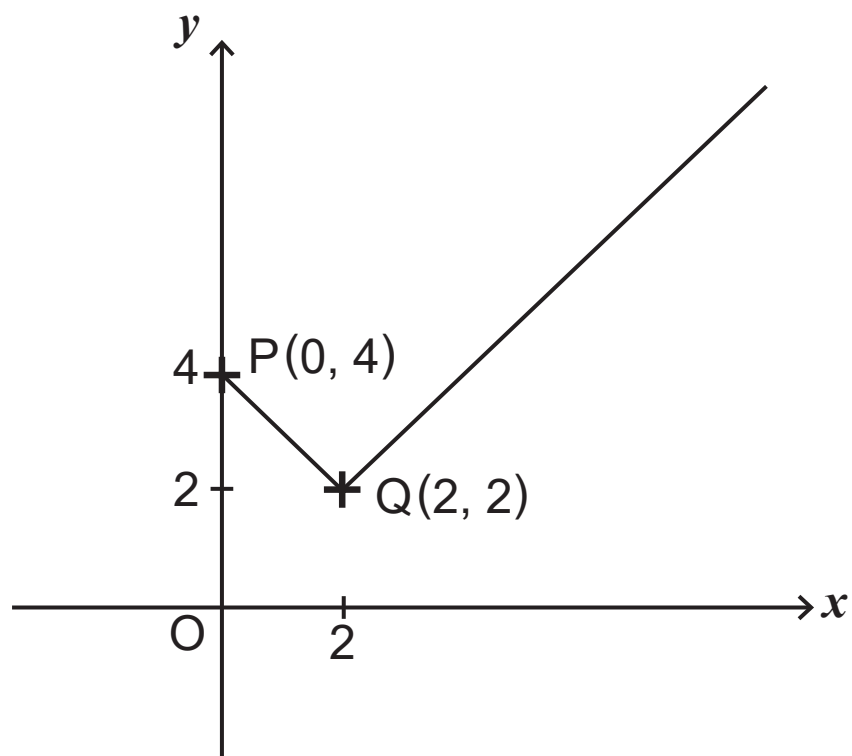
(ii) In this arithmetic progression, the last term is the only negative term.

Find the number of terms in the progression. [4 marks]

3 Fig. 1 below shows the graph of $y = f(x)$

The points $P(0, 4)$ and $Q(2, 2)$ are labelled as shown.

Fig. 1

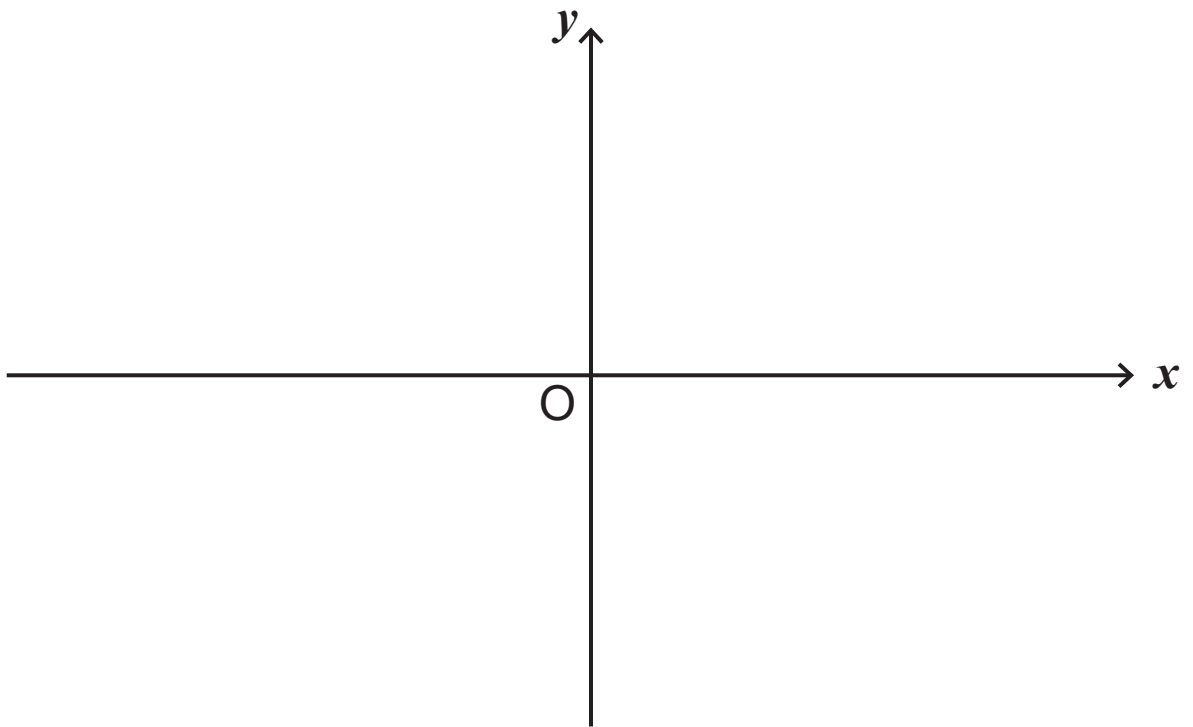


(i) On the axes below, sketch the graph of

$$y = 1 + f\left(\frac{x}{2}\right)$$

Clearly label the images of the points P and Q.

[3 marks]

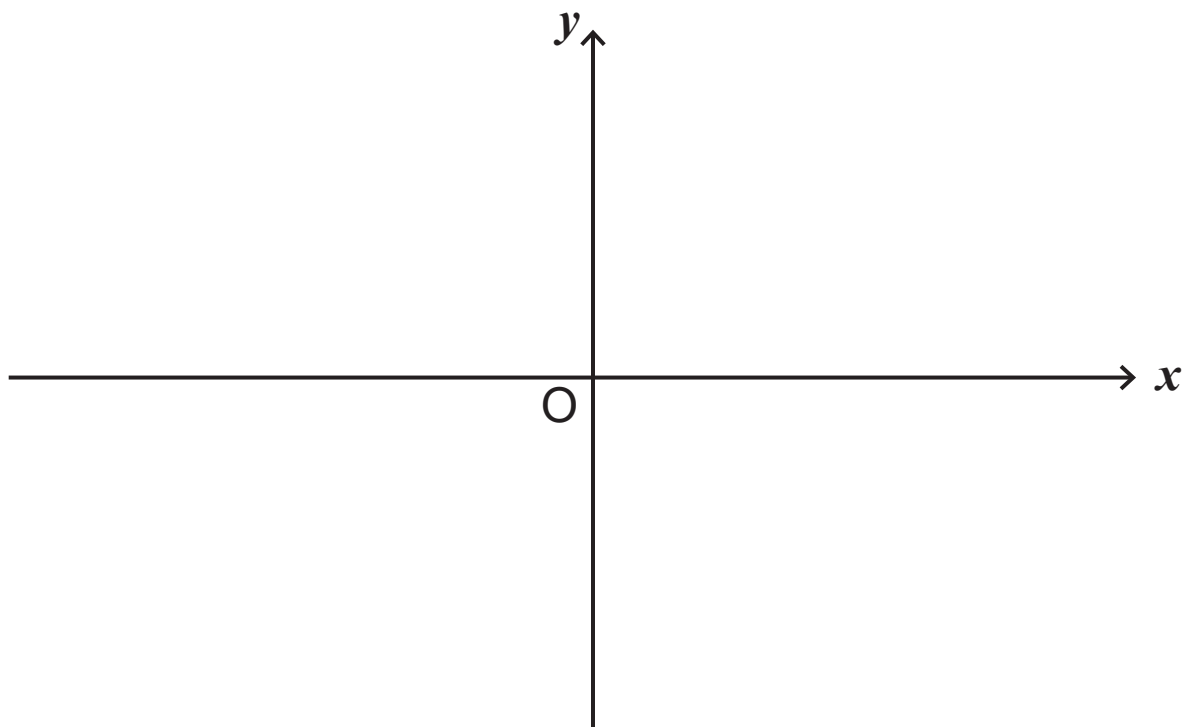


(ii) On the axes below, sketch the graph of

$$y = 4 - f(x)$$

Clearly label the images of the points P and Q.

[3 marks]



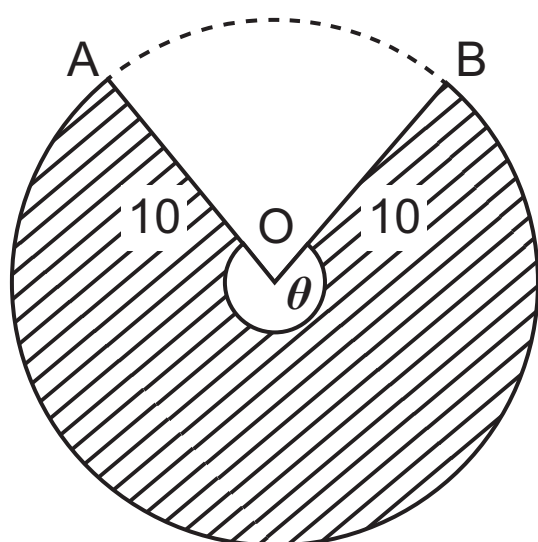
4 Ella wants to make party hats for her son's birthday party.

She creates a template by cutting a major sector AOB from circular card.

The card has centre O and radius 10 cm.

The major arc AB subtends an angle θ radians at O, as shown in **Fig. 2** below.

Fig. 2



She will then fold the cards into cones before decorating them.

The template must have a major arc length of 14π cm.

(i) Find the exact value of θ that Ella should use when creating her sector template. [2 marks]

- 5 (a) On the axes below, sketch the graph of $y = \cot \theta$ for $0^\circ \leq \theta \leq 360^\circ$ [3 marks]



- (b) (i) Prove the identity [4 marks]

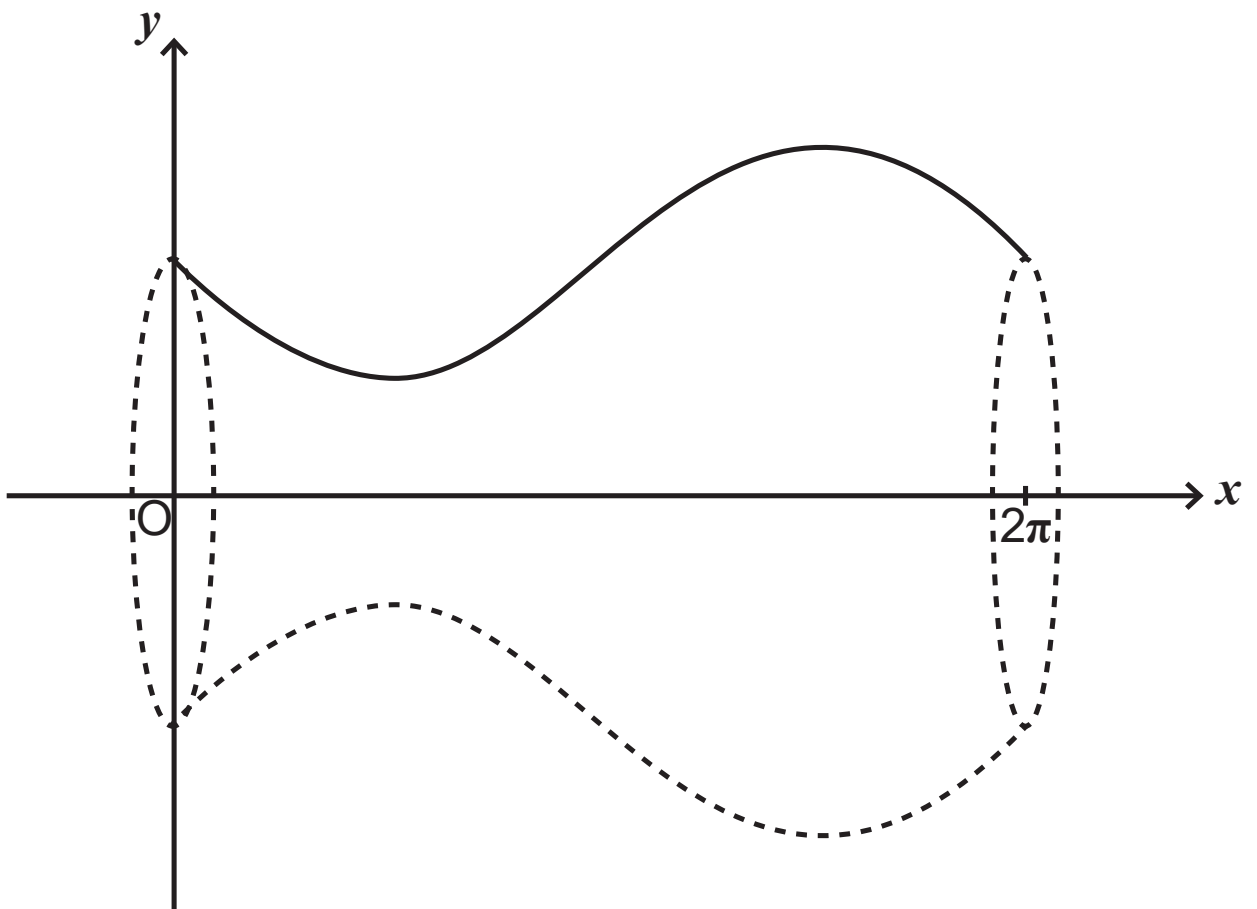
$$2 \cot 2\theta \equiv \cot \theta - \tan \theta$$

(ii) A vase is modelled by rotating the curve

$$y = 2 - \sin x$$

between the lines $x = 0$ and $x = 2\pi$ through 2π radians about the x -axis, as shown in **Fig. 3** below.

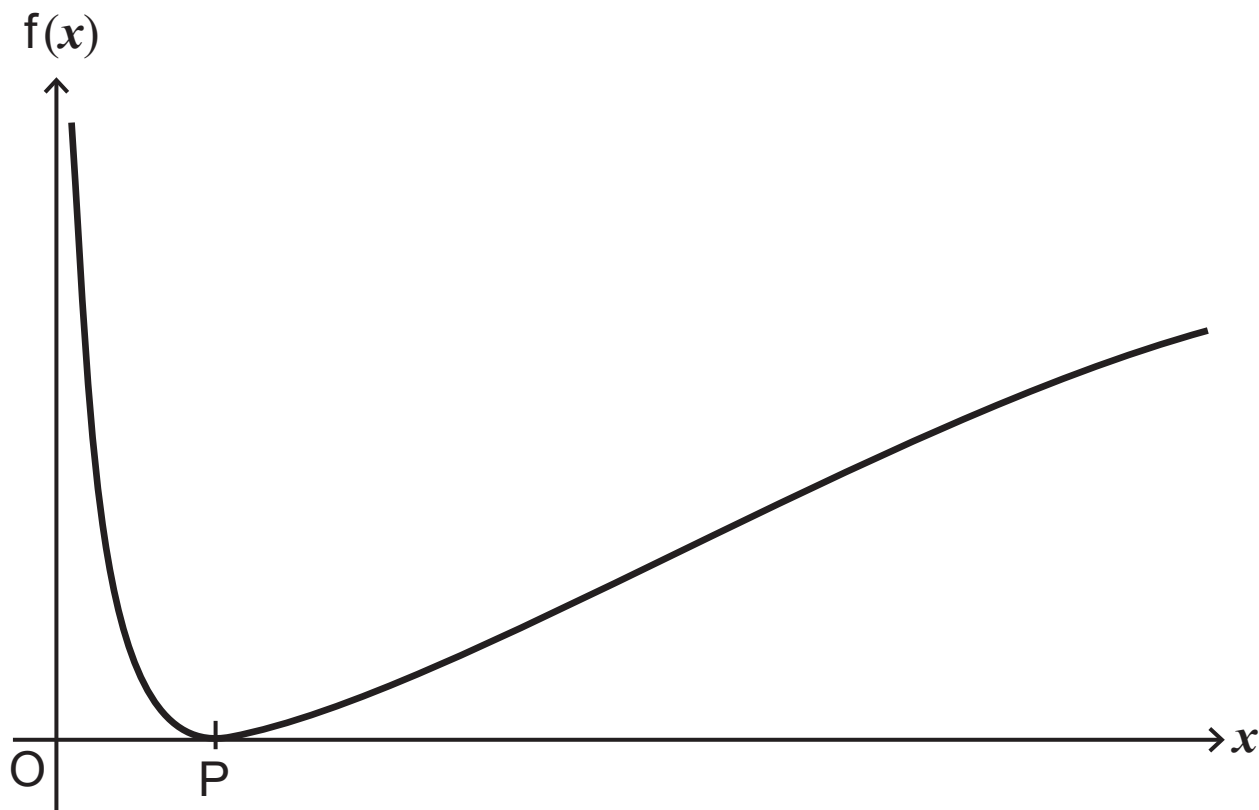
Fig. 3



Using the answer shown in (i), or otherwise, find the exact volume of the vase. [7 marks]

- 8 The graph of the function $f(x) = 3(1 + \ln x)^2$ is shown in Fig. 4 below.

Fig. 4



The stationary point P lies on the x -axis.

- (i) Using differentiation, find the exact value of the x coordinate of P.

Confirm that P is a minimum turning point. [9 marks]

$f(x)$ can be considered as a composite function such that $f(x) = hg(x)$, where

$$g(x) = \ln x - 1 \quad x \in \mathbb{R}, \quad x > 0$$

and $h(x)$ has domain $x \in \mathbb{R}$

(iv) Write down the function $h(x)$. [1 mark]

(v) Find the inverse function $g^{-1}(x)$, stating its domain. [4 marks]

(iii) Explain how the use of the Trapezium Rule in **(i)** could be modified to obtain a better approximation to the integral [1 mark]

$$\int_0^1 \frac{2}{5 + \sqrt{x}} dx$$

(ii) Hence, determine the minimum value of

$$3 + 4\sqrt{2} \cos x + 2 \sin x \quad [3 \text{ marks}]$$

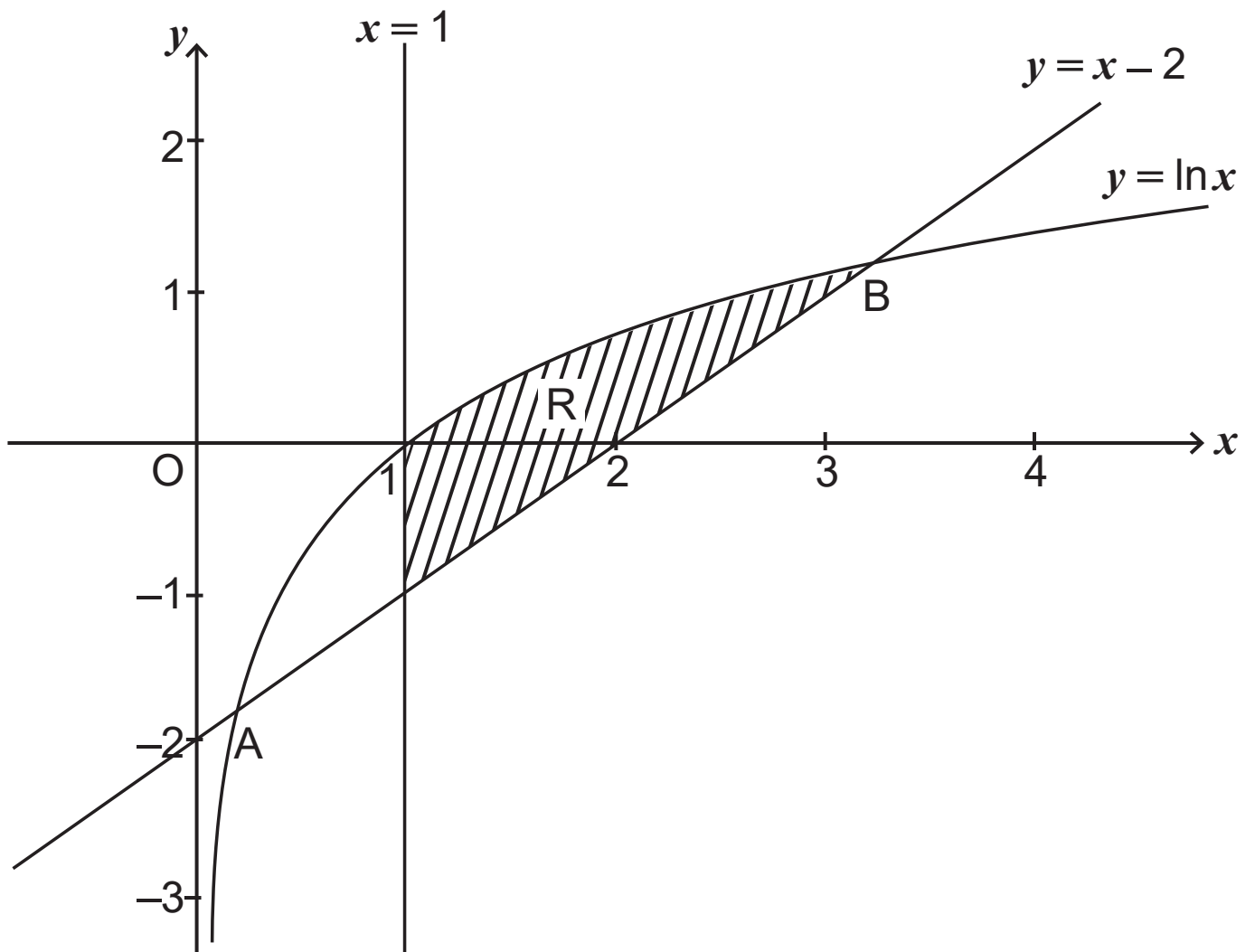
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12 The graphs of

$$y = \ln x, \quad y = x - 2 \quad \text{and} \quad x = 1$$

are shown in **Fig. 5** below.

Fig. 5



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SOURCES

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Question Number	Marks
1	
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12	
Total Marks	

Examiner Number

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