



Rewarding Learning

ADVANCED
General Certificate of Education
2025

Centre Number

--	--	--	--	--

Candidate Number

--	--	--	--

Mathematics

Assessment Unit A2 1

assessing

Pure Mathematics



[AMT11]

AMT11

THURSDAY 29 MAY, MORNING

TIME

2 hours 30 minutes.

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 outside the boxed area on each page or 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 down the right-hand side of pages 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 $\ln z \equiv \log_e z$

15865



44AMT1101

BLANK PAGE
DO NOT WRITE ON THIS PAGE

15865



44AMT1102

1 List the terms of the following sequences for $n = 1, 2, 3, 4$

State whether each sequence diverges, converges or oscillates.

(i) $\frac{2n^2}{3+n}$ [2]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(ii) $\frac{1-2n}{3n}$ [2]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

[Turn over]



2 The 4th and 9th terms in an arithmetic progression are 89 and 69 respectively.

(i) Find the first term and the common difference for this arithmetic progression. [5]

[illegible]

[illegible]

[4]

This image shows a single page of white paper with horizontal blue or grey ruling lines. The lines are evenly spaced and run across the width of the page, leaving small margins at the top and bottom. There are no vertical margin lines, and the page is completely blank except for the lines themselves.

15865



44AMT1105

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

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

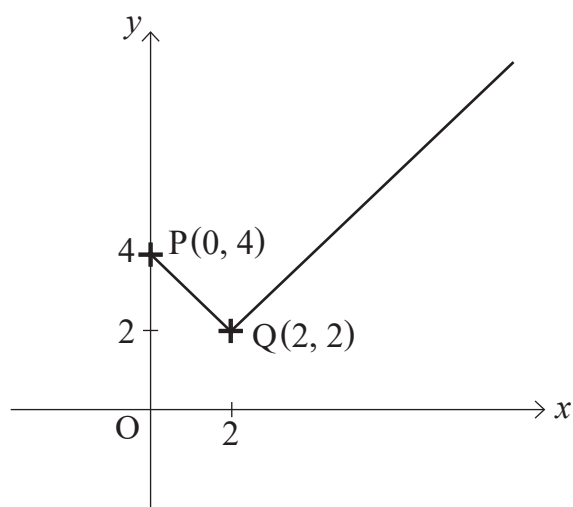
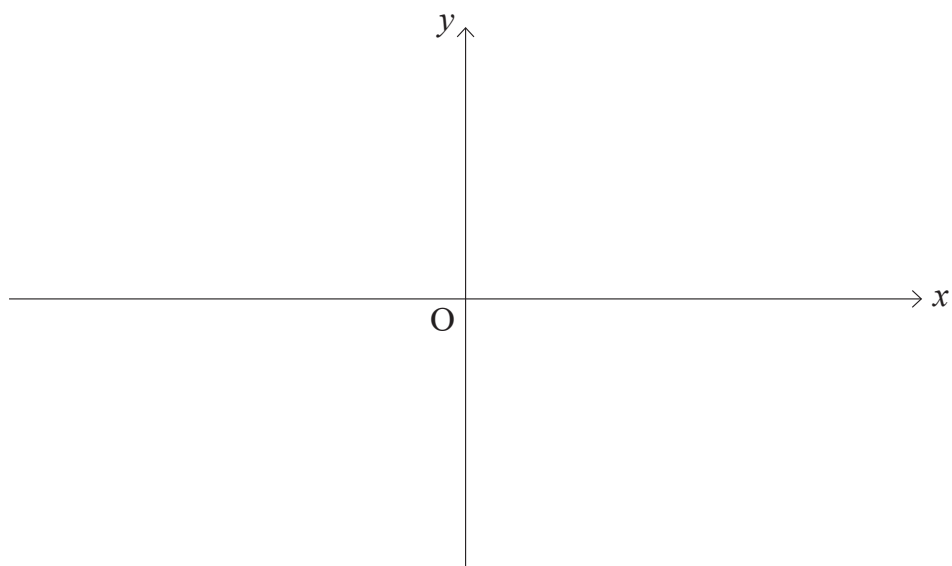


Fig. 1

(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.



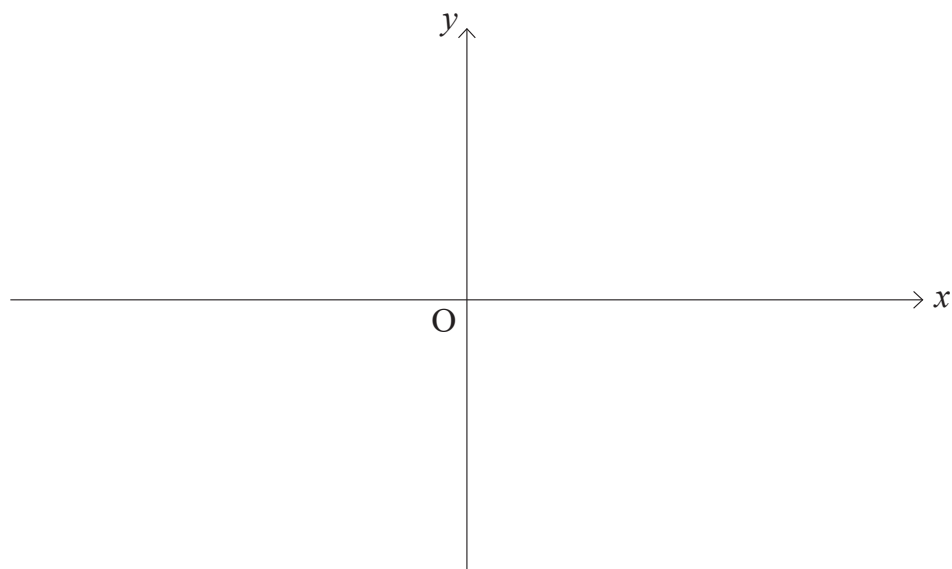
[3]



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

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

Clearly label the images of the points P and Q.



[3]



- 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.

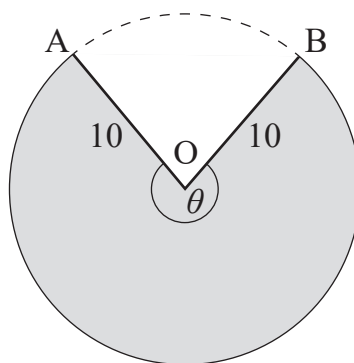


Fig. 2

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]

.....

.....

.....

.....

.....

.....

.....

.....

.....



[4]

[Turn over

15865



44AMT1109

- 6 (a) Differentiate the function $f(x)$ with respect to x , where $f(x)$ is defined as

$$f(x) = e^{2x+1} \operatorname{cosec} 3x \quad [4]$$

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

- (b) A curve is given by the equation

$$2x + \frac{5x^2}{y^3} = 3$$

Find the equation of the tangent to the curve at the point $(-1, 1)$.

Leave your answer in the form $ax + by + c = 0$, where a , b and c are integers. [9]

.....

.....

.....

.....

.....

.....

.....

.....



7 (i) Show that

$$\int \sin^2 x \, dx = \frac{1}{2}x - \frac{1}{2}\sin x \cos x + c \quad [5]$$





BLANK PAGE

DO NOT WRITE ON THIS PAGE

(Questions continue overleaf)

15865

[Turn over



44AMT1115

(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.

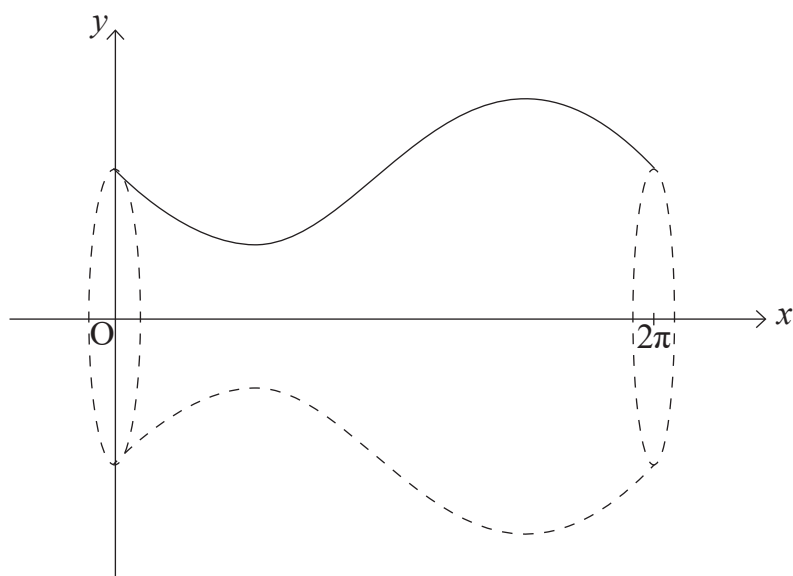


Fig. 3

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

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....



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

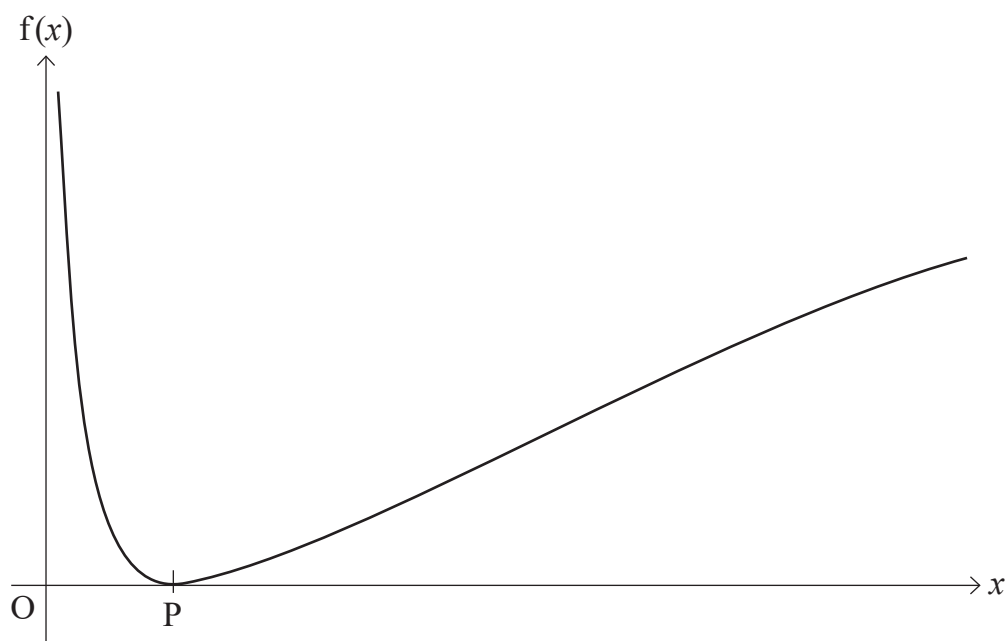


Fig. 4

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]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....



15865

[Turn over



44AMT1119

(ii) State the equation of the vertical asymptote of the function $f(x)$.

[1]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(iii) State the domain and range of the function $f(x)$.

[2]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....



$f(x)$ 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]

.....

.....

.....

.....

.....

.....

.....

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

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

[Turn over]



BLANK PAGE
DO NOT WRITE ON THIS PAGE

15865



44AMT1122

[illegible]

[5]

This image shows a full page of white paper with horizontal dotted lines, typical of primary school writing paper. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

15865



44AMT1123

(ii) Using the substitution $u = 5 + \sqrt{x}$, find the value of

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

[8]

This image shows a single page of white paper with horizontal blue or grey ruling lines. The lines are evenly spaced and run across the width of the page, leaving small margins at the top and bottom. There are no vertical margin lines, text, or other markings on the page.

[illegible]

[3]

[illegible]

15865



44AMT1127

- (b)** A toy car is moving around a circular track such that its coordinates relative to a fixed origin O are given parametrically by

$$x = 3 \cos t + 4 \sin t + 2 \quad \text{and} \quad y = 4 \cos t - 3 \sin t - 1$$

where t is the time in seconds.

- (i) By using parametric differentiation, show that

$$\frac{dy}{dx} = \frac{2-x}{y+1} \quad [5]$$

This image shows a full page of white paper with horizontal dotted lines. The lines are evenly spaced and run across the width of the page, providing a guide for handwriting practice. There are no margins, text, or other markings on the page.





BLANK PAGE

DO NOT WRITE ON THIS PAGE

(Questions continue overleaf)

15865

[Turn over



44AMT1131

(ii) Hence, using the binomial theorem, expand

$$\frac{4x^2 + 11x + 7}{(1 + 2x)(3 + x)}$$

in ascending powers of x , up to and including the term in x^2

[8]

[illegible]

12 The graphs of

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

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

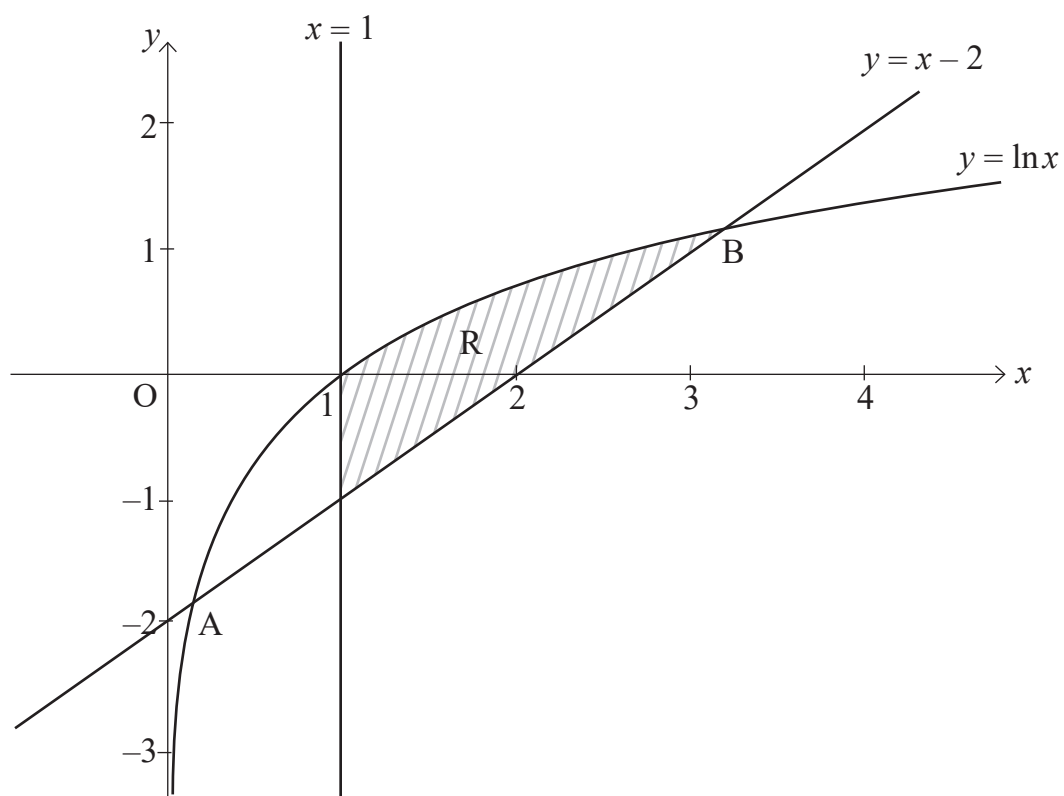


Fig. 5

The graphs of $y = \ln x$ and $y = x - 2$ intersect at the points A and B.

Point B has an x coordinate close to 3



[4]

[Turn over



44AMT1137

- (ii) Starting with $x_0 = 3$, use the Newton-Raphson method once to find a better approximation for the x coordinate of B.

Give your answer correct to three decimal places.

[5]

[illegible]

(iii) Using the approximation you have found in **(ii)**, find the area of R. [10]

This image shows a full page of white paper with horizontal dotted lines. The lines are evenly spaced and run across the width of the page, providing a guide for handwriting or typing. There are no margins, text, or other markings on the page.

15865



44AMT1139





THIS IS THE END OF THE QUESTION PAPER

15865



44AMT1141

BLANK PAGE
DO NOT WRITE ON THIS PAGE

15865



44AMT1142



BLANK PAGE

DO NOT WRITE ON THIS PAGE

15865



44AMT1143

DO NOT WRITE ON THIS PAGE

For Examiner's use only	
Question Number	Marks
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	

Total Marks	
-------------	--

Examiner Number

Permission to reproduce all copyright material has been applied for.
In some cases, efforts to contact copyright holders may have been unsuccessful and CCEA will be happy to rectify any omissions of acknowledgement in future if notified.

