



Rewarding Learning

ADVANCED
General Certificate of Education
2023

Centre Number

--	--	--	--	--

Candidate Number

--	--	--	--

Mathematics

Assessment Unit A2 1

assessing

Pure Mathematics



[AMT11]

AMT11

TUESDAY 6 JUNE, AFTERNOON

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 eleven** 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 $\ln z \equiv \log_e z$

13356



36AMT1101

[3]

[Turn over

13356



36AMT1103

(iii) Hence find the perimeter of the minor segment ABC.

[3]

13356



36AMT1104

2 (a) Solve the following

$|4x - 1| > 5$

[4]

[illegible]

[Turn over

13356



36AMT1105

.....

.....

.....

13356



- 3 The graph in **Fig. 2** below shows the function $y = x^2 \sqrt{x^3 + 1}$

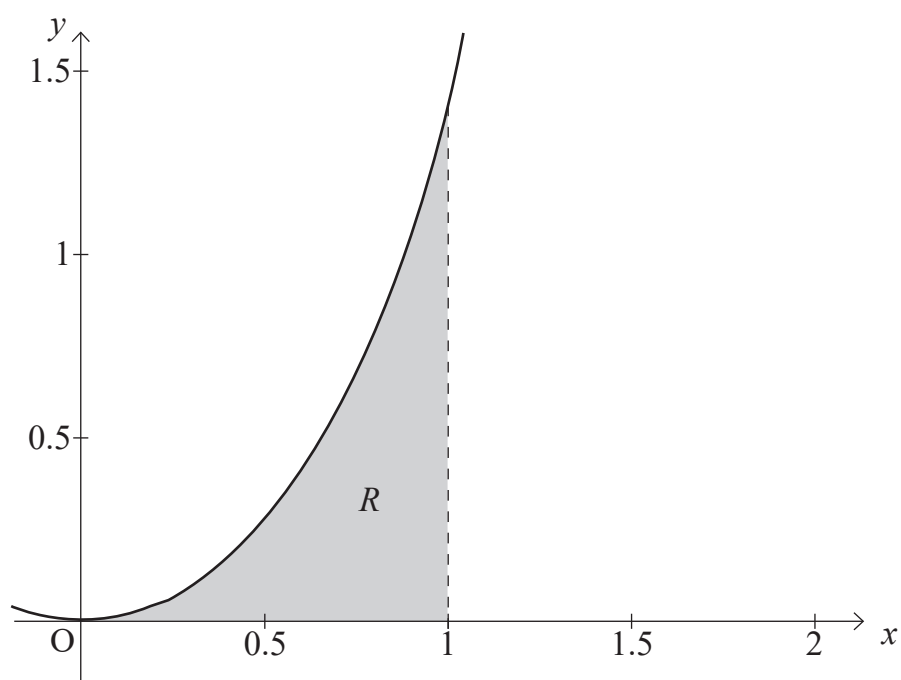


Fig. 2

The region R is the area enclosed between the curve $y = x^2 \sqrt{x^3 + 1}$, the x -axis and the line $x = 1$

- (i) Find an approximation for the shaded area R using the trapezium rule with 4 strips. [5]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....



.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

The region R in **Fig. 2** forms a solid when rotated through 2π radians about the x -axis.

(ii) Find the volume of this solid. [6]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

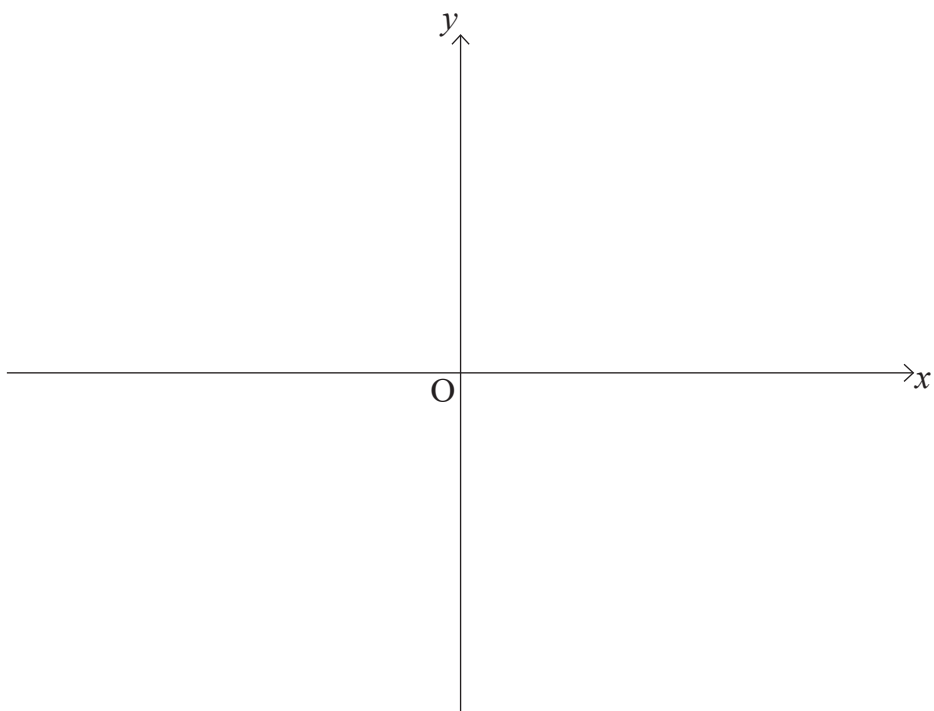
[Turn over



4 The function $f(x) = \sin^{-1} x$

(i) Sketch the graph of $y = f(x)$

[3]



(ii) State clearly the domain and range for this function.

[2]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....



$$g(x) = 3 + 2 \sin^{-1}x$$

[illegible]

13356



5 (i) Express $f(x) = \frac{25x}{(x-2)(x+3)^2}$ in partial fractions.

[7]



.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(ii) Hence find the exact value of $\int_0^1 f(x) \, dx$ [6]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

[Turn over]







BLANK PAGE

DO NOT WRITE ON THIS PAGE

(Questions continue overleaf)

13356

[Turn over



36AMT1115

[illegible][illegible]

- [illegible]

[illegible][illegible]

7 (a) Using the compound angle formula for $\cos(A + B)$ prove that

$$\cos 2A \equiv 1 - 2 \sin^2 A \quad [3]$$

This image shows a full page of a handwriting practice worksheet. It consists of multiple sets of three horizontal dotted lines spaced evenly down the page, providing a guide for letter height and placement. The background is plain white, and there are no other markings or text present.

[3]

[illegible]

13356



36AMT1119

[4]

[illegible]

13356



36AMT1121

8 (a) A curve is defined by the equation

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

Find $\frac{dy}{dx}$ in terms of x and y .

[8]

[illegible]

13356

[Turn over



36AMT1123

- [9]

This image shows a full page of white paper with horizontal dotted lines, resembling notebook paper. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings present.

13356

[Turn over



36AMT1125

13356

[Turn over]



36AMT1127

- 9 (a) The graphs of the functions $f(x) = e^x$ and $g(x) = x + 4$ intersect at the point where $x = a$.

- (i) Show that the value of a lies between $x = 1$ and $x = 2$ [4]

.....

.....

.....

.....

.....

.....

.....

.....

.....

- (ii) Starting with $x_0 = 1.5$ use the Newton-Raphson method twice to find a better approximation for the value of a . [6]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....



$$x = \operatorname{cosec}^2 t, \quad y = \cot t$$

where $0 < t < \pi$

Find an expression for $\frac{dy}{dx}$ in terms of t .

[7]

[illegible]

[Turn over

13356



36AMT1129

- 10 A cylindrical water tank is leaking water. A student believes that the rate of change of depth, D metres, of water in the tank is proportional to the square of the depth at time t minutes.

(i) Using this model, form a differential equation.

[2]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

The initial depth of water in the tank was 3 m and after 4 minutes the depth of water in the tank had reduced to 1.2 m.

(ii) By solving the differential equation, find the time it will take for the depth of water in the tank to drop to 0.5 m.

[10]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....



[Turn over

13356



36AMT1131

11 (a) Find the exact value of

$$\int_0^{\frac{\pi}{6}} (\sin x + \cos x)^2 dx \quad [7]$$

[illegible]

[illegible]

[Turn over

13356



36AMT1133

(b) The graphs of the functions

$$f(x) = x \ln x$$

and

$$g(x) = x + 1$$

are shown in **Fig. 3** below.

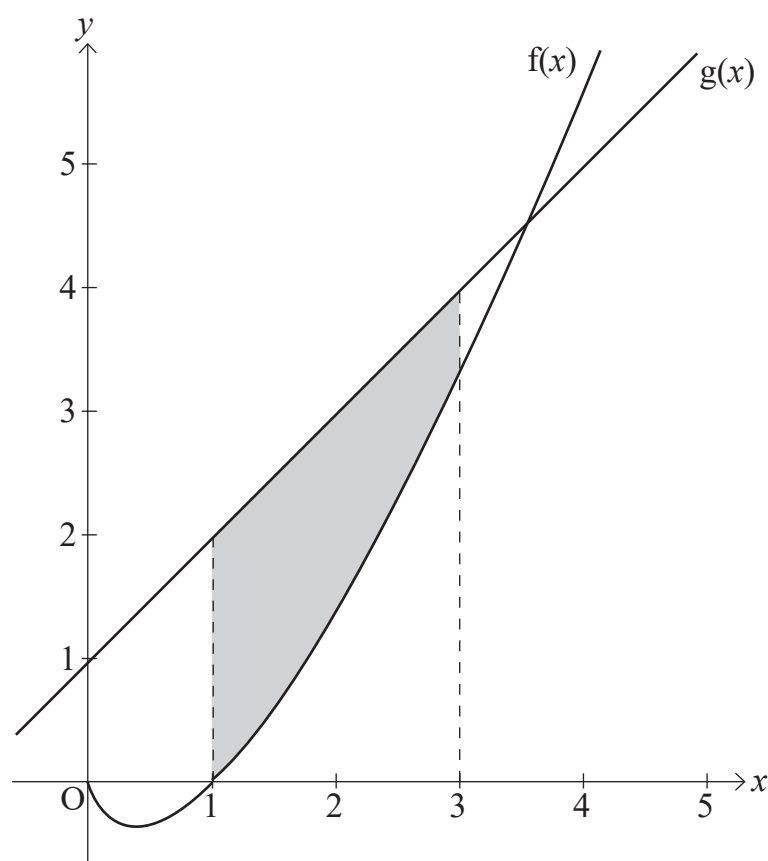


Fig. 3

Find the exact value of the shaded area.

[11]

.....

.....

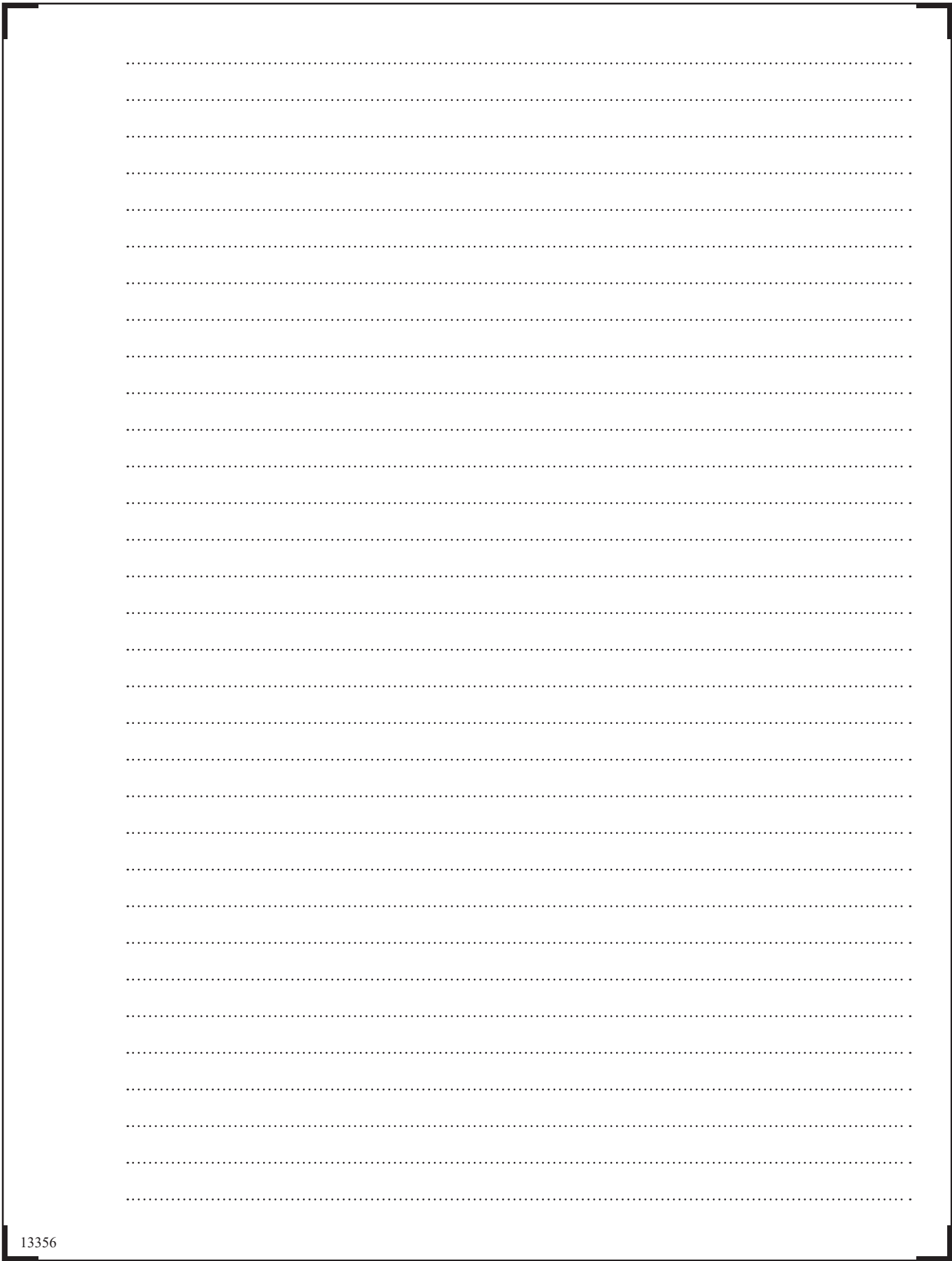
.....

.....

.....

.....





36AMT1135

THIS IS THE END OF THE QUESTION PAPER

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	

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.

