

New
Specification



Rewarding Learning

ADVANCED
General Certificate of Education

Centre Number

--	--	--	--	--

Candidate Number

--	--	--	--

Mathematics

Assessment Unit A2 1

assessing

Pure Mathematics



[AMT11]

AMT11

Assessment

TIME

2 hours 30 minutes.

Assessment Level of Control:

Tick the relevant box (✓)

Controlled Conditions	
Other	

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 $\ln z \equiv \log_e z$

12355



44AMT1101

- 1 Fig. 1 below shows the rotor blades for the propeller of a boat.

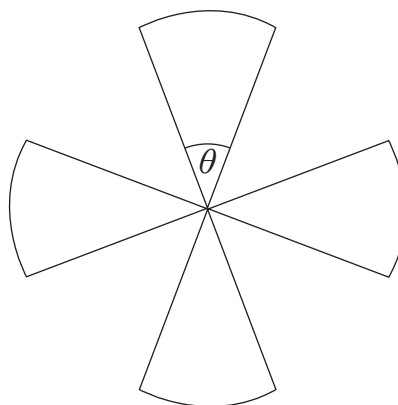


Fig. 1

They are made up of four equal sectors of a circle of radius 30 cm.

- (i) If the total area of the blades is $300\pi \text{ cm}^2$, find the exact value of θ in radians. [3]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....



[3]

This image shows a single sheet of white paper with horizontal blue ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

12355



2 (a) State whether the following sequences diverge, converge or oscillate:

(i) $\frac{n}{n^2 + 1}$

[1]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(ii) $\sin\left(\frac{n\pi}{6}\right)$

[1]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....



[illegible]

$$\sqrt{1-3x}$$

in ascending powers of x up to and including the term in x^3 [5]

This image shows a full page of a handwriting practice worksheet. It consists of approximately 20 horizontal rows. Each row is defined by two parallel dotted lines, creating a series of uniform gaps for letter height. The entire page is otherwise blank, with no margins, text, or other markings.

[Turn over

12355



44AMT1105

[illegible]

[5]

[illegible]

12355



44AMT1107

- (b) Part of a logo for a ski company can be modelled by the area between the curves $y = 4x - x^2$ and $y = x^2 - 6$ as shown in **Fig. 2** below.

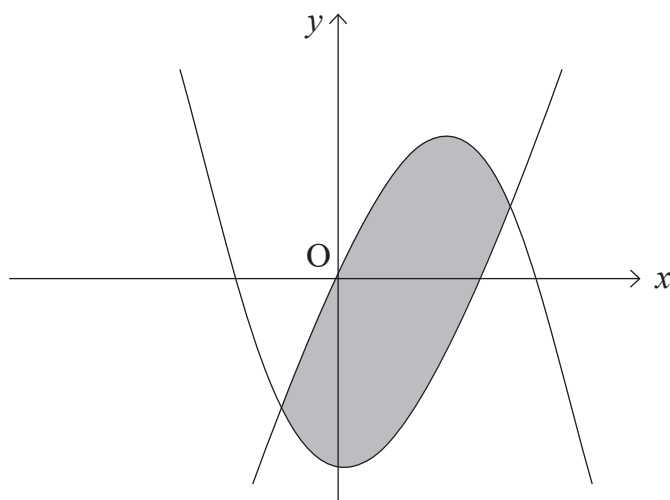


Fig. 2

Use calculus to find this area.

[7]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....



[Turn over

12355



44AMT1109

[4]

[illegible]

(ii) $y = \frac{\cot x}{e^{4x}}$

[4]

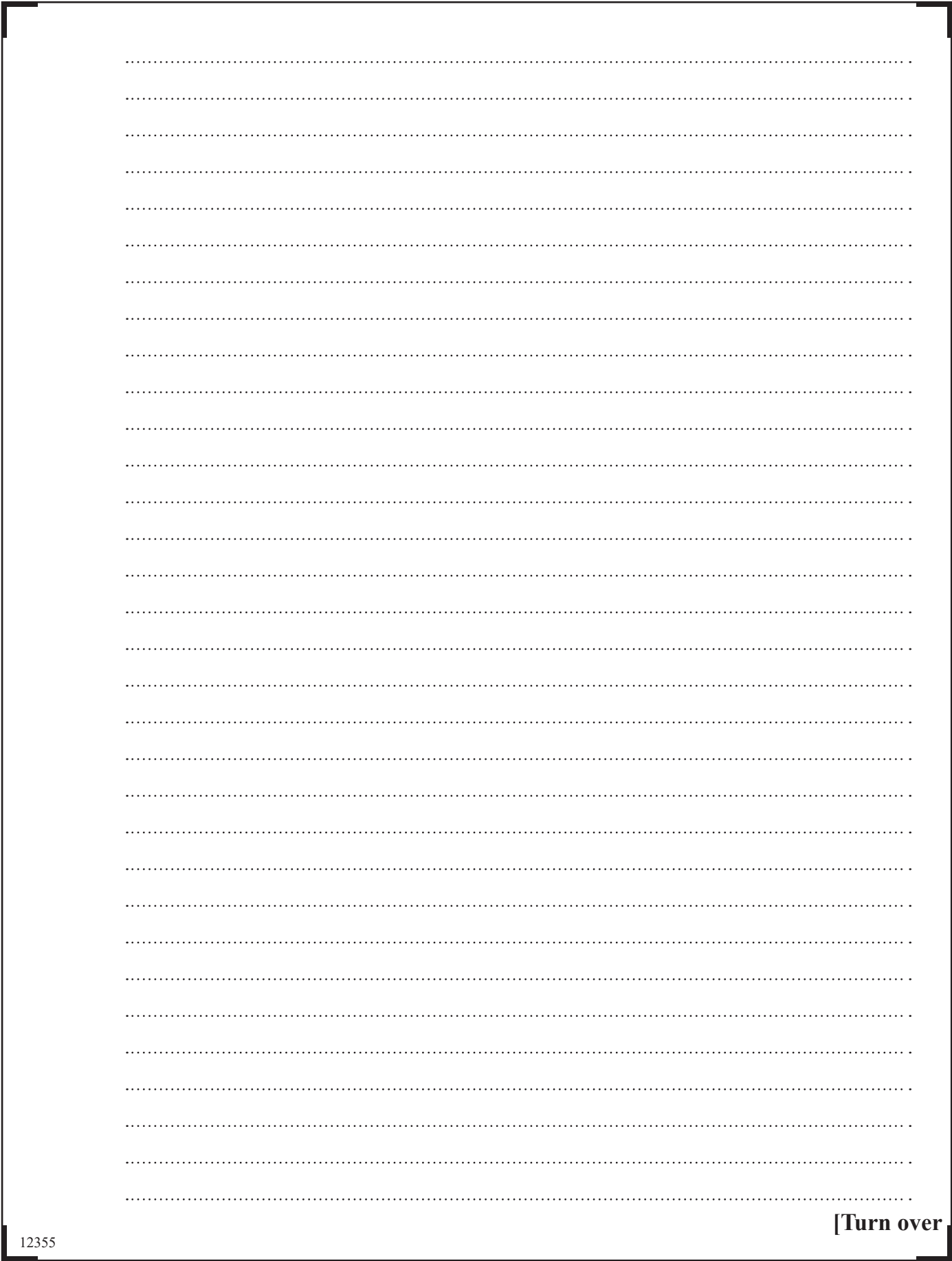
[Turn over

12355



44AMT1111





5 (i) Write the following expression in partial fractions.

$$\frac{3x^2 - 10x + 5}{(x + 1)(x - 2)^2}$$

[6]



[Turn over

12355



44AMT1115

(ii) Hence show that

$$\int_0^1 \frac{3x^2 - 10x + 5}{(x+1)(x-2)^2} dx = \ln 2 - \frac{1}{2}$$

[6]

12355



44AMT1116

[Turn over

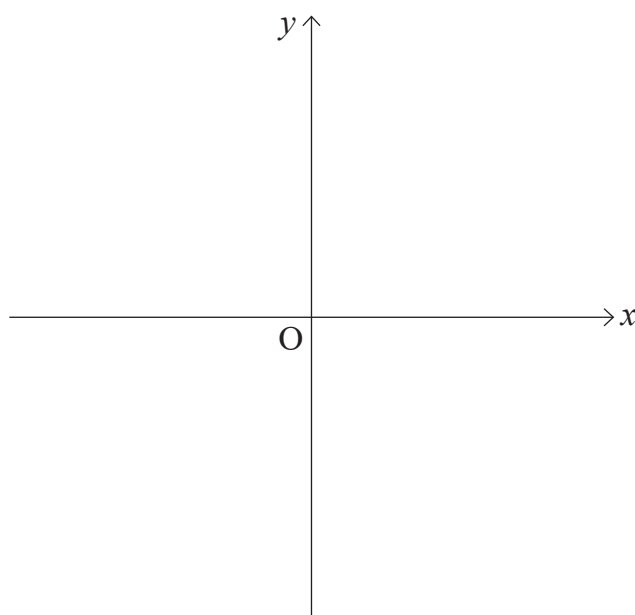
12355



44AMT1117

- 6 (a) Sketch the graph of $y = \sin^{-1}(x)$ on the axes below for $-1 \leq x \leq 1$

[2]



- (b) Express

$$\cos x - \sqrt{3} \sin x$$

in the form $R \cos(x + \alpha)$ where R is an integer and $0 < \alpha < 90^\circ$

[7]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....



[Turn over

12355



44AMT1119

[4]

12355



44AMT1121

- (b) The graph of the function $y = f(x)$ is sketched below in **Fig. 4**
The graph cuts the x -axis at $A(2, 0)$ and has an asymptote of $x = 1$

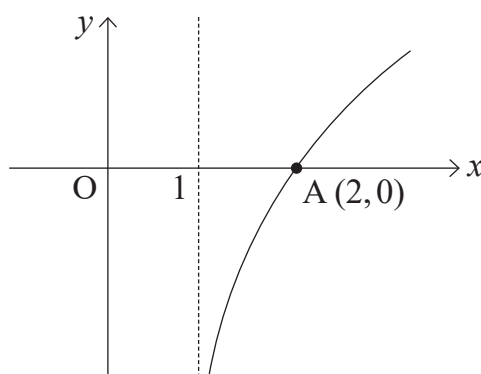


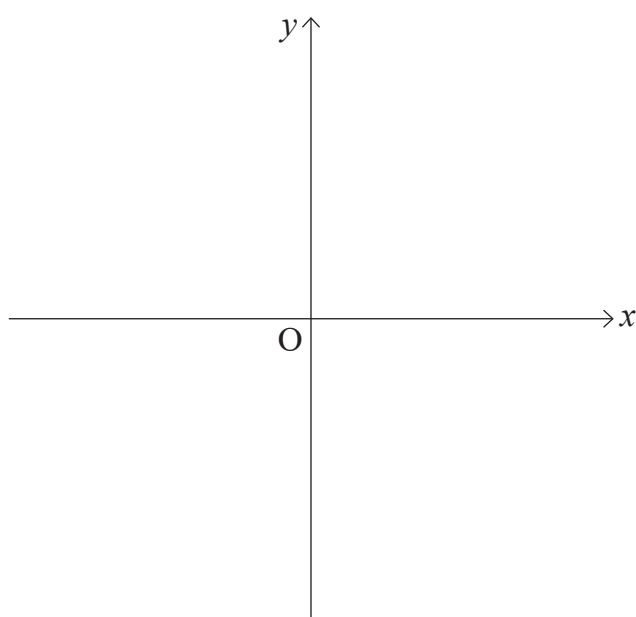
Fig. 4

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

$$y = f(2x) + 3$$

and clearly label the image of A and the asymptote.

[3]

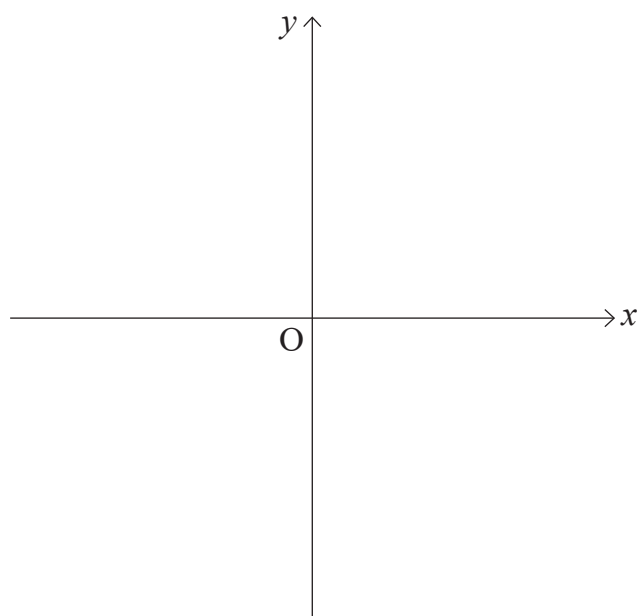


(ii) On the axes below, sketch the graph of

$$y = -f(x + 2)$$

and clearly label the image of A and the asymptote.

[3]



(c) The functions f and g are defined as:

$$f(x) = \frac{10}{x-1} \quad x \in \mathbb{R}, x > 1$$

$$g(x) = e^{3x} \quad x \in \mathbb{R}, x > 0$$

(i) State the range of $f(x)$ and the range of $g(x)$. [2]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

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

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....



[3]

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.

12355



8 Find the equation of the tangent to the curve

$$x^2 + 5y \ln x - xy^2 = 0$$

at the point $(1, -1)$.

[11]

[illegible]

12355

[Turn over



44AMT1127

9 (a) Find

$$\int \ln x \, dx$$

[5]

12355



44AMT1128



BLANK PAGE

DO NOT WRITE ON THIS PAGE

(Questions continue overleaf)

12355

[Turn over



44AMT1129

(b) Using the substitution $x = \frac{2}{3} \sin \theta$ evaluate

$$\int_0^{\frac{1}{3}} \sqrt{4 - 9x^2} \, dx$$

[12]

12355



[Turn over

12355



44AMT1131

12355

[Turn over



44AMT1133

[4]

[2]

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.

12355



[Turn over

12355



44AMT1137

(ii) Using $\frac{d^2y}{dx^2}$ classify this stationary point.

[6]

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

[Turn over

12355



44AMT1139

THIS IS THE END OF THE QUESTION PAPER



44AMT1141

BLANK PAGE
DO NOT WRITE ON THIS PAGE

12355



44AMT1142



BLANK PAGE

DO NOT WRITE ON THIS PAGE

12355



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.

