

New
Specification



Rewarding Learning

ADVANCED
General Certificate of Education
2019

Centre Number

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Candidate Number

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Mathematics

Assessment Unit A2 1

assessing

Pure Mathematics



[AMT11]

AMT11

TUESDAY 28 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 H.B. 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 $\ln z \equiv \log_e z$

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40AMT1101

2 A curve is defined parametrically by

$$x = at^2 \quad \text{and} \quad y = 3at$$

where a is a constant and t is the parameter.

Find the Cartesian equation of this curve.

[4]

[illegible]

[Turn over



[illegible]

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40AMT1105

4 (i) Prove that

$$\operatorname{cosec} 2\theta - \cot 2\theta \equiv \tan \theta \quad [7]$$

[illegible]

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5 (a) A function f is defined by

$$f: x \rightarrow x^2 - 8, \quad x \in \mathbb{R}, \quad x \geq 0$$

(ii) State the range of the function $f(x)$. [1]

[illegible]

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

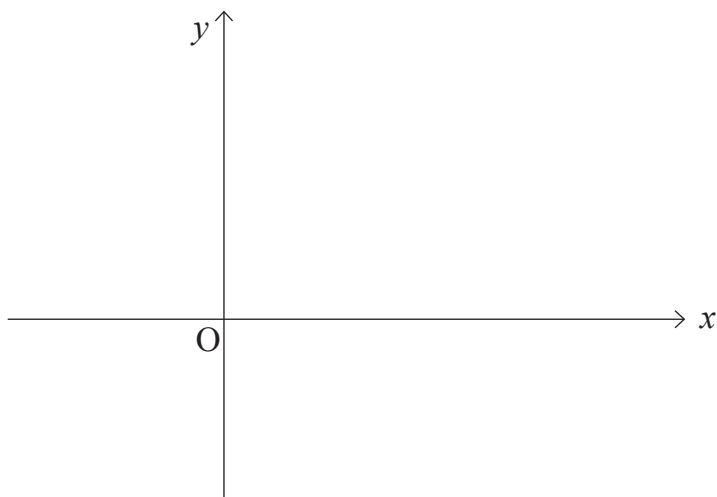
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A function g is defined by

$$g: x \rightarrow |x - 3|, \quad x \in \mathbb{R}$$

(iii) On the axes below sketch the graph of $y = g(x)$. [2]



(iv) Find the composite function $gf(x)$. [2]

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[Turn over]



(b) The graph of the function $y = h(x)$ is sketched in **Fig. 2** below.

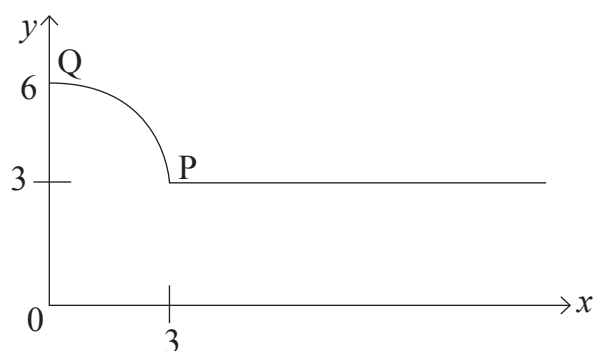


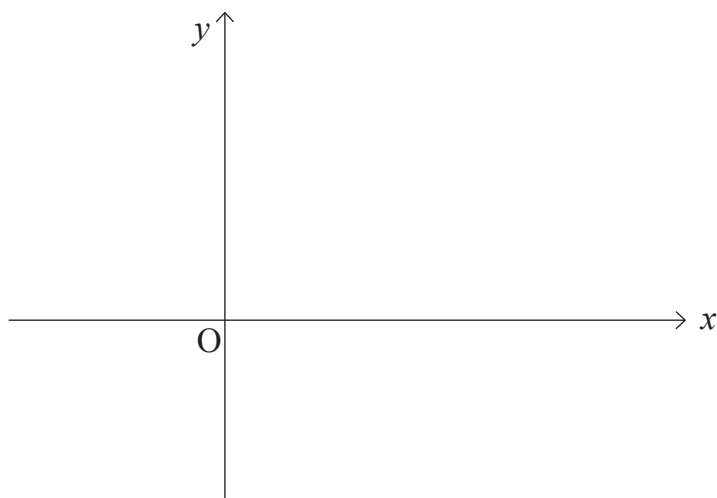
Fig. 2

(i) On the axes below sketch the graph of

$$y = \frac{1}{3}h(3x)$$

and clearly label the images of the points P and Q.

[2]

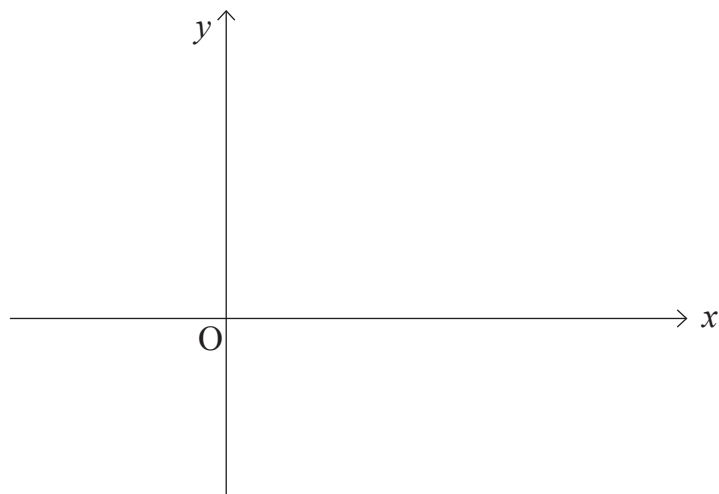


(ii) On the axes below sketch the graph of

$$y = 6 - h(x)$$

and clearly label the images of the points P and Q.

[2]



[Turn over]



- 6** The expression $8 \sin x + 15 \cos x$ can be written in the form $R \sin(x + \alpha)$, where R is an integer and $0^\circ \leq \alpha \leq 90^\circ$

(i) Find the values of R and α .

[6]

[illegible]



[illegible]

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 gaps between them. There are no margins, text, or other markings on the page.

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40AMT1115



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

$$\int_2^3 \frac{x^2}{(x+3)(x-1)} dx \quad [1]$$

[illegible]

- 8 The population, P , in a housing development grows at a rate proportional to the population at any time t (years).

This can be modelled by the differential equation

$$\frac{dP}{dt} = kP$$

where k is a constant.

The initial population is P_0

- (i) Show that

$$P = P_0 e^{kt} \quad [6]$$

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- [illegible]

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[1]

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9 A curve has the equation

$$y = (x - 5) \ln x$$

(i) Show that

$$\frac{dy}{dx} = 1 - \frac{5}{x} + \ln x \quad [4]$$

This image shows a full page of a handwriting practice worksheet. It consists of multiple rows of 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 margins or additional markings.

[3]

[Turn over

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40AMT1123

(iii) By taking 2.4 as a first approximation to the x -coordinate of the turning point, use the Newton Raphson method once to find a better approximation. [5]



[Turn over

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40AMT1125

10 (a) Find

$$\int x^{-\frac{1}{2}} \ln x \, dx \quad [7]$$



[Turn over

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40AMT1127

[Turn over

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40AMT1129



-



[6]

[illegible]

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40AMT1131



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[Turn over

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40AMT1133

The first term of an arithmetic progression is 7 and the last term is 79
The sum of the progression is 1075

(ii) Find the number of terms. [3]

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(iii) Find the common difference. [3]

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[Turn over



- (b)** A salesman receives a bonus at the end of each year and decides to invest this money in a savings account.

At the end of Year 1 he invests £400

At the end of Year 2 he invests a further £400 and receives 2% interest on the first year's £400

At the end of Year 3 he invests a further £400 and 2% interest is added to the total sum of money which he has accumulated during the first two years.

- (i) Show that he has £1,224.16 in his account at the end of Year 3 [4]

[illegible]

-



(iii) Hence find the least number of years until his investment exceeds £7,000 [4]

[illegible]

THIS IS THE END OF THE QUESTION PAPER





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40AMT1139

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For Examiner's use only	
Question Number	Marks
1	
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Total Marks	
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Examiner Number

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