



Rewarding Learning

ADVANCED  
General Certificate of Education  
2015

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## Mathematics

Assessment Unit C3

*assessing*

Module C3: Core Mathematics 3

MV18

[AMC31]

WEDNESDAY 13 MAY, MORNING

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### TIME

1 hour 30 minutes, plus your additional time allowance.

### INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number on the Answer Booklet provided.

Answer **all eight** questions.

Show clearly the full development of your answers.

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 75

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  $\ln z \equiv \log_e z$

**Answer all eight questions.**

**Show clearly the full development of your answers.**

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

- 1 Use Simpson's Rule with four strips to find an approximate value for

$$\int_{0.1}^{0.5} \sin x \cos x \, dx \quad [6 \text{ marks}]$$

- 2 A number of goldfish were introduced into a garden pond. After  $t$  years the number of goldfish,  $N$ , can be modelled by the equation

$$N = 5e^{0.25t} \quad t \geq 0$$

- (i) Find the number of goldfish that were introduced into the garden pond. [1 mark]

- (ii) Find the number of complete years it would take for the number of goldfish to double. [3 marks]

- (iii) Evaluate  $\frac{dN}{dt}$  when  $t = 4$  and state what this value represents. [4 marks]

**3 (a) Simplify**

$$\frac{12x + 18}{2x^2 + 5x + 3} - \frac{2x + 3}{x + 1} \quad [4 \text{ marks}]$$

**(b) Write**

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

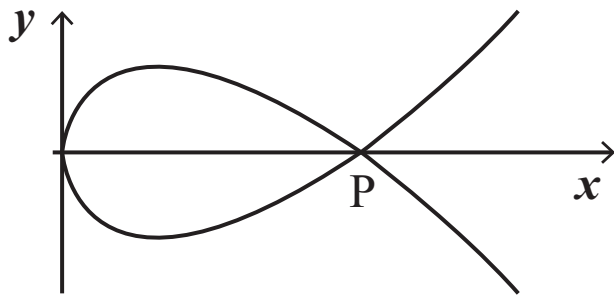
in partial fractions. [6 marks]

**4** In the binomial expansion, in ascending powers of  $x$ , of

$$(1 + ax)^n$$

the coefficients of  $x$  and  $x^2$  are  $-\frac{1}{4}$  and  $-\frac{1}{32}$  respectively.  
Find the values of  $a$  and  $n$ . [7 marks]

5 A child's drawing of a fish is shown in **Fig. 1** below.



**Fig. 1**

P is a point where the curve crosses the  $x$ -axis.

The curve can be modelled by the parametric equations

$$x = 3t^2 \quad y = 3t - t^3$$

The corresponding Cartesian equation of the curve has the form

$$y^2 = ax^3 + bx^2 + cx$$

(i) Find  $a$ ,  $b$  and  $c$ . [4 marks]

(ii) Find P. [3 marks]

6 Find the equation of the normal to the curve

$$y = x \ln x^2$$

at the point where  $x = -1$  [8 marks]

7 (a) (i) Sketch the graph of

$$y = \left| \tan \frac{\theta}{2} \right|$$

where  $0 \leq \theta \leq 4\pi$  [2 marks]

(ii) Find the exact solutions of

$$\left| \tan \frac{\theta}{2} \right| = 1$$

where  $0 \leq \theta \leq 4\pi$  [4 marks]

(b) (i) Prove the identity

$$\frac{\operatorname{cosec} \theta}{\operatorname{cosec}^2 \theta - 1} \equiv \sec \theta \tan \theta \quad [6 \text{ marks}]$$

(ii) Hence solve the equation

$$\frac{\operatorname{cosec} \theta}{\operatorname{cosec}^2 \theta - 1} = 2 \tan \theta$$

where  $-\pi < \theta < 0$  [6 marks]

8 (a) Find

$$\frac{d}{dx} \left( \frac{\cot^2 x}{3x - 2} \right) \quad [6 \text{ marks}]$$

(b) Find

$$\int \frac{1}{\cos^2 4x} + \frac{3}{(3 - 4x)} + 5e^x + \frac{\tan x}{\cos x} dx \quad [5 \text{ marks}]$$

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**THIS IS THE END OF THE QUESTION PAPER**

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