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General Certificate of Education  
2015

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# Mathematics

Assessment Unit C3

*assessing*

Module C3: Core Mathematics 3

[AMC31]

WEDNESDAY 13 MAY, MORNING

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## TIME

1 hour 30 minutes.

## 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 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  $\ln z \equiv \log_e z$

**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

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

- 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]
- (ii) Find the number of complete years it would take for the number of goldfish to double. [3]
- (iii) Evaluate  $\frac{dN}{dt}$  when  $t = 4$  and state what this value represents. [4]

- 3 (a)** Simplify

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

- (b) Write

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

in partial fractions. [6]

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

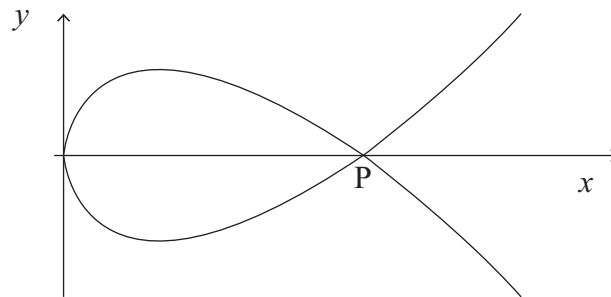
$$(1 + ax)^n$$

the coefficients of  $x$  and  $x^2$  are  $-\frac{1}{4}$  and  $-\frac{1}{32}$  respectively.

Find the values of  $a$  and  $n$ .

[7]

- 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]

- (ii) Find P.

[3]

- 6 Find the equation of the normal to the curve

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

at the point where  $x = -1$

[8]

7 (a) (i) Sketch the graph of

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

where  $0 \leq \theta \leq 4\pi$

[2]

(ii) Find the exact solutions of

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

where  $0 \leq \theta \leq 4\pi$

[4]

(b) (i) Prove the identity

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

[6]

(ii) Hence solve the equation

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

where  $-\pi < \theta < 0$

[6]

8 (a) Find

$$\frac{d}{dx} \left( \frac{\cot^2 x}{3x - 2} \right)$$

[6]

(b) Find

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

[5]

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

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