



ADVANCED  
General Certificate of Education  
January 2012

## Mathematics

Assessment Unit C3

*assessing*

Module C3: Core Mathematics 3

[AMC31]



TUESDAY 17 JANUARY, MORNING

### 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 Simplify

$$\frac{x^2 - 16}{x^2 - 2x - 8} \times \frac{x^2 + 5x + 6}{x + 4} \quad [5]$$

2 Differentiate

(i)  $x(x+2)^4$  [3]

(ii)  $\frac{\ln x}{3x+1}$  [4]

3 (a) Find the first 3 terms in the binomial expansion of

$$(8+x)^{\frac{1}{3}} \quad [6]$$

(b) Express  $\frac{x^2+1}{x^2-x}$  in partial fractions. [8]

4 (a) Solve

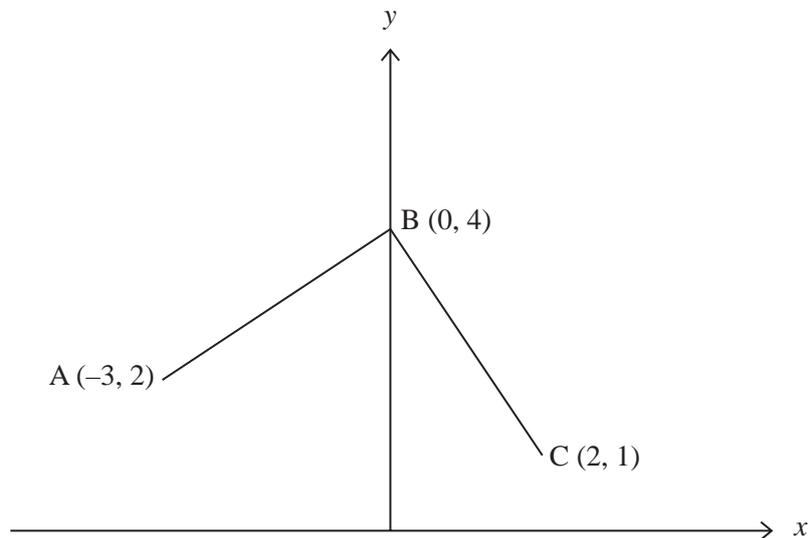
$$|x-5| \leq 3 \quad [4]$$

(b) Sketch the graph of  $y = e^{|x|}$  [2]

- 5 (a) Find a single Cartesian equation, in  $x$  and  $y$ , which is equivalent to the pair of parametric equations

$$x = 3 \sec t \qquad y = 2 \operatorname{cosec} t \qquad [5]$$

- (b) The graph of the function  $y = f(x)$  is sketched in **Fig. 1** below.



**Fig. 1**

Sketch the graph of  $y = 2f(-x)$  stating the coordinates of the images of A, B and C. [3]

- 6 (a) Find the equation of the tangent to the curve

$$y = \tan x + \sin 4x$$

at the point where  $x = \frac{\pi}{4}$  [7]

- (b) Find

$$\int \cos x + \frac{x^2 + 1}{x} dx \qquad [4]$$

7 Fig. 2 below shows a bell tent with shaded vertical section ABCD where

$$\begin{aligned} AD &= 0.7 \text{ m} \\ BC &= 2.3 \text{ m} \\ DC &= 2 \text{ m} \end{aligned}$$

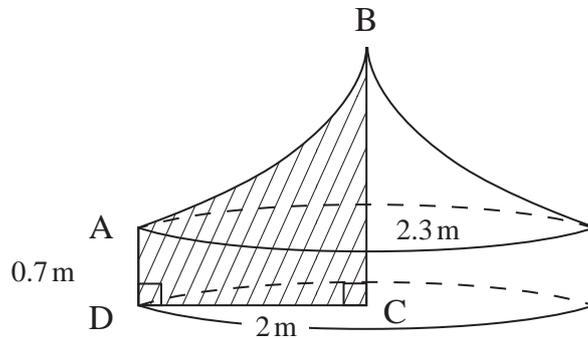


Fig. 2

The tent's manufacturer measures the height of the curve AB at intervals of 0.5 m along DC. The measurements are shown in Fig. 3 below.

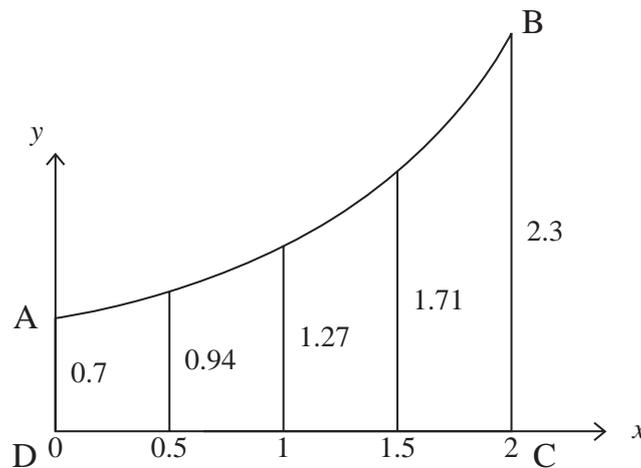


Fig. 3

(i) Use Simpson's rule with 5 ordinates to find an approximation to the area ABCD. [4]

The manufacturer assumes that the curve AB can be modelled by the function  $y = 0.7e^{kx}$

(ii) Using  $BC = 2.3$ , show that  $k \approx 0.595$  [3]

(iii) By integrating the function  $y = 0.7e^{0.595x}$ , find an estimate for the area ABCD. [5]

8 (a) Prove that

$$\operatorname{cosec} x - \sin x \equiv \cot x \cos x$$

[5]

(b) Solve the equation

$$\cot^2 \theta = \operatorname{cosec} \theta + 5$$

$$\text{for } -\frac{\pi}{2} \leq \theta \leq \frac{\pi}{2}$$

[7]

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

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