Rewarding Learning

ADVANCED
General Certificate of Education
January 2012

Mathematics

Assessment Unit C3

assessing

Module C3: Core Mathematics 3

[AMC31]

TUESDAY 17 JANUARY, MORNING

AMC31

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

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

2 Differentiate

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

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

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

$$(8+x)^{\frac{1}{3}}$$

[6]

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

4 **(a)** Solve

$$|x-5|\leqslant 3$$

[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

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

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

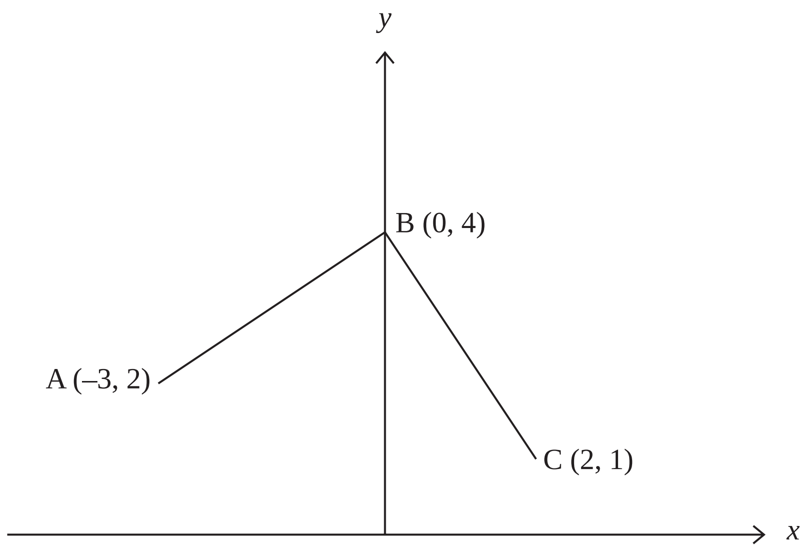

Fig. 1

Sketch the graph of $y = 2\mathrm{f}(-x)$ 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

$$\int \cos x + \frac{x^2 + 1}{x} \, \mathrm{d}x$$ [4]

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

AD = 0.7 m
BC = 2.3 m
DC = 2 m

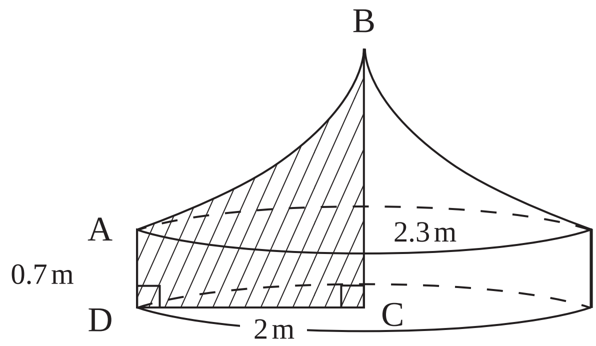

Fig. 2

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.

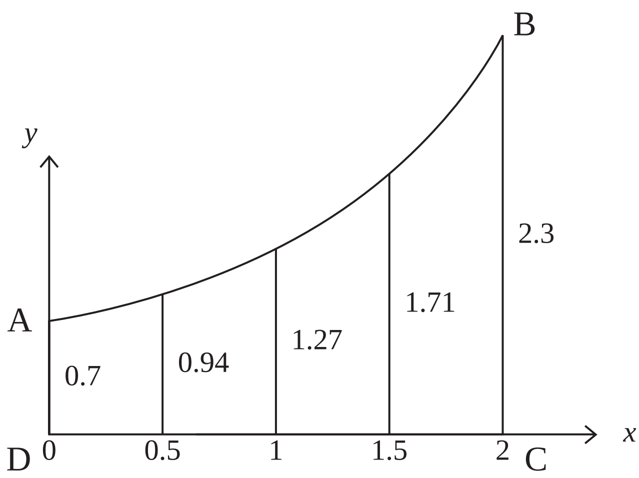

Fig. 3

(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

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

for $-\frac{\pi}{2} \leq \theta \leq \frac{\pi}{2}$ [7]

THIS IS THE END OF THE QUESTION PAPER

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