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ADVANCED
General Certificate of Education
January 2011

Mathematics

Assessment Unit C3

assessing

Module C3: Core Mathematics 3

[AMC31]

FRIDAY 14 JANUARY, AFTERNOON

TIME

1 hour 30 minutes.

INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number on the Answer Booklet provided.
Answer **all seven** 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 $\ln z \equiv \log_e z$

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Answer all seven questions.

Show clearly the full development of your answers.

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

1 Simplify

$$\frac{x^2 + x - 6}{x^2 - 9} \div \frac{x - 2}{4}$$ [5]

2 A curve is defined by the parametric equations

$$x = \sin\theta + 1 \qquad\qquad y = 2\cos\theta - 1$$

(i) Find the cartesian equation of this curve. [4]

(ii) Find the points where this curve crosses the x-axis. [4]

3 **Fig. 1** below shows the graph of $y = \ln x$

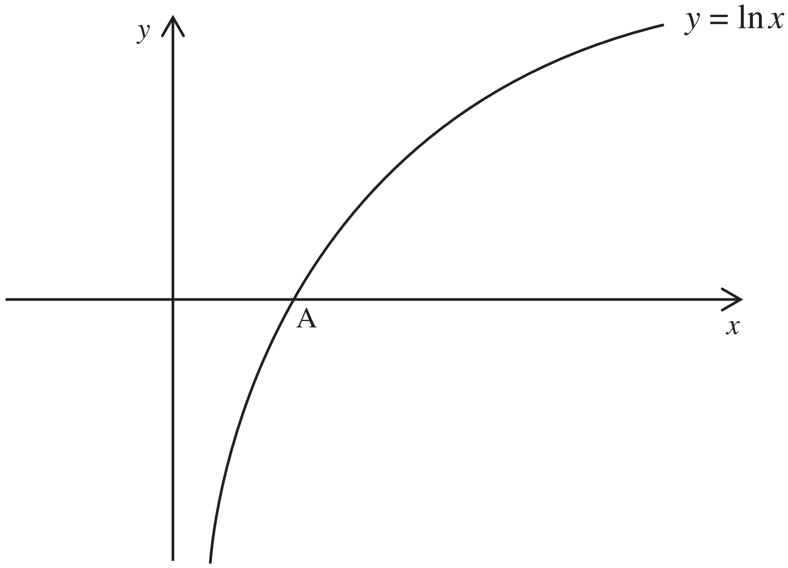

Fig. 1

(i) Sketch the graph of

$$y = \ln(x + 2)$$

showing the vertical asymptote.
Write down the coordinates of A′, the image of the point A. [3]

(ii) Sketch the graph of

$$y = |\ln(x + 2)|$$ [2]

(iii) Find the exact values of x for which

$$|\ln(x + 2)| = 2$$ [5]

4 Solve the equation

$$\tan^2 \theta = 1 - \sec \theta$$

where $0 \leqslant \theta \leqslant 2\pi$ [8]

5 Differentiate with respect to x

(i) $\dfrac{x^2}{\ln x}$ [4]

(ii) $x \sec x$ [3]

(iii) $\cot^3 (2x)$ [5]

6 The cross-section through a half-pipe in a skate park can be modelled by the curve

$$y = \frac{4}{x+1} + \frac{e^x}{5}$$

between $x = 0$ and $x = 3$ metres as shown in **Fig. 2** below:

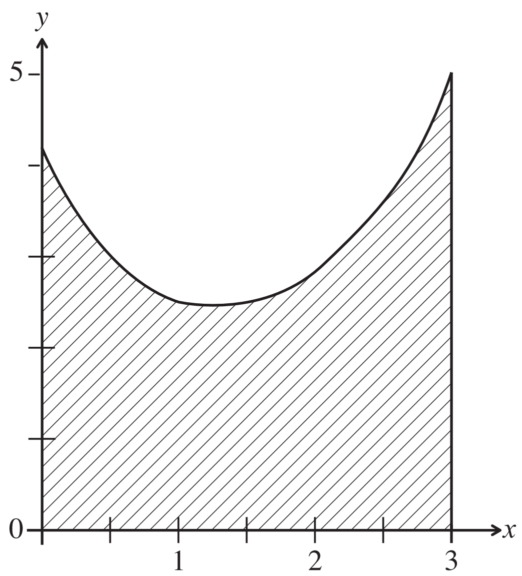

Fig. 2

(i) By using Simpson's Rule with 6 strips, find an approximate value for the shaded area. [6]

(ii) Find the exact value of the shaded area. [7]

7 **(i)** By using partial fractions, show that

$$\frac{2-x}{(1+2x)(3+x)} = \frac{1}{1+2x} - \frac{1}{3+x}$$ [7]

(ii) Hence, using the binomial theorem, expand,

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

in ascending powers of x, up to and including the term in x^2 [9]

(iii) Find the range of values of x for which the expression is valid. [3]

THIS IS THE END OF THE QUESTION PAPER