



ADVANCED  
General Certificate of Education  
January 2011

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## Mathematics

Assessment Unit C3

*assessing*

Module C3: Core Mathematics 3

[AMC31]



FRIDAY 14 JANUARY, AFTERNOON

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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 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  $\ln z \equiv \log_e z$



**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

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

**2** A curve is defined by the parametric equations

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

**(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  $y = \ln x$

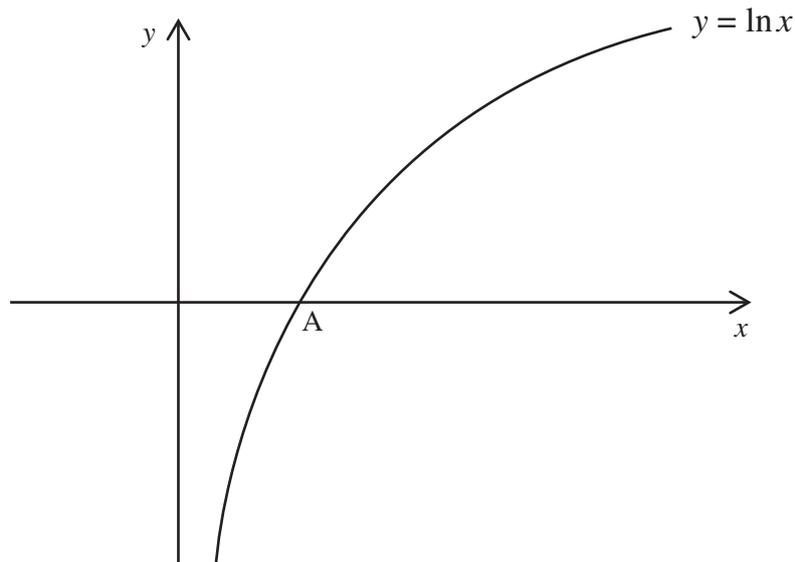


Fig. 1

(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  $0 \leq \theta \leq 2\pi$

[8]

5 Differentiate with respect to  $x$

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

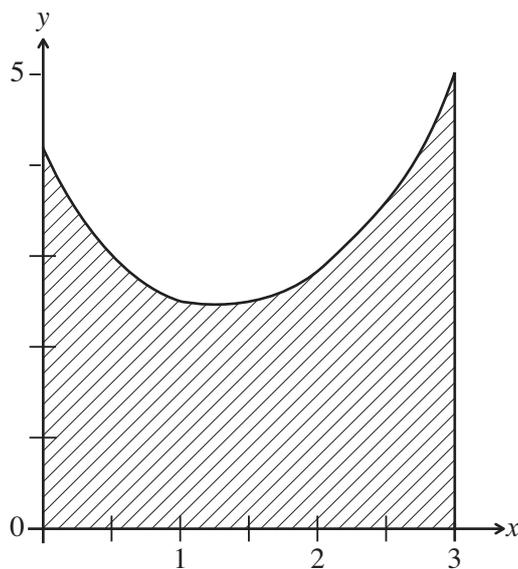
(ii)  $x \sec x$  [3]

(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

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

(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]

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

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