



Rewarding Learning

ADVANCED  
General Certificate of Education  
January 2009

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## Mathematics

### Assessment Unit C3

*assessing*

### Module C3: Core Mathematics 3

[AMC31]



FRIDAY 9 JANUARY, 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 (i) Sketch the graph of

$$y = |2x - 5| \quad [2]$$

- (ii) Solve

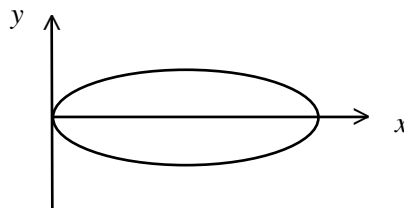
$$|2x - 5| > 10 \quad [4]$$

- 2 The area bounded by the curve  $y = \sqrt{2 + \cos x}$ , the  $x$ -axis and the lines  $x = 0$  and  $x = 3$  is given by

$$\int_0^3 \sqrt{2 + \cos x} \, dx$$

Use Simpson's Rule with 6 strips to find an approximation for this area. [6]

- 3 Part of the new logo for a rugby club is shown in **Fig. 1** below.



**Fig. 1**

It can be modelled by the parametric equations

$$x = 3 + 3 \cos \theta \quad \text{and} \quad y = 2 \sin \theta$$

- (i) Find the corresponding Cartesian equation. [4]

- (ii) Find the coordinates of the points where the curve crosses the  $x$ -axis. [3]

4 (a) Simplify as far as possible

$$\frac{4x^2 - 9}{x^2 + 2x + 1} \div \frac{2x - 3}{2x + 2} \quad [5]$$

(b) Express  $\frac{2x^2 - 9}{x(x - 2)}$  in partial fractions. [9]

5 The temperature,  $C^\circ$  centigrade, of an oven,  $t$  minutes after it has been turned on, is given by the expression

$$C = 180 - 150e^{kt}$$

(i) Find the initial temperature of the oven. [1]

(ii) If the oven takes 5 minutes to reach a temperature of  $130^\circ$  centigrade, show that  $k = -0.22$  correct to 2 decimal places. [4]

(iii) Find the rate at which the temperature is changing after 10 minutes. [4]

6 (a) Differentiate

(i)  $5x \ln(x^2 - 2)$  [4]

(ii)  $\frac{\sin x}{\cos 3x}$  [4]

(b) Find [5]

$$\int \left( 2 + \frac{2}{x} + e^{3x} + \sec^2 x \right) dx$$

7 Find the first 4 terms in the binomial expansion of

$$\sqrt{4 - x}$$

in ascending powers of  $x$ . [7]

8 (a) Find the **exact** solutions of the equation

$$\tan^2 \theta + 2 \sec^2 \theta = 11$$

in the range  $-\pi < \theta < \pi$

[6]

(b) Prove the identity

$$\frac{\sec \theta - \cos \theta}{\operatorname{cosec} \theta - \sin \theta} \equiv \tan^3 \theta$$

[7]