



Rewarding Learning

ADVANCED
General Certificate of Education
2013

Mathematics

Assessment Unit C4

assessing

Module C4: Core Mathematics 4

[AMC41]

THURSDAY 6 JUNE, 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** The motion of a toy car on a race track can be modelled by the equations

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

Find $\frac{dy}{dx}$ when $t = 2$

[5]

- 2** **a** and **b** are two vectors where

$$\mathbf{a} = t\mathbf{i} + 5\mathbf{j} + \mathbf{k}$$

$$\mathbf{b} = 2t\mathbf{i} + t\mathbf{j} + 2\mathbf{k}$$

- (i)** State the value of t for which the vectors are parallel.

[1]

- (ii)** Find the values of t for which the vectors are perpendicular.

[6]

- 3** **(a)** **(i)** Use partial fractions to find A and B where

$$\frac{4}{x(2-x)} = \frac{A}{x} + \frac{B}{2-x} \quad [4]$$

- (ii)** Hence find

$$\int \frac{4}{2x-x^2} dx \quad [3]$$

- (b)** Use integration by parts to find

$$\int x e^{3x} dx \quad [5]$$

4 The area under the curve

$$y = 2\sqrt{x} + 1$$

between $x = 0$ and $x = 4$ is rotated through 360° about the x -axis.

Find the volume of the body so formed.

[7]

5 (a) Sketch the graph of $y = \cos^{-1} x$, stating its domain.

[3]

(b) Solve the equation

$$\sin(\theta + 30^\circ) - \cos(\theta + 60^\circ) = 1$$

where $-180^\circ \leq \theta \leq 180^\circ$

[8]

6 The rate at which a body loses speed $S \text{ m s}^{-1}$ as it travels through a resistive medium at time t seconds is proportional to the square of its speed at that time.

(i) Model this by a differential equation.

[2]

(ii) If its initial speed is 100 m s^{-1} and after 3 seconds its speed is 60 m s^{-1} , find how much longer it will take to reduce its speed to 30 m s^{-1}

[9]

7 The function h is defined as

$$h(x) = \frac{x+2}{x-3} \quad x \in \mathbb{R} \quad x \neq 3$$

(i) Find the inverse function $h^{-1}(x)$ stating its domain.

[6]

(ii) Rewrite $\frac{x+2}{x-3}$ in the form $a + \frac{b}{x-3}$

[3]

(iii) Write down two functions $f(x)$ and $g(x)$ such that $h(x) = fg(x)$.

Neither $f(x)$ nor $g(x)$ may be the identity function.

[2]

8 Part of the graph of

$$2 \sin x - x = \tan y$$

is shown in **Fig. 1** below.

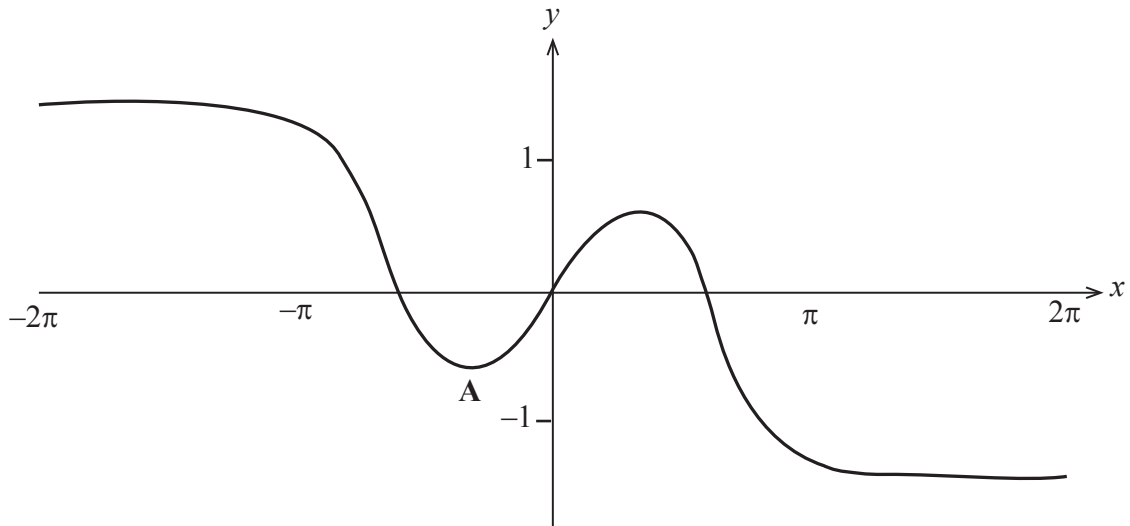


Fig. 1

- (i) Find $\frac{dy}{dx}$ [4]
- (ii) Hence find the coordinates of the turning point labelled **A** in **Fig. 1** above. [5]
- (iii) State the equations of the 2 horizontal asymptotes. [2]

THIS IS THE END OF THE QUESTION PAPER
