



Rewarding Learning

ADVANCED
General Certificate of Education
2013

Mathematics

Assessment Unit C3

assessing

Module C3: Core Mathematics 3

[AMC31]



FRIDAY 17 MAY, 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 Differentiate:

(i) $x \cos x$ [3]

(ii) $\frac{\tan 2x}{x}$ [5]

(iii) $\ln(x^2 + 3)$ [2]

2 (a) Simplify as far as possible

$$\frac{(2x^2 + 7x - 15)(2x - 14)}{(x^2 - 2x - 35)(4x^2 - 9)} \quad [5]$$

(b) Solve the inequality

$$|2x - 3| < 1 \quad [5]$$

3 (i) Find the first 3 terms in the binomial expansion of

$$(1 - 2x)^{\frac{1}{3}} \quad [4]$$

(ii) Hence, clearly showing your method, find an approximation to $\sqrt[3]{0.88}$ without using a calculator. [2]

4 The graph of a function $y = f(x)$ is sketched below in **Fig. 1**

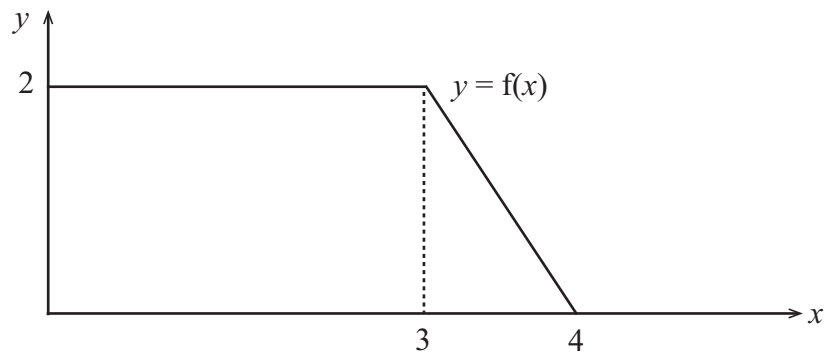


Fig. 1

On separate diagrams sketch the graphs of:

(i) $y = 1 - f(x)$ [3]

(ii) $y = \frac{1}{2} f(x + 2)$ [3]

labelling clearly where the graphs cross or touch the axes.

5 (a) The temperature, C , of an ingot of cooling metal can be modelled by

$$C = 12 + 80 e^{\frac{-t}{30}}$$

where t is measured in minutes.

Find C when $t = 20$ [2]

(b) Find a Cartesian equation of the curve defined parametrically by

$$x = e^{-t} \quad y = 3 + e^{2t} \quad [4]$$

6 (a) (i) Use partial fractions to rewrite

$$\frac{x+10}{(2x-5)x^2} \text{ in the form } \frac{A}{2x-5} + \frac{B}{x} + \frac{C}{x^2}$$

where A , B and C are integers. [6]

(ii) Hence find

$$\frac{d}{dx} \left(\frac{x+10}{(2x-5)x^2} \right) \quad [3]$$

(b) Solve

$$\cot 2\theta = -\frac{4}{3}$$

where $0 \leq \theta \leq 2\pi$ [4]

7 **Fig. 2** below shows the graph of $y = x^2 + 1.3$ and $y = 2 \cos x$.

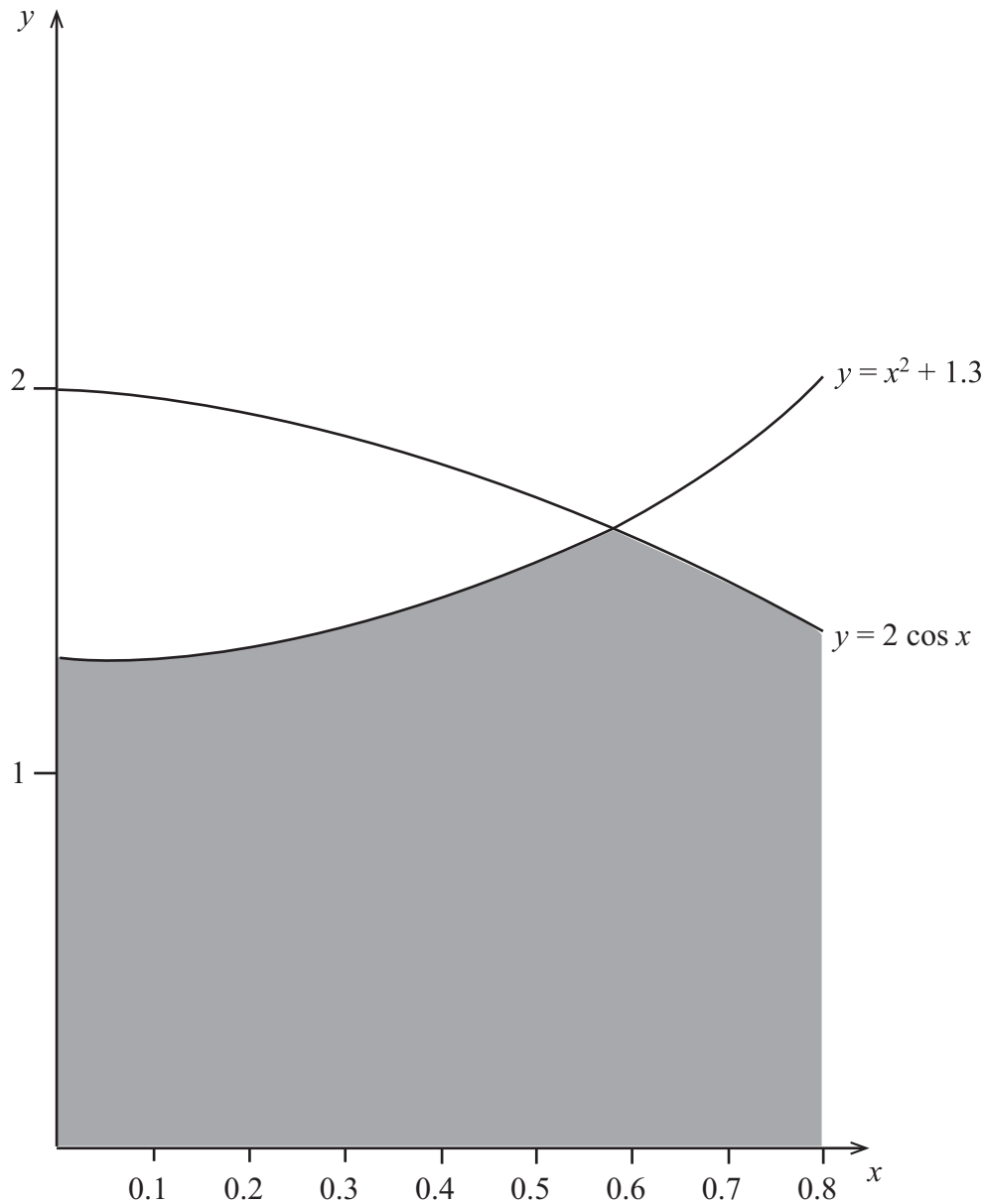


Fig. 2

- (i) Taking $x_0 = 0.5$ as a first approximation, use the Newton-Raphson method twice to find a better approximation to the x -coordinate of the point of intersection of the curves. [8]

A glazier designs a pane of a stained glass window identical to the shaded area in **Fig. 2** above, i.e. the area between the curves, the axes and the line $x = 0.8$

- (ii) Use Simpson's rule with 5 ordinates to find an approximation to the area of the pane. [6]

8 (i) Prove the identity

$$\tan A \sec A + \frac{1}{1 + \sin A} \equiv \sec^2 A \quad [5]$$

(ii) Hence find

$$\int \left(\tan 2x \sec 2x - \frac{3}{x} + e^{2x} + \frac{1}{1 + \sin 2x} \right) dx \quad [5]$$

THIS IS THE END OF THE QUESTION PAPER
