



Rewarding Learning

ADVANCED
General Certificate of Education
2010

Mathematics

Assessment Unit C3

assessing

Module C3: Core Mathematics 3

[AMC31]



WEDNESDAY 2 JUNE, AFTERNOON

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 a 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 Solve

$$|5x + 3| < 2 \quad [4]$$

2 (i) Sketch, on the same diagram, the graphs of

$$y = \sin x \quad \text{and} \quad y = \cos x \quad \text{for } 0^\circ \leq x \leq 360^\circ \quad [2]$$

(ii) Given that $\sin x \equiv \cos(x - a)$, write down a possible value of a . [1]

(iii) Sketch the graph of

$$y = \sin(2x) - 1$$

for $0^\circ \leq x \leq 360^\circ$ [2]

3 (a) Differentiate with respect to x

$$x^2 \ln x \quad [3]$$

(b) Find

$$\int \left(3x^2 + e^{-x} - \operatorname{cosec} x \cot x + \frac{3}{x} \right) dx \quad [5]$$

4 A curve is defined by the parametric equations

$$x = \tan t - 1 \quad y = \cot^2 t + 1$$

Find the cartesian equation of this curve. [5]

- 5 (a) Use partial fractions to rewrite

$$\frac{2x - 7}{(x - 3)^2} \quad [6]$$

- (b) Find the first 3 terms in the binomial expansion of

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

- 6 (a) The equation $4e^{-x} - x = 0$ has a root which is approximately 1.3
Starting with this value for x , use the Newton-Raphson method twice
to find a better approximation to the root. [7]

- (b) The amount of the Carbon-14 isotope remaining in a substance after t years can be written as

$$N = N_0 e^{-kt}$$

where N_0 is the amount of the substance when $t = 0$

The half-life of the Carbon-14 isotope is 5730 years.

- (i) Find the value of the constant k . [3]

- (ii) Calculate what percentage of the isotope will be left after 1000 years. [2]

- 7 (a) Solve the equation

$$4 \sin x + 1 = 3 \operatorname{cosec} x$$

for $0^\circ \leq x \leq 360^\circ$ [7]

- (b) Prove the identity

$$\operatorname{cosec} 2\theta - \cot 2\theta \equiv \tan \theta \quad [6]$$

8 The logo for a ski lift company is shown in **Fig. 1** below.

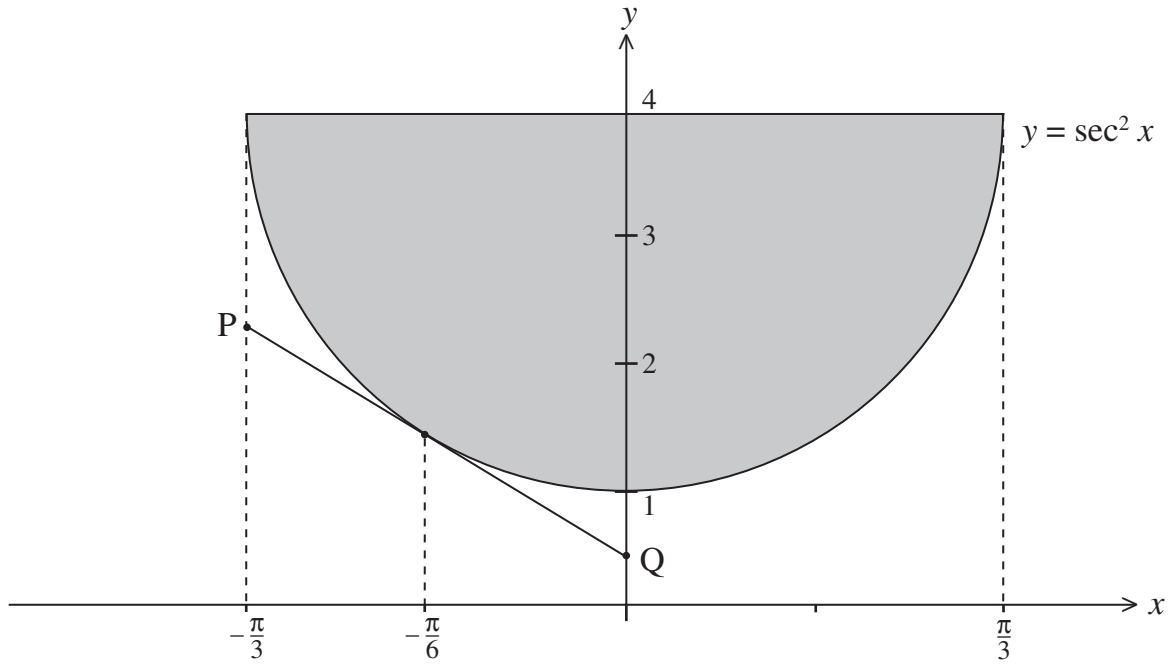


Fig. 1

It can be modelled by a part of the curve $y = \sec^2 x$ between $x = -\frac{\pi}{3}$ and $x = \frac{\pi}{3}$

(i) Find the **exact** area of the shaded region.

[8]

PQ is the tangent to the curve at $x = -\frac{\pi}{6}$

(ii) Find the equation of this tangent.

[7]

THIS IS THE END OF THE QUESTION PAPER
