Rewarding Learning

ADVANCED SUBSIDIARY (AS)
General Certificate of Education
2010

Mathematics

Assessment Unit C2

assessing

Module C2: AS Core Mathematics 2

[AMC21]

AMC21

THURSDAY 27 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 **(i)** Write down the first 5 terms of the sequence defined by the recurrence relationship

$$u_{n+1} = \frac{2}{1+u_n}, \text{ where } n > 0 \text{ and } u_1 = 3$$ [3]

(ii) State if the sequence diverges, converges and/or oscillates. [2]

2 **(i)** Write down the centre of the circle whose equation is

$$x^2 + y^2 + 4y - 21 = 0$$

and find the circle's radius. [4]

(ii) Find the gradient of the tangent to this circle at the point (3, 2). [3]

3 A gold earring can be modelled as a sector of a circle with a triangle removed as shown in **Fig. 1** below.

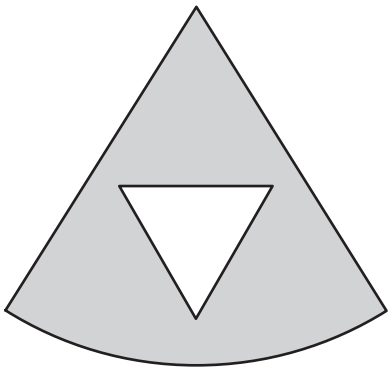

Fig. 1

The sector has angle $\frac{\pi}{4}$ radians and is cut from a circle of radius 3 cm.

(i) Find the area of this sector. [2]

The triangle is equilateral and of side 1 cm.
The gold is 0.1 cm thick.

(ii) Find the volume of gold in the earring. [5]

4 The first, second and third terms of a geometric series are

5, 3 and x.

(i) Find x. [3]

(ii) State why a sum to infinity for this series exists. [1]

(iii) Find the sum to infinity of this series. [2]

5 **(i)** Find the first four terms in the binomial expansion, in ascending powers of x, of

$$(1 + 3x)^4$$ [4]

The first three terms in the binomial expansion, in ascending powers of x, of

$$(1 + x)^{12}$$

are

$$1 + 12x + 66x^2$$

For a certain value of x, where $x \neq 0$, the sum of the first three terms in the binomial expansion of $(1 + x)^{12}$ is equal to the sum of the first four terms in the binomial expansion in **(i)**.

(ii) Find x. [3]

6 **(a)** Find

$$\int 3 - x^{-3}\, dx$$ [3]

(b) **Fig. 2** below shows a sketch of the graph of

$$y = 4x^2 - x^3$$

for $0 \leqslant x \leqslant a$, where $a > 4$

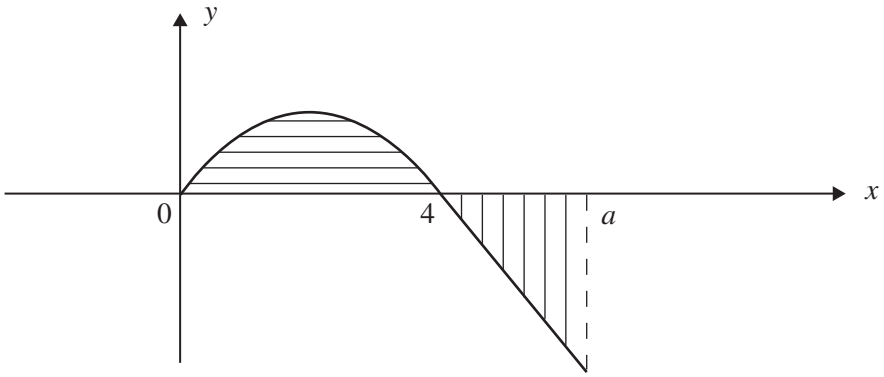

Fig. 2

Given that the two shaded regions have equal areas, find a. [8]

7 **(a)** Solve the equation

$$3\sin^2 x + 8\cos x = 0$$

for $-\pi \leqslant x < \pi$ [7]

(b) Two ships, C and D, leave harbour at 0900 hours.
Ship D travels at a speed of 24 knots on a bearing of 030°
Ship C travels at a speed of 15 knots on a bearing of 140° as shown in **Fig. 3** below.

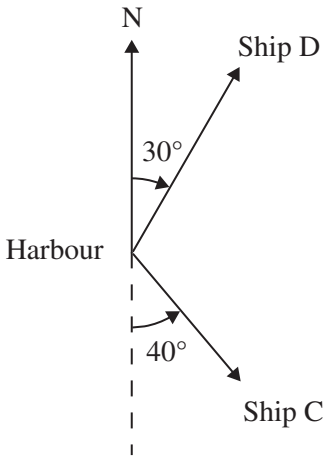

Fig. 3

[1 knot is a speed of 1 nautical mile per hour]

Find the bearing and the distance, in nautical miles, of ship C from ship D at 1200 hours. [10]

8 **(a)** Find x given that

$$3^{2x} = 7$$ [4]

(b) Find x given that

$$\log x + \log x^2 + 2 \log x^3 = 1$$ [5]

(c) Given that

$$\log_2 x - \log_2 y = 6$$

and that

$$2^3 = \frac{1}{z}$$

show that

$$y = z^2x$$ [6]

THIS IS THE END OF THE QUESTION PAPER