Rewarding Learning

ADVANCED SUBSIDIARY (AS)
General Certificate of Education
January 2010

Mathematics

Assessment Unit C2

assessing

Module C2: AS Core Mathematics 2

[AMC21]

AMC21

MONDAY 25 JANUARY, MORNING

TIME

1 hour 30 minutes.

INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number on the Answer Booklet provided.
Answer **all seven** 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 seven questions.

Show clearly the full development of your answers.

Answers should be given to three significant figures unless otherwise stated.

1 A circle has centre C and radius 3
Fig. 1 below shows a sketch of this circle.

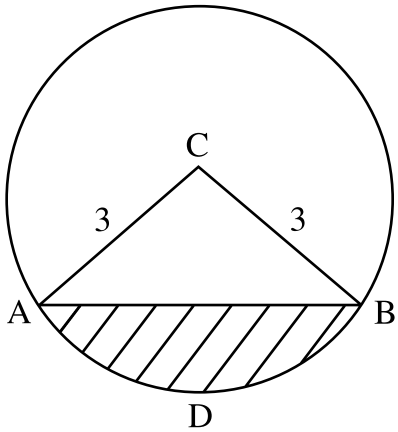

Fig. 1

The chord AB is 4 units long.

(i) Show that the angle ACB is approximately 1.46 radians. [3]

(ii) Find the area of the sector ADBC. [2]

(iii) Hence find the area of the shaded segment. [4]

C has coordinates (2, 1).

(iv) Write down an equation for this circle. [3]

2 **(i)** Given that

$$\frac{(x^2+2)^2}{x^2} = x^2 + B + \frac{C}{x^2}$$

show that $B = C = 4$ [3]

(ii) Hence find

$$\int_1^2 \frac{(x^2+2)^2}{x^2}\,\mathrm{d}x$$

[5]

3 **(i)** Prove that the sum of the first n terms of an arithmetic series, with first term a and common difference d, is

$$S_n = \frac{n}{2}\left[2a + (n-1)d\right]$$ [5]

The sum of the first two terms of an arithmetic series is 2
The 41st term is 475

(ii) Show that the first term and the common difference are –5 and 12 respectively. [7]

(iii) Hence find the sum of the first 20 terms of this series. [2]

4 Find the term in x^3 in the binomial expansion of

$$(2 - x)^{10}$$ [4]

5 The depth of a river of width 60 m is measured at 10 m intervals across its cross-section.

Distance, x, in metres	0	10	20	30	40	50	60
Depth, y, in metres	0	1.16	2.48	5.25	3.79	6.24	1.31

(i) Use the trapezium rule to find an approximate value for the area of the cross-section. [4]

This cross-section of the river is now modelled as the region bounded by the curve

$$y = \frac{1}{180}(x^2 - 60x) \quad \text{for } 0 \leqslant x \leqslant 60$$

and the line $y = 0$

(ii) Using integration, find the area of the cross-section given by the model. [6]

(iii) Suggest one reason why the model may not be a good one. [1]

6 **(a)** Given that

$$\sin A = \frac{p}{q}$$

and that A is acute, find

$$\tan^2 A$$ [4]

(b) Solve

$$\frac{1}{2}\tan x - \sin x = 0$$

for $-180° \leqslant x \leqslant 180°$ [7]

7 **(a)** Write as a single logarithm in base 5

$$\log_5 15 + 2\log_5 2 - \log_{25} 9$$ [8]

(b) A country's population at the end of each year is 5% greater than at the start of that year.
Model the population to be increasing at a constant rate.

(i) Find an expression for the population after t years. [2]

(ii) Find how many years it will take for the population to increase by 50% [5]

THIS IS THE END OF THE QUESTION PAPER