Rewarding Learning

ADVANCED SUBSIDIARY (AS)
General Certificate of Education
2016

Mathematics

Assessment Unit C2
assessing
Module C2: AS Core Mathematics 2

AMC21

[AMC21]
TUESDAY 31 MAY, 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 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 **(a)** The gradient of a curve is given by

$$\frac{dy}{dx} = 4 + \frac{1}{x^2}$$

The point (1, 7) lies on the curve.

Find the equation of the curve. [5]

(b) **Table 1** below shows the coordinates (x, y) of five points on the curve

$$y = (1 + \cos x)^2$$

where x is in radians.

Table 1

x	0	0.5	1	1.5	2
y	4	3.525	a	1.146	b

(i) Find the values of a and b. [2]

(ii) Use the Trapezium Rule with 5 ordinates to find an estimate of

$$\int_0^2 (1 + \cos x)^2 \, dx$$ [3]

2 Initially the number of fish in a lake is 625 000
The population of fish in the lake can be modelled by the recurrence relation

$$u_{n+1} = 1.04u_n - d \qquad u_0 = 625\,000$$

In this relation u_n is the number of fish in the lake after n years and d is the number of fish which are caught each year.

(i) Given that $d = 18\,750$, calculate u_1, u_2 and u_3 and comment briefly on your results. [3]

(ii) Given instead that $d = 125\,000$ and $u_5 = 83\,367.7$, briefly explain what happens to the fish population during the sixth year. [1]

(iii) Find the value of d which would leave the fish population unchanged each year. [2]

3 **(a)** Solve the equation

$$1 + \sin\theta + \cos^2\theta - 2\sin^2\theta = 0$$

where $-180° \leqslant \theta \leqslant 180°$ [5]

(b) The graph of the curve

$$y = x^{\frac{1}{3}} + 4x$$

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

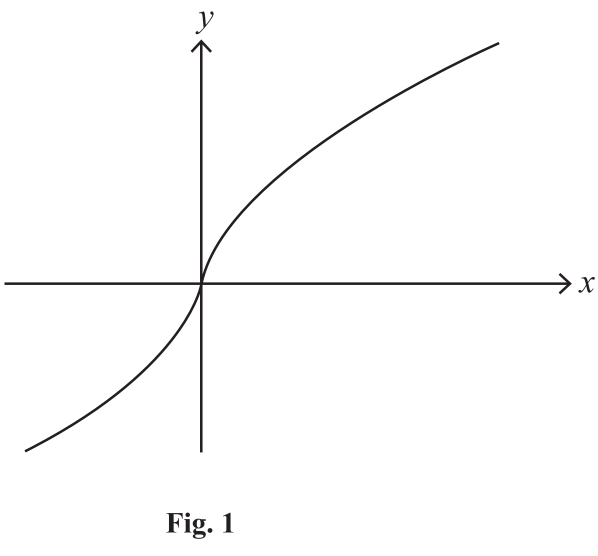

Fig. 1

Find the area of the region bounded by the curve, the lines $x = 1$ and $x = 8$ and the x-axis. [4]

4 Patrick is going to walk his dog on a path in his local park.
The path runs due north.
When he is at the start of the path he sees an oak tree on a bearing of 040°

Patrick walks 200 m due north along the path.
The bearing of the oak tree is now 070°

(i) Find, to the nearest metre, the shortest distance of the oak tree from the path. [6]

Patrick walks a further 200 m due north along the path.

(ii) Find the distance Patrick now is from the oak tree. [3]

5 **Fig. 2** below shows the logo for an ice-cream parlour.

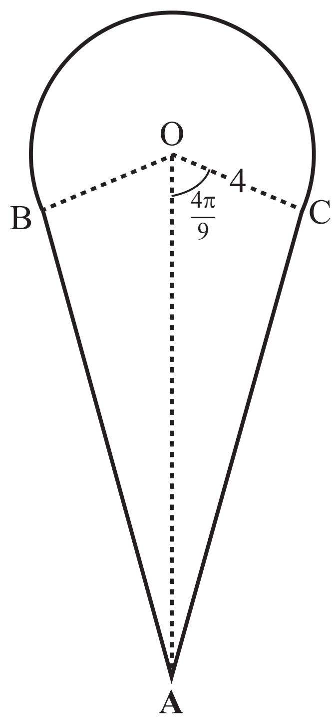

Fig. 2

O is the centre of a circle of radius 4 cm.
AB and AC are tangents to the circle.
Angle AOC = $\frac{4\pi}{9}$ radians.

(i) Find the perimeter of the logo. [5]

(ii) Find the area of the logo. [4]

6 **(a)** Evaluate

$$2 \log_2 a + \log_4 4a^2 - 3 \log_2 2a \qquad [6]$$

(b) Given that

$$3(2^{2x}) + 2(2^x) - 1 = 0$$

find x. [5]

7 In the binomial expansion, in ascending powers of x, of

$$\left(1 + \frac{x}{k}\right)^n \qquad k \neq 0 \qquad n \neq 0$$

the coefficients of x and x^2 are equal and non-zero.

(i) Form an equation in n and k. [4]

The coefficient of x^4 is four times the coefficient of x^5

(ii) Show that $4n = 5k + 16$ [4]

(iii) Hence find n and k. [2]

8 A circle has centre (a, b) and radius r.
The centre of this circle lies on the line $y = 2$

(i) Write down the value of b. [1]

The circle passes through the points $(1, 5)$ and $(-6, 6)$.

(ii) Find the equation of this circle. [10]

THIS IS THE END OF THE QUESTION PAPER