Rewarding Learning

ADVANCED SUBSIDIARY (AS)
General Certificate of Education
2011

Mathematics

Assessment Unit C2

assessing

Module C2: AS Core Mathematics 2

[AMC21]

MONDAY 13 JUNE, 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 The line joining the points A (– 7, 4) and B (1, – 2) is a diameter of a circle.

(i) Find the coordinates of the centre of the circle. [1]

(ii) Find the radius of the circle. [1]

(iii) Hence write down the equation of the circle. [2]

The point $(0, t)$ lies on the circumference of the circle.

(iv) Find the two possible values of t. [4]

2 **(i)** Sketch the graphs of

$$y = 3^x$$
$$\text{and } y = 3^{x+2}$$

on the same axes. [3]

(ii) Solve the equation

$$3^{x+2} = 2$$ [3]

3 A railway tunnel has a cross section shaped as a major segment of a circle, centre O, with radius 10 m, as shown in **Fig. 1** below.

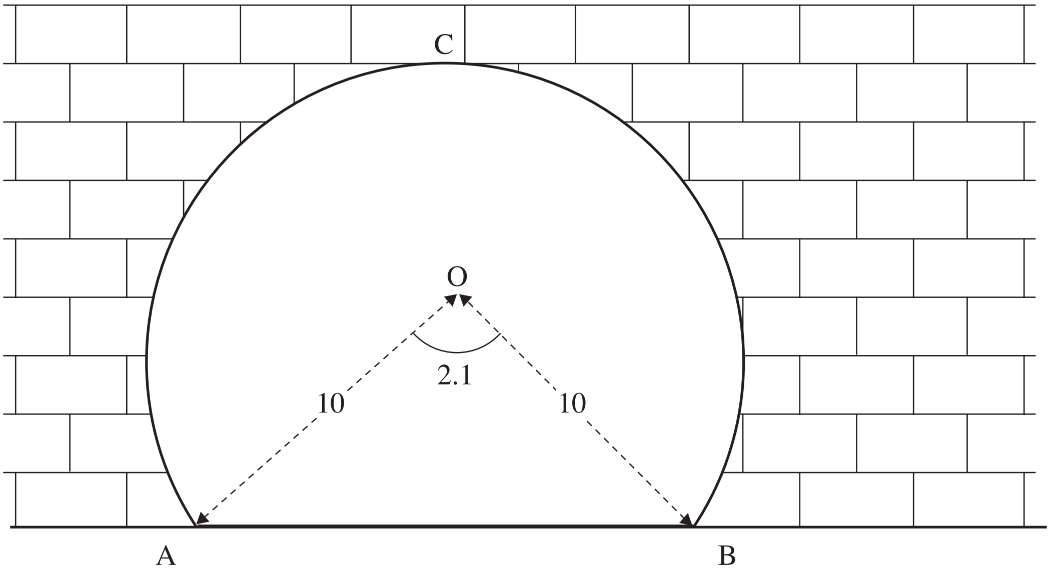

Fig. 1

The angle AOB is 2.1 radians.

(i) Find the area of the **major** sector ACBO. [3]

(ii) Hence find the area of the cross section of the tunnel. [3]

4 **(i)** Use the Binomial theorem to expand

$$(2 + x)^5$$ [4]

(ii) Hence expand

$$(2 - \sqrt{5})^5$$

and express your answer in the form $a + b\sqrt{5}$ [2]

5 **(a)** Integrate

$$4x^{-2} + 3 - 7x^{\frac{1}{2}}$$ [4]

(b) A hill walking club has designed a new club logo.
The club drew the logo as shown in **Fig. 2** below.

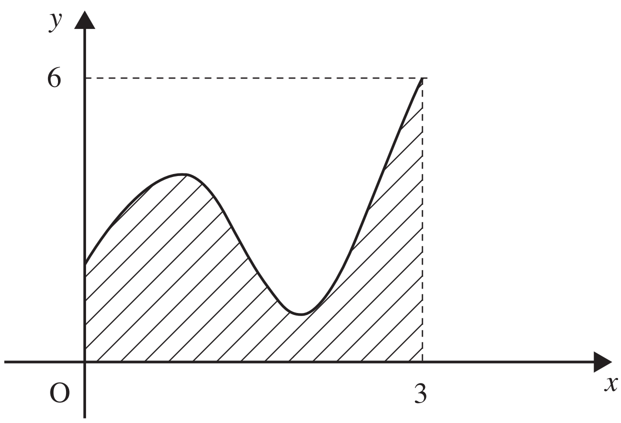

Fig. 2

The curve can be modelled by the equation

$$y = 2x^3 - 8x^2 + 7x + 3$$

The shaded area is to be coloured green.

Calculate the area of the green part of the logo. [6]

(c) Use the trapezium rule with 5 ordinates to find an approximation for

$$\int_0^2 \frac{2}{1+x}\,dx$$ [6]

6 **(a)** Solve the equation

$$\sin\theta = 3\cos\theta$$

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

(b) Prove the identity

$$(\cos\theta + \sin\theta)^2 + (\cos\theta - \sin\theta)^2 \equiv 2$$ [5]

7 **(a)** A pendulum is set swinging.
During its first oscillation it travels a distance of 50 cm.
Each successive oscillation is 90% of the length of the preceding oscillation.
The distance travelled in each successive oscillation forms a geometric progression.

(i) Find the distance the pendulum travels during the 9th oscillation. [3]

(ii) Find after how many oscillations the length of the oscillation is less than 10 cm. [5]

(iii) Find the total distance travelled by the pendulum at the end of the 20th oscillation. [2]

(b) For the arithmetic progression

$$a,\ a+d,\ a+2d...$$

prove that the sum of the first n terms is

$$S_n = \frac{n}{2}(2a+(n-1)d)$$ [6]

8 Solve the equation

$$1 + 2\log_5 x = \log_5(16x - 3)$$ [8]

THIS IS THE END OF THE QUESTION PAPER