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General Certificate of Education
January 2012

Mathematics

Assessment Unit C2

assessing

Module C2: AS Core Mathematics 2

[AMC21]

AMC21

MONDAY 23 JANUARY, 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 $\ln z \equiv \log_e z$

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Answer all eight questions.

Show clearly the full development of your answers.

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

1 Use the trapezium rule with 5 ordinates to find an approximate value for

$$\int_0^2 \sqrt{1+x^2}\,\mathrm{d}x$$

[6]

2 **(a)** **(i)** Find the first four terms of the sequence

$$u_n = n^2 + 3 \qquad \text{for } n \geq 1$$

[2]

(ii) State whether this sequence converges or diverges. [1]

(b) Find a formula, in terms of n, for the n^{th} term of the sequence

$$1,\ -3,\ 5,\ -7,\ 9,\ \ldots.$$

[2]

(c) Find the coefficient of x^5 in the binomial expansion of

$$(1 - 2x)^9$$

[4]

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3 A theatre has a floor plan where the seats are arranged in rows as shown in **Fig. 1** below.

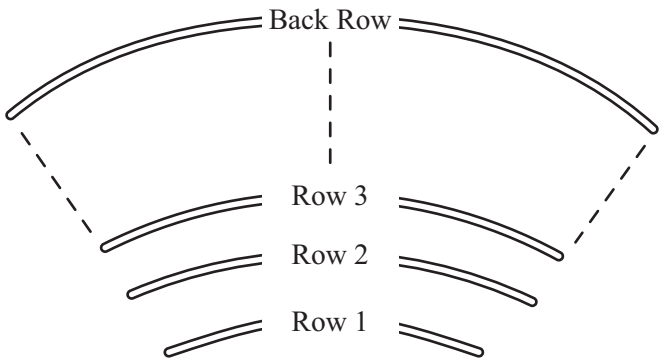

Fig. 1

There are 21 seats in the 5th row and 66 seats in the 20th row.
The number of seats in the rows form an arithmetic progression.

(i) Find how many seats there are in the first row. [5]

There are 24 rows of seats in the theatre.

(ii) Find the total number of seats in the theatre. [2]

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4 **(a)** Find

$$\int 5x^2 - 7x^{-2}\ \mathrm{d}x \qquad [3]$$

(b) The curve $y = 8 - x^{\frac{3}{2}}$ is sketched in **Fig. 2** below.

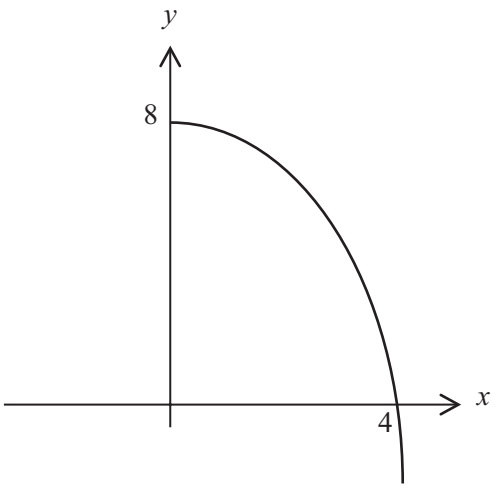

Fig. 2

Find the area bounded by the curve and the axes. [6]

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5 **(a)** The graph of

$$y = 4^x - 3$$

is sketched in **Fig. 3** below.

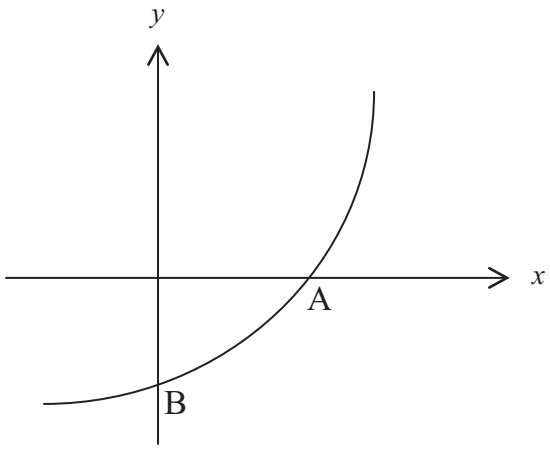

Fig. 3

The graph crosses the axes at A and B as shown.

Find the coordinates of A and B. [3]

(b) Solve the equation

$$\log_2 x + \log_2(17 - 2x) = 3$$ [6]

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6 **(a)** Solve the equation

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

where $0° \leqslant \theta \leqslant 360°$

[6]

(b) A warning siren in a factory causes a sound wave which can be modelled by the equation

$$A = p\cos(qt)°$$

where p and q are constants and $0 \leqslant t \leqslant 30$

where A is the intensity of the siren after t seconds.
The graph in **Fig. 4** below represents the sound wave.

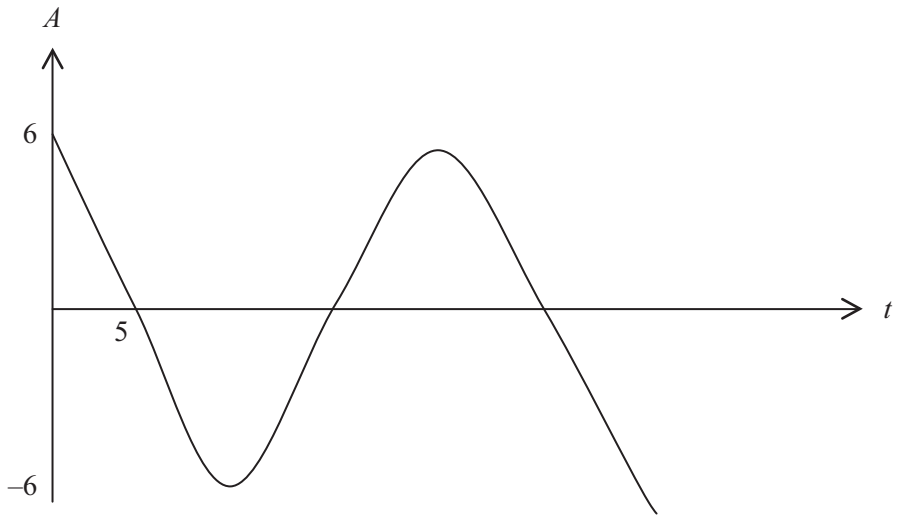

Fig. 4

At $t = 0$, the intensity is 6 and at $t = 5$ the intensity is 0

(i) Find the values of p and q. [4]

(ii) Find the value of t when $A = 2$ for the first time. [3]

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7 **(a)** Triangle ABC is shown in **Fig. 5** below.

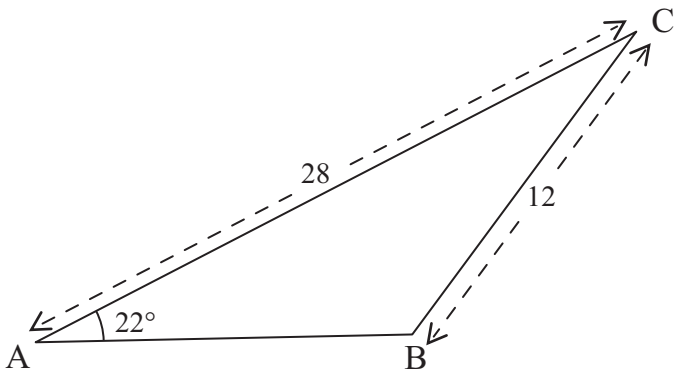

Fig. 5

AC = 28 cm
BC = 12 cm
Angle BAC = 22°
Angle ABC is obtuse.

(i) Find angle ABC. [3]

(ii) Find the area of the triangle ABC. [3]

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(b) The sector of a circle of radius r centimetres and angle θ radians is shown in **Fig. 6** below.

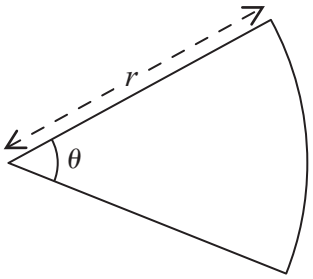

Fig. 6

The perimeter of the sector is 108 cm.

(i) Show that

$$\theta = \frac{108 - 2r}{r}$$ [2]

The area of the sector is 720 cm^2

(ii) Find the possible values of r. [5]

(iii) Hence find the possible values of θ. [2]

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8 The edge of the network coverage of a radio mast can be modelled by a circle as shown in **Fig. 7** below.

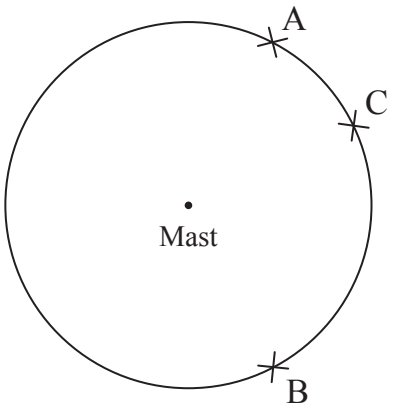

Fig. 7

Points A, B and C lie on the circumference of the circle.
A = (0, 6) B = (0, −2) C = (1, 5)

Find the equation of the circle. [7]

THIS IS THE END OF THE QUESTION PAPER

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