Rewarding Learning

ADVANCED SUBSIDIARY (AS)
General Certificate of Education
2012

Mathematics

Assessment Unit C2

assessing

Module C2: AS Core Mathematics 2

[AMC21]

AMC21

FRIDAY 8 JUNE, 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 **(i)** Find the coordinates of the centre of the circle whose equation is

$$x^2 + y^2 - 6x + 4y - 12 = 0$$ [2]

(ii) Find the gradient of the radius from the centre of this circle to the point $(-1, 1)$. [2]

(iii) Hence find the equation of the tangent to this circle at the point $(-1, 1)$. [3]

2 **(a)** In the triangle ABC

$$\text{AB} = 20\,\text{cm} \qquad \text{AC} = 40\,\text{cm} \qquad \text{BC} = 30\,\text{cm}$$

(i) Find the angle ABC. [2]

(ii) Find the area of the triangle ABC. [2]

(b) A toy spinner consists of 6 identical blades as shown in **Fig. 1** below.

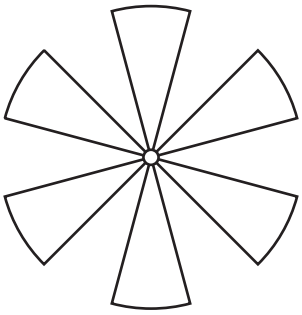

Fig. 1

Each blade is in the shape of a sector of a circle as shown in **Fig. 2** below.

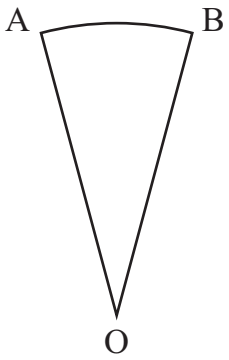

Fig. 2

$A\hat{O}B = 0.75$ radians
$AO = OB = 12\,\text{cm}$

(i) Find the area of plastic used to make a blade. [2]

The 3 edges of each blade are trimmed with red piping.

(ii) Find the length of red piping needed for one of the blades. [3]

3 **(i)** Sketch the graph of

$$y = \cos 2x \qquad \text{for} \qquad 0 \leqslant x \leqslant 2\pi$$ [2]

(ii) State the period of this graph. [1]

(iii) Solve the equation

$$\cos 2x = \frac{1}{2} \qquad \text{for} \qquad 0 \leqslant x \leqslant 2\pi$$ [5]

4 **(a)** Expand $\left(1+\frac{x}{5}\right)^{10}$ up to and including the term in x^3 [4]

(b) A fishing lake is initially stocked with 1000 fish.
It is estimated that each year 20% of the fish are caught or die.
At the end of each year the lake is restocked with 100 fish.

(i) Calculate the estimated number of fish in the lake at the end of Year 1, Year 2 and Year 3 [3]

These numbers are the first 3 terms of a sequence.

(ii) Find a recurrence relation for this sequence. [2]

(iii) Find the limit to which this sequence converges. [2]

5 The height of tides in a harbour can be modelled by the equation

$$H = a + b \sin (30t)°$$

where H is the height in metres of the water t hours after midnight.

(i) Find the values of a and b for the following tide table.

	Time	**Height**
High Tide	0300	8
Low Tide	0900	2

[5]

(ii) Hence find the height of the tide at 0500 [1]

(iii) Find the first time, after midnight, when the height of the tide is 3 m. [4]

6 **(a)** Integrate $(5x + x^{\frac{1}{3}} + 7)$ [4]

(b) Part of the graph of $y = \frac{1}{x^2}$ is shown in **Fig. 3** below.

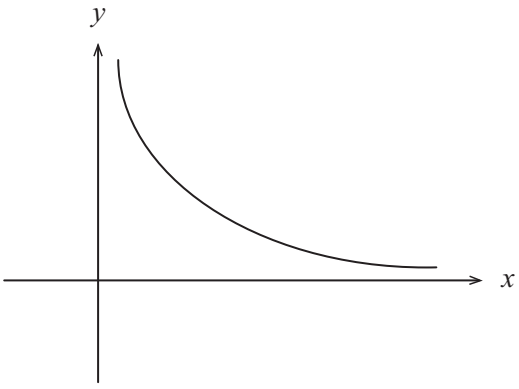

Fig. 3

Find the area enclosed between this part of the graph, the ***y*-axis** and the lines $y = 1$ and $y = 4$ [6]

7 **(a)** In a Geometric Progression the sum of the 1st and 4th terms is 560
The sum of the 3rd and 6th terms is 1260

Find the possible values of the common ratio. [6]

(b) The sum to infinity of a different Geometric Progression is five times its first term a, where $a \neq 0$

Find the common ratio. [3]

8 **(i)** Prove that

$$\log_a x = \frac{\log_b x}{\log_b a}$$ [5]

(ii) Hence solve the equation

$$\log_4 x + \log_x 16 = 3$$ [6]

THIS IS THE END OF THE QUESTION PAPER

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