



*Rewarding Learning*  
ADVANCED SUBSIDIARY (AS)  
General Certificate of Education  
2016

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# Mathematics

Assessment Unit C2  
*assessing*

Module C2: AS Core Mathematics 2

[AMC21]

**TUESDAY 31 MAY, AFTERNOON**

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## **Time**

1 hour 30 minutes, plus your additional time allowance.

## **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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**(Questions start overleaf)**

**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 marks]

(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 marks]

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

$$\int_0^2 (1 + \cos x)^2 dx \quad [3 \text{ marks}]$$

- 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

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

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

3 (a) Solve the equation

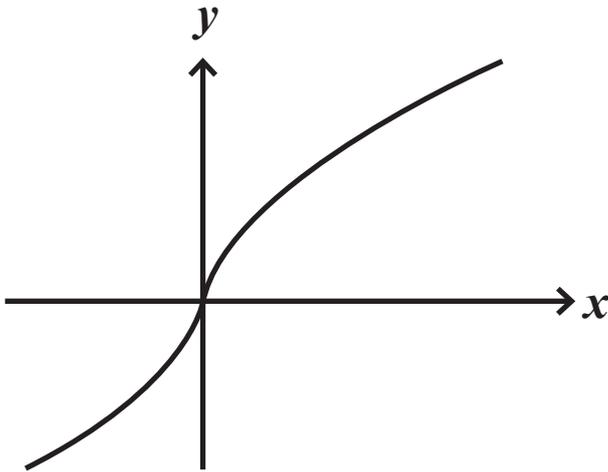
$$1 + \sin \theta + \cos^2 \theta - 2\sin^2 \theta = 0$$

where  $-180^\circ \leq \theta \leq 180^\circ$  [5 marks]

(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 marks]

- 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  $040^\circ$

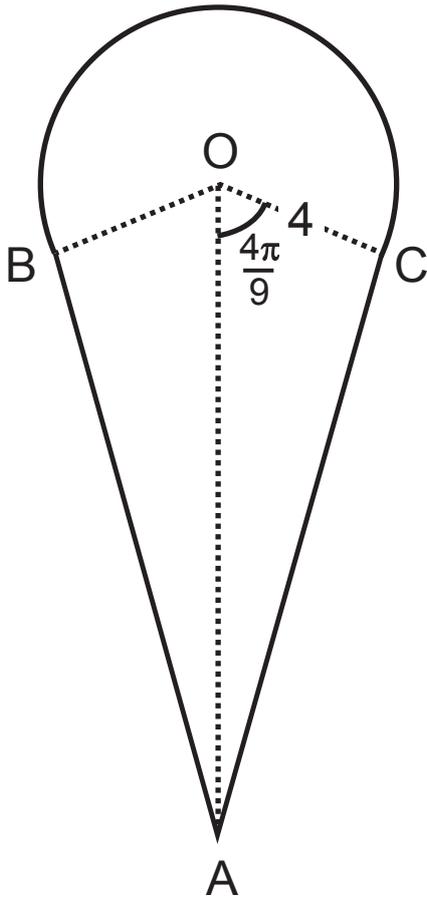
Patrick walks 200 m due north along the path. The bearing of the oak tree is now  $070^\circ$

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

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

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

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

6 (a) Evaluate

$$2 \log_2 a + \log_4 4a^2 - 3 \log_2 2a \quad [6 \text{ marks}]$$

(b) Given that

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

find  $x$ . [5 marks]

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

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

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

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

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

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

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

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 mark]

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

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

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**THIS IS THE END OF THE QUESTION PAPER**

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