

ADVANCED SUBSIDIARY (AS) General Certificate of Education 2014

# **Mathematics**

Assessment Unit C2 assessing Module C2: AS Core Mathematics 2

## [AMC21]

## FRIDAY 6 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 (a) The first five terms of a sequence are

$$\frac{2}{1}, \frac{3}{4}, \frac{4}{9}, \frac{5}{16}, \frac{6}{25}$$
...

- (i) Write down the next term in this sequence. [1]
- (ii) Write down, in terms of n, a formula for the nth term of this sequence. [2]
- (iii) State whether this sequence converges or diverges or oscillates. [1]
- (b) Find the coefficient of  $x^5$  in the binomial expansion of

$$(3-x)^7$$
 [4]

2 Find

$$\int \frac{16}{x^2} + x^{\frac{1}{3}} + 9x - 7 \,\mathrm{d}x \tag{5}$$

3 A surveyor has made a sketch of a patch of waste ground, ABCD, as shown in **Fig. 1** below.





The points A, B and E lie along the same straight line. He records the following measurements:

AB = 4.9 km AD = 5.4 km BC = 2.1 kmangle  $DAB = 35^{\circ}$ angle  $CBE = 50^{\circ}$ 

(i) Find the length of DB.

(ii) Find the angle ABD.

(iii) Find the area of the waste ground ABCD.

[2]

[4]

[2]

4 (a) A right circular cone has a base radius of r and slant height l as shown in Fig. 2 below.



Fig. 2

The curved surface area of this cone can be unfolded to form the sector of a circle as shown in **Fig. 3** below.



Fig. 3

The radii of this sector subtend an angle of  $\theta$  radians at its centre.

(ii) Hence show that the curved surface area of a cone is given by  $\pi rl$ . [2]

(b) The circle

$$x^2 - 6x + y^2 + 10y + 18 = 0$$

has its centre at the point C.

Tangents drawn from the point A (-2, 4) meet the circle at the points B and D respectively, as shown in **Fig. 4** below.



Fig. 4

Find the area of the kite ABCD.

5 (a) A geometric progression has first term 100 and common ratio  $\frac{3}{5}$ 

- (i) Find the 16th term of this progression.
- (ii) Find the sum to infinity of this progression.
- (b) Prove that the sum of the first *n* terms of a geometric progression, with first term *a* and common ratio *r*, is

5

$$S_n = \frac{a(1-r^n)}{1-r}$$
 [6]

[7]

[2]

[2]

#### 6 The graphs of the curves

$$y = x^2$$
 and  $y = 8\sqrt{x}$ 

are shown in Fig. 5 below.



Fig. 5

The curves cross at the point A.

(i) Find the coordinates of A.

A garden centre has created a logo by reflecting the area between the curves

$$y = x^2$$
 and  $y = 8\sqrt{x}$ 

in the y-axis, as shown shaded in Fig. 6 below.



Fig. 6

(ii) Find the area of the logo.

[3]

## 7 (a) Solve the equation

$$4 - \sin\theta = 6\,\cos^2\!\theta$$

for  $0^{\circ} \le \theta \le 360^{\circ}$ 

(b) Prove the identity

$$\tan\theta + \frac{1}{\tan\theta} \equiv \frac{1}{\sin\theta\cos\theta}$$
 [5]

8 Solve the simultaneous equations

$$\log_4 x + \log_4 y = 2$$
  

$$\log_9 x - \log_9 y = -\frac{1}{2}$$
[10]

[7]

# THIS IS THE END OF THE QUESTION PAPER