



Rewarding Learning

ADVANCED SUBSIDIARY (AS)  
General Certificate of Education  
2015

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# Mathematics

Assessment Unit C2

*assessing*

Module C2: AS Core Mathematics 2

[AMC21]

**THURSDAY 28 MAY, MORNING**

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## 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** Three sequences are given below:

A  $u_n = n^2 - 1$

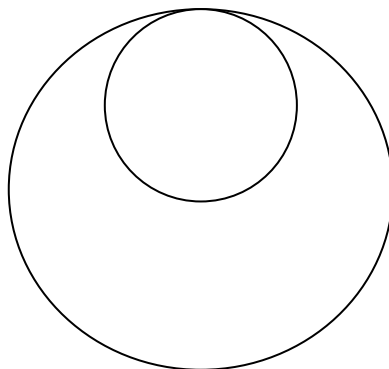
B  $u_n = \frac{3n^2 + 1}{n^2}$

C  $u_{n+1} = 4 - u_n \quad u_1 = 6$

For each sequence describe the behaviour of the sequence as  $n \rightarrow \infty$   
If a sequence converges, state its limit.

[4]

**2** A jeweller is making a pendant for a necklace.  
It can be modelled as two touching circles as shown in **Fig. 1** below.



**Fig. 1**

The equation of the larger circle is

$$x^2 - 6x + y^2 - 8y + 21 = 0$$

**(i)** Find the centre and radius of this circle.

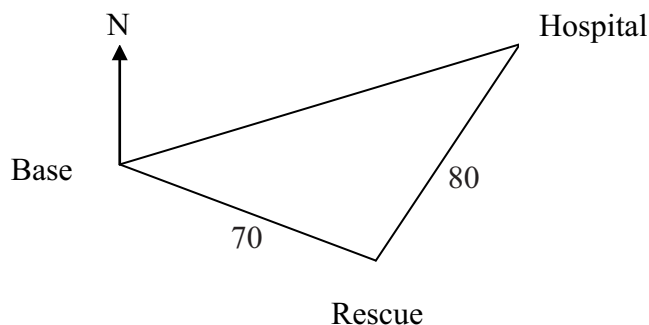
[4]

The diameter of the smaller circle is half the diameter of the larger circle.  
The centre of the smaller circle is vertically above the centre of the larger circle.

**(ii)** Find the equation of the smaller circle.

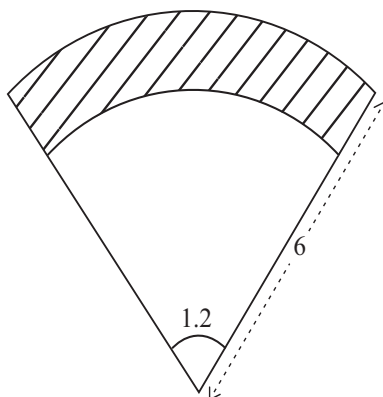
[3]

- 3 (a) A rescue helicopter takes off from its base and flies for 70 km on a bearing of  $110^\circ$  to rescue an injured sailor. After picking up the sailor, the helicopter flies 80 km, on a bearing of  $030^\circ$  to the nearest hospital. The helicopter then returns directly to its base, as shown in **Fig. 2** below.



**Fig. 2**

- (i) Calculate the distance the helicopter flies from the hospital directly back to its base. [3]
- (ii) Calculate the bearing of the base from the hospital. [3]
- (b) **Fig. 3** below shows part of an ornamental garden in the shape of a sector of a circle, with radius 6 m and angle 1.2 radians.



**Fig. 3**

The shaded area is to be a flowerbed and the unshaded area is to be lawn. The lawn is also a sector. The area of the lawn is  $\frac{2}{3}$  the area of the total sector.

- (i) Find the radius of the sector of the circle which is to be lawn. [4]
- (ii) Find the perimeter of the flowerbed. [4]

4 The second term of a Geometric Progression is 270  
The fifth term of the Geometric Progression is 80

(i) Find the first term and the common ratio. [5]

(ii) Why does a sum to infinity exist for this Geometric Progression? [1]

(iii) Find the sum to infinity of this Geometric Progression. [2]

5 Find the first three terms, in descending powers of  $x$ , in the binomial expansion of

$$\left(2x - \frac{5}{x^2}\right)^9 \quad [5]$$

6 (a) (i) Sketch the graph of

$$y = \sin 2x$$

for  $0 \leq x \leq 2\pi$  [2]

(ii) Use the trapezium rule with 5 ordinates to find an approximate value for

$$\int_0^1 \sin 2x \, dx \quad [5]$$

(b) Solve

$$2 \cos \theta = 3 \tan \theta$$

for  $0^\circ \leq \theta \leq 360^\circ$  [7]

7 (a) Integrate

$$\frac{x}{3} + \frac{4}{x^2} - 6\sqrt{x}$$

with respect to  $x$ .

[4]

(b) Find the area enclosed by the curve  $y = x^2 - 4x + 3$ , the  $x$ -axis and the lines  $x = 1$  and  $x = 4$

[7]

8 (a) Sketch the graph of

$$y = 2^x - 5$$

clearly indicating where it crosses the  $x$ -axis and the  $y$ -axis.

[3]

(b) If  $\log_4 x = k$ , express the following in terms of  $k$ :

(i)  $\log_4 x^3$

[1]

(ii)  $\log_4 \frac{\sqrt[3]{x}}{16}$

[2]

(iii)  $\log_2 x$

[2]

(iv) Hence solve for  $x$

$$\log_4 x^3 + \log_4 \frac{\sqrt[3]{x}}{16} = \log_2 x$$

[4]

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

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