Rewarding Learning

ADVANCED SUBSIDIARY (AS)
General Certificate of Education
January 2013

Mathematics

Assessment Unit C2
assessing
Module C2: AS Core Mathematics 2

[AMC21]

FRIDAY 18 JANUARY, AFTERNOON

AMC21

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)** Find

$$\int 4x^3 + 2x^{\frac{1}{2}} + 7 + x^{-2}\,\mathrm{d}x$$

[5]

(b) A car starts from rest and its speed is measured, by an electronic device, every 2 seconds during the first 10 seconds of its motion.
Table 1 below gives the results obtained.

Table 1

Time (s)	0	2	4	6	8	10
Speed ($\mathrm{m\,s^{-1}}$)	0	4.91	10.8	15.4	17.0	17.9

Use the trapezium rule with 6 ordinates to estimate the distance travelled by the car. [4]

2 A circle has the equation

$$(x-1)^2 + (y-2)^2 = 13$$

(i) Write down the centre of this circle. [2]

The circle cuts the positive x-axis at the point A.

(ii) Find the coordinates of A. [3]

(iii) Find the gradient of the tangent to the circle at the point A. [3]

3 Three sequences are given below ($n \geqslant 1$):

A $U_n = 2^n$

B $U_n = \dfrac{1}{2^n}$

C $U_n = 2(-1)^n$

(i) For each sequence write down the first four terms and hence state if the sequence converges, oscillates or diverges. [4]

(ii) For any sequence that converges state its limit. [1]

4 **Fig. 1** below shows sketches of the curve $y = x^2 - 4x + 4$ and the straight line $y = x + 4$

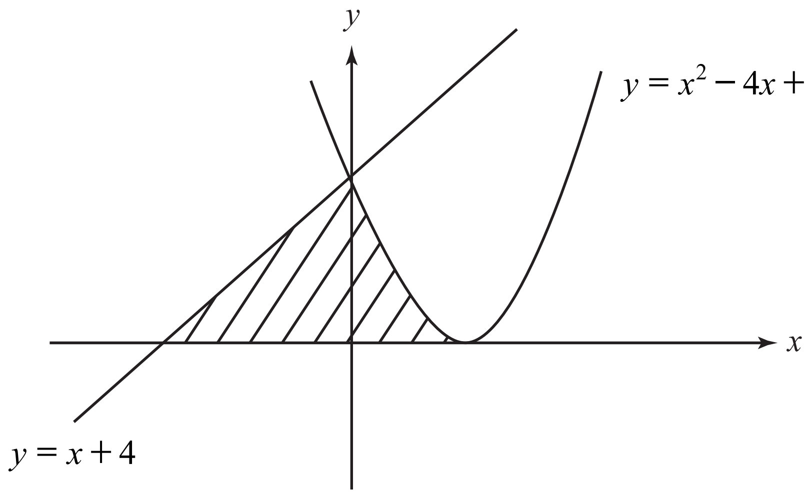

Fig. 1

(i) Verify that the curve and the line intersect at the point (0, 4). [2]

(ii) Find the shaded area. [11]

5 A man wishes to share £C between his six children.
The children are to get increasing amounts of money according to their position in the family.
The youngest is to get the smallest amount of money and the eldest is to get the largest amount of money.
The amounts of money form a geometric progression.

The youngest child gets £17 and the eldest £4131

(i) Find the common ratio of the geometric progression. [5]

(ii) Hence find C. [2]

6 A circle centre A has a radius of 10 m.
BC is a chord of the circle as shown in **Fig. 2** below.

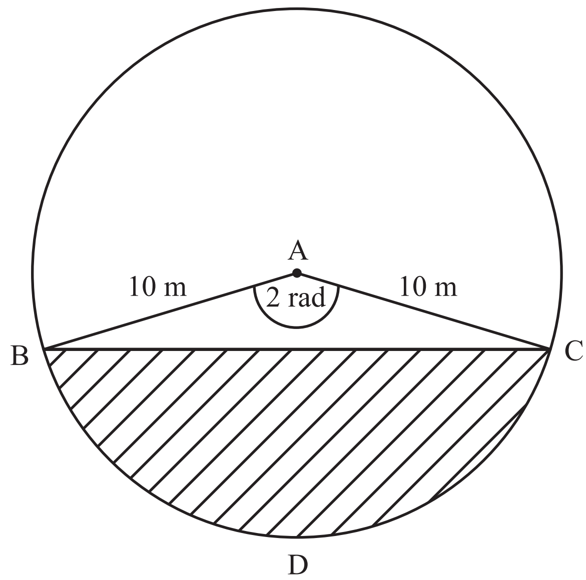

Fig. 2

The angle BAC is 2 radians.
D is a point on the circumference of the circle.

(i) Find the area of the **sector** ACDB. [2]

(ii) Hence find the shaded area. [4]

A millionaire wishes to build a swimming pool in the shape of two intersecting circles. Each circle is to be of radius 10 m as shown in **Fig. 3** below.

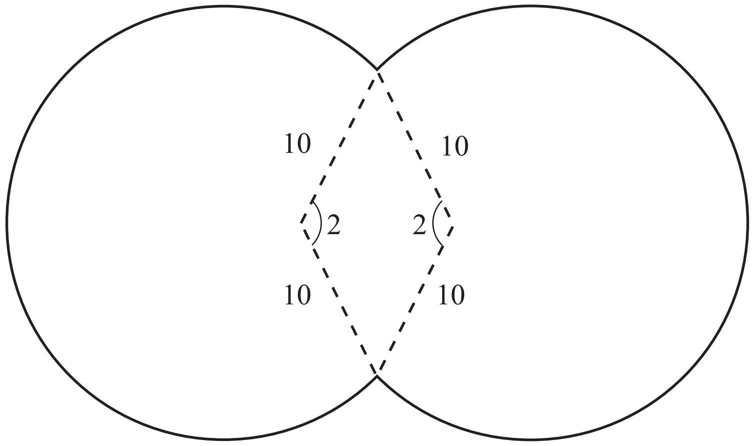

Fig. 3

The angle between the radii at the centre of each circle is to be 2 radians as shown.

(iii) Find the surface area of the swimming pool. [4]

(iv) Find the perimeter of the swimming pool. [5]

7 Find the term independent of x in the binomial expansion of

$$\left(3x + \frac{1}{x^2}\right)^9$$ [5]

8 (a) **A solution by trial and improvement will not be accepted.**

The cost of living is increasing by 15% per year.
If this rate is maintained and the cost of living this year is £L, then the cost of living after t years can be modelled by £$L(1.15)^t$

Find how many **complete** years it will take for the cost of living to treble. [5]

(b) Find the **exact** values of x and y given that

$$\log_y x = 3$$

$$\text{and } \log_3 x - \log_3 y = 5$$ [8]

THIS IS THE END OF THE QUESTION PAPER