Rewarding Learning

ADVANCED SUBSIDIARY (AS)
General Certificate of Education
January 2009

Mathematics

Assessment Unit C1

assessing

Module C1: AS Core Mathematics 1

[AMC11]

AMC11

WEDNESDAY 7 JANUARY, 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 not permitted to use any calculating aid 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.

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 not permitted to use any calculating aid in this paper.

1 Point A has coordinates (1,7) and point B has coordinates (–3,–1)
Find the equation of the line which is perpendicular to AB and which passes through the mid point of AB. [6]

2 **(a)** **Fig. 1** below shows the graph of the function $y = f(x)$

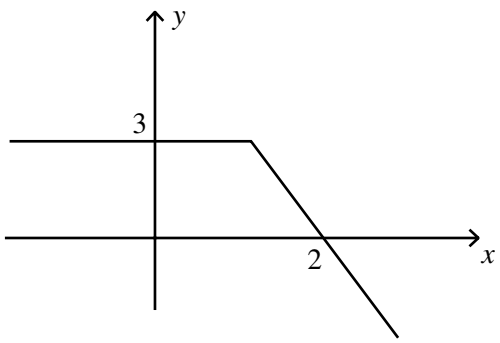

Fig. 1

Sketch, on separate diagrams the graphs of:

(i) $y = f(-x)$ [2]

(ii) $y = f(x + 2)$ [2]

clearly identifying the points where the graphs cross the axes.

(b) **(i)** Write $x^2 + 6x - 1$ in the form $(x + p)^2 + q$ [2]

(ii) Hence state the minimum value of $x^2 + 6x - 1$ and the value of x at which it occurs. [2]

(iii) Hence state the range of values of x for which the function

$$y = x^2 + 6x - 1$$

is increasing. [2]

3 **(a)** Rationalise the denominator of

$$\frac{\sqrt{7}+1}{3-\sqrt{7}}$$ [3]

(b) **(i)** If $f(x) = 2x^3 + x^2 - 13x + 6$ find $f(2)$ [1]

(ii) Hence express $f(x)$ as a product of three linear factors. [4]

(iii) Hence solve the equation

$$2x^3 + x^2 = 13x - 6$$ [3]

4 **(a)** Differentiate

$$5x + 3x^{-2} + 4\sqrt{x} - 7$$ [4]

(b) Find the equation of the normal to the curve

$$y = 2x^3 - 4x^2 + 9$$

at the point where $x = 3$ [7]

5 An aquarium needs a new tank.
The tank is to be in the shape of a cuboid with a square base and an **open** top as shown in **Fig. 2** below.
The length of the base of the tank is to be x metres and its height is to be h metres.

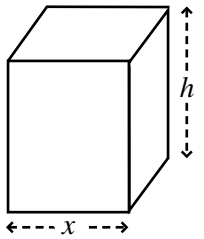

Fig. 2

The tank must have a volume of $500\,\text{m}^3$

(i) Find h in terms of x. [2]

(ii) Show that the total surface area of the tank can be expressed as

$$x^2 + \frac{2000}{x}$$ [2]

(iii) Find the dimensions of the tank that give the minimum surface area. [7]

6 **(i)** Write down, in terms of k, the discriminant of the quadratic equation

$$kx^2 + (k - 2)x + 2 = 0$$ [2]

The equation $kx^2 + (k - 2)x + 2 = 0$ has two distinct real roots.

(ii) Find the range of values that k can take. [6]

7 A cyclist usually covers 75 km at a steady speed of v kmh^{-1}

(i) Express the time taken in terms of v [1]

If the cyclist increases her speed by 5 kmh^{-1} the journey takes $1\frac{1}{4}$ hours **less**.

(ii) Show that

$$v^2 + 5v - 300 = 0$$ [6]

(iii) Hence find v [2]

8 Solve the simultaneous equations

$$4x - 3y = 11$$

and $\quad 27^x \times 9^{y+3} = 3\sqrt{3}$ [9]

THIS IS THE END OF THE QUESTION PAPER