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ADVANCED SUBSIDIARY (AS)
General Certificate of Education
January 2011

Mathematics

Assessment Unit C1

assessing

Module C1: AS Core Mathematics 1

[AMC11]

MONDAY 10 JANUARY, MORNING

AMC11

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.

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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 **(i)** If

$$y = 5x + 4x^3$$

find $\frac{dy}{dx}$ [2]

(ii) Hence find the coordinates of the points on the curve

$$y = 5x + 4x^3$$

at which the gradient is 8 [4]

2 **(a)** **(i)** Using the Factor Theorem, show that $(x + 3)$ is a factor of

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

(ii) Hence fully factorise the expression

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

(iii) Hence solve the equation

$$2x^3 + x^2 - 13x + 6 = 0$$ [3]

(b) The remainder when the function

$$f(x) = px^4 - 2x^3 - 4x - 6$$

is divided by $(x - 2)$ is six times the remainder when it is divided by $(x + 1)$.
Find p. [5]

3 Simplify to a single algebraic fraction

$$\left(\frac{3}{x+4} + \frac{2}{x-1}\right) \div \frac{x+1}{x-1}$$

[6]

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4 Points A, B, C and D form the vertices of a kite as shown in **Fig. 1** below.

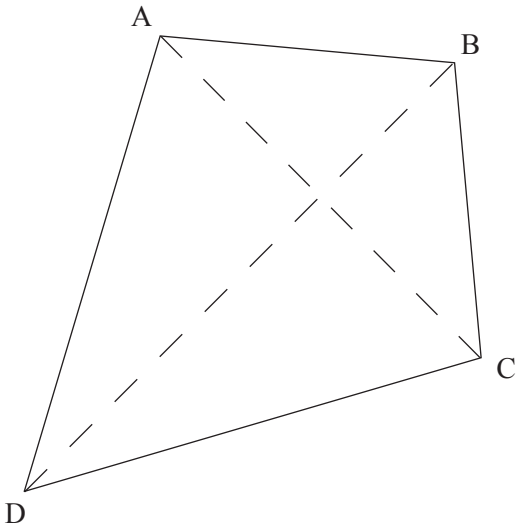

Fig. 1

Point A has coordinates (2, 1) and point C has coordinates (4, –5).
Find the equation of the diagonal BD. [6]

5 **(a)** The graph of the function $y = f(x)$ is sketched in **Fig. 2** below.

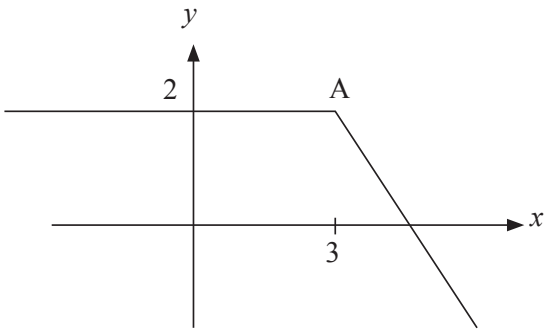

Fig. 2

Draw a sketch of the graph of $y = f(x + 2)$ clearly labelling the image of point A. [2]

(b) A rectangle has an area of $12\,\text{cm}^2$
Its length is $(\sqrt{7} + 2)$ cm.
Find the width of the rectangle in the form $(a\sqrt{b} + c)$. [5]

(c) Solve the equation

$$x^{\frac{1}{3}} = 2 + 15x^{-\frac{1}{3}}$$ [6]

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6 The number of bacteria b in a Petri dish after time t hours can be modelled by the equation

$$b = 4t + \frac{64}{\sqrt{t}} + 7 \qquad t > 0$$

(i) Find the number of bacteria after 16 hours. [1]

(ii) Find the rate of change of the number of bacteria after t hours. [3]

(iii) Hence find the range of values of t for which the number of bacteria is increasing. [3]

7 **(i)** Find the coordinates of the points where the curve

$$y = x(9 - x^2)$$

crosses the x-axis. [3]

(ii) Find the coordinates of the turning points on the curve

$$y = 9x - x^3$$

and determine their nature. [9]

(iii) **Hence** sketch the graph of the curve $y = 9x - x^3$ [2]

8 A rectangular sheet of cardboard has width x cm and an area of 48 cm^2
Small **squares** of side 2 cm are removed from each corner and the sides are folded up to form an open box.
The volume of the box must be more than 16 cm^3

(i) Show that

$$x^2 - 14x + 48 < 0$$ [6]

(ii) Hence find the possible range of values of x. [4]

THIS IS THE END OF THE QUESTION PAPER

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