

General Certificate of Education
January 2005
Advanced Subsidiary Examination



**MATHEMATICS AND STATISTICS
(SPECIFICATION B)
Unit Pure 1**

MBP1

Monday 10 January 2005 Afternoon Session

In addition to this paper you will require:

- an 8-page answer book;
- the AQA booklet of formulae and statistical tables.

You may use a graphics calculator.

Time allowed: 1 hour 15 minutes

Instructions

- Use blue or black ink or ball-point pen. Pencil should only be used for drawing.
- Write the information required on the front of your answer book. The *Examining Body* for this paper is AQA. The *Paper Reference* is MBP1.
- Answer **all** questions.
- All necessary working should be shown; otherwise marks for method may be lost.
- The **final** answer to questions requiring the use of tables or calculators should normally be given to three significant figures.

Information

- The maximum mark for this paper is 60.
- Mark allocations are shown in brackets.

Advice

- Unless stated otherwise, formulae may be quoted, without proof, from the booklet.

Answer **all** questions.

- 1 (a) Factorise the expression $3x^2 - 2x - 8$. *(2 marks)*
- (b) Solve the inequality $3x^2 - 2x - 8 < 0$. *(2 marks)*
- 2 The sixth term of an arithmetic series is 19 and the tenth term is 55.
- (a) (i) Show that the common difference is 9. *(3 marks)*
- (ii) Find the first term. *(1 mark)*
- (b) Find the sum of the first 400 terms of the series. *(3 marks)*
- 3 (a) Express each of the following as a power of 3:
- (i) $\sqrt{3}$; *(1 mark)*
- (ii) $3^x \times 9$. *(1 mark)*
- (b) Hence, or otherwise, solve the equation $3^x \times 9 = \sqrt{3}$. *(2 marks)*
- 4 The points A and B have coordinates $(1, 3)$ and $(3, 8)$ respectively.
- (a) (i) Find the gradient of AB . *(1 mark)*
- (ii) Find an equation for the line AB in the form $ax + by + c = 0$, where a , b and c are integers. *(3 marks)*
- (b) The point C has coordinates $(13, k)$ and the lines AB and BC are perpendicular.
- (i) Find the value of k . *(3 marks)*
- (ii) Calculate the area of the triangle ABC . *(3 marks)*

5 Solve the equation

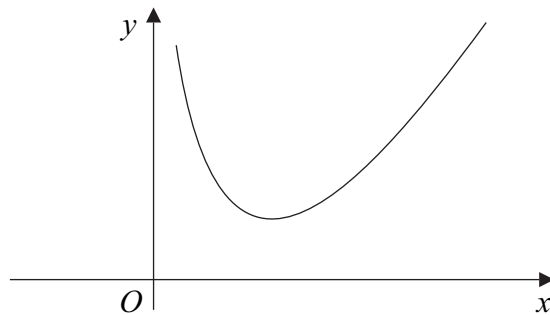
$$\cos(4x + 40^\circ) = -0.5$$

giving all solutions in the interval $0^\circ < x < 180^\circ$.

(No credit will be given for simply reading values from a graph.)

(6 marks)

6 The curve with equation $y = 3x^2 + \frac{2}{x^3}$ for $x > 0$ is sketched below.



(a) (i) Find $\frac{dy}{dx}$. (3 marks)

(ii) Find the x -coordinate of the stationary point of the curve. (3 marks)

(b) The curve has gradient 12 at the point where $x = \alpha$.

(i) Show that α satisfies the equation $x^5 - 2x^4 - 1 = 0$. (2 marks)

(ii) Show that α lies between 2.0 and 2.1. (2 marks)

(c) (i) Find $\int \left(3x^2 + \frac{2}{x^3} \right) dx$. (3 marks)

(ii) Hence find the area bounded by the curve, the x -axis and the lines $x = 1$ and $x = 2$. (2 marks)

Turn over ►

7 The function f is defined for all values of x by

$$f(x) = 3(x - 2)^2$$

- (a) Describe in detail the geometrical transformations that map the graph of $y = x^2$ onto the graph of $y = f(x)$. *(4 marks)*
- (b) (i) Sketch the graph of $y = f(x)$. *(1 mark)*
(ii) Find the range of f . *(2 marks)*
- (c) Find the exact solutions of the equation $f(x) = 15$. *(3 marks)*
- (d) Explain why the inverse of f does not exist. *(1 mark)*
- (e) (i) Show that $\frac{f(h) - f(0)}{h} = 3h - 12$. *(2 marks)*
(ii) Deduce the value of the derivative $f'(0)$. *(1 mark)*

END OF QUESTIONS