

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.

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Answer **all** questions.

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- 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

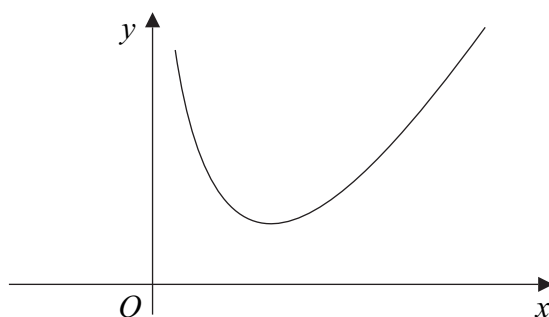
$$\cos(4x + 40^\circ) = -0.5$$

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  $\alpha$  satisfies the equation  $x^5 - 2x^4 - 1 = 0$ . (2 marks)

(ii) Show that  $\alpha$  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)

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**