

Please write clearly, in block capitals.

Centre number

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Candidate number

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Surname

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Forename(s)

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Candidate signature

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# A-level MATHEMATICS

## Paper 1

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Exam Date

Morning

Time allowed: 2 hours

### Materials

For this paper you must have:

- The AQA booklet of formulae and statistical tables.
- You may use a graphics calculator.

### Instructions

- Use black ink or black ball-point pen. Pencil should be used for drawing.
- Answer **all** questions.
- You must answer each question in the space provided for that question. If you require extra space, use an AQA supplementary answer book; do **not** use the space provided for a different question.
- Do not write outside the box around each page.
- Show all necessary working; otherwise marks for method may be lost.
- Do all rough work in this book. Cross through any work that you do not want to be marked.

### Information

- The marks for questions are shown in brackets.
- The maximum mark for this paper is 100.

### Advice

Unless stated otherwise, you may quote formulae, without proof, from the booklet. You do not necessarily need to use all the space provided.

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Answer **all** questions in the spaces provided.

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- 1 Find the gradient of the line with equation  $2x + 5y = 7$

Circle your answer.

[1 mark]

$$\frac{2}{5}$$

$$\frac{5}{2}$$

$$-\frac{2}{5}$$

$$-\frac{5}{2}$$

- 2 A curve has equation  $y = \frac{2}{\sqrt{x}}$

Find  $\frac{dy}{dx}$

Circle your answer.

[1 mark]

$$\frac{\sqrt{x}}{3}$$

$$\frac{1}{x\sqrt{x}}$$

$$-\frac{1}{x\sqrt{x}}$$

$$-\frac{1}{2x\sqrt{x}}$$

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**4**       $p(x) = 2x^3 + 7x^2 + 2x - 3$

**4 (a)**      Use the factor theorem to prove that  $x + 3$  is a factor of  $p(x)$

**[2 marks]**

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**6** Sam goes on a diet. He assumes that his mass,  $m$  kg after  $t$  days, decreases at a rate that is inversely proportional to the cube root of his mass.

**6 (a)** Construct a differential equation involving  $m$ ,  $t$  and a positive constant  $k$  to model this situation.

**[3 marks]**

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**6 (b)** Explain why Sam's assumption may not be appropriate.

**[1 mark]**

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**9** A curve has equation  $y = \frac{2x+3}{4x^2+7}$

**9 (a) (i)** Find  $\frac{dy}{dx}$

**[2 marks]**

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**9 (a) (ii)** Hence show that  $y$  is increasing when  $4x^2 + 12x - 7 < 0$

**[4 marks]**

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**9 (b)** Find the values of  $x$  for which  $y$  is increasing.

**[2 marks]**

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**Turn over for the next question**

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**10** The function  $f$  is defined by

$$f(x) = 4 + 3^{-x}, \quad x \in \mathbb{R}$$

**10 (a)** Using set notation, state the range of  $f$

**[2 marks]**

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**10 (b)** The inverse of  $f$  is  $f^{-1}$

**10 (b) (i)** Using set notation, state the domain of  $f^{-1}$

**[1 mark]**

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**10 (b) (ii)** Find an expression for  $f^{-1}(x)$

**[3 marks]**

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**10 (c)** The function  $g$  is defined by

$$g(x) = 5 - \sqrt{x}, \quad (x \in \mathbb{R} : x > 0)$$

**10 (c) (i)** Find an expression for  $gf(x)$

**[1 mark]**

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**10 (c) (ii)** Solve the equation  $gf(x) = 2$ , giving your answer in an exact form.

**[3 marks]**

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**11** A circle with centre  $C$  has equation  $x^2 + y^2 + 8x - 12y = 12$

**11 (a)** Find the coordinates of  $C$  and the radius of the circle.

**[3 marks]**

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13 Prove the identity  $\cot^2 \theta - \cos^2 \theta \equiv \cot^2 \theta \cos^2 \theta$

[3 marks]













**There are no questions printed on this page**

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ANSWER IN THE SPACES PROVIDED**