



Please write clearly, in block capitals.

Centre number

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Candidate number

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Surname

Forename(s)

Candidate signature

A-level MATHEMATICS

Paper 1

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.

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

- 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]

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

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

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

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

-
- 3 When θ is small, find an approximation for $\cos 3\theta + \theta \sin 2\theta$, giving your answer in the form $a + b\theta^2$

[3 marks]

Turn over for the next question

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]

5 (b) Find the value of θ . Explain why it is the only possible value.

[4 marks]

Turn over for the next question

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]

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

[1 mark]

8 (a) Given that $u = 2^x$, write down an expression for $\frac{du}{dx}$

[1 mark]

8 (b) Find the exact value of $\int_0^1 2^x \sqrt{3 + 2^x} \, dx$

Fully justify your answer.

[6 marks]

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

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

[2 marks]

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

[4 marks]

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

[2 marks]

Turn over for the next question

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]

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

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

[1 mark]

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

[3 marks]

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]

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

[3 marks]

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]

17 $f(x) = \sin x$

Using differentiation from first principles find the exact value of $f'\left(\frac{\pi}{6}\right)$

Fully justify your answer.

[6 marks]

END OF QUESTIONS

There are no questions printed on this page

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