

GCE Examinations  
Advanced Subsidiary

## Core Mathematics C2

Paper A

Time: 1 hour 30 minutes

### *Instructions and Information*

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Candidates may use any calculator EXCEPT those with the facility for symbolic algebra, differentiation and/or integration.

Full marks may be obtained for answers to ALL questions.

Mathematical formulae and statistical tables are available.

This paper has nine questions.

### *Advice to Candidates*

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You must show sufficient working to make your methods clear to an examiner.  
Answers without working may gain no credit.



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1.  $f(x) = 3x^3 - 2x^2 + kx + 9.$

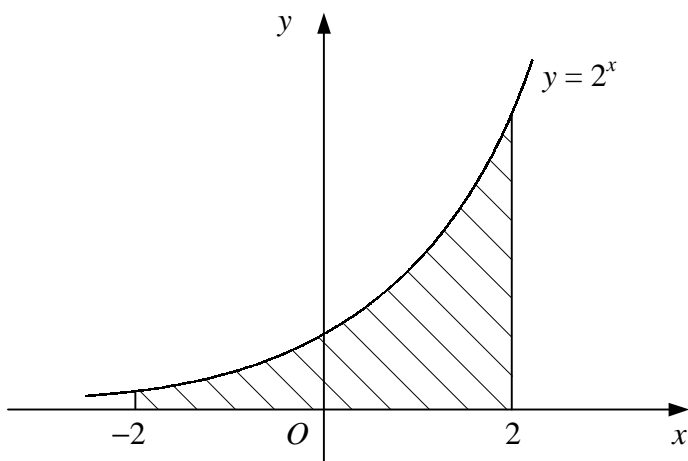
Given that when  $f(x)$  is divided by  $(x + 2)$  there is a remainder of  $-35$ ,

(a) find the value of the constant  $k$ , (2)

(b) find the remainder when  $f(x)$  is divided by  $(3x - 2)$ . (3)

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2.



**Figure 1**

Figure 1 shows the curve with equation  $y = 2^x$ .

Use the trapezium rule with four intervals of equal width to estimate the area of the shaded region bounded by the curve, the  $x$ -axis and the lines  $x = -2$  and  $x = 2$ . (5)

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3. Giving your answers in terms of  $\pi$ , solve the equation

$$3 \tan^2 \theta - 1 = 0,$$

for  $\theta$  in the interval  $-\pi \leq \theta \leq \pi$ . (6)

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4. (a) Expand  $(1 + 3x)^8$  in ascending powers of  $x$  up to and including the term in  $x^3$ . You should simplify each coefficient in your expansion. (4)

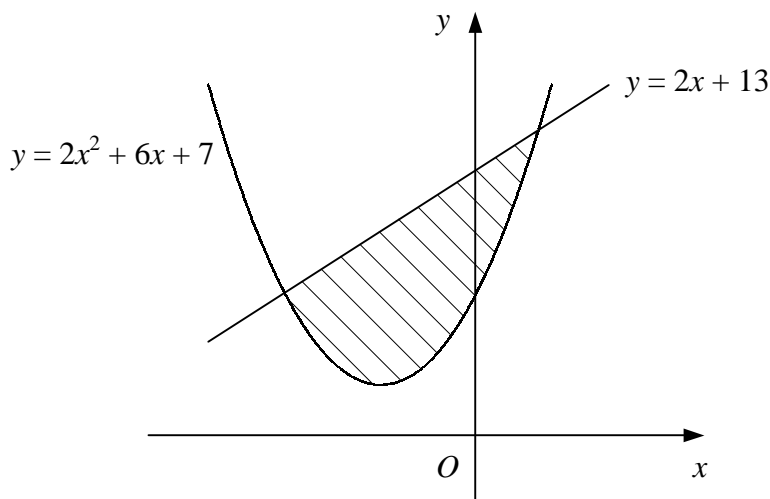
(b) Use your series, together with a suitable value of  $x$  which you should state, to estimate the value of  $(1.003)^8$ , giving your answer to 8 significant figures. (3)

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5. (a) Given that  $t = \log_3 x$ , find expressions in terms of  $t$  for
- (i)  $\log_3 x^2$ ,
- (ii)  $\log_9 x$ . (4)
- (b) Hence, or otherwise, find to 3 significant figures the value of  $x$  such that
- $$\log_3 x^2 - \log_9 x = 4. \quad (3)$$
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6. The circle  $C$  has centre  $(-3, 2)$  and passes through the point  $(2, 1)$ .
- (a) Find an equation for  $C$ . (4)
- (b) Show that the point with coordinates  $(-4, 7)$  lies on  $C$ . (1)
- (c) Find an equation for the tangent to  $C$  at the point  $(-4, 7)$ . Give your answer in the form  $ax + by + c = 0$ , where  $a, b$  and  $c$  are integers. (5)
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7.



**Figure 2**

Figure 2 shows the curve  $y = 2x^2 + 6x + 7$  and the straight line  $y = 2x + 13$ .

- (a) Find the coordinates of the points where the curve and line intersect. (4)
- (b) Find the area of the shaded region bounded by the curve and line. (7)
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*Turn over*

8. A geometric series has first term  $a$  and common ratio  $r$  where  $r > 1$ .  
The sum of the first  $n$  terms of the series is denoted by  $S_n$ .

Given that  $S_4 = 10 \times S_2$ ,

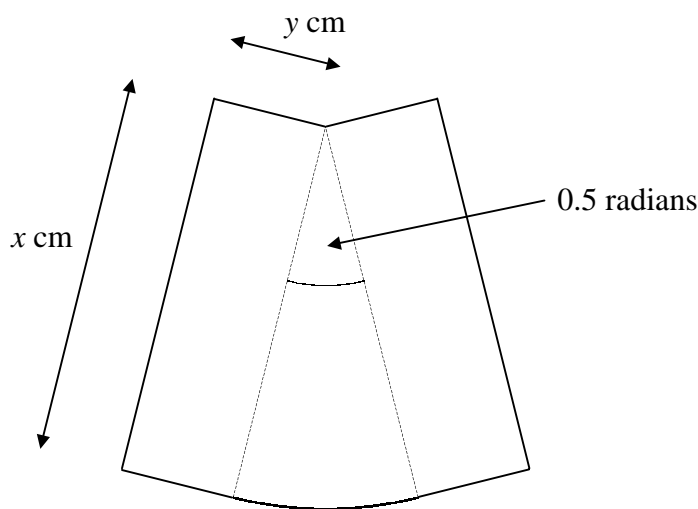
- (a) find the value of  $r$ . (6)

Given also that  $S_3 = 26$ ,

- (b) find the value of  $a$ , (3)

- (c) show that  $S_6 = 728$ . (2)

9.



**Figure 3**

Figure 3 shows a design consisting of two rectangles measuring  $x$  cm by  $y$  cm joined to a circular sector of radius  $x$  cm and angle 0.5 radians.

Given that the area of the design is  $50 \text{ cm}^2$ ,

- (a) show that the perimeter,  $P$  cm, of the design is given by

$$P = 2x + \frac{100}{x}. \quad (5)$$

- (b) Find the value of  $x$  for which  $P$  is a minimum. (4)

- (c) Show that  $P$  is a minimum for this value of  $x$ . (2)

- (d) Find the minimum value of  $P$  in the form  $k\sqrt{2}$ . (2)

**END**