

# Core Mathematics C1 Paper G

1. Find the value of  $y$  such that

$$4^{y+1} = 8^{2y-1}. \quad [4]$$

2. Express  $\sqrt{22.5}$  in the form  $k\sqrt{10}$ . [4]

3. A circle has the equation

$$x^2 + y^2 + 8x - 4y + k = 0,$$

where  $k$  is a constant.

- (i) Find the coordinates of the centre of the circle. [2]

Given that the  $x$ -axis is a tangent to the circle,

- (ii) find the value of  $k$ . [3]

4.  $f(x) = 4x - 3x^2 - x^3$ .

- (i) Fully factorise  $4x - 3x^2 - x^3$ . [3]

- (ii) Sketch the curve  $y = f(x)$ , showing the coordinates of any points of intersection with the coordinate axes. [3]

5. (i) Find in exact form the coordinates of the points where the curve  $y = x^2 - 4x + 2$  crosses the  $x$ -axis. [4]

- (ii) Find the value of the constant  $k$  for which the straight line  $y = 2x + k$  is a tangent to the curve  $y = x^2 - 4x + 2$ . [4]

6. Some ink is poured onto a piece of cloth forming a stain that then spreads.

The area of the stain,  $A \text{ cm}^2$ , after  $t$  seconds is given by

$$A = (p + qt)^2,$$

where  $p$  and  $q$  are positive constants.

Given that when  $t = 0$ ,  $A = 4$  and that when  $t = 5$ ,  $A = 9$ ,

(i) find the value of  $p$  and show that  $q = \frac{1}{5}$ , [5]

(ii) find  $\frac{dA}{dt}$  in terms of  $t$ , [3]

(iii) find the rate at which the area of the stain is increasing when  $t = 15$ . [2]

7. The curve  $C$  has the equation  $y = x^2 + 2x + 4$ .

(i) Express  $x^2 + 2x + 4$  in the form  $(x + p)^2 + q$  and hence state the coordinates of the minimum point of  $C$ . [4]

The straight line  $l$  has the equation  $x + y = 8$ .

(ii) Sketch  $l$  and  $C$  on the same set of axes. [3]

(iii) Find the coordinates of the points where  $l$  and  $C$  intersect. [4]

8. 
$$f(x) \equiv \frac{(x-4)^2}{2x^{\frac{1}{2}}}, \quad x > 0.$$

- (i) Find the values of the constants  $A$ ,  $B$  and  $C$  such that

$$f(x) = Ax^{\frac{3}{2}} + Bx^{\frac{1}{2}} + Cx^{-\frac{1}{2}}. \quad [3]$$

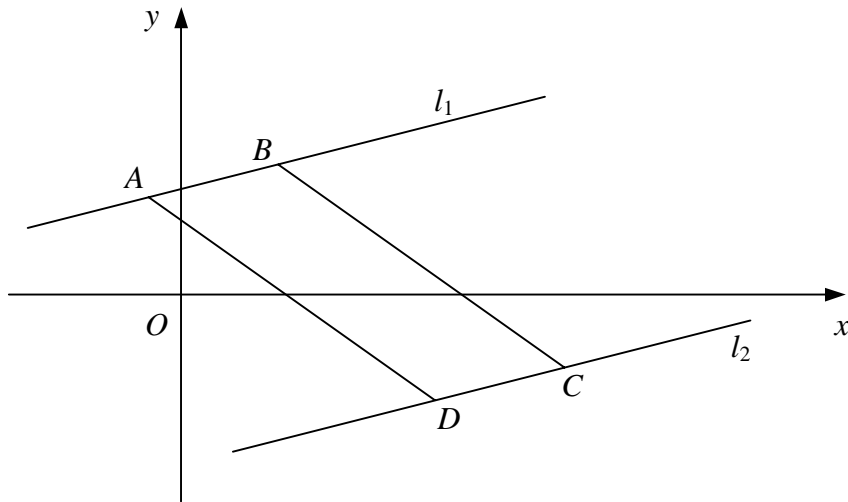
- (ii) Show that

$$f'(x) = \frac{3x^2 - 8x - 16}{4x^{\frac{3}{2}}}. \quad [5]$$

(iii) Find the coordinates of the stationary point of the curve  $y = f(x)$ . [3]

**Turn over**

9.



The diagram shows the parallelogram  $ABCD$ .

The points  $A$  and  $B$  have coordinates  $(-1, 3)$  and  $(3, 4)$  respectively and lie on the straight line  $l_1$ .

- (i) Find an equation for  $l_1$ , giving your answer in the form  $ax + by + c = 0$ , where  $a$ ,  $b$  and  $c$  are integers. [4]

The points  $C$  and  $D$  lie on the straight line  $l_2$  which has the equation  $x - 4y - 21 = 0$ .

- (ii) Show that the distance between  $l_1$  and  $l_2$  is  $k\sqrt{17}$ , where  $k$  is an integer to be found. [7]
- (iii) Find the area of parallelogram  $ABCD$ . [2]