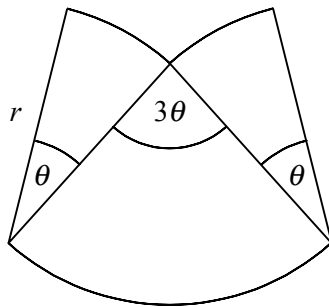


- 1 $f(x) \equiv 7 + 24x + 3x^2 - x^3$.
- a Find $f'(x)$. (2)
- b Find the set of values of x for which $f(x)$ is increasing. (4)

- 2 The curve with equation $y = x^3 + ax^2 - 24x + b$, where a and b are constants, passes through the point $P(-2, 30)$.
- a Show that $4a + b + 10 = 0$. (2)
- Given also that P is a stationary point of the curve,
- b find the values of a and b , (4)
- c find the coordinates of the other stationary point on the curve. (3)

- 3 $f(x) \equiv x^2 + \frac{16}{x}$, $x \neq 0$.
- a Find $f'(x)$. (2)
- b Find the coordinates of the stationary point of the curve $y = f(x)$ and determine its nature. (6)

4



The diagram shows a design to be used on a new brand of cat-food. The design consists of three circular sectors, each of radius r cm. The angle of two of the sectors is θ radians and the angle of the third sector is 3θ radians as shown.

Given that the area of the design is 25 cm^2 ,

- a show that $\theta = \frac{10}{r^2}$, (3)
- b find the perimeter of the design, P cm, in terms of r . (3)
- Given that r can vary,
- c find the value of r for which P takes its minimum value, (4)
- d find the minimum value of P , (1)
- e justify that the value you have found is a minimum. (2)

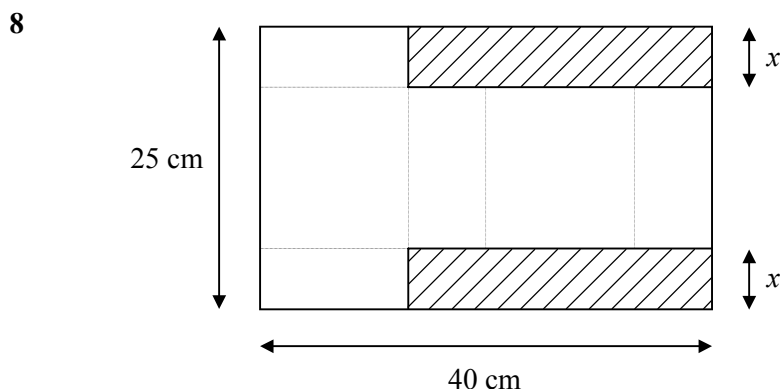
- 5 The curve C has the equation

$$y = 2x - x^{\frac{3}{2}}, \quad x \geq 0.$$

- a Find the coordinates of any points where C meets the x -axis. (3)
- b Find the x -coordinate of the stationary point on C and determine whether it is a maximum or a minimum point. (6)
- c Sketch the curve C . (2)

- 6 The curve $y = x^3 - 3x + 1$ is stationary at the points P and Q .
- a Find the coordinates of the points P and Q . (5)
- b Find the length of PQ in the form $k\sqrt{5}$. (3)

- 7 $f(x) \equiv 2x - 5 + \frac{2}{x}, x \neq 0$.
- a Solve the equation $f(x) = 0$. (4)
- b Solve the equation $f'(x) = 0$. (4)
- c Sketch the curve $y = f(x)$, showing the coordinates of any turning points and of any points where the curve crosses the coordinate axes. (3)



Two identical rectangles of width x cm are removed from a rectangular piece of card measuring 25 cm by 40 cm as shown in the diagram above. The remaining card is the net of a cuboid of height x cm.

- a Find expressions in terms of x for the length and width of the base of the cuboid formed from the net. (3)
- b Show that the volume of the cuboid is $(2x^3 - 65x^2 + 500x)$ cm³. (2)
- c Find the value of x for which the volume of the cuboid is a maximum. (5)
- d Find the maximum volume of the cuboid and show that it is a maximum. (3)
- 9 a Find the coordinates of the stationary points on the curve
- $$y = 2 + 9x + 3x^2 - x^3. \quad (6)$$
- b Determine whether each stationary point is a maximum or minimum point. (2)
- c State the set of values of k for which the equation
- $$2 + 9x + 3x^2 - x^3 = k$$
- has three solutions. (2)
- 10 $f(x) = 4x^3 + ax^2 - 12x + b$.
- Given that a and b are constants and that when $f(x)$ is divided by $(x + 1)$ there is a remainder of 15,
- a find the value of $(a + b)$. (2)
- Given also that when $f(x)$ is divided by $(x - 2)$ there is a remainder of 42,
- b find the values of a and b , (3)
- c find the coordinates of the stationary points of the curve $y = f(x)$. (6)