# Chapter 3: Coordinate Geometry

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**7.**

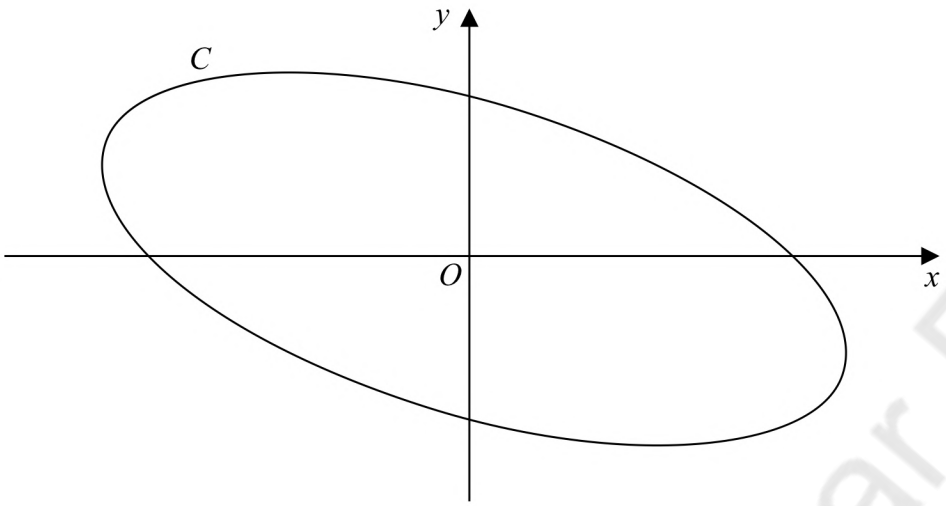


**Figure 3**

Figure 3 shows a sketch of the curve $C$ with parametric equations

$$x = 4\cos\left(t + \frac{\pi}{6}\right) \qquad y = 2\sin t \qquad 0 \leqslant t \leqslant 2\pi$$

(a) Show that

$$x + y = 2\sqrt{3}\cos t$$

**(3)**

(b) Show that a cartesian equation of $C$ is

$$(x + y)^2 + ay^2 = b$$

where $a$ and $b$ are integers to be found.

**(2)**

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**4.**

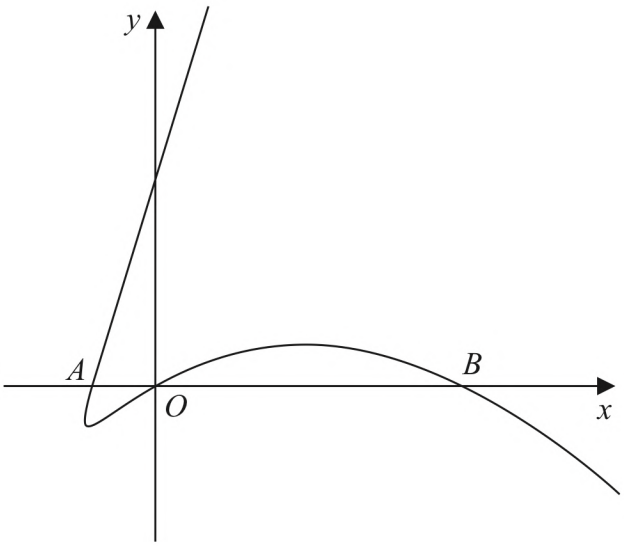


**Figure 2**

Figure 2 shows a sketch of part of the curve with parametric equations

$$x = 2t^2 - 6t, \qquad y = t^3 - 4t, \qquad t \in \mathbb{R}$$

The curve cuts the $x$-axis at the origin and at the points $A$ and $B$, as shown in Figure 2.

(a) Find the coordinates of $A$ and show that $B$ has coordinates (20, 0).

**(3)**

(b) Show that the equation of the tangent to the curve at $B$ is

$$7y + 4x - 80 = 0$$

**(5)**

The tangent to the curve at $B$ cuts the curve again at the point $P$.

(c) Find, using algebra, the $x$ coordinate of $P$.

**(4)**

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**4.** The curve $C$ is defined by the parametric equations

$$x = \frac{1}{t} + 2 \qquad y = \frac{1 - 2t}{3 + t} \qquad t > 0$$

(a) Show that the equation of $C$ can be written in the form $y = g(x)$ where g is the function

$$g(x) = \frac{ax + b}{cx + d} \qquad x > k$$

where $a$, $b$, $c$, $d$ and $k$ are integers to be found.

**(5)**

(b) Hence, or otherwise, state the range of g.

**(2)**

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**3.** The curve $C$ has parametric equations

$$x = 3 + 2\sin t \qquad y = \frac{6}{7 + \cos 2t} \qquad -\frac{\pi}{2} \leqslant t \leqslant \frac{\pi}{2}$$

(a) Show that $C$ has Cartesian equation

$$y = \frac{12}{(7 - x)(1 + x)} \qquad p \leqslant x \leqslant q$$

where $p$ and $q$ are constants to be found.

**(6)**

(b) Hence, find a Cartesian equation for $C$ in the form

$$y = \frac{a}{x + b} + \frac{c}{x + d} \qquad p \leqslant x \leqslant q$$

where $a$, $b$, $c$ and $d$ are constants.

**(3)**

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**1.** A curve $C$ has parametric equations

$$x = \frac{t}{t-3} \qquad y = \frac{1}{t} + 2 \qquad t \in \mathbb{R} \qquad t > 3$$

Show that all points on $C$ lie on the curve with Cartesian equation

$$y = \frac{ax - 1}{bx}$$

where $a$ and $b$ are constants to be found.

**(3)**

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**2.** A set of points $P(x, y)$ is defined by the parametric equations

$$x = \frac{t-1}{2t+1} \qquad y = \frac{6}{2t+1} \qquad t \neq -\frac{1}{2}$$

(a) Show that all points $P(x, y)$ lie on a straight line.

**(4)**

(b) Hence or otherwise, find the $x$ coordinate of the point of intersection of this line and the line with equation $y = x + 12$

**(2)**

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**5.**

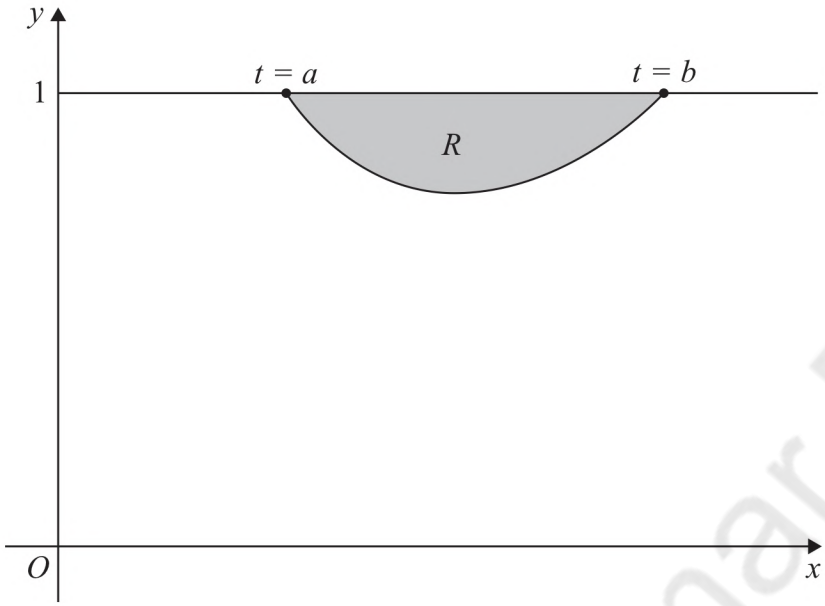


**Figure 2**

Figure 2 shows a sketch of the curve defined by the parametric equations

$$x = t^2 + 2t \qquad y = \frac{2}{t(3-t)} \qquad a \leqslant t \leqslant b$$

where $a$ and $b$ are constants.

The ends of the curve lie on the line with equation $y = 1$

(a) Find the value of $a$ and the value of $b$

**(2)**

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