

- 1 A curve has parametric equations

$$x = t^2, \quad y = \frac{2}{t}.$$

- a Find $\frac{dy}{dx}$ in terms of t . (3)
- b Find an equation for the normal to the curve at the point where $t = 2$, giving your answer in the form $y = mx + c$. (3)

- 2 A curve has the equation $y = 4^x$.

Show that the tangent to the curve at the point where $x = 1$ has the equation

$$y = 4 + 8(x - 1) \ln 2. \quad (4)$$

- 3 A curve has parametric equations

$$x = \sec \theta, \quad y = \cos 2\theta, \quad 0 \leq \theta < \frac{\pi}{2}.$$

- a Show that $\frac{dy}{dx} = -4 \cos^3 \theta$. (4)
- b Show that the tangent to the curve at the point where $\theta = \frac{\pi}{6}$ has the equation

$$3\sqrt{3}x + 2y = k,$$

where k is an integer to be found. (4)

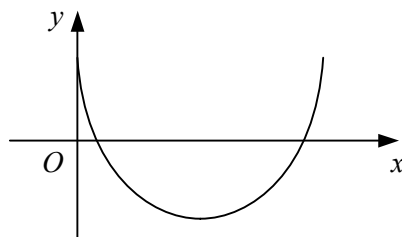
- 4 A curve has the equation

$$2x^2 + 6xy - y^2 + 77 = 0$$

and passes through the point $P(2, -5)$.

- a Show that the normal to the curve at P has the equation (6)
- $$x + y + 3 = 0.$$
- b Find the x -coordinate of the point where the normal to the curve at P intersects the curve again. (3)

- 5



The diagram shows the curve with parametric equations

$$x = \theta - \sin \theta, \quad y = \cos \theta, \quad 0 \leq \theta \leq 2\pi.$$

- a Find the exact coordinates of the points where the curve crosses the x -axis. (3)
- b Show that $\frac{dy}{dx} = -\cot \frac{\theta}{2}$. (5)
- c Find the exact coordinates of the point on the curve where the tangent to the curve is parallel to the x -axis. (2)

- 6 A curve has parametric equations

$$x = \sin \theta, \quad y = \sec^2 \theta, \quad -\frac{\pi}{2} < \theta < \frac{\pi}{2}.$$

The point P on the curve has x -coordinate $\frac{1}{2}$.

- a Write down the value of the parameter θ at P . (1)

- b Show that the tangent to the curve at P has the equation

$$16x - 9y + 4 = 0. \quad (6)$$

- c Find a cartesian equation for the curve. (2)

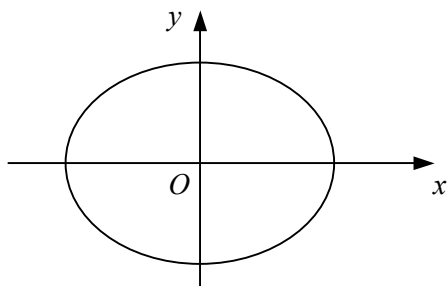
- 7 A curve has the equation

$$2 \sin x - \tan 2y = 0.$$

- a Show that $\frac{dy}{dx} = \cos x \cos^2 2y$. (4)

- b Find an equation for the tangent to the curve at the point $(\frac{\pi}{3}, \frac{\pi}{6})$, giving your answer in the form $ax + by + c = 0$. (3)

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A particle moves on the ellipse shown in the diagram such that at time t its coordinates are given by

$$x = 4 \cos t, \quad y = 3 \sin t, \quad t \geq 0.$$

- a Find $\frac{dy}{dx}$ in terms of t . (3)

- b Show that at time t , the tangent to the path of the particle has the equation

$$3x \cos t + 4y \sin t = 12. \quad (3)$$

- c Find a cartesian equation for the path of the particle. (3)

- 9 The curve with parametric equations

$$x = \frac{t}{t+1}, \quad y = \frac{2t}{t-1},$$

passes through the origin, O .

- a Show that $\frac{dy}{dx} = -2 \left(\frac{t+1}{t-1} \right)^2$. (4)

- b Find an equation for the normal to the curve at O . (2)

- c Find the coordinates of the point where the normal to the curve at O meets the curve again. (4)

- d Show that the cartesian equation of the curve can be written in the form

$$y = \frac{2x}{2x-1}. \quad (4)$$