# Edexcel (U.K.) Pre 2017

## Questions By Topic

# C4 Chap02 Coordinate Geometry and Chap4 Parametric


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**6.** A curve has parametric equations

$$x = 2\cot t, \quad y = 2\sin^2 t, \quad 0 < t \leqslant \frac{\pi}{2}.$$

(a) Find an expression for $\frac{dy}{dx}$ in terms of the parameter $t$.

**(4)**

(b) Find an equation of the tangent to the curve at the point where $t = \frac{\pi}{4}$.

**(4)**

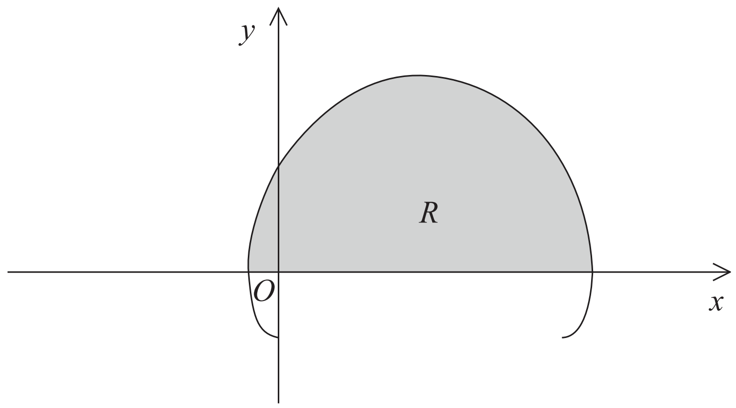
(c) Find a cartesian equation of the curve in the form $y = f(x)$. State the domain on which the curve is defined.

**(4)**

Leave blank

**8.**

**Figure 2**




The curve shown in Figure 2 has parametric equations

$$x = t - 2\sin t, \quad y = 1 - 2\cos t, \quad 0 \leqslant t \leqslant 2\pi.$$

(a) Show that the curve crosses the $x$-axis where $t = \frac{\pi}{3}$ and $t = \frac{5\pi}{3}$.

**(2)**

The finite region $R$ is enclosed by the curve and the $x$-axis, as shown shaded in Figure 2.

(b) Show that the area of $R$ is given by the integral

$$\int_{\frac{\pi}{3}}^{\frac{5\pi}{3}} (1 - 2\cos t)^2 \, dt.$$

**(3)**

(c) Use this integral to find the exact value of the shaded area.

**(7)**

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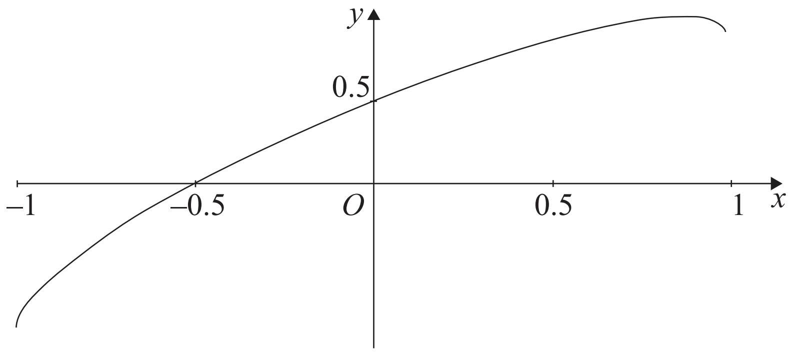
**4.**

**Figure 2**




The curve shown in Figure 2 has parametric equations

$$x = \sin t, \quad y = \sin\left(t + \frac{\pi}{6}\right), \qquad -\frac{\pi}{2} < t < \frac{\pi}{2}.$$

(a) Find an equation of the tangent to the curve at the point where $t = \frac{\pi}{6}$.

**(6)**

(b) Show that a cartesian equation of the curve is

$$y = \frac{\sqrt{3}}{2}x + \frac{1}{2}\sqrt{(1 - x^2)}, \qquad -1 < x < 1.$$

**(3)**

Leave blank

**6.** A curve has parametric equations

$$x = \tan^2 t, \qquad y = \sin t, \qquad 0 < t < \frac{\pi}{2}.$$

(a) Find an expression for $\frac{\mathrm{d}y}{\mathrm{d}x}$ in terms of $t$. You need not simplify your answer.

**(3)**

(b) Find an equation of the tangent to the curve at the point where $t = \frac{\pi}{4}$.

Give your answer in the form $y = ax + b$, where $a$ and $b$ are constants to be determined.

**(5)**

(c) Find a cartesian equation of the curve in the form $y^2 = \mathrm{f}(x)$.

**(4)**

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**7.**

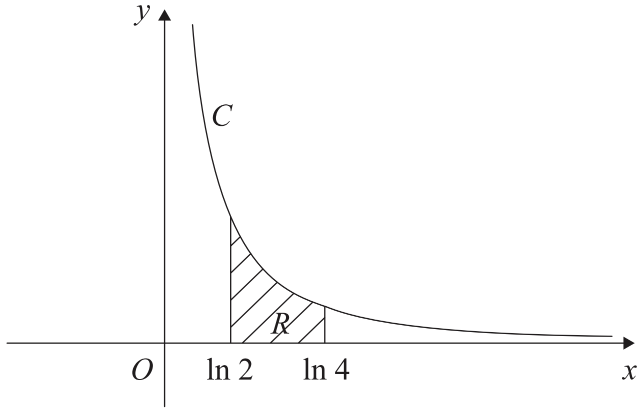


**Figure 3**

The curve $C$ has parametric equations

$$x = \ln(t+2), \qquad y = \frac{1}{(t+1)}, \qquad t > -1.$$

The finite region $R$ between the curve $C$ and the $x$-axis, bounded by the lines with equations $x = \ln 2$ and $x = \ln 4$, is shown shaded in Figure 3.

(a) Show that the area of $R$ is given by the integral

$$\int_0^2 \frac{1}{(t+1)(t+2)}\,\mathrm{d}t.$$

**(4)**

(b) Hence find an exact value for this area.

**(6)**

(c) Find a cartesian equation of the curve $C$, in the form $y = \mathrm{f}(x)$.

**(4)**

(d) State the domain of values for $x$ for this curve.

**(1)**



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**8.**

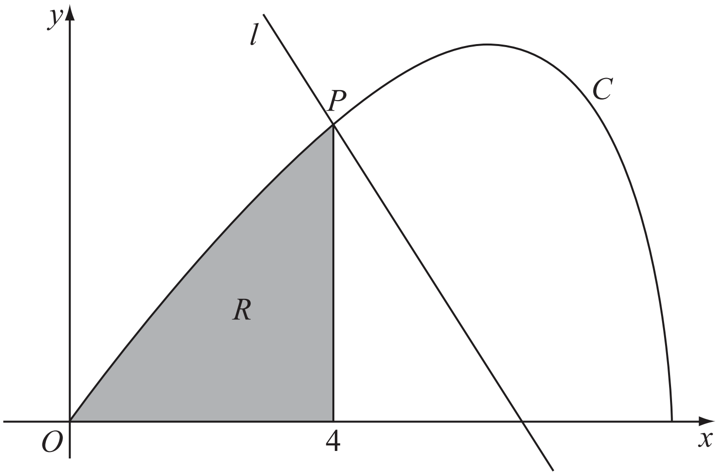


**Figure 3**

Figure 3 shows the curve $C$ with parametric equations

$$x = 8\cos t, \qquad y = 4\sin 2t, \qquad 0 \leqslant t \leqslant \frac{\pi}{2}.$$

The point $P$ lies on $C$ and has coordinates $(4, 2\sqrt{3})$.

(a) Find the value of $t$ at the point $P$.

**(2)**

The line $l$ is a normal to $C$ at $P$.

(b) Show that an equation for $l$ is $y = -x\sqrt{3} + 6\sqrt{3}$.

**(6)**

The finite region $R$ is enclosed by the curve $C$, the $x$-axis and the line $x = 4$, as shown shaded in Figure 3.

(c) Show that the area of $R$ is given by the integral $\int_{\frac{\pi}{3}}^{\frac{\pi}{2}} 64\sin^2 t\cos t \, dt$.

**(4)**

(d) Use this integral to find the area of $R$, giving your answer in the form $a + b\sqrt{3}$, where $a$ and $b$ are constants to be determined.

**(4)**

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**7.**

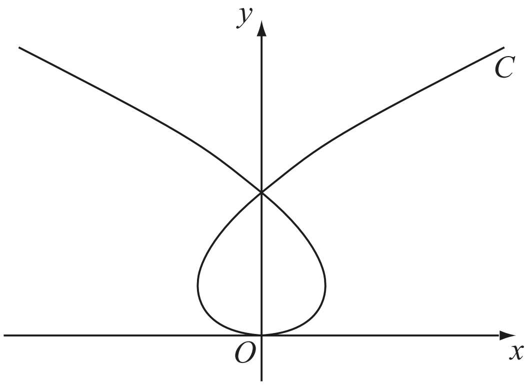


**Figure 3**

The curve $C$ shown in Figure 3 has parametric equations

$$x = t^3 - 8t, \quad y = t^2$$

where $t$ is a parameter. Given that the point $A$ has parameter $t = -1$,

(a) find the coordinates of $A$.

**(1)**

The line $l$ is the tangent to $C$ at $A$.

(b) Show that an equation for $l$ is $2x - 5y - 9 = 0$.

**(5)**

The line $l$ also intersects the curve at the point $B$.

(c) Find the coordinates of $B$.

**(6)**

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**5.**

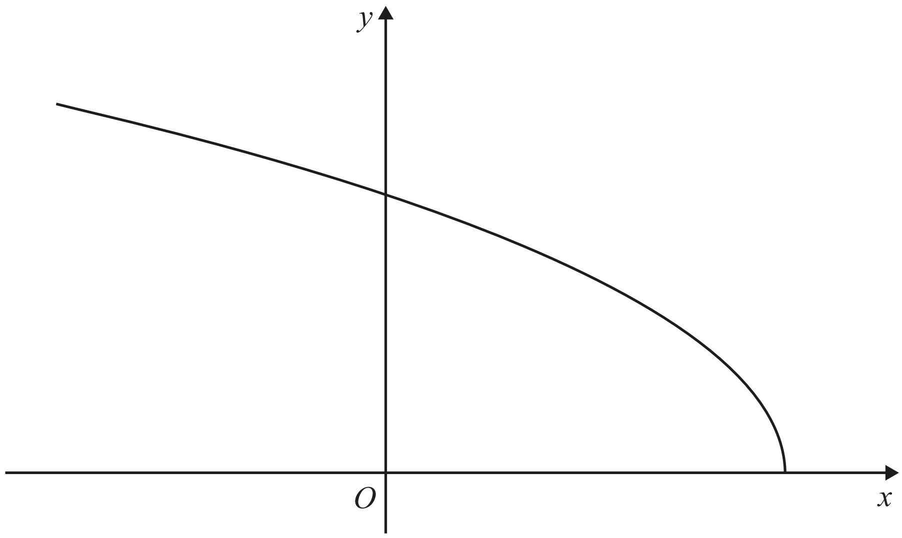


**Figure 2**

Figure 2 shows a sketch of the curve with parametric equations

$$x = 2\cos 2t, \qquad y = 6\sin t, \qquad 0 \leqslant t \leqslant \frac{\pi}{2}$$

(a) Find the gradient of the curve at the point where $t = \dfrac{\pi}{3}$.

**(4)**

(b) Find a cartesian equation of the curve in the form

$$y = \mathrm{f}(x), \quad -k \leqslant x \leqslant k,$$

stating the value of the constant $k$.

**(4)**

(c) Write down the range of $\mathrm{f}(x)$.

**(2)**

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**7.**

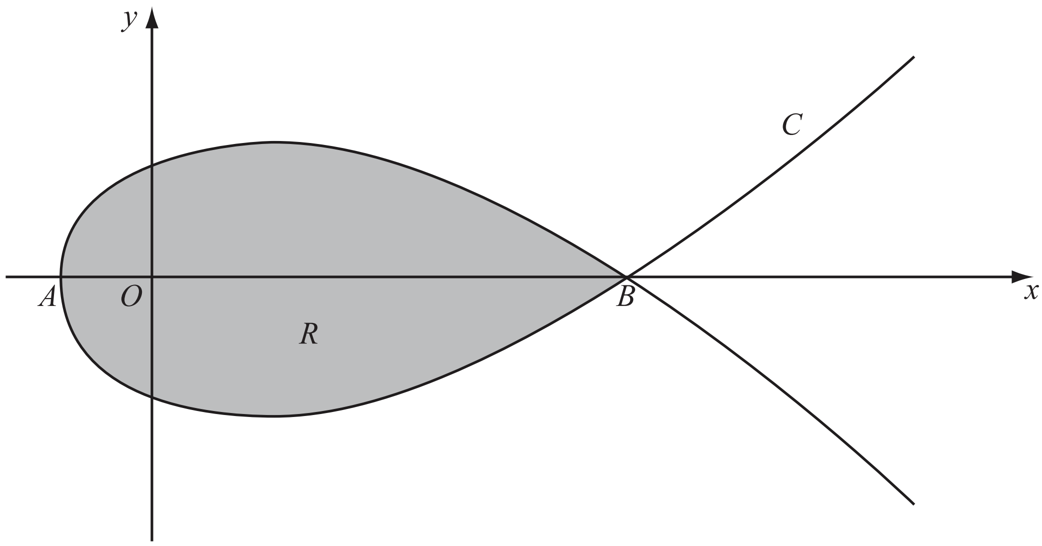


**Figure 2**

Figure 2 shows a sketch of the curve $C$ with parametric equations

$$x = 5t^2 - 4, \quad y = t(9 - t^2)$$

The curve $C$ cuts the $x$-axis at the points $A$ and $B$.

(a) Find the $x$-coordinate at the point $A$ and the $x$-coordinate at the point $B$.

**(3)**

The region $R$, as shown shaded in Figure 2, is enclosed by the loop of the curve.

(b) Use integration to find the area of $R$.

**(6)**

Leave blank

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

$$x = \sin^2 t, \quad y = 2\tan t, \quad 0 \leqslant t < \frac{\pi}{2}$$

(a) Find $\frac{\mathrm{d}y}{\mathrm{d}x}$ in terms of $t$.

**(4)**

The tangent to $C$ at the point where $t = \frac{\pi}{3}$ cuts the $x$-axis at the point $P$.

(b) Find the $x$-coordinate of $P$.

**(6)**

Leave blank

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

$$x = \ln t, \quad y = t^2 - 2, \quad t > 0$$

Find

(a) an equation of the normal to $C$ at the point where $t = 3$,

**(6)**

(b) a cartesian equation of $C$.

**(3)**

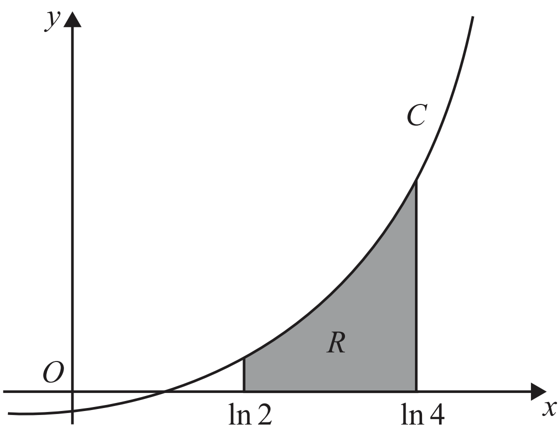


**Figure 1**

The finite area $R$, shown in Figure 1, is bounded by $C$, the $x$-axis, the line $x = \ln 2$ and the line $x = \ln 4$. The area $R$ is rotated through $360°$ about the $x$-axis.

(c) Use calculus to find the exact volume of the solid generated.

**(6)**

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**7.**

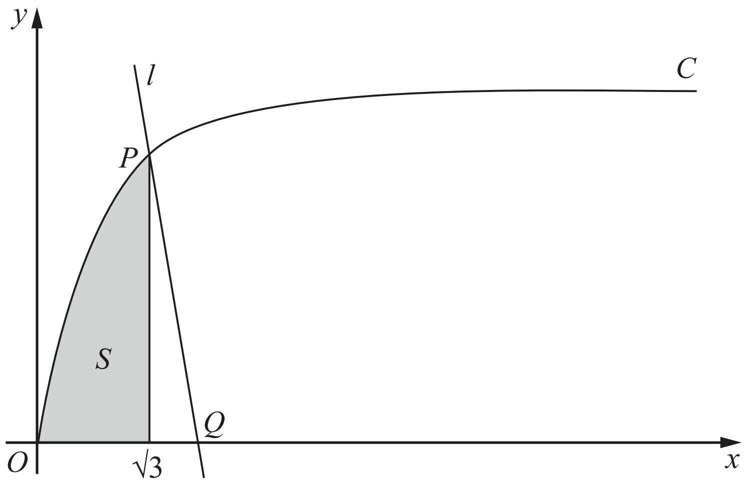


**Figure 3**

Figure 3 shows part of the curve $C$ with parametric equations

$$x = \tan\theta, \qquad y = \sin\theta, \qquad 0 \leqslant \theta < \frac{\pi}{2}$$

The point $P$ lies on $C$ and has coordinates $\left(\sqrt{3}, \frac{1}{2}\sqrt{3}\right)$.

(a) Find the value of $\theta$ at the point $P$.

**(2)**

The line $l$ is a normal to $C$ at $P$. The normal cuts the $x$-axis at the point $Q$.

(b) Show that $Q$ has coordinates $(k\sqrt{3}, 0)$, giving the value of the constant $k$.

**(6)**

The finite shaded region $S$ shown in Figure 3 is bounded by the curve $C$, the line $x = \sqrt{3}$ and the $x$-axis. This shaded region is rotated through $2\pi$ radians about the $x$-axis to form a solid of revolution.

(c) Find the volume of the solid of revolution, giving your answer in the form $p\pi\sqrt{3} + q\pi^2$, where $p$ and $q$ are constants.

**(7)**

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**5.**

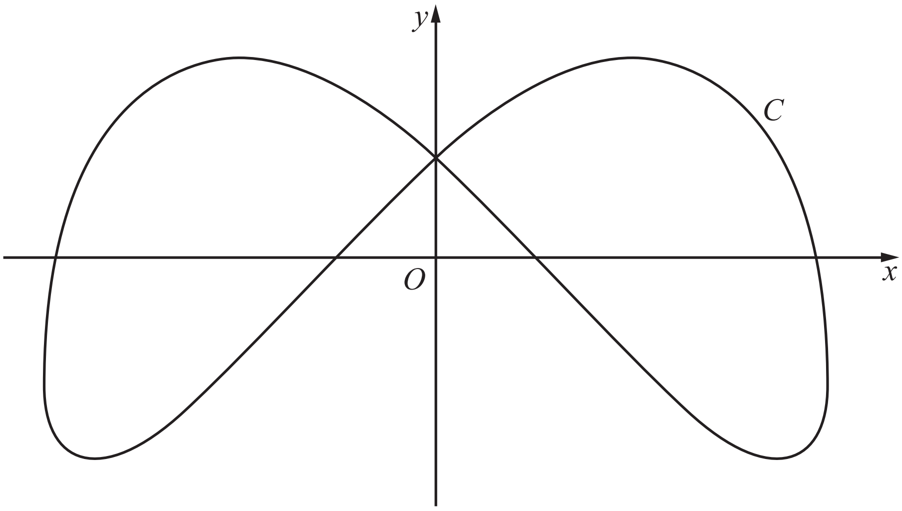


**Figure 2**

Figure 2 shows a sketch of the curve $C$ with parametric equations

$$x = 4\sin\left(t + \frac{\pi}{6}\right), \qquad y = 3\cos 2t, \qquad 0 \leqslant t < 2\pi$$

(a) Find an expression for $\frac{\mathrm{d}y}{\mathrm{d}x}$ in terms of $t$.

**(3)**

(b) Find the coordinates of all the points on $C$ where $\frac{\mathrm{d}y}{\mathrm{d}x} = 0$

**(5)**

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**5.**

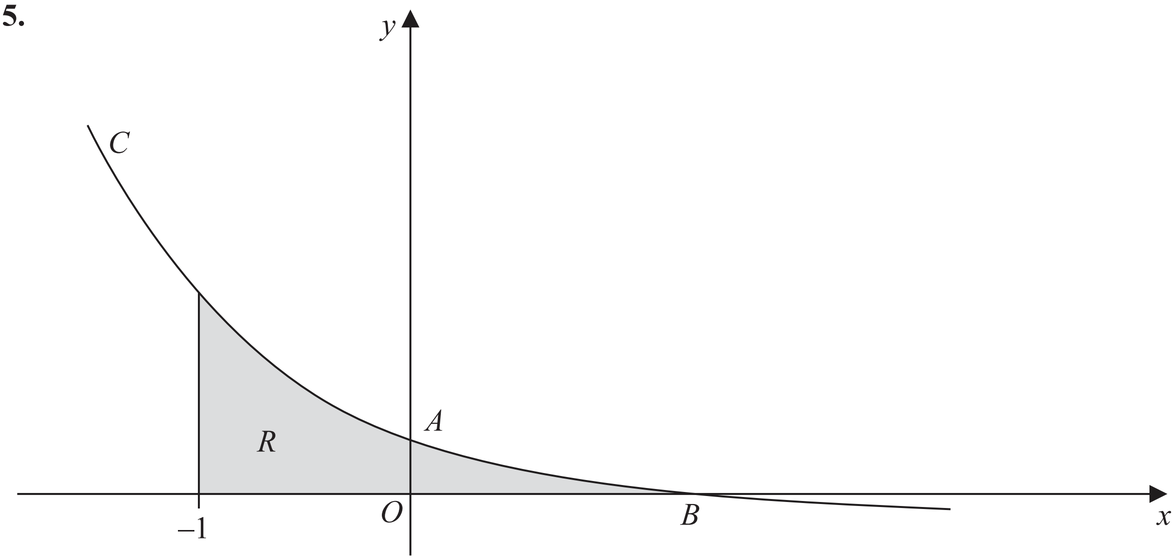


**Figure 2**

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

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

The curve crosses the $y$-axis at the point $A$ and crosses the $x$-axis at the point $B$.

(a) Show that $A$ has coordinates (0, 3).

**(2)**

(b) Find the $x$ coordinate of the point $B$.

**(2)**

(c) Find an equation of the normal to $C$ at the point $A$.

**(5)**

The region $R$, as shown shaded in Figure 2, is bounded by the curve $C$, the line $x = -1$ and the $x$-axis.

(d) Use integration to find the exact area of $R$.

**(6)**

Leave blank

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

$$x = 2\sin t, \quad y = 1 - \cos 2t, \quad -\frac{\pi}{2} \leqslant t \leqslant \frac{\pi}{2}$$

(a) Find $\frac{dy}{dx}$ at the point where $t = \frac{\pi}{6}$

**(4)**

(b) Find a cartesian equation for $C$ in the form

$$y = f(x), \quad -k \leqslant x \leqslant k,$$

stating the value of the constant $k$.

**(3)**

(c) Write down the range of $f(x)$.

**(2)**

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**7.**

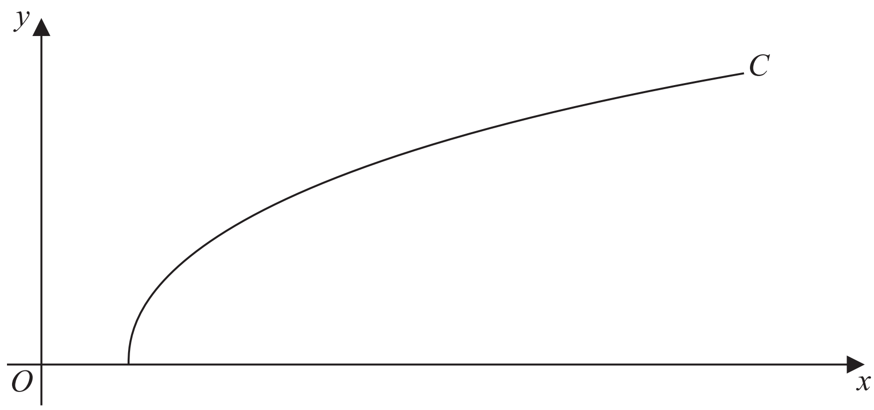


**Figure 2**

Figure 2 shows a sketch of the curve $C$ with parametric equations

$$x = 27\sec^3 t, \quad y = 3\tan t, \qquad 0 \leqslant t \leqslant \frac{\pi}{3}$$

(a) Find the gradient of the curve $C$ at the point where $t = \frac{\pi}{6}$

**(4)**

(b) Show that the cartesian equation of $C$ may be written in the form

$$y = (x^{\frac{2}{3}} - 9)^{\frac{1}{2}}, \qquad a \leqslant x \leqslant b$$

stating the values of $a$ and $b$.

**(3)**

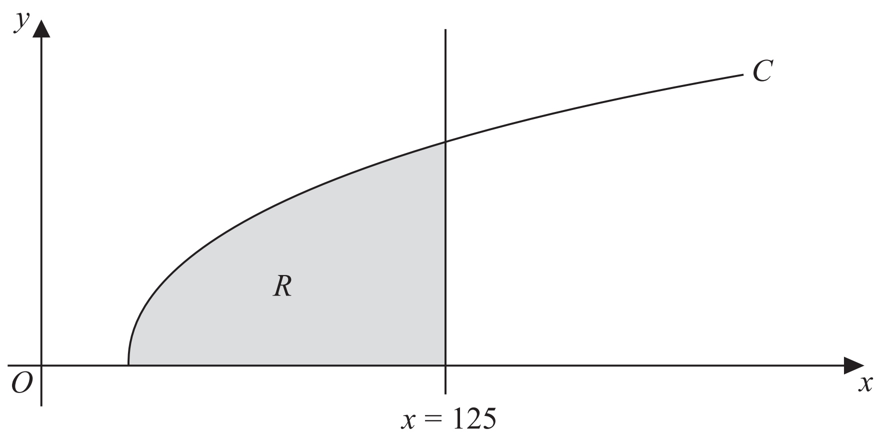


**Figure 3**

The finite region $R$ which is bounded by the curve $C$, the $x$-axis and the line $x = 125$ is shown shaded in Figure 3. This region is rotated through $2\pi$ radians about the $x$-axis to form a solid of revolution.

(c) Use calculus to find the exact value of the volume of the solid of revolution.

**(5)**