

8.

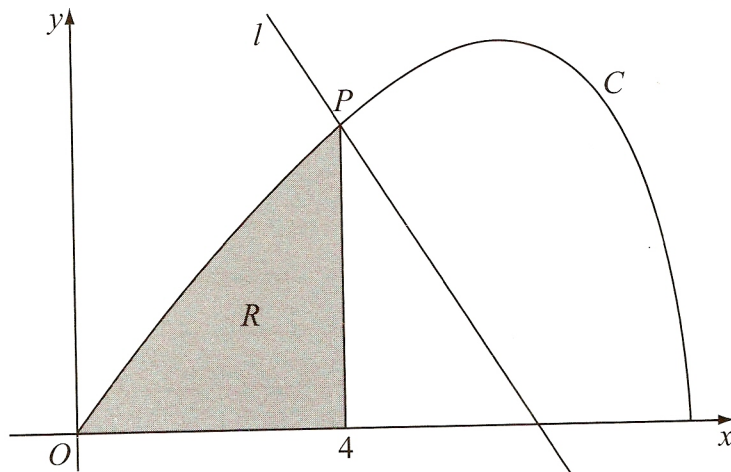


Figure 3

Figure 3 shows the curve C with parametric equations

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

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)