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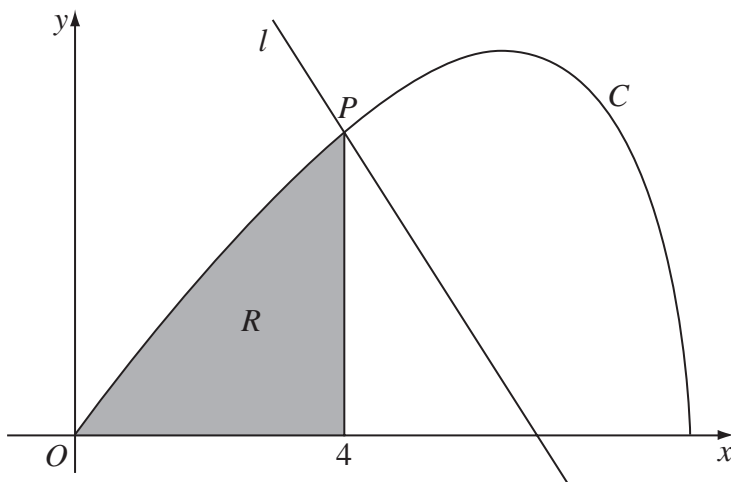


Figure 3

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)

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