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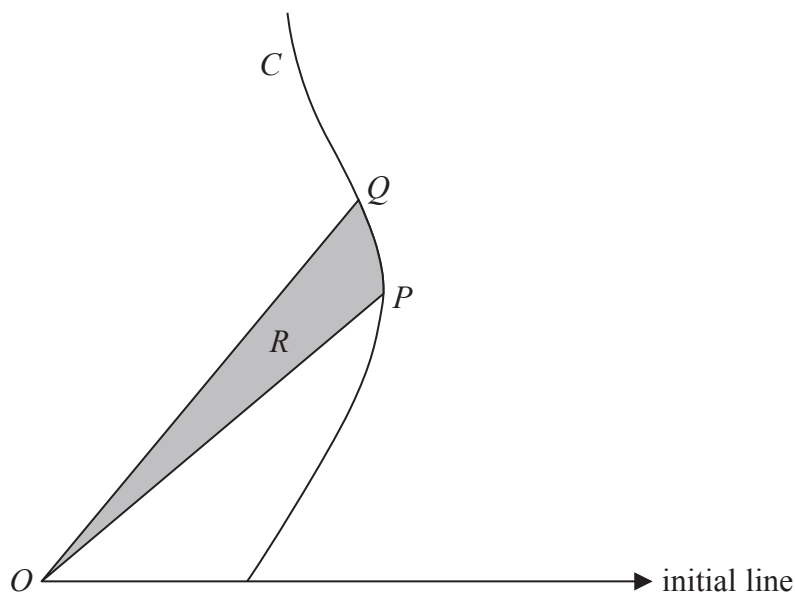


Figure 1

Figure 1 shows a sketch of part of the curve  $C$  with polar equation

$$r = 1 + \tan \theta, \quad 0 \leq \theta < \frac{\pi}{2}$$

The tangent to the curve  $C$  at the point  $P$  is perpendicular to the initial line.

- (a) Find the polar coordinates of the point  $P$ . (5)

The point  $Q$  lies on the curve  $C$ , where  $\theta = \frac{\pi}{3}$

The shaded region  $R$  is bounded by  $OP$ ,  $OQ$  and the curve  $C$ , as shown in Figure 1

- (b) Find the exact area of  $R$ , giving your answer in the form

$$\frac{1}{2} (\ln p + \sqrt{q} + r)$$

where  $p$ ,  $q$  and  $r$  are integers to be found. (7)

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