6.

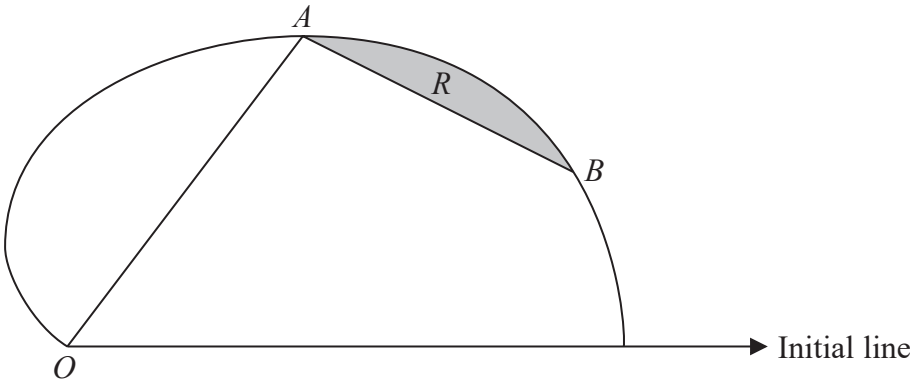


Figure 1

The curve shown in Figure 1 has polar equation

$$r = 4a(1 + \cos\theta) \qquad 0 \leqslant \theta < \pi$$

where a is a positive constant.

The tangent to the curve at the point A is parallel to the initial line.

(a) Show that the polar coordinates of A are $\left(6a, \frac{\pi}{3}\right)$

(6)

The point B lies on the curve such that angle $AOB = \frac{\pi}{6}$

The finite region R, shown shaded in Figure 1, is bounded by the line AB and the curve.

(b) Use calculus to determine the area of the shaded region R, giving your answer in the form $a^2\left(n\pi + p\sqrt{3} + q\right)$, where n, p and q are integers.

(7)

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(Total for Question 6 is 13 marks)

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