8.

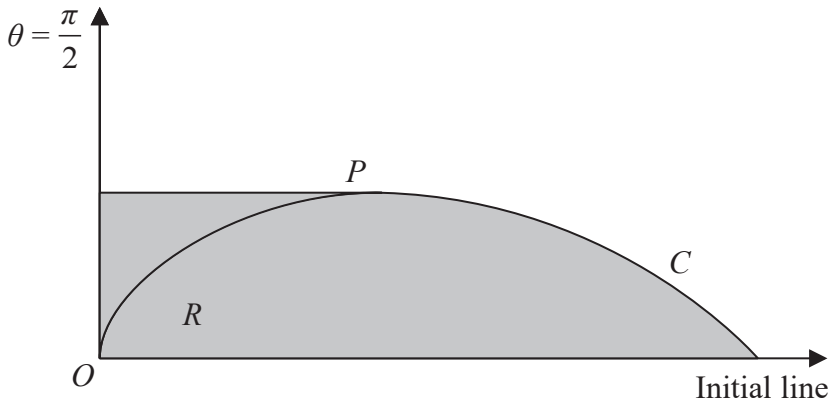


Figure 1

The curve C shown in Figure 1 has polar equation

$$r = 1 - \sin\theta \qquad 0 \leqslant \theta < \frac{\pi}{2}$$

The point P lies on C, such that the tangent to C at P is parallel to the initial line.

(a) Use calculus to determine the polar coordinates of P

(4)

The finite region R, shown shaded in Figure 1, is bounded by

- the line with equation $\theta = \frac{\pi}{2}$
- the tangent to C at P
- part of the curve C
- the initial line

(b) Use algebraic integration to show that the area of R is

$$\frac{1}{32}\left(a\pi + b\sqrt{3} + c\right)$$

where a, b and c are integers to be determined.

(6)

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(Total for Question 8 is 10 marks)

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