6. **In this question you must show all stages of your working.**
Solutions relying entirely on calculator technology are not acceptable.

The curve C_1 has equation

$$r = \sqrt{3} + \tan\theta \qquad 0 < \theta < \frac{\pi}{2}$$

The tangent to C_1 is perpendicular to the initial line at the point P

(a) Use calculus to determine, in simplest form, the exact polar coordinates of P

(4)

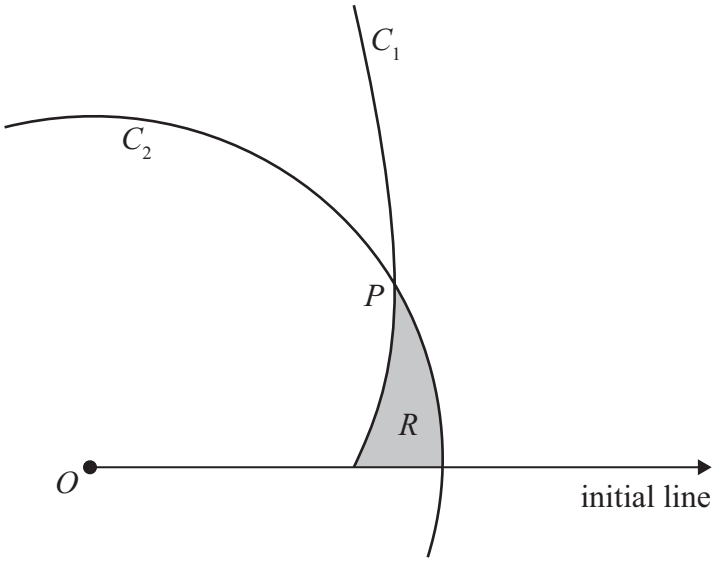


Figure 3

Figure 3 shows a sketch of part of the curve C_1 and part of the curve C_2

The curve C_2 is a circle with centre at the pole O.

The curves C_1 and C_2 intersect at P.

The region R, shown shaded in Figure 3, is bounded by C_1, C_2 and the initial line.

(b) Use algebraic integration to determine the area of R, giving the answer in the form

$$a\pi + \frac{\sqrt{3}}{2}(\ln b + c)$$

where a, b and c are rational numbers.

(8)

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Question 6 continued

(Total for Question 6 is 12 marks)