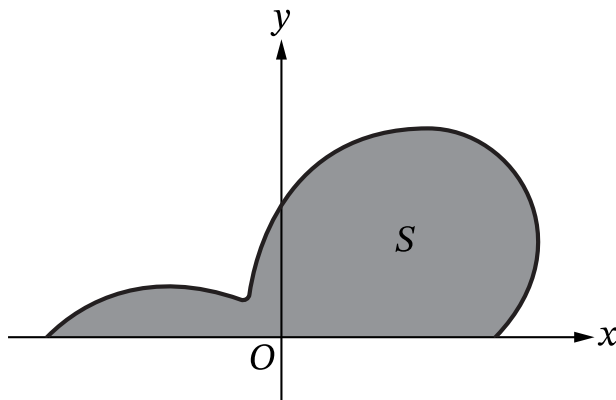


2. Let S be the shaded region bounded by the graph of the polar curve $r(\theta) = 3 + 2 \sin(2\theta) + \cos(2\theta)$ for $0 \leq \theta \leq \pi$, as shown in the figure.



It can be shown that $r'(\theta) = 4 \cos(2\theta) - 2 \sin(2\theta)$.

(Note: Your calculator should be in radian mode.)

Part A

Find the area of region S . Show the setup for your calculations.

Part B

There is a point on the curve at which the slope of the line tangent to the curve is $-\frac{3}{7}$. At this point, $\frac{dy}{d\theta} = \frac{3\sqrt{2}}{2}$. Find $\frac{dx}{d\theta}$ at this point. Show the work that leads to your answer.

Part C

- Find the value of θ in the interval $0 < \theta < \frac{\pi}{2}$ at which r has a critical point.
- Use a derivative test to determine whether the critical point is the location of a relative minimum, a relative maximum, or neither for r .

Part D

Find the average distance from the origin to a point on the polar curve

$r(\theta) = 3 + 2 \sin(2\theta) + \cos(2\theta)$ for $\frac{\pi}{2} \leq \theta \leq \pi$. Show the setup for your calculations.

END OF PART A