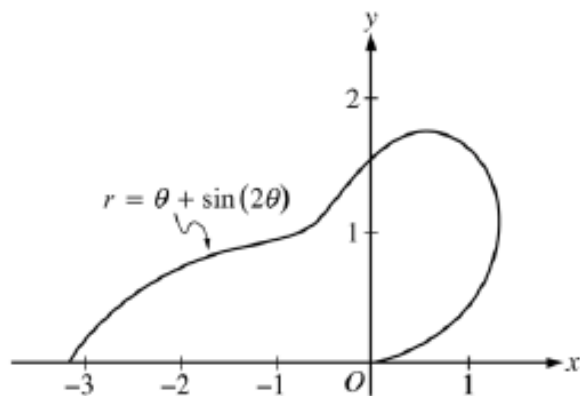


Free Response:

1) 2005 BC #2 (Calculator)



The curve above is drawn in the xy -plane and is described by the equation in polar coordinates $r = \theta + \sin(2\theta)$ for $0 \leq \theta \leq \pi$, where r is measured in meters and θ is measured in radians. The derivative of r with respect to θ is given by $\frac{dr}{d\theta} = 1 + 2\cos(2\theta)$.

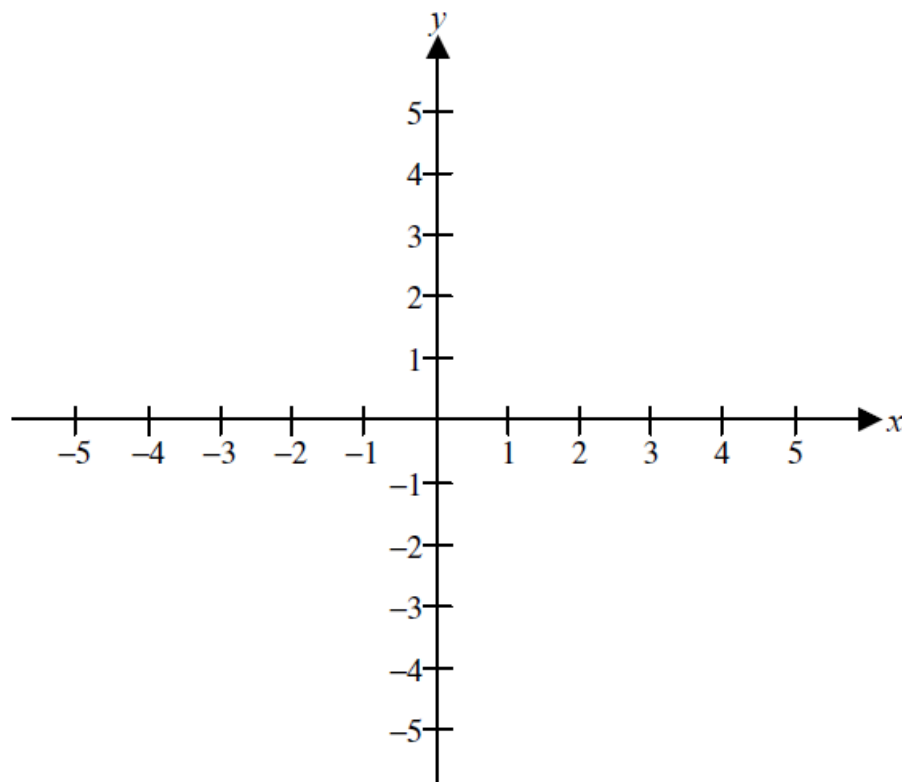
- (a) Find the area bounded by the curve and the x -axis.
- (b) Find the angle θ that corresponds to the point on the curve with x -coordinate -2 .
- (c) For $\frac{\pi}{3} < \theta < \frac{2\pi}{3}$, $\frac{dr}{d\theta}$ is negative. What does this fact say about r ? What does this fact say about the curve?
- (d) Find the value of θ in the interval $0 \leq \theta \leq \frac{\pi}{2}$ that corresponds to the point on the curve in the first quadrant with greatest distance from the origin. Justify your answer.

2)

1990 BC4

Let R be the region inside the graph of the polar curve $r = 2$ and outside the graph of the polar curve $r = 2(1 - \sin \theta)$.

- (a) Sketch the two polar curves in the xy -plane provided below and shade the region R .



- (b) Find the area of R .

3) **BC 1985 #5**

Consider the curves $r = 3 \cos \theta$ and $r = 1 + \cos \theta$.

- (a) Sketch the curves on the same set of axes.
- (b) Find the area of the region inside the curve $r = 3 \cos \theta$ and outside the curve $r = 1 + \cos \theta$ by setting up and evaluating a definite integral. Your work must include an antiderivative.