The curve above is drawn in 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 \( \theta \) is measured in radians. The derivative of \( r \) with respect to \( \theta \) is given by 
\[ \frac{dr}{d\theta} = 1 + 2\cos(2\theta) \].

a. Find the slope of the curve at the point \( \theta = \frac{\pi}{2} \).

\[ x = r \cos \theta = (\theta + \sin(2\theta)) \cos \theta \]
\[ y = r \sin \theta = (\theta + \sin(2\theta)) \sin \theta \]
\[ \frac{dy}{dx} = \frac{-1}{(\theta + \sin(2\theta)) \cos \theta} \]

b. Find the angle \( \theta \) that corresponds to the point on the curve with \( x \)-coordinate -2.

\[ x = r \cos \theta = -2 \]
\[ 2 = (\theta + \sin(2\theta)) \cos \theta \]
\[ \theta = 2.786 \]

c. For \( \frac{\pi}{2} < \theta \leq \frac{2\pi}{3} \), \( \frac{dr}{d\theta} \) is negative. What does this fact say about \( r \)? What does this fact say about the curve? Radii is getting smaller and \( r \) is closer to the origin.

d. Opp sign, \( \frac{dr}{d\theta} \) and \( r \) are opp signs.

\[ e. \text{ Find the value of } \theta \text{ in the interval } 0 \leq \theta \leq \frac{\pi}{2} \text{ that corresponds to the point on the curve in the first quadrant with greatest distance from the origin. Justify your answer.} \]

\[ r = \theta + \sin(2\theta) \]
\[ \frac{dr}{d\theta} = 1 + 2\cos(2\theta) \]
\[ r(0) = 0 \]
\[ r\left(\frac{\pi}{3}\right) = \frac{\pi}{3} + \sqrt{3} \]
\[ \frac{\pi}{2} \text{ abs max} \]
\[ r\left(\frac{\pi}{2}\right) = \frac{\pi}{2} \]
56. Inside the four-petaled rose \( r = 4 \cos 2\theta \) and outside the circle \( r = 2 \)

Determine the polar curves and shaded area represented by the integral given below.

\[
A = \frac{1}{2} \int_{\pi/6}^{5\pi/6} (2 \sin \theta)^2 \, d\theta - \frac{1}{2} \int_{\pi/6}^{5\pi/6} (1)^2 \, d\theta
\]