Unit #6: Parametric and Polar Derivatives
Topic: Polar Derivatives
Objective: SWBAT write the equation of the tangent line to a polar curve by using the formula for a polar derivative.

Warm Up #7:

1) Find the rectangular coordinates for the points with the given polar coordinates.

a) $(16, \frac{5\pi}{6})$ b) $(-\sqrt{2}, -\frac{\pi}{4})$

2) Find two different sets of polar coordinates for the points with given rectangular coordinates.

a) (0,-4) b) $(1, \sqrt{3})$

The Slope of a Polar Curve

Using the method for finding the slope of a parametric curve and the Product Rule we can find the derivative of a Polar Curve.

$$\frac{dy}{dx} =$$

Example #1:

Find the slope of the curve $r = 2 + 3sin\theta$ at the point where $\theta = \frac{3\pi}{4}$.

Example #2:

Find the slope of the curve $r = 2sin3\theta$ at the point where $\theta = \frac{\pi}{6}$ and use it to find the equation of the tangent line to the curve at this point.

Problem Set #7:

Write the equation of the tangent line to each of the following curves at the indicated point.

1) $r = 3(1 - cos\theta);\ \ \theta = \frac{\pi}{2}$

2) $r = cos2\theta;\ \ \theta = -\frac{\pi}{2}$

3) $r = 2 - 3sin\theta;\ \ \theta = \pi$

4) $r = 4sin\theta;\ \ \theta = \frac{\pi}{3}$

5) $r = 2sin(3\theta);\ \ \theta = \frac{\pi}{4}$

6) $r = 2(1 + cos\theta);\ \ \theta = \frac{\pi}{6}$

Example #3:

Find all the points on the graph of $r = 1 - sin\theta$ where the tangent lines to the graph are

a) horizontal

b) vertical

Problem Set #8:

7) Find all the points on the interval $0 \leq \theta \leq 2\pi$ at which the tangent lines to the graph of the curve $r = 2 - 2cos\theta$ are horizontal and vertical. Give your answer in the polar form (r, θ).

8) At what point(s) on the graph of $r = -5sin\theta$ is the tangent line (a) vertical and (b) horizontal?

9) Find all angles on the interval $[0,2\pi)$ at which the tangent line to the graph of the polar equation $r = 2csc\theta + 3$ is horizontal.

Answers

1) $y-3=-x$ 2) $y=-1$ 3) $y=\frac{2}{3}(x+2)$ 4) $y-3=-\sqrt{3}\,(x-\sqrt{3}\,)$

5) $y-1=\frac{1}{2}(x+1)$ 6) $y-\left(1+\frac{\sqrt{3}}{2}\right)=-(x-(\sqrt{3}+3)$

7) Horizontal $\left(3,\frac{2\pi}{3}\right)\left(3,\frac{4\pi}{3}\right)$ Vertical $\left(1,\frac{\pi}{3}\right)\left(1,\frac{5\pi}{3}\right)(4,\pi)$

8) Vertical $\left(\frac{-5\sqrt{2}}{2},\frac{\pi}{4}\right)\left(\frac{-5\sqrt{2}}{2},\frac{3\pi}{4}\right)\left(\frac{5\sqrt{2}}{2},\frac{5\pi}{4}\right)\left(\frac{5\sqrt{2}}{2},\frac{7\pi}{4}\right)$

Horizontal $POLE,\left(-5,\frac{\pi}{2}\right)\left(5,\frac{3\pi}{2}\right)(0,\pi)(0,2\pi)$

9) $\theta=\frac{\pi}{2},\frac{3\pi}{2}$