In-Class Assignment 11: Polar Curves

MATH 142

Directions: Work neatly on a separate sheet of paper. Your **group** will hand in one write-up with everyone's name on it. **DO NOT** fold the corner over to hold everything together!

Work together on each problem; do not delegate different problems to different people.

In **polar coordinates**, a point P in the plane is specified by r, its distance from the origin O, and θ, the angle (measured counterclockwise) that the ray $\overrightarrow{OP}$ makes with the positive x-axis. We allow $r < 0$ with the understanding that in that case, the ray $\overrightarrow{OP}$ points in the opposite direction from what θ would indicate.

NOTE: Our usual (x, y) coordinates are referred to as **rectangular** coordinates.

1. Plot the points with polar coordinates $(2, \pi/6)$, $(5, -\pi/3)$, and $(-2, 6\pi)$.
2. Give three different pairs of polar coordinates for the point $(0, 1)$ (given in rectangular coordinates).
3. If P has polar coordinates (r, θ), what are its rectangular (i.e., (x, y)) coordinates? [Hint: draw a picture and do a little geometry.]
4. Using the relationship from 3, determine the polar coordinates of the point with rectangular coordinates (x, y).
5. Convert to rectangular coordinates the points in number 1.
6. Suppose that $r = \cos(\theta)$. Sketch the polar curve this represents. [Let's do this first one together.]
7. Sketch the polar curve $r = \sin(2\theta)$.
8. Sketch the polar curve $r = 1 - 2\cos\theta$.
9. Sketch the polar curve $r = 3$.
10. Sketch the polar curve $\theta = \pi/3$.
11. If r is given as a function of θ, then we can view θ as a parameter and the polar curve as a parametric curve. With this information, develop formulas for
    (a) the slope of the tangent line to a polar curve and
    (b) the arc length of a polar curve.
12. Find an equation of the tangent line to the polar graph of $r = 2 - \sin\theta$ at $\theta = \pi/3$.

Areas are a little trickier; we will deal with them when we return.

Have a great break!