MAT 301
Homework # 5
Due: Friday, October 27th, 2017

Directions: Write careful solutions to each of the following problems on separate sheets of paper. (You may put more than one solution on the same sheet of paper, if you have enough room). Be sure to show all of your work. You are allowed to talk to your classmates about these problems. If you do receive help from a classmate, be sure to give them credit by noting their name on your solution. All solutions should be written in your own words, regardless of if you've received help. Partial credit is available. Each problem is worth five points.

1. Consider the parametric equations $x = 3\cos t$ and $y = 3\sin t$.

(a) Briefly describe the curve represented by these equations.

(b) How does the curve represented by the parametric equations $x = 3\cos t - 3$ and $y = 3\sin t + 2$ compare to the curve in part (a)?

(c) How does the curve represented by the parametric equations $x = 5\cos t$ and $y = 5\sin t$ compare to the curve in part (a)?

(d) How would you use parametric equations to describe a circle with center (h, k) and radius r?

2. Consider the curve defined by the parametric equations $x = t^2$ and $y = t^3 - t^2 - 6t$ for $-4 \le t \le 4$.

(a) Find all points where the curve has a horizontal tangent line.

(b) Find all points where the curve has a vertical tangent line.

(c) Find the slope of the curve when $t = -2$.

(d) Sketch a graph of the curve, including the orientation.

3. The curve defined by the parametric equations $x = \cos\theta + \theta\sin\theta$ and $y = \sin\theta - \theta\cos\theta$ for $\theta \in [0, 2\pi]$ is called the *involute of the circle.*

(a) Sketch a graph of the curve.

(b) Find the arc length of the curve.