# Math 2315 - Calculus 2

**Exam #2 - 2017.02.24**

Name: ______________________________

---

1. Solve the following initial value problem explicitly: $y' = e^{x+y}, \quad y(0) = 3$

2. Write the parametric equations $(x, y) = (x(t), y(t))$ which represents a circle of radius 3 centered at $(-1, 1)$ such that all of the following holds simultaneously:
   (a) $(x(0), y(0)) = (-1, 4)$,
   (b) the curve is oriented counter-clockwise,
   (c) it takes a total of $\pi$ time units to complete a full revolution back to the point $(-1, 4)$.

3. Consider the parametric equations $(x(t), y(t)) = (\sqrt{t^2 + 3}, \sin(\pi t))$.

(a) Verify that $(x(-1), y(-1)) = (x(1), y(1))$.

(b) Find the equations of the two tangents lines to $(x(t), y(t))$ for $t = -1$ and $t = 1$.

(c) Find all values of $t$ on the interval $[-1, 1]$ for which $(x(t), y(t))$ has a horizontal or vertical tangent line.

4. Consider the parametric equations $(x(t), y(t)) = (t\cos(t), t\sin(t))$. Verify that the arclength of the curve for $-1 \leq t \leq 1$ is given by the integral

$$\int_{-\pi/4}^{\pi/4} \sec^3(\theta)\, \mathrm{d}\theta$$

*You do not have to calculate this integral, just simplify your arclength formula until you end up with this integral.*

5. Plot the polar curve $r = \theta\sin(2\theta)$ for $0 \leq \theta \leq 2\pi$.

6. Compute the area of the loop in the first quadrant of the graph of the polar equation $r = \theta\sin(2\theta)$ from the previous problem. You may need to make use of the trigonometric identity:

$$\sin^2(\theta) = \frac{1}{2}(1 - \cos(2\theta))$$