# Math 308 Quiz 2

Monday, January 29, 2024

**Name:**_____

**Directions:** Please upload a PDF file of your solutions on Gradescope by Friday 2 February at 10pm. You may discuss in groups but please submit your own work.

1. (5 points) Solve the initial value problem $y' = 2y^2 + xy^2, \quad y(0) = 1$ and determine where the solution attains its minimum value.

2. (5 points) Consider the logistic equation $y' = y(1 - y)$

   (a) Find the equilibrium solutions and draw a phase line.

   (b) Using the phase line, predict the large $t$ limit of the solution $y(t)$ that satisfies the initial condition $y(0) = 1/2$

   (c) Find the explicit solution to the initial value problem with initial condition $y(0) = 1/2$ and compare with your prediction.

3. (5 points) Find the general solution to

$$3x^2 \sin(2y) + \left(2x^3 \cos(2y) + \frac{1}{y}\right) y' = 0.$$

4. The amount of salt in a mixing tank is described by the equation

$$\frac{dQ}{dt} = 3 - \frac{Q}{200 + 2t}.$$

Initially, the tank contains $Q(0) = 100$ grams of salt. Find the amount of salt at time $t$.