MATH 252: Elementary Differential Equations

Quiz 1

NAME: _____ Date: September 15, 2017

Solve the following problems, and hand in by the end of class on **Tuesday, September 19th**. No calculators or other electronic devices should be used (of course, this is unenforceable), and you should show all work. **Note that there is a problem on the back.**

1. (4 points) Find the general solution of the below differential equation:

$$\frac{dy}{dt} = 2y + 1$$

2. (3 points) Consider the differential equation

$$\frac{dy}{dt} = y^3 - y^2 - 12y.$$

   (a) For what values of y is $y(t)$ in equilibrium?

   (b) For what values of y is $y(t)$ increasing?

   (c) For what values of y is $y(t)$ decreasing?

3. (3 points) Answer (in a short sentence or two) the following questions relating to the below predator-prey system:

$$\frac{dx}{dt} = \alpha x - \alpha \frac{x^2}{N} - \beta xy$$
$$\frac{dy}{dt} = \gamma y + \delta xy.$$

Assume all parameters are positive.

(a) Which population is the predator, and which is the prey? Why?

(b) Is the growth of the prey limited by any factors other than the number of predators? If so, what term represents this?

(c) Do the predators have a food source other than the prey? If so, what term represents this?