

MATH 252: Elementary Differential Equations

Quiz 1

NAME: _____

Date: September 15, 2016

Solve the following problems on this sheet of paper. **Note that there is a problem on the back.**
No calculators or other electronic devices are permitted.

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:

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

Assume all parameters are positive.

- Which population is the predator, and which is the prey? Why?
- Is the growth of the prey limited by any factors other than the number of predators? If so, what term represents this?
- Do the predators have a food source other than the prey? If so, what term represents this?