

MATH 252: Elementary Differential Equations

Quiz 2

NAME: _____

Date: September 28, 2017

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) Consider the differential equation

$$\frac{dy}{dt} = 1 + \cos y.$$

- (a) Plot the phase line for this differential equation. *Hint:* I suggest first plotting the right-hand side ($f(y)$) as a function of y .
- (b) Identify **ALL** equilibrium points as stable (sinks), unstable (sources), or semi-stable (nodes).

2. (2 points) Suppose we know that the function $f(t, y)$ is continuous and that $f(t, 3) = -1$ for all t .

- (a) What does this tell you about the slope field for the differential equation

$$y' = f(t, y)?$$

I suggest drawing a picture, representing only the information you have been given.

- (b) Suppose $y(0) < 3$. Is it possible that $y(t) \rightarrow \infty$ as t increases? Give a (short) reason, using your answer from part (a). **No credit will be given to simple yes/no answers.**

3. (4 points) Consider the IVP

$$\begin{cases} \frac{dy}{dt} = y^3 \\ y(0) = 1. \end{cases}$$

- (a) Find a formula for the solution.
- (b) State the domain of definition of the solution.
- (c) What happens to the solution as it approaches the limits of its domain of definition?