Exam 1: Take-Home

Name: _____

Math 230: Differential Equations

Due Wednesday, October 10, at the beginning of class time

Take-Home Instructions:

1. *For this part of the exam, you may use your textbook, your notes, the course web site, and computing technology (e.g.* Mathematica*).*
2. *Do not consult other sources, people, web sites, etc.*
3. *Answer the following questions. Write your answers on separate paper. Check your work.*
4. *Consider the pledge at the end of this page. Turn this page, along with your solutions, at the beginning of the final exam session.*

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1. (8 points) Consider the differential equation:

$$\frac{dy}{dt} = \frac{\cos(\pi y) + 1}{t + 1}$$

   (a) Draw the slope field for this differential equation and sketch the solution with $y(0) = 0$.

   (b) If $y(0) = 0$, use Euler's method to approximate $y(3)$.

2. (10 points) Consider the system of two differential equations:

$$\frac{dx}{dt} = x^2 - 1$$
$$\frac{dy}{dt} = 2x^2 + xy - y^2$$

   (a) Find all equilibrium solutions of this system.

   (b) Draw the phase portrait for this system.

   (c) What is the long-term behavior of the solution with initial point $(-4, -2)$?

   (d) What is the long-term behavior of the solution with initial point $(2, 0)$?

St. Olaf Honor Pledge: I pledge my honor that on this examination I have neither given nor received assistance not explicitly approved by the professor and that I have seen no dishonest work.

Signed: _____

☐ I have intentionally not signed the pledge. (Check the box if appropriate.)