Worksheet 1: Section 1.1, 1.3

May 30, 2017

Name: _____

Assignment: Read sections 1.1 and 1.3, and watch the 'Day 1 Videos' posted to the Canvas site. The last few questions on this sheet will come from the end of the videos.

1 Section 1.1

1. What are differential equations?

2. What is the term for equation used to describe a physical process?

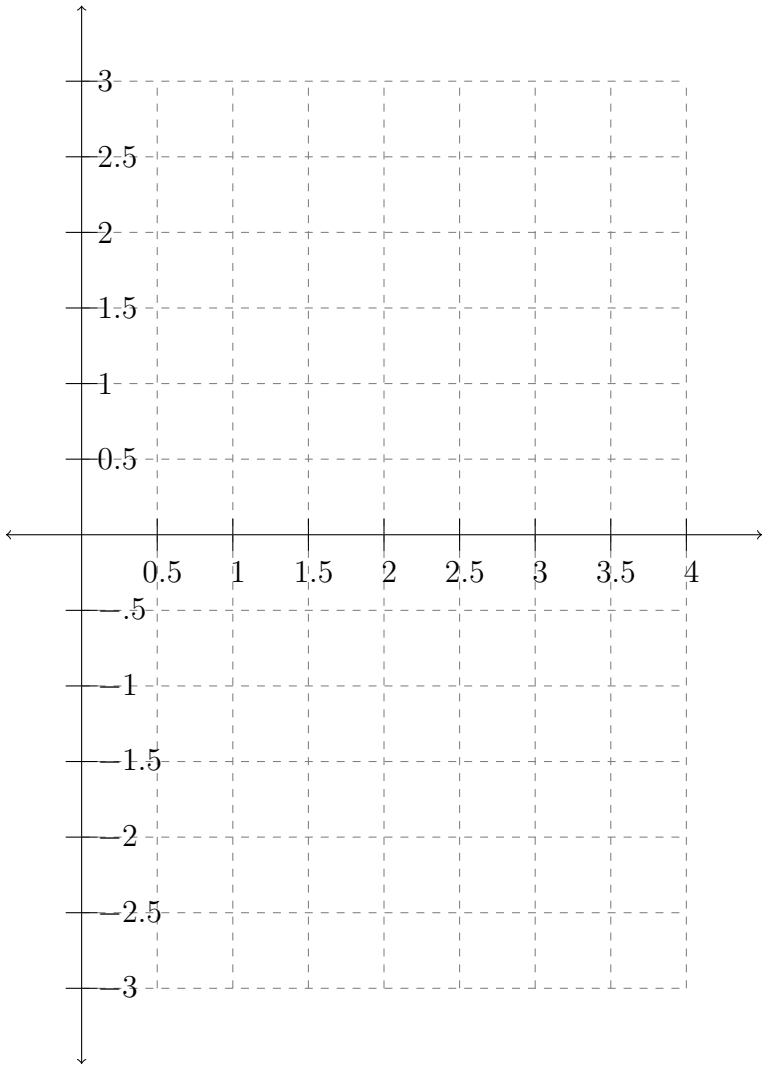
3. If I have the ODE $\frac{dy}{dt} = f(t, y)$ for a function f, how would I draw the direction field on a set of axes?

4. A solution that is constant in time is called a(n):

5. Consider the ODE

$$\frac{dy}{dt} = y^2 - 4$$

Draw the direction field over the range $0 \leq t \leq 4$ and $-3 \leq y \leq 3$. Draw an approximate vector every 0.5 units, and identify any equilibrium solutions.



2 Section 1.3

1. What is the main difference between ordinary differential equations and partial differential equations?

2. How are systems distinguished from ordinary differential equations?

3. How do you determine the order of an ODE?

4. Consider an ODE of the form $F(t, y, y', ..., y^{(n)}) = 0$. How do you tell if the ODE is linear or non-linear?

5. Give an example of a third-order linear ODE, and an example of a 5th order non-linear ODE.

6. If a non-linear ODE has a 'small' linearity, then we can use *this* process to make the equation linear.

7. Consider the ODE $y^{(n)} = f(t, y, y', ..., y^{(n-1)})$. What does it mean for a function ϕ to be a solution on the interval (a, b)?

8. How do we verify that ϕ is a solution to the ODE above?

9. There are two more theoretical questions to ask about ODEs. Give the names of these two questions.

   (i) Is there a solution to a given ODE?

   (ii) Is there only one solution to the ODE?

10. What alternative do we have if we can't solve an ODE by hand?

3 Video Questions

(a) Video 2 Question

(b) Video 3 Question