

**Homework 1**  
**Due Monday, April 8th**

Instructions: write up solutions to all problems below. Neatness counts: be sure to follow guidelines for homework in the syllabus.

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Reading Assignment: Chapters 1.1, 1.2, 1.3.

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1. (Chapter 1.3, # 9, 11, 13) Verifying solutions. Show that the following functions are solutions to the given differential equations.

(a)  $ty' - y = t^2$ ;  $y(t) = 3t + t^2$

(b)  $2t^2y'' + 3ty' - y = 0$ ;  $y_1(t) = t^{1/2}$ ,  $y_2(t) = \frac{1}{t}$

(c)  $y'' + y = \sec(t)$ ;  $y_1(t) = (\cos t) \ln(\cos t) + t \sin(t)$

2. (Chapter 1.1, # 12) Make a slope field for the following differential equation.

$$y' = y(4 - y)$$

3. (Chapter 1.1 # 22) A spherical raindrop evaporates at a rate proportional to its surface area. Write a differential equation for the volume of the raindrop. Show any work you do, and explain how you arrived at your answer.
4. (Chapter 1.2, # 16) Suppose that a building loses heat in accordance with Newton's law of cooling, which we derived in class as

$$\frac{dT}{dt} = k(T_a - T),$$

where  $T_a$  is the ambient temperature. Assume that the rate constant is  $k = 0.15 \text{ hours}^{-1}$ . In the winter when the outside temperature is 10 degrees F, if the building starts at 70 degrees F, how long will it take to reach 32 degrees F? [Please show your work for finding the solution to the differential equation.]