MATH 0290 SEC 1050 Introduction to Differential Equations
HW #3 Due Friday September 11th 11:59pm
EST updated 9/7/2020 at 6pm EST-fixed a typo in number 2.4 #15

Questions from Polking, Boggess and Arnold, *Differential Equations with Boundary Value Problems*, second edition

Chapter 2.2 #3, 5, 9, 33
Chapter 2.3 #9
Chapter 2.4 #5, 15, 19

Chapter 2.2
For exercises 3, 5 and 9, find the general solution of the indicated differential equation. If possible, find an explicit solution.

3. $y' = e^{x-y}$
5. $y' = xy + y$
9. $x^2y' = y \ln y - y'$

33. A murder victim is discovered at midnight and the temperature of the body is recorded at 31°C. One hour later, the temperature of the body is 29°C. Assume that the surrounding air temperature remains constant at 21°C. Use Newton's law of cooling to calculate the victim's time of death. Note: the temperature of a living human being is approximately 37°C.

Chapter 2.3
9. A ball having mass $m = 0.1$ kg falls from rest under the influence of gravity in a medium that provides a resistance that is proportional to its velocity. For a velocity of 0.2 m/s, the force due to the resistance of the medium is -1 N. [One Newton [N] is the force required to accelerate a 1kg mass at a rate of 1 m/s^2. Hence, 1 N = 1kg m/s^2.] Find the terminal velocity of the ball.

Chapter 2.4
5. Find the general solution of the first-order, linear equation. $x' - 2x/(t+1) = (t+1)^2$

15. Find the solution of the initial value problem. $(x^2+1)y' + 3xy = 6x, \qquad y(0) = -1$

19. Find the solution of the initial value problem. Discuss the interval of existence and provide a sketch of your solution $(2x+3)y' = y + (2x+3)^{1/2}$, $y(-1) = 0$