MATH 250
SPRING 2015 NAME:
EXAM 2

1. [15 pts.] A thermometer is taken from inside a house to the great outdoors where the air temperature is 5° F. After 1 minute the thermometer reads 55° F, and after 5 minutes it reads 30° F. What is the temperature in the house?

2. [15 pts.] A large tank is partially filled with 400 liters of water in which 5 kilograms of sugar is dissolved. Water containing 0.05 kg of sugar per liter is pumped into the tank at a rate of 20 L/min. The well-mixed solution is meanwhile pumped out at a slower rate of 15 L/min. Find the number of kilograms of sugar in the tank after 30 minutes.

3. [10 pts.] Using either the Wronskian determinant or the definition of linear independence, determine whether the functions $f(x) = x$, $g(x) = x - 1$, and $h(x) = x + 3$ are linearly independent on $(-\infty, \infty)$.

4. [10 pts.] Given that $y = c_1 + c_2x^2$ is the general solution to $xy'' - y' = 0$ on $(-\infty, \infty)$, find a solution to the boundary value problem

$$xy'' - y' = 0, \quad y(0) = 1, \quad y'(1) = 6.$$

5. [10 pts.] Given that $y_1(x) = x\sin(\ln x)$ is a solution to

$$x^2y'' - xy' + 2y = 0,$$

use reduction of order to find a second solution $y_2(x)$.

6. [10 pts.] Find the general solution to $2y'' + 2y' + y = 0$.

7. [10 pts.] Find the general solution to $y''' - 6y'' + 12y' - 8y = 0$.

8. [10 pts.] Find a homogeneous linear differential equation with constant coefficients whose general solution is

$$y = c_1 + c_2x + c_3e^{8x}.$$

A couple trigonometric identities: $\sin(2t) = 2\sin t\cos t, \quad \cos(2t) = 2\cos^2 t - 1.$