Math 2C

Exam 2 Review

The second exam will be on **Wednesday, March 29th**. It will cover sections 3.1 and 4.1-4.4. The exam will consist of questions worth various values for a total of 125 points. You may use one 3" by 5" notecard (no specific examples). Prepare well and good luck!

You will need to be able to:
1. Solve problems involving exponential growth/decay, Newton's law of cooling/warming, mixtures.
2. Use the method of reduction of order to find a second solution of a homogeneous linear DE.
3. Solve homogeneous linear DEs with constant coefficients.
4. Use the method of undetermined coefficients to solve nonhomogeneous linear DEs.
5. Form the general solution of homogeneous and nonhomogeneous DEs.
6. Determine if a set of functions forms a fundamental set of solutions to a DE.

Section 3.1, pages 90-91: # 6, 7, 14

Chapter 3 Review Exercises, pages 113-114: # 1, 3

Chapter 4 Review Exercises, pages 190-191: # 2, 8, 9, 10, 12, 13a, 15-20, 22, 23, 24, 31, 34-37

Additional Problems:

1. Suppose a 120-gallon well-mixed tank initially contains 90 lb of salt mixed with 90 gal of water. Salt water (with a concentration of 2 lb/gal) flows into the tank at a rate of 4 gal/min. The solution flows out of the tank at a rate of 3 gal/min. How much salt is in the tank at any time t? How much salt is in the tank when it is full?

2. A full 20-liter tank has 20 grams of green food coloring dissolved in it. If a green food coloring solution (with a concentration of 2 grams/liter) is piped into the tank at a rate of 3 liters/minute while the well mixed solution is drained out of the tank at a rate of 3 liters/minute, what is the limiting concentration of green food coloring solution in the tank?

3. Consider the differential equation $y^{(3)} - 2y'' + 9y' - 18y = 0$.

   a) Find the general solution of $y^{(3)} - 2y'' + 9y' - 18y = 0$.
   b) If you were going to solve the following non-homogeneous differential equation by using the method of undetermined coefficients, state the form of your particular solution y_p. Do not solve the differential equation. $y^{(3)} - 2y'' + 9y' - 18y = 3x^2 e^x + 5\sin(3x)$

4. Solve the differential equation using the method of undetermined coefficients.

   $4y'' - 4y' + 17y = 34x + 9 + 15e^x$

Answers to Additional Problems:

1. $A(t) = 2(90 + t) - \dfrac{90^4}{(90 + t)^3}$; The tank will be full at $t = 30$ minutes so $A(30) \approx 202$ lb.

2. $A(t) = 40 - 20e^{-\frac{3}{20}t}$; $\displaystyle\lim_{t \to \infty} \dfrac{A(t)}{V(t)} = 2$ The limiting concentration is 2 grams/liter.

3. a) $y = c_1 e^{2x} + c_2 \cos(3x) + c_3 \sin(3x)$

    b) $y_p = (Ax^2 + Bx + C)e^x + Dx\cos(3x) + Ex\sin(3x)$

4. $y = e^{\frac{1}{2}x}(c_1 \cos(2x) + c_2 \sin(2x)) + 2x + 1 + \dfrac{15}{17}e^x$