

PRINT Your Name: \_\_\_\_\_

### Quiz 4, Spring, 2013

The quiz is worth 5 points. Remove **EVERYTHING** from your desk except **this quiz and a pen or pencil**. SHOW your work. Express your work in a neat and coherent manner. **BOX** your answer. Check your answer. The solution will be posted later today.

Solve the Initial Value Problem with Differential Equation  $y''' - 6y'' + 11y' - 6y = 0$  and Initial Conditions:  $y(0) = 0$ ,  $y'(0) = 0$ , and  $y''(0) = 3$ . You will find it helpful to know that  $y_1 = e^x$ ,  $y_2 = e^{2x}$ , and  $y_3 = e^{3x}$  all are solutions of the Differential Equation.

$$y = c_1 e^x + c_2 e^{2x} + c_3 e^{3x}$$
$$y' = c_1 e^x + 2c_2 e^{2x} + 3c_3 e^{3x}$$
$$y'' = c_1 e^x + 4c_2 e^{2x} + 9c_3 e^{3x}$$

$$0 = y(0) = c_1 + c_2 + c_3$$
$$0 = y'(0) = c_1 + 2c_2 + 3c_3$$
$$3 = y''(0) = c_1 + 4c_2 + 9c_3$$

Replace EQ 2 by EQ2 - EQ1  
Replace EQ 3 by EQ3 - EQ1

$$0 = c_1 + c_2 + c_3$$
$$0 = c_2 + 2c_3$$
$$3 = 3c_2 + 8c_3$$

Replace EQ 3 by EQ3 - 3EQ2

$$0 = c_1 + c_2 + c_3$$
$$0 = c_2 + 2c_3$$
$$3 = 2c_3$$

Eq 3 says  $c_3 = \frac{3}{2}$

Eq 2 says  $c_2 = -3$

Eq 1 says  $c_1 = 3 - \frac{3}{2} = \frac{3}{2}$

$$y = \frac{3}{2} e^x - 3e^{2x} + \frac{3}{2} e^{3x}$$

check

$$y = \frac{3}{2} e^x - 3e^{2x} + \frac{3}{2} e^{3x}$$
$$y' = \frac{3}{2} e^x - 6e^{2x} + \frac{9}{2} e^{3x}$$
$$y'' = \frac{3}{2} e^x - 12e^{2x} + \frac{27}{2} e^{3x}$$

$$y(0) = \frac{3}{2} - 3 + \frac{3}{2} = 0 \checkmark$$

$$y'(0) = \frac{3}{2} - 6 + \frac{9}{2} = 0 \checkmark$$

$$y''(0) = \frac{3}{2} - 12 + \frac{27}{2} = \frac{30}{2} - 12 = 15 - 12 = 3 \checkmark$$