

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

**Quiz for March 4, 2010**

The quiz is worth 5 points. **Remove EVERYTHING from your desk except this quiz and a pen or pencil. SHOW every step.** Express your work in a neat and coherent manner. BOX your answer.

Solve the initial value problem  $\frac{1}{2}x'' + 3x' + 4x = 0$ ,  $x(0) = 2$ ,  $x'(0) = 0$ .

**ANSWER:** This is a second order homogeneous linear DE with constant coefficients. We try for solutions of the form  $x(t) = e^{rt}$ . We see that  $x' = re^{rt}$  and  $x'' = r^2e^{rt}$ . Our candidate is a solution of the differential equation if  $\frac{1}{2}r^2 + 3r + 4 = 0$ . Multiply through by 2:  $r^2 + 6r + 8 = 0$ . Factor:  $(r+2)(r+4) = 0$ . So  $r = -2, -4$ , The general solution of the DE is  $x = c_1e^{-2t} + c_2e^{-4t}$ . We compute  $x'(t) = -2c_1e^{-2t} - 4c_2e^{-4t}$ . Plug in  $t = 0$ :

$$2 = x(0) = c_1 + c_2$$

$$0 = x'(0) = -2c_1 - 4c_2$$

Replace the second equation with E2+2E1 to obtain:  $4 = -2c_2$ ; so,  $c_2 = -2$ ,  $c_1 = 4$  and the solution is

$$\boxed{x(t) = 4e^{-2t} - 2e^{-4t}}$$