Math 274 | Quiz 3 | Name: _____

9 Feb 2018 | Show Appropriate Work | Point Values in $\boxed{\text{boxes}}$.

1. Find a general solution for the following.

(a) $\boxed{2}$ $x'' + 3x' + 2x = 0$

$r^2 + 3r + 2 = 0$

$(r+1)(r+2) = 0$

$r_1 = -1, \quad r_2 = -2$

$x(t) = C_1 e^{-t} + C_2 e^{-2t}$

(b) $\boxed{2}$ $y'' + 2y' + 1y = 0$

$y(t) = C_1 e^{-t} + C_2 t e^{-t}$

$r^2 + 2r + 1 = 0$

$(r+1)^2 = 0$

$r = -1$, repeated

(c) $\boxed{2}$ $z'' + 2z' + 2z = 0$

$z(t) = C_1 e^{-t} \cos t + C_2 e^{-t} \sin t$

$r^2 + 2r + 2 = 0$

$(r+1)^2 = -1$

$r = -1 \pm i$

2. Consider the mass-spring system given by

$$y'' + 6y' + 8y = 0.$$

The system has initial data $y(0) = -1$ and $y'(0) = -2$. Solve the initial value problem for this system.

$r^2 + 6r + 8 = 0$

$(r+2)(r+4) = 0$

$r_1 = -2, \quad r_2 = -4$

$y = C_1 e^{-2t} + C_2 e^{-4t}$

$y(0) = C_1 + C_2 = -1$

$y' = -2C_1 e^{-2t} - 4C_2 e^{-4t}$

$y'(0) = -2C_1 - 4C_2 = -2$

$2C_1 + 2C_2 = -2$

$-2C_1 - 4C_2 = -2$

$-2C_2 = -4$ so $C_2 = 2$

$C_1 = -3$

$y = 2e^{-4t} - 3e^{-2t}$