MATH225, Fall 2009 **Name:**
Worksheet 8 (3.6, 4.1) **Section:**

For full credit, you must show all work and box answers.

1. Find the solutions of the given second-order equations or initial-value problems. Use the method from section 3.6.

   (a) $y'' + 5y' + 6y = 0, \quad y(0) = 2, \quad y'(0) = 3$

   (b) $\dfrac{d^2y}{dt^2} - \dfrac{dy}{dt} + \dfrac{1}{4}y = 0$

   (c) $y'' + 4y = 0, \quad y(0) = 0, \quad y'(0) = 1$

   (d) $16y'' - 8y' + 145y = 0$

2. Consider the harmonic oscillator with the second-order equation $\frac{d^2y}{dt^2} + 4\frac{dy}{dt} + 5y = 0$.

   (a) Find the general solution of the second-order equation that models the motion of the oscillator. Use the method from section 3.6.

   (b) Classify the oscillator.

   (c) Find the particular solution with the initial condition $y(0) = 0$ and $v(0) = 1$.

   (d) Write the first-order system that corresponds to the second-order differential equation using $v = \frac{dy}{dt}$.

   (e) Find the eigenvalues. Do not find the general solution.

   (f) Sketch the phase portrait. Classify the origin.

3. Given the second-order differential equation

$$ay'' + by' + cy = f(t)$$

For the given $f(t)$ below give the form of $y_p(t)$.

$f(t)$	$y_p(t)$
EX: 1	A
(a) $3t + 2$	
(b) $t^2 + 1$	
(c) e^{6t}	
(d) $(5t - 1)e^{2t}$	
(e) te^{4t}	
(f) $9t^3 + t + 3e^{2t}$	
(g) $5e^{3t} + e^{-t}$	

4. Find the solutions of the given second-order equations or initial-value problems.

(a) $y'' + y' - 2y = 2t, \quad y(0) = 0, \quad y'(0) = 1$

(b) $\dfrac{d^2y}{dt^2} + 2y = 5e^{-4t}$

(c) $y'' + 3y' = 3$

5. Find the solutions of the given second-order equations or initial-value problems.

(a) $y'' - 2y' - 3y = 3te^{2t}$

(b) $y'' - 2y' + 5y = 3t + e^{2t}$