Math 240 - Assignment 6

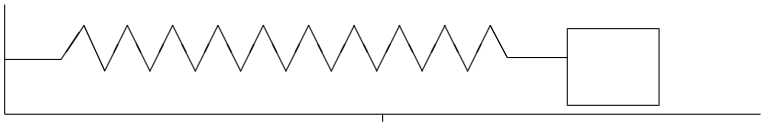
Name _____

October 2, 2025

Score _____

Show all work to receive full credit. Supply explanations when necessary. This assignment is due October 9.

1. A 2-kg mass is attached to a spring with spring constant 16 N/m. The damping constant for the system is 1 N-sec/m. The mass is moved 1 m to the **left** of equilibrium (compressing the spring) and pushed to the **right** with a speed of 4 m/sec. Find the equation of motion. Write your solution in terms of a single sine or cosine with a phase shift.



$x = 0$
(Equilibrium)

2. A 9-kg mass is attached to a spring with spring constant 37 N/m. The damping constant for the system is 6 N-sec/m. The mass is moved 1 m to the **right** of equilibrium (stretching the spring) and pushed to the **left** at 2 m/sec. (See the figure above.) Find the equation of motion. If applicable, write your solution in terms of a single sine or cosine with a phase shift. When does the mass pass through equilibrium for the third time?

3. Find the general solution: $y'' - y' + 9y = 3\sin 2t$

4. Solve the initial value problem: $y'' - 8y' + 7y = x + 3e^{7x}$ $y(0) = 1$, $y'(0) = 1$

5. Consider the following equation:

$$y'' - 6y' + 9y = 5t^6 e^{3t}.$$

Solve the corresponding homogeneous equation. Then find the appropriate form of the particular solution for the nonhomogeneous equation. Do not solve for the undetermined coefficients.

6. Consider the following equation:

$$y'' + y = \sin t + t\cos t + e^t.$$

Solve the corresponding homogeneous equation. Then find the appropriate form of the particular solution for the nonhomogeneous equation. Do not solve for the undetermined coefficients.

7. Solve the initial value problem: $y^{(3)} + y'' = x + e^{-x}$ $y(0) = 1$, $y'(0) = 0$, $y''(0) = 1$