

# Math 240 - Assignment 5

February 26, 2025

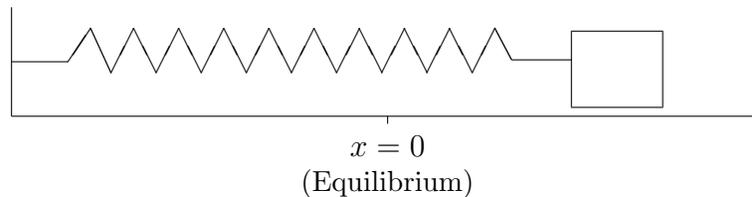
Name \_\_\_\_\_

Score \_\_\_\_\_

Show all work to receive full credit. Supply explanations when necessary. This assignment is due March 5.

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1. Find the general solution:  $y'' + y' + y = 0$
2. Solve the initial value problem:  $y'' - 4y' + 13y = 0$ ;  $y(0) = -1$ ,  $y'(0) = 2$
3. Find the general solution:  $y''' + 3y'' - 4y = 0$
4. Find the general solution:  $y^{(4)} + 2y'' + y = 0$
5. Solve the Cauchy-Euler equation:  $4x^2 \frac{d^2y}{dx^2} + 8x \frac{dy}{dx} + y = 0$
6. Solve the Cauchy-Euler equation:  $x^2 \frac{d^2y}{dx^2} + 3x \frac{dy}{dx} + 3y = 0$
7. A 1/2-kg mass is attached to a spring with spring constant 5 N/m. The damping constant for the system is 1 N-sec/m. The mass is moved 2 m to the left of equilibrium (compressing the spring) and released from rest. Find the equation of motion. If applicable, write your solution in terms of a single sine or cosine with a phase shift.



8. 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 second time?
9. A 1/4-kg mass is attached to a spring with spring constant 4 N/m. The damping constant for the system is 2 N-sec/m. Starting at equilibrium, the mass is pushed to the left (compressing the spring) at 3 m/sec. (See the figure above.) Find the equation of motion. Is the system underdamped, overdamped, or critically damped? How do you know?