Math 240 - Assignment 5

Name _____

September 25, 2025

Score _____

Show all work to receive full credit. Supply explanations when necessary. This assignment is due October 2.

1. Find the general solution: $36y'' + 12y' + 37y = 0$

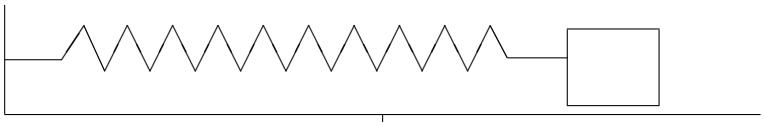
2. Solve the initial value problem: $y'' + 2y' + 17y = 0; \quad y(0) = 1,\ y'(0) = -1$

3. Find the general solution: $y''' - y'' + 2y = 0$

4. A homogeneous, constant-coefficient, linear differential equation has the following characteristic equation:
$$r^3(r+2)(r^2+4r+29)^2 = 0.$$
Find the general solution of the original differential equation.

5. Solve the Cauchy-Euler equation $x^2y'' + 9xy' + 17y = 0$.

6. 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)

7. 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?

8. A 1-kg mass is attached to a spring with spring constant 21 N/m. The damping constant for the system is 10 N-sec/m. The mass is moved 1 m to the **left** of equilibrium (compressing the spring) and pushed to the **right** at 4 m/sec. (See the figure above.) Find the equation of motion.