

Math 240 - Assignment 6

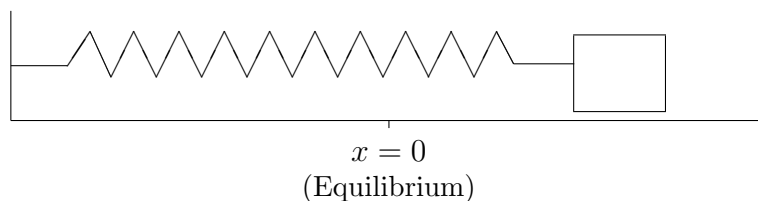
October 1, 2026

Name _____

Score _____

Show all work to receive full credit. Supply explanations when necessary. This assignment is due October 8.

1. A 1-slug mass is attached to a spring with spring constant 9 lb/ft. There is no damping. The mass is moved 1 ft to the right of equilibrium (stretching the spring) and pushed to the right at $\sqrt{3}$ ft/sec. Find the displacement at time t . Write your solution in terms of a single sine or cosine with a phase shift. Find the times for which the mass is moving leftward at 3 ft/sec.



2. A 1-kg mass is attached to a spring with spring constant 16 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 released from rest. (See the figure above.) Find the displacement at time t . Is the system underdamped, overdamped, or critically damped? How do you know?
3. 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 displacement at time t . 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?
4. 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 displacement at time t . Is the system underdamped, overdamped, or critically damped? How do you know?
5. A 0.1-kg mass is attached to a spring with spring constant 2.0 N/m. The damping constant for the system is 0.4 N-sec/m. The mass is moved 1 m to the left of equilibrium (compressing the spring) and released from rest. (See the figure above.) Find the displacement at time t . Write your solution in terms of a single sine or cosine with a phase shift. When does the mass pass through equilibrium for the first time?

Turn over.

6. Use undetermined coefficients to solve the following equation.

$$y'' + 8y = 2e^{-x}$$

7. Use undetermined coefficients to solve the following equation.

$$y'' + 3y' + 2y = 4x^2$$

8. Use undetermined coefficients to solve the following equation.

$$y'' - 3y' = 4 \sin x$$