1. A mass weighing 10 N stretches a spring 1/4 m. This mass is removed and replaced with a mass of 1.6 kg, which is initially released from a point 1/3 m above the new equilibrium position with a downward velocity of 5/4 m/s.

   (a) Find the function $x(t)$ describing the equation of motion at time $t \geq 0$.

   (b) Express your answer in part (a) in the form $x(t) = A\sin(\omega t + \phi)$ for appropriate values of A, ω and ϕ.

   (c) Determine the first time $t > 0$ at which the mass reaches a displacement below equilibrium that is equal to half the amplitude of the motion.

2. A 4 m spring measures 8 m long after a mass weighing 8 N is attached to it. The medium through which the mass moves offers a damping force numerically equal to $\sqrt{2}$ times the instantaneous velocity. The mass is initially released from the equilibrium position with a downward velocity of 5 m/s.

   (a) Find the function $x(t)$ describing the equation of motion at time $t \geq 0$.

   (b) Find the time $T \geq 0$ at which the mass attains its most extreme displacement from the equilibrium position.

   (c) What is the value of the displacement at the time $t = T$ from part (b)?

3. A mass of 1 kg, when attached to a spring, stretches it 2 m and then comes to rest at the equilibrium position. Starting at $t = 0$ and external force equal to $f(t) = 8\sin(4t)$ is applied to the system. Find the equation of motion if the surrounding medium offers a damping force that is numerically equal to 8 times the instantaneous velocity.