1. A force of 3 N stretches a spring by 1 m. A mass of 4 kg is attached to the spring. At t=0 the mass is pulled down a distance 1 m from equilibrium and released with a downward velocity of 0.5 m/s. Assuming that damping is negligible, determine an expression for the position of the mass at time t. Find the circular frequency of the system and the amplitude, phase, and period of the motion.

2. (a) Determine the motion of the spring-mass system govern by
   \[ \frac{d^2 y}{dt^2} + 5 \frac{dy}{dt} + 6y = 0, y(0) = -1, \frac{dy}{dt}(0) = 4. \]
   (a) Find the time at which the mass passes through the equilibrium position, and determine the maximum positive displacement of the mass from equilibrium.
   (b) Make a sketch depicting the motion.

3. Consider the damped spring-mass system whose motion is governed by
   \[ \frac{d^2 y}{dt^2} + 2 \frac{dy}{dt} + 5y = 17 \sin 2t, y(0) = -2, \frac{dy}{dt}(0) = 0. \]
   (a) Determine whether the motion is underdamped, overdamped or critically damped.
   (b) Determine the solution to the given initial conditions and identify the transient and steady-state parts.

4. Consider the spring-mass system whose motion is governed by
   \[ \frac{d^2 y}{dt^2} + 3 \frac{dy}{dt} + 2y = 10 \sin t. \]
   Determine the steady-state solution, \( y_p \), and express your answer in the form
   \[ y_p(t) = A_0 \sin(t - \phi), \]
   for appropriate constants \( A_0 \) and \( \phi \).