1. (a) Find the general solution for each of the following differential equations:
   
i. \( y'' + 3y' + 2y = 0; \)

   ii. \( y'' - 4y = 0. \)

   (b) According to the results gotten in Part a, determine the form of a particular solution for each of the following equations:
   
i. \( y'' + 3y' + 2y = xe^{2x} + 4 \sin 3x; \)

   ii. \( y'' - 4y = xe^{2x} + 4 \sin 3x. \)
2. Find the solution of the initial-value problem:

\[ y'' - 4y' + 4y = 0, \quad y(0) = 3, \quad y'(0) = 5. \]

3. Rewrite the equation \( x'' - 4x' + 4x = 0 \) as a system of first order equations.
4. A mass $m = 1$ is attached to both a spring (with given spring constant $k = 125$) and a dashpot (with given damping constant $c = 10$). The mass is set in motion with initial position $x_0 = 6$ and initial velocity $v_0 = 50$. Find the position function $x(t)$ and determine the motion is overdamped, critically damped, or underdamped.
5. Find a particular solution to the following equation using the method of undetermined coefficients

\[ y'' + 4y = 8e^{2x} - 6\sin x. \]
6. Find a particular solution to the following equation using the method of variation of parameters

\[ y'' + y = 8\sec x. \]

(Hint: \( \int \frac{\sin u}{\cos u} \, du = -\ln |\cos u| \).)