1. For the differential equation in the form \( y' = f(y) \) given below, sketch the graph of \( f \) and plot the phase line. Identify the equilibria and determine their stability.

   (a) \( y' = (y + 1) (y - 4) \),

   (b) \( y' = 9y - y^3 \).

2. Find general solutions for the following differential equations:

   (a) \( y'' - y' - 2y = 0 \),

   (b) \( y'' + 4y = 0 \),

   (c) \( y'' + 8y' + 16y = 0 \).

   For the equation in (c), solve an initial value problem with initial condition \( y(0) = 1 \), \( y'(0) = 4 \).

3. For each of the equations below, find a particular solution and a general solution.

   (a) \( y'' - y' - 2y = t - e^t \),

   (b) \( y'' - y' - 2y = t - e^{-t} \).

4. Consider a system of differential equations

   \[ y' = Ay, \quad A = \begin{pmatrix} 0 & 5 \\ 1 & 4 \end{pmatrix}. \]  

   Find the eigenvalues and the corresponding eigenvectors of \( A \). Sketch the phase portrait and determine the type of the equilibrium at the origin (saddle, node, focus, center).