1. Solve the following using the Method of Undetermined Coefficients.
   (a) \( y'' + 2y' - 15y = e^{6t} \)
   (b) \( y'' + 2y' - 15y = e^t \cos(2t) \)
   (c) \( y'' + 2y' - 15y = te^{3t} \) with \( y(0) = 1 \) and \( y'(0) = 3 \)

2. Find general solutions to the following DEs using Variation of Parameters. A fundamental pair of solutions to the associated homogeneous differential equation is given.
   (a) \( y'' - 5y' + 6y = 2e^t \) with \( Y_1(t) = e^{2t} \) and \( Y_2(t) = e^{3t} \).
   (b) \( t^2y'' - 2y = 3t^2 - 1 \) with \( Y_1(t) = t^2 \) and \( Y_2(t) = t^{-1} \).
   (c) \( x^2y'' - 3xy' + 4y = x^2 \ln x \) with \( Y_1(x) = x^2 \) and \( Y_2(x) = x^2 \ln x \).

3. Consider the differential equation \( y'' - 3y' - 10y = t^2 e^{5t} \).
   (a) Find the characteristic polynomial and roots for the associated homogeneous differential equation.
   (b) Find the fundamental pair for the associated homogeneous differential equation.
   (c) Find a specific solution to the original DE using Undetermined Coefficients.
   (d) Find a specific solution to the original DE using Variation of Parameters.
   (e) Solve the initial value problem having \( y(\ln 2) = 1 \) and \( y'(\ln 2) = -1 \).