(1) Please use the method of undetermined coefficients to find the form of the particular solution (**WITHOUT SOLVING FOR CONSTANTS**) of the following ODEs.

(a)
$$y'' + 5y' + 6y = -t + e^{-3t} + te^{-2t} + e^{-3t}\cos t$$

(b)
$$y'' + 3y' + 2y = e^{t}(t^2+1)\sin(2t) + 3e^{-t}\cos t + 4e^{t}.$$

(2) Please find the general solution of the ODE: $y'' + 4y' + 4y = t^{-2}e^{-2t};\ t > 0$

(3) Consider the ODE $y'' + 2y' + 2y = \cos t$.
(a) Please find the general solution.
(b) What happens to the solution as $t \to \infty$?

(4) Please solve the IVP: $y'' + 4y = 6\sin(4t);\ y(0) = y'(0) = 0$.

(5) Consider the IVP $y'' - 3y' - 4y = t + 2;\ y(0) = 3,\ y'(0) = 0$.
(a) Please find the solution to the IVP.
(b) What happens to the solution as $t \to \infty$?

(6) Consider the ODE $2t^2y'' - ty' + y = t\sqrt{t}$.
(a) Verify the solutions to the homogeneous ODE are $y_1 = t$ and $y_2 = \sqrt{t}$
(b) Use the characteristic solution $y_c = c_1y_2 + c_2y_2$ to find the general solution to the full ODE.

(7) A mass weighing 1/2 lb (i.e. mass $= 1/64 lb\cdot s^2/ft$) stretches a spring 1/2 ft.
(a) Suppose the system has no damping. The mass is initially pulled down 1/2 ft and released.
  (i) Write down the IVP for this system.
  (ii) Solve the IVP.
  (iii) When does the mass return to the equilibrium position (i.e. $x = 0$).
(b) Now suppose the system has a damping constant of $2lb\cdot s/ft$. The mass is initially pushed up 1/2 ft and released with a downward velocity of 1/2 ft/s.
  (i) Write down the IVP for this system.
  (ii) Solve the IVP.

(8) Please solve the following IVP
$$y'' + 4y = 3\sin 2t;\ y(0) = 2,\ y'(0) = -1.$$