#1/7. Use the Laplace Transform to solve the given IVP (initial value problem).

\[ y'' - 6y' + 13y = e^{-t}, \quad y(0) = 0, \quad y'(0) = 2 \]

#2/7. Solve using VOP (variation of parameters).

\[ y'' + y = \sec(x) \]

#3/7. I believe that the following equation is exact. Please check it to make sure that it is, then solve it using the method of exact equations.

\[ (5x + 4y) \, dx + (4x - 8y^3) \, dy = 0 \]

#4/7. Initially 100 pounds of salt is dissolved in a large tank holding 500 gallons of water. A brine solution is pumped into the tank at a rate of 5 gpm (gallons per minute), and the well-stirred solution is then pumped out at the same rate. If the concentration of the solution entering the tank is 3 pounds per gallon, (A) determine the amount of salt in the tank at time \( t \). (B) How much salt (in pounds) is present in the tank after one hour? Draw a picture!

#5/7. Solve this linear equation by finding and using an IF (integrating factor).

\[ \frac{dy}{dx} + y = e^{3x} \]

#6/7. Solve this differential equation subject to the given initial conditions. Be sure to state explicitly which method you are using to solve this problem.

\[ y'' - 2y' + y = 0, \quad y(0) = 5, \quad y'(0) = 10 \]

#BONUS Verify that \( y = x^2e^x \) is a solution of the differential equation

\[ y'' - 3y'' + 3y' - y = 0 \]