1. (10 points)
   Find the solution, \( y(x) \), to the following differential equation
   \[
x^2 y'' + 5 x y' + 13 y = 0
   \]
3. (15 points)
Find the fundamental solution set for the following forced oscillator problem

\[ m x'' + k x = 5 e^{-t} \]

where \( m = 1 \) and \( k = 4 \) (\( x \) is assumed to be \( x(t) \))

4. (15 points)
Use variation of parameters to find the solution to the following differential equation

\[ y'' - 4y = e^x \]

Extra Credit (5 points)

The governing equation for the mixing of salt water in a tank is given by:

\[ S' + \frac{f_{out}}{v_0 + (f_1 + f_2 - f_{out})t} S = f_2 C_{in} \]

Given that \( f_1 = f_2 = f_{out} = v_0 = 1 \), \( C_{in} = \frac{1}{1+t} \), and \( S(0) = 1 \), find the solution \( S(t) \)