1. (15 points) Applying the method of undetermined coefficients (annihilator approach), find the general solution for
\[ y'' - 2y' - 3y = 8e^{-x}. \]

2. (a) (10 points) Verify \( y_1 = x^{1/2}e^x \) and \( y_2 = x^{1/2}e^{-x} \) are solutions for
\[ x^2y'' - xy' + \left( \frac{3}{4} - x^2 \right) y = 0. \]

(b) (15 points) Using (a), find a particular solution of
\[ x^2y'' - xy' + \left( \frac{3}{4} - x^2 \right) y = x^{5/2} \]
by the method of variation of parameters.

3. (20 points) Find the general solution of the Cauchy-Euler equation
\[ x^2y'' - xy' + 2y = x \sec(\ln x) \]
by the method of variation of parameters.