Show steps, explain what you do, no calculators. Ten point problems or as marked.

1. Use Integrating Factor method to solve the IVP: \((t^2 + 1)y' - 2ty = 2t, \ y(0) = 0\)

2. Use Euler’s characteristic equation to solve the IVP \(y'' + 2y' + 2y = 0, \ y(0) = 1, \ y'(0) = 0\)
3. Solve \( y'' + 5y' + 6y = e^{-t} \) using auxiliary equation plus undetermined coefficients

4. Solve the same as 3 above \( y'' + 5y' + 6y = e^{-t} \) using auxiliary equation plus variation of parameters
5. Sketch and label the direction field for \( \frac{dy}{dt} = 1 - \sqrt{y}, \quad 0 \leq t \leq 3 \) with solution corresponding to \( y(0) = 4 \)

6. Solve the IVP: \( y'' + 4y' + 4y = 4x^2 + 2, \quad y(0) = 3, \quad y'(0) = 0 \) using any method.