QUESTIONS: Choose any four out of the following five problems

[25] 1. Solve \( \frac{\partial z}{\partial x} + \frac{\partial z}{\partial y} = \frac{2z}{x+y} \) with the initial curve \( C = \{(x, y, z) \in \mathbb{R}^3 \mid y + 2x = 0, z - x^2 = 0\} \)

[25] 2. Use the method of characteristics to solve the following initial value problem: \((z_x)^2 + (z_y)^2 = 8\), with the initial curve \( C = \{(x, y, z) \in \mathbb{R}^3 \mid x+y = 0, z = 1\} \)

[25] 3. Find at least two different complete integrals of the equation \( x (\frac{\partial z}{\partial x})^2 + y \frac{\partial z}{\partial y} = z \).

[25] 4. Solve the equation \( u_{,xx} - u_{,y} = x \) where \( u = z_{,xxx} - 4z_{,xxy} + 4z_{,xyy} \)

[25] 5. Find the family of surfaces which represents the solution of the partial differential equation \((x + z) \frac{\partial z}{\partial x} + (y + z) \frac{\partial z}{\partial y} + z = 0\) and obtain the integral surface which contains the circle \( x^2 + y^2 = a^2 \), \( z = a \) where \( a \neq 0 \) is a constant.