1. State the forms for the following equations:
   (a) Heat equation.
   (b) Korteweg-de Vries equation.
   (c) Minimal surface equation.
   (d) Black–Scholes equation.

2. State the local existence theorem concerning the Cauchy problem for the first-order quasilinear PDE.

3. Use the method of characteristics to solve the problem \( u_x + u_y = x, \ u(x, 0) = h(x) \).

4. What is a characteristic strip of the general first-order equation?

5. Use the method of characteristics to solve the problem \( u_x u_y = u, \ u(0, x) = x^2 \).

6. State the general form of the second-order quasilinear PDE and name and define the three classifications for this PDE.

7. Reduce the equation \( u_{xx} + x^2 u_{yy} = y u_y \) for \( x < 0 \) to standard form.

8. Solve the equation \( y^2 u_{xx} - 2xyu_{xy} + x^2 u_{yy} - \frac{y^2}{x} u_x - \frac{x^2}{y} u_y = 0 \) by reducing it to standard form.


10. Solve \( u_{tt} = u_{xx}, \ u(x, 0) = 2 \sin(x) - \sin(2x), \ u_t(x, 0) = 0, \ u(x, 0) = 0, \ u(0, t) = u(\pi, t) = 0. \)