

1. Use separation of variables to find solutions of

$$u_{xx} + 2u_x - u_y = 0.$$

2. Transform the equation

$$2u_{xx} + 4u_{xt} + 2u_{tt} = 3u$$

into standard form. Solve the obtained standard PDE. Then use your transformation to obtain the solution of the original PDE. What is the type of the original PDE?

3. Find the general solution of

$$x^2 u_x + e^{-t} u_t = 0.$$

Sketch the three characteristic curves that pass through $(1, 0)$, $(5, 0)$, and $(0.25, 0)$.

4. Find the solutions (and check both answers) of the problems

$$x^2 u_x + e^{-t} u_t = 0, \quad u(x, 0) = \frac{1}{x}$$

and

$$x^2 u_x + e^{-t} u_t = x, \quad u(x, 0) = \ln(2 - x).$$
