



For each of the partial differential equations below find the solution that satisfies the given initial data.

**Exercise 1.** 
$$u \frac{\partial u}{\partial x} + \frac{\partial u}{\partial y} = y - 2u$$
$$u(x, 0) = x - 4$$

**Exercise 2.** 
$$\frac{1}{u} \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y} = u$$
$$u(0, y) = 1 - y$$

**Exercise 3.** 
$$y \frac{\partial u}{\partial x} + x \frac{\partial u}{\partial y} = \frac{xy}{u^2}$$
$$u(x, 3x) = \frac{x^2}{1 + x^2}$$

[*Suggestion:* At some point consider  $y^2 - x^2$ .]

**Exercise 4.** 
$$(y^2 + xy) \frac{\partial u}{\partial x} + (x^2 + xy) \frac{\partial u}{\partial y} = 1$$
$$u(1 - y, y) = \sin y$$

[*Suggestion:* First divide through by  $y^2 + xy$ .]