



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  $y^2 - x^2$ . Alternatively, divide through by  $xy$  first.]

**Exercise 4.** 
$$(x + 4y) \frac{\partial u}{\partial x} + (3x + 2y) \frac{\partial u}{\partial y} = x(1 + u^2)$$
$$u(8y, y) = \tan(y)$$