

**MATH3403**  
TUTORIAL SHEET 2

Solve the following quasi-linear equations.

Determine the region in which a solution exists in each case.

(1) 
$$x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y} = \frac{xy}{u}$$
$$u(1, y) = \sqrt{2y}, \quad y > 0$$

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

(3) 
$$x(y - u) \frac{\partial u}{\partial x} + y(u - x) \frac{\partial u}{\partial y} = u(x - y)$$
$$u(s, s) = -\frac{2s}{s^2 + 1}, \quad s > 0$$

**Assignment** Question 2.