

Math 4381/Math 6378
Symmetry Analysis for Differential Equations
Home Work 1
Due: Feb. 1, 2021

1. Solve the following ODEs

$$(i) \quad \frac{dy}{dx} = \frac{y}{x} + x^3$$

$$(ii) \quad \frac{dy}{dx} = -\frac{y}{x} + y^2$$

$$(iii) \quad \frac{dy}{dx} = \frac{2xy + y^2}{x^2}$$

$$(iv) \quad \frac{dy}{dx} = \frac{1 - 2xy}{x^2 - 3y^2}$$

2. Solve the following PDEs

$$(i) \quad u_x - 2u_u = 1$$

$$(ii) \quad xu_x + yu_y = u, \quad u(x, 1) = x^2$$

$$(iii) \quad yu_x - xu_y = 0, \quad u(x, 0) = x^4$$

$$(iv) \quad u_x + (u + x)u_y = x$$

3. Solve the following nonlinear PDE

$$u_t = u_x^2$$

subject to the IC's

$$(i) \quad u(x, 0) = x$$

$$(ii) \quad u(x, 0) = x^2$$