

Math 4315 - PDEs Sample Test 1

Test Date: Fri. Oct. 5, 2018

1. Solve the following first order PDEs by introducing an alternate coordinate system (i.e. $(x, y) \rightarrow (r, s)$)

$$(i) \quad xu_x - yu_y = 2u,$$

$$(ii) \quad yu_x - u_y = 1,$$

2. Solve the following using the method of characteristics

$$(i) \quad xu_x + (x + 2y)u_y = u, \quad u(x, 0) = x^2$$

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

3. Solve the following nonlinear PDE

$$(i) \quad xu_x^2 + u_y = 1, \quad u(x, 1) = x + 1.$$

$$(i) \quad u_x u_y - 2xu_x - 2yu_y = 0, \quad u(x, 0) = x^2.$$