MATH4220 PDE – Quiz 1 (15 points)
February 14, 2017
(in class)

1. (5 points) For each of the following equations, state the order, type and whether it is nonlinear, linear inhomogeneous, or linear homogeneous:

   (1) $4\partial_t u - \partial_x^2 u + 1 = 0$

   (2) $\partial_t^2 u - \partial_x^2 u + u^2 = 0$

   (3) $\partial_{xy}^2 u = \sin^2(4x) + 1$

   (4) $2\partial_x^2 u + \partial_{xy}^2 u + \partial_y^2 u = 0$

2. (5 points) Solve the equation $\partial_x u + x\partial_y u = 0$ with the following two conditions:

   (a) $u(0, y) = y^2$

   (b) $u(x, 0) = x^2$

3. (5 points) Is the backward heat equation well-posed?

$$\begin{cases} \partial_t u = \partial_x^2 u, & -\infty < x < +\infty, \quad t < 0 \\ u(x, t = 0) = \varphi(x) \end{cases}$$

   Why?