Homework 1: January 17, 2017

1. Read Sections 1.1 and 1.2 from the textbook.

2. Problem 1.2.8 in Textbook (page 11).

3. Verify whether $u(x,t) = 3t + x^2$ satisfies the following heat equation:

$$u_t = \frac{3}{2} u_{xx}.$$

4. Let α and β be some positive constants. Determine the constant C such that $w(x,t) = e^{-\alpha t} \cos \beta x + Ct$ satisfies the following heat equation with a source term:

$$u_t = \frac{\alpha}{\beta^2} u_{xx} + 4, \quad t > 0, x \in \mathbf{R}.$$

5. Specify the order of the following PDEs:

- $u_{tt} = u_x + u_y$
- $u_t - u_x = 3x$
- $6u_{xx} + 6xu_{yy} = u$

6. Consider the following heat equation

$$4u_t = u_{xx}, \quad x \in (0,2), t > 0. \tag{1}$$

Verify whether the following functions satisfy equation (1):

- $f(x,t) = 2\sin(\pi x/2)\exp(-\pi^2 t/16)$
- $g(x,t) = \sin(\pi x)\exp(-\pi^2 t/4)$
- $h(x,t) = \sin(2\pi x)\exp(-\pi^2 t)$
- $k(x,t) = f(x,t) - g(x,t) - h(x,t)$.