Math 241, Fall 2015   **Renato Ghini Bettiol**

Homework Set 2

Due: Sep 15, 2015 (in class)

1. Which of the following operators L are linear? Either justify why L is linear, or give a counter-example to show that L is not linear.

$$L(u) = \Delta u \qquad\qquad L(u) = \Delta(\Delta u) \qquad\qquad L(u) = u\frac{\partial u}{\partial x}$$

$$L(u) = \frac{\partial u}{\partial t} - \frac{\partial u}{\partial x} \qquad\qquad L(u) = \frac{\partial^2 u}{\partial t^2} - \frac{\partial^2 u}{\partial x^2} \qquad\qquad L(u) = u_{xx} + u^2$$

2. Haberman 2.3.1

3. Haberman 2.3.2 (a), (b), (c), (d), (e)

4. Haberman 2.3.3 (a), (b), (c)

5. Haberman 2.3.5

6. Haberman 2.4.1

7. Apply the method of separation of variables to find the solution $u(x,t)$ of the PDE

$$u_{tt} + 2u_t = u_{xx}$$

for $x \in [-1,1]$ and $t \geq 0$, subject to periodic boundary conditions and initial conditions

$$u(x,0) = 0, \quad u_t(x,0) = \cos(\pi x) + 3\sin(3\pi x).$$

(Your answer should not contain any integrals.)