

## Homework 6

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**Last name:** \_\_\_\_\_

**First name:** \_\_\_\_\_

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*Due in class on Wednesday May 30th.*

**Exercise 1.** Find the Formal solution to the vibrating string problem:

$$\frac{\partial^2 u}{\partial t^2} = \frac{\partial^2 u}{\partial x^2}, \quad 0 < x < 1, \quad t > 0,$$

$$u(0, t) = u(1, t) = 0, \quad t > 0$$

$$u(x, 0) = x(1 - x), \quad 0 < x < 1$$

$$\frac{\partial u}{\partial t}(x, 0) = \sin 7\pi x, \quad 0 < x < 1$$

**Exercise 2.** Use the method of separation of variables to derive a formal solution to the telegraph problem

$$\frac{\partial^2 u}{\partial t^2} + \frac{\partial u}{\partial t} + u = \alpha^2 \frac{\partial^2 u}{\partial x^2}, \quad 0 < x < L, t > 0,$$

$$u(0, t) = u(L, t) = 0, \quad t > 0$$

$$u(x, 0) = f(x), \quad 0 < x < L$$

$$\frac{\partial u}{\partial t}(x, 0) = 0, \quad 0 < x < L$$

**Exercise 3.** Find the formal solution to

$$\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0, \quad 0 < x < \pi, \quad 0 < y < 1,$$

$$\frac{\partial u}{\partial x}(0, y) = \frac{\partial u}{\partial x}(\pi, y) = 0, \quad 0 \leq y \leq 1$$

$$u(x, 0) = \cos x - \cos 3x, \quad 0 \leq x \leq \pi$$

$$u(x, 1) = \cos 2x, \quad 0 \leq x \leq \pi$$