

## Problem Set 9

DUE: Thurs. April 9 in class. [Late papers will be accepted until 1:00 PM Friday.]

**This week:** Please read Chapter 8 in the Haberman text.

1. [See Section 7.3 in Haberman] Solve the wave equation  $u_{tt} = c^2 \Delta u$  in the square  $\Omega = \{0 < x < \pi, 0 < y < \pi\}$  in the plane with  $\nabla u \cdot N = 0$  on the boundary and initial conditions  $u(x, y, 0) = 0$ ,  $u_t(x, y, 0) = \cos 2x \cos 5y$ .

2. [See Section 7.3 in Haberman] In the square  $0 \leq x \leq a$ ,  $0 \leq y \leq a$  in the plane, a substance is diffusing whose molecules multiply at a rate proportional to the concentration. It thus satisfies

$$u_t = k\Delta u + \gamma u,$$

where  $k$  and  $\gamma$  are constants. Assume that  $u = 0$  on all four sides of the square. What is the condition on  $\gamma$  so that the concentration does not grow without bound?

3. p. 287 #7.4.1

4. p. 290 #7.5.2

5. p. 291 #7.5.6 [This generalized Eq. 7.5.7 on page 289]

6. p. 338 #7.10.1(a)

7. p. 339 #7.10.2(b)

[Last revised: April 10, 2015]