

## Homework Assignment # 3

**Exercises:** Strauss pp. 256–7: 2, 3, 5, p. 267: 1, 2\*, p. 273: 2.

\* The eigenfunction should be  $\sin 3x \sin 2y + \sin 2x \sin 3y$ .

1. A flat quarter disk of radius 1 has its circular edge and one of its straight edges attached to the  $xy$  plane, while the other straight edge is left free. At time  $t = 0$  the disk is struck with a hammer (unit delta function) at its midpoint, i.e., at the position with radius  $\frac{1}{2}$  and angle  $45^\circ$  with the straight edges.

- (a) Write down an initial-boundary value problem for the subsequent vibrations of the quarter disk.
- (b) Assuming the physical units are chosen so that the wave speed  $c = 1$ , determine the vibrational frequencies of the quarter disk.
- (c) Write down a series solution for the subsequent motion of the quarter disk. Is the motion unstable? Periodic? If so, what is the minimal period?

**Due:** Thursday, March 10

**Text:** Walter A. Strauss, *Partial Differential Equations: an Introduction*, John Wiley & Sons, New York, 1992.

**First Midterm:** Tuesday, March 8

Will cover two-dimensional heat and wave equations, series solutions of ordinary differential equations, and Bessel functions.

You will be allowed to use one 8"  $\times$  11" sheet of notes.

Tables will be supplied as needed.