3.12.1.1: Vibrating Membranes

As we have seen string modes of vibration can be labeled by a single mode number, n, and the modes are harmonic. Each subsequent mode (or overtone) produces a frequency that is a multiple of the fundamental.

> **Note**
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> There are slight variations to this rule when the string amplitude gets very large or if the string is very stiff but we won't worry about that here.

In the simulation of the square surface in Chapter 11 we saw that two mode numbers, n and m, are needed to specify a mode on a two dimensional surface. We also discovered that some of the modes were degenerate meaning two different combinations of n and m lead to the same frequency but in general the frequencies were not harmonic. This is generally true of most vibrating surfaces and membranes; they do not have harmonic overtones. As a result our ear-brain system does not detect a distinct pitch from most drums.

Video/audio examples:

- Pennsylvania State simulations of circular membranes.
- Wikipedia explanation of circular membranes (first admire the mathematics and then scroll to the bottom to see the simulations).
- YouTube of a membrane driven by a speaker.