6.084: The Art of Approximation

Problem Set 2 *Due Monday 2006-09-18*

You're right, the tidal-wave example on Wednesday could have been more clear. One way to understand it more clearly, as well as learn a useful approximation technique, is to do a **kitchen-sink experiment**. Kitchen-sink experiments let you investigate large- and small-scale phenomena using ordinary objects around the house, illustrating how the laws of nature work over many orders of magnitude.

The claim, which we arrived at in class using dimensional analysis, is that the velocity of the sloshing wave is

$$v \sim \sqrt{gh}. \tag{1}$$

To investigate this result, find a rectangular, flat-bottomed object for water-wave experiments. A bathtub, sink, or lasagne dish have worked for me. Fill it partway with water and make a wave by tilting and releasing the dish or splashing one end. You've just made a tidal wave in a bathtub (or whatever container you chose).

Measure v, the speed of the sloshing wave, for a few water depths h. Great accuracy is not important. Describe your system, explain how you measured v, give a table of h and v, and compare your results with theory. Here are a few questions to consider, and maybe you can think of your own (whether or not you know how to answer them):

1. Is the square-root dependence on h correct?

2. If so, what's the unknown dimensionless constant C in

$$v = C\sqrt{gh}\,? \tag{2}$$