Math 285 - Intro Differential Equations
Spring 2011, sections G1 and X1
Homework 12 additional problem

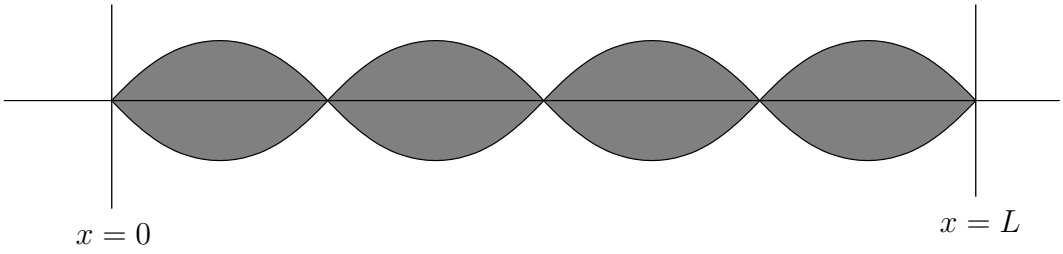

Figure 1: Whirling string.

Section 3.8 - Whirling strings

A string is made to whirl about the x-axis between endpoints $x = 0$ and $x = L = 2$ m at a constant angular velocity ω. The tension in the string is 0.5 N and its density is 5 g/m. Assume the deflection of the string (relative to its equilibrium position on the x-axis) is very small.

a. As the string whirls fast, you notice that its shape goes through 4 half-periods (figure 1). Find the angular velocity of the string, i.e. how many times per second does it whirl about its rotation axis? (Recall: 1 N = 1 kg m/s^2.)

b. The maximal deflection of the string is 1 mm; that is the height of each "hump" in figure 1. Find the maximal **rate of change** of the deflection with respect to the position x. (For example, the rate of change of the deflection at the top of a "hump" is 0, so that is certainly not where the maximal rate of change is attained.)