MA 501 SP22 Lubkin HW 6 due Mon 4/4/22

Objectives:

- Consolidating understanding of the significance of BC through observation
- Practice visualizing by multiple methods
- Improving familiarity with the wave nature of solutions of the wave equation

1. Solve the wave equation $\frac{\partial^2 u}{\partial t^2} = c^2 \frac{\partial^2 u}{\partial x^2}$ on a ring $x \in (0, 2\pi)$ with periodic BC, and initial conditions $u(x,0) = f(x)$, $\frac{\partial u}{\partial t}(x, 0) = 0$, with $f(x) = \begin{cases} M, & \frac{\pi}{2} < x < \pi \\ 0, \text{ otherwise} \end{cases}$ where $f(x)$ is 2π-periodic. For specific values of c and M, look at an animation to see what it does over a full period. Make plots of partial sums three ways:

a. Curves $u(x)$, at specific times, all on the same axes. If it gets messy having too many curves on one set of axes, find a way to make it easy to visualize (line thickness? color?).

b. A contourplot of u in the x-t plane, with filled contours.

c. A 3D plot

Use enough terms in your partial sums so the solution looks nice. For (b) and (c), have t go for at least a couple of periods. Do you notice anything?

Why am I not emphasizing constrained scaling this time?