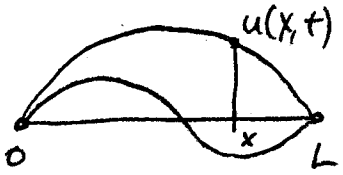
# MTHSC 208, Fall 2010

## Week 14 summary

- The (1-D) wave equation: $u_{tt} = c^2 u_{xx}$




  Boundary conditions: $u(0,t) = u(L,t) = 0$

  Initial conditions: $u(x,0) = h_1(x)$ "initial position"

  $u_t(x,0) = h_2(x)$ "initial velocity"

  Main difference: $g(t) = a\cos(c\lambda t) + b\sin c\lambda t$, instead of $Ae^{-c^2\lambda^2 t}$.

- 2D heat equation: $u_t = c^2(u_{xx} + u_{yy})$

  2D wave equation: $u_{tt} = c^2(u_{xx} + u_{yy})$

- nD heat equation: $u_t = c^2\nabla^2 u = c^2\left(\frac{\partial^2 u}{\partial x_1^2} + \cdots + \frac{\partial^2 u}{\partial x_n^2}\right)$

  nD wave equation: $u_{tt} = c^2\nabla^2 u$

- Harmonic functions: $\nabla^2 u = 0$.

Harmonic functions: $\nabla^2 u = 0$ ⟷ same ⟷ steady-state solns to the heat eqn ⟷ same ⟷ "Flat" functions; "plastic wrap surfaces"

- Solving the 2D heat eqn: $u(x,y,t) = u_{ss}(x,y) + u_n(x,y,t)$.