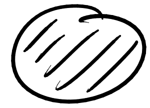
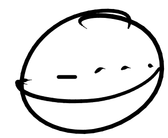
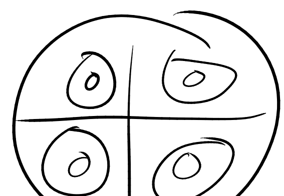
The heat equation in 2 or 3 spatial dimensions and 1 time dimension is $\frac{\partial u}{\partial t} = k \Delta u$

Think of heat in plate  or ball 

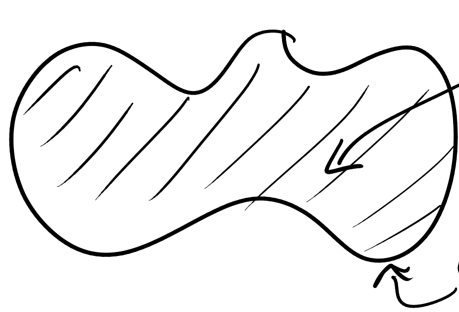
The wave equation in 2 or 3 spatial dimensions and 1 time dim.

$$\frac{\partial^2 u}{\partial t^2} = c^2 \Delta u$$

Think vibrations in a drum head 

Steady state temperature: $\frac{\partial u}{\partial t} = k \Delta u$ and $\frac{\partial u}{\partial t} = 0$,

Hence $\Delta u = 0$. So Laplace's equation describes Temperature distribution in equilibrium. But we still need a boundary condition: We can specify u on the boundary of the domain



$\Delta u = 0$ inside domain

$u(x,y) =$ given $g(x,y)$ on boundary

These are called <u>Dirichlet</u> boundary conditions (keep temperature on the boundary fixed.)

There are also Neumann boundary conditions, where we require $\vec{n} \cdot \nabla u = 0$ along boundary, where $\vec{n}$ is the normal vector to the boundary.