♢♡ The Idea of Flux ♡♢

Imagine water flowing through a fishing net stretched across a stream. Suppose we want to measure flow rate of water through the net, i.e., the volume of fluid that passes through the surface per unit time.

This flow rate is called the flux of the fluid through the surface.

We can also compute the flux of vector fields, such as electric or magnetic fields, where no flow is actually taking place.

Suppose velocity vector field, $\vec{v}$, of a fluid is constant and $\vec{A}$ is the area vector of a flat surface. The flux through this surface is the volume of fluid that flows through in one unit of time.

The volume of fluid that flows through in one unit of time has cross-sectional area $||\vec{A}||$ and height $||\vec{v}|| \cos\theta$, so its volume is

$$\left(||\vec{v}|| \cos\theta\right) ||\vec{A}|| = \vec{v} \cdot \vec{A}.$$