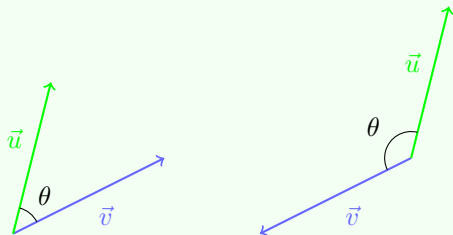## Definition: Dot Product

Geometric

Let $\vec{u}, \vec{v} \in \mathbb{R}^n$ and let θ be the angle between the two (the one in the range $[0, \pi]$), then we have the dot product:

$$\vec{v} \cdot \vec{u} \stackrel{\text{D}}{=} \|v\| \, \|u\| \cos(\theta)$$

Algebraic

Let $u_1, u_2, \ldots, u_{n-1}, u_n$ and $v_1, v_2, \ldots, v_{n-1}, v_n$ denote the components of $\vec{u}$ and $\vec{v}$ respectively, then we have:

$$\vec{v} \cdot \vec{u} \stackrel{\text{D}}{=} \sum_{i=1}^{n} v_i u_i$$