

## Definition: Dot Product

### Geometric

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

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

### Algebraic

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

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