Important operations

① Length (Magnitude) of a vector

$$|\bar{v}| = \sqrt{x^2 + y^2 + z^2}$$

② Normalizing a vector

$$\frac{\bar{V}}{|\bar{V}|} \quad \bar{V}' = \frac{x}{|\bar{v}|}, \frac{y}{|\bar{v}|}, \frac{z}{|\bar{v}|}$$

$\bar{V}'$ has the same DIRECTION as $\bar{V}$ but has magnitude $= 1$

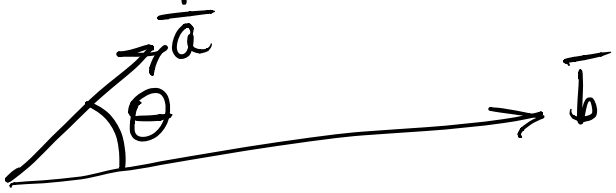
③ Dot product

2 vectors in one scalar out

$$\bar{a} \cdot \bar{b} = a_x b_x + a_y b_y + a_z b_z$$

$$\bar{a} \cdot \bar{b} = |\bar{a}| * |\bar{b}| * \cos(\theta)$$

Dot product (cont.)



dot product give measure of the angle between $\bar{a}$ & $\bar{b}$ <u>but</u> it is scaled by product of the lenghts of $\bar{a}$ & $\bar{b}$.

We want only the angle

So normalize $\bar{a}$ & $\bar{b}$ before taking dot product.

$1 \cdot 1 \cdot \cos(\theta) = \cos(\theta)$

Cross Product

Given $\bar{a} \neq \bar{b}$, $\bar{a} \times \bar{b}$ is a Vector N which is $\perp$ to the $\bar{a}\bar{b}$ plane.

2 vectors in 1 vector out

the length of $\bar{N}$ is the area between $\bar{a}$ & $\bar{b}$ or

Typically $\bar{N}$ would then be normalized.

The sign of $\bar{N}$ is determined by order of $\bar{a}$ & $\bar{b}$

Right hand Rule (once again)

Cross product (cont.)

right hand:

thumb is x call this $\vec{a}$

pointer is y call this $\vec{b}$

index is z call this $\vec{a} \times \vec{b}$

$\vec{b} \times \vec{a}$ would be $-z$

Order matters!