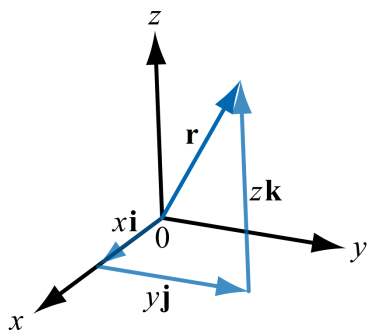


Vectors (for AP Physics C)



Vector means

a spatial relationship between an arrowhead and an arrow tail.

Symbols and features

Symbol: \vec{r}

Length (magnitude): $\|\vec{r}\|$

Direction (for example, for a vector confined to the xy plane, one could use the angle θ counter-clockwise from the $+x$ axis).

Component expression

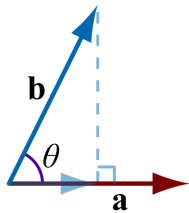
$$\vec{r} = x\hat{i} + y\hat{j} + z\hat{k}$$

$$\vec{a} = a_x\hat{i} + a_y\hat{j} + a_z\hat{k}$$



Dot product means

Light rays perpendicular to \vec{a} are partially blocked by \vec{b} . Multiply the length of the shadow of \vec{b} by the length of \vec{a} .

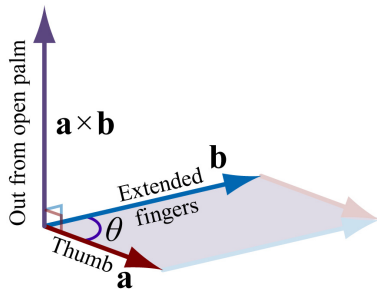


Mathematical definition

$$\vec{a} \cdot \vec{b} := \|\vec{a}\| \|\vec{b}\| \cos \theta$$

Computing formula

$$\begin{aligned} (a_x\hat{i} + a_y\hat{j} + a_z\hat{k}) \cdot (b_x\hat{i} + b_y\hat{j} + b_z\hat{k}) \\ = a_x b_x + a_y b_y + a_z b_z \end{aligned}$$



Cross product means

Construct a vector perpendicular to both \vec{a} and \vec{b} using the **RHR**. The magnitude of the vector equals the area of the parallelogram spanned by \vec{a} and \vec{b} .

Mathematical definition

$$\vec{a} \times \vec{b} := \|\vec{a}\| \|\vec{b}\| \sin \theta \left(\widehat{\vec{a} \times \vec{b}} \right)$$

Computing formula

$$\vec{a} \times \vec{b} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ a_x & a_y & a_z \\ b_x & b_y & b_z \end{vmatrix}$$