

Dot Product Between Vectors



Consider two vectors $\vec{A} = A_x\hat{i} + A_y\hat{j} + A_z\hat{k}$ and $\vec{B} = B_x\hat{i} + B_y\hat{j} + B_z\hat{k}$.

- $\vec{A} \cdot \vec{B} = AB \cos \phi = AB_A = BA_B$.
- $\vec{A} \cdot \vec{B} = \vec{B} \cdot \vec{A}$.
- $\vec{A} \cdot \vec{B} = AB$ if $\vec{A} \parallel \vec{B}$.
- $\vec{A} \cdot \vec{B} = 0$ if $\vec{A} \perp \vec{B}$.
- $\vec{A} \cdot \vec{B} = (A_x\hat{i} + A_y\hat{j} + A_z\hat{k}) \cdot (B_x\hat{i} + B_y\hat{j} + B_z\hat{k})$
 $= A_xB_x(\hat{i} \cdot \hat{i}) + A_xB_y(\hat{i} \cdot \hat{j}) + A_xB_z(\hat{i} \cdot \hat{k})$
 $+ A_yB_x(\hat{j} \cdot \hat{i}) + A_yB_y(\hat{j} \cdot \hat{j}) + A_yB_z(\hat{j} \cdot \hat{k})$
 $+ A_zB_x(\hat{k} \cdot \hat{i}) + A_zB_y(\hat{k} \cdot \hat{j}) + A_zB_z(\hat{k} \cdot \hat{k})$.
- Use $\hat{i} \cdot \hat{i} = \hat{j} \cdot \hat{j} = \hat{k} \cdot \hat{k} = 1$,
 $\hat{i} \cdot \hat{j} = \hat{j} \cdot \hat{k} = \hat{k} \cdot \hat{i} = 0$.
- $\Rightarrow \vec{A} \cdot \vec{B} = A_xB_x + A_yB_y + A_zB_z$.

