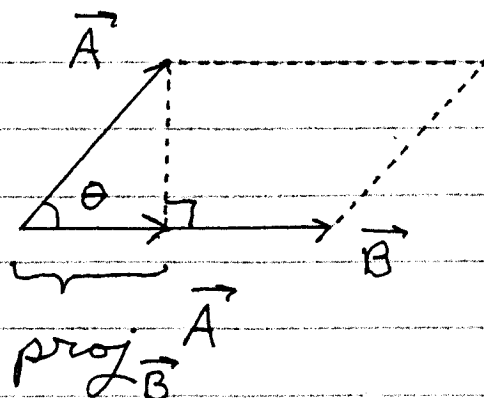


Problem Solving Tools

$$1.) \vec{A} \cdot \vec{B} = |\vec{A}| |\vec{B}| \cos \theta$$

so that

$$\cos \theta = \frac{\vec{A} \cdot \vec{B}}{|\vec{A}| |\vec{B}|}$$



$$2.) \text{proj}_{\vec{B}} \vec{A} = \left(\frac{\vec{A} \cdot \vec{B}}{|\vec{B}|^2} \right) \vec{B} = \left(\frac{\vec{A} \cdot \vec{B}}{\vec{B} \cdot \vec{B}} \right) \vec{B}$$

$$\text{and } |\text{proj}_{\vec{B}} \vec{A}| = |\vec{A}| |\cos \theta| = \frac{|\vec{A} \cdot \vec{B}|}{|\vec{B}|}$$

$$3.) \vec{A} \times \vec{B} = \begin{vmatrix} \vec{i} & \vec{j} & \vec{k} \\ a_1 & a_2 & a_3 \\ b_1 & b_2 & b_3 \end{vmatrix}$$

$$4.) a.) |\vec{A} \times \vec{B}| = |\vec{A}| |\vec{B}| \sin \theta$$

b.) $|\vec{A} \times \vec{B}|$ is area of parallelogram

$$5.) a.) \vec{A} \perp \vec{A} \times \vec{B} \text{ and } \vec{B} \perp \vec{A} \times \vec{B}$$

b.) $\vec{A} \times \vec{B}$ satisfies Right Hand Rule

6.) The volume of parallelepiped formed by vectors $\vec{u} = (a_1, a_2, a_3)$,

$$\vec{v} = (b_1, b_2, b_3),$$

$$\text{and } \vec{w} = (c_1, c_2, c_3) \text{ is } |(\vec{u} \times \vec{v}) \cdot \vec{w}| = abc \begin{vmatrix} a_1 & a_2 & a_3 \\ b_1 & b_2 & b_3 \\ c_1 & c_2 & c_3 \end{vmatrix}$$