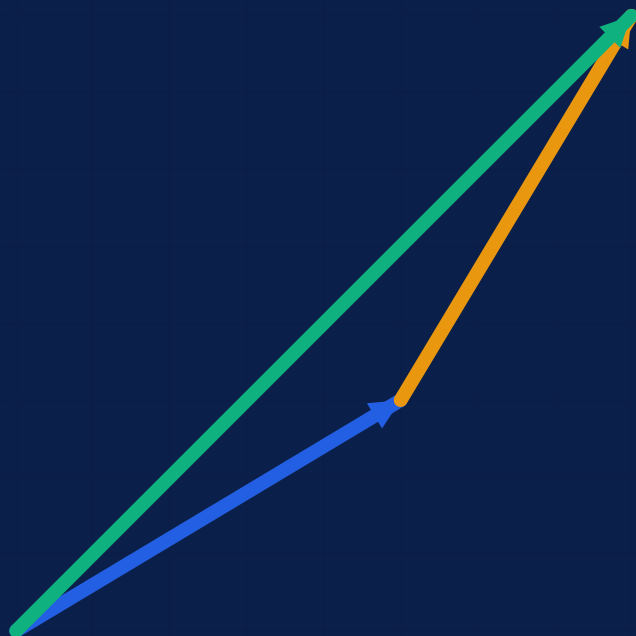


Vector Algebra



Magnitude; unit vector $|\vec{a}| = \sqrt{x^2 + y^2 + z^2}, \quad \hat{a} = \frac{\vec{a}}{|\vec{a}|}$

Direction cosines $l = \frac{x}{|\vec{r}|}, m = \frac{y}{|\vec{r}|}, n = \frac{z}{|\vec{r}|}, \quad l^2 + m^2 + n^2 = 1$

Section, $m : n$
internal; external $\frac{m\vec{b} + n\vec{a}}{m+n}; \quad \frac{m\vec{b} - n\vec{a}}{m-n}$

Section, $m : n$
internal; external $\frac{m\vec{b} + n\vec{a}}{m+n}; \quad \frac{m\vec{b} - n\vec{a}}{m-n}$

Dot product $\vec{a} \cdot \vec{b} = |\vec{a}||\vec{b}| \cos \theta = a_1b_1 + a_2b_2 + a_3b_3$

Perpendicular;
projection of $\vec{a}$ on $\vec{b}$ $\vec{a} \cdot \vec{b} = 0; \quad \frac{\vec{a} \cdot \vec{b}}{|\vec{b}|}$

Cross product $\vec{a} \times \vec{b} = |\vec{a}||\vec{b}| \sin \theta \hat{n} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ a_1 & a_2 & a_3 \\ b_1 & b_2 & b_3 \end{vmatrix}$

Area: parallelogram;
triangle $|\vec{a} \times \vec{b}|; \quad \frac{1}{2} |\vec{a} \times \vec{b}|$