Vector Product

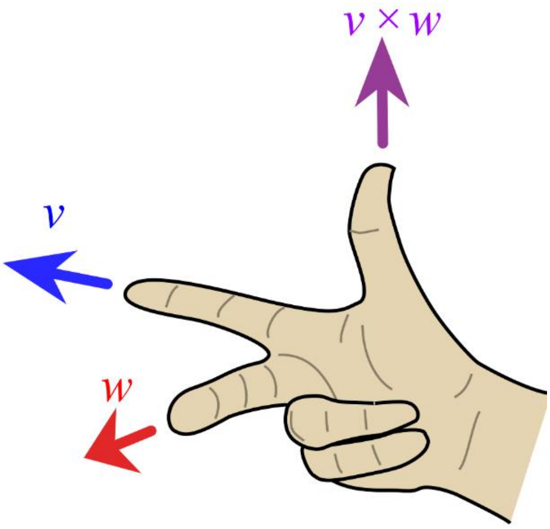
$\boldsymbol{v} \times \boldsymbol{w}$ is a vector perpendicular to $\boldsymbol{v}$ and $\boldsymbol{w}$

$$\boldsymbol{v} \times \boldsymbol{w} = \begin{pmatrix} v_1 \\ v_2 \\ v_3 \end{pmatrix} \times \begin{pmatrix} w_1 \\ w_2 \\ w_3 \end{pmatrix} = \begin{pmatrix} v_2w_3 - v_3w_2 \\ v_3w_1 - v_1w_3 \\ v_1w_2 - v_2w_1 \end{pmatrix} = \begin{pmatrix} v_2w_3 - v_3w_2 \\ -(v_1w_3 - v_3w_1) \\ v_1w_2 - v_2w_1 \end{pmatrix}$$

$$\boldsymbol{v} \times \boldsymbol{w} = |\boldsymbol{v}||\boldsymbol{w}| sin\theta\, \boldsymbol{n}$$

$$|\boldsymbol{v} \times \boldsymbol{w}| = |\boldsymbol{v}||\boldsymbol{w}| sin\theta = area\ of\ parallelogram$$

You can find the **direction** of the vector product using the ***right-hand rule***



Useful Properties

$$\boldsymbol{v} \times \boldsymbol{w} = -\boldsymbol{w} \times \boldsymbol{v}$$

$$\boldsymbol{u} \times (\boldsymbol{v} + \boldsymbol{w}) = \boldsymbol{u} \times \boldsymbol{v} + \boldsymbol{u} \times \boldsymbol{w}$$

$$(k\boldsymbol{v}) \times \boldsymbol{w} = k(\boldsymbol{v} \times \boldsymbol{w})$$

$$\boldsymbol{v} \times \boldsymbol{v} = \boldsymbol{0}$$