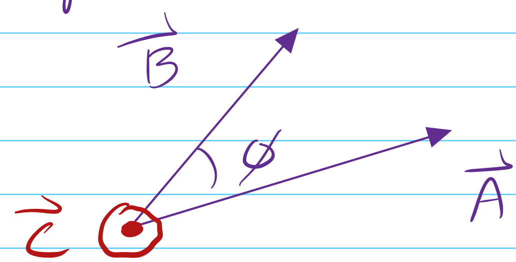
The cross product is discussed in Chapter 1, Section 10.

define: $\vec{C} = \vec{A} \times \vec{B}$ to mean



$$|\vec{C}| = |\vec{A}|\,|\vec{B}| \sin\phi$$

or $C = A\,B\,\sin\phi$

direction: $\vec{C} \perp \vec{A}, \vec{B}$ plane

Right Hand Rule (many ways to express this — here is my favorite :)

① Place right hand fingers along $\vec{A}$.

② Rotate or curl them to point along $\vec{B}$.

③ Thumb points along $\vec{C}$.

Special cases

$\vec{A} \perp \vec{B}$? $\sin\phi = 1$, $C = AB$

$\vec{A} \parallel \vec{B}$? $\sin\phi = 0$ $C = 0$.

Anti-symmetry: order matters

$$\vec{A} \times \vec{B} = -\vec{B} \times \vec{A}$$

Unit vectors:

$\hat{\imath} \times \hat{\jmath} = \hat{k}$ (note, all in order

$\hat{\jmath} \times \hat{k} = \hat{\imath}$ $i\ j\ k\ i\ j\ k$ ....)

$\hat{k} \times \hat{\imath} = \hat{\jmath}$

This also leads to a vector component version.
(assume $\vec{A}$ and $\vec{B}$ are in $x-y$ plane for simplicity)

$$\vec{A} \times \vec{B} = (A_x \hat{\imath} + A_y \hat{\jmath}) \times (B_x \hat{\imath} + B_y \hat{\jmath})$$

expand term-by-term, keeping in order

$$\vec{A} \times \vec{B} = A_x B_x \underbrace{\hat{\imath} \times \hat{\imath}}_{0} + A_x B_y \underbrace{\hat{\imath} \times \hat{\jmath}}_{\hat{k}}$$

$$+ A_y B_x \underbrace{\hat{\jmath} \times \hat{\imath}}_{-\hat{k}} + A_y B_y \underbrace{\hat{\jmath} \times \hat{\jmath}}_{0}$$

$$\vec{A} \times \vec{B} = (A_x B_y - A_y B_x) \hat{k}$$ ($\vec{A}, \vec{B}$ in $x-y$ plane)

(full 3-D, see Eq 1.24 in Ch. 1.)

So here

$$\vec{\tau} = \vec{r} \times \vec{F}$$

$\vec{\tau}$ is $\perp \vec{r}$, $\perp \vec{F}$, $\tau = r F \sin\phi$.