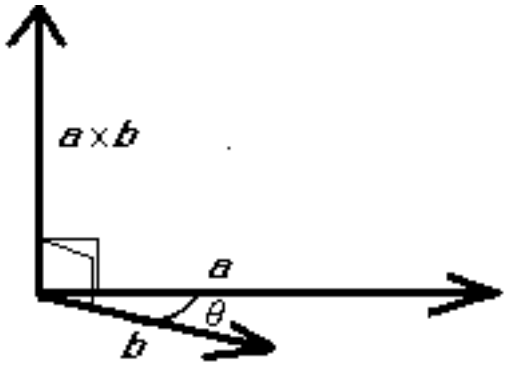
Cross products

Cross (or vector) product $\vec{a} \times \vec{b}$ (in 3D only):



Magnitude:

$$||\vec{a} \times \vec{b}|| = ||\vec{a}||||\vec{b}|| \sin \vartheta$$

Direction: $\vec{a} \times \vec{b}$ is normal to both $\vec{a}$ and $\vec{b}$.

$$\vec{a} \times \vec{b} \equiv \begin{vmatrix} \hat{\imath} & \hat{\jmath} & \hat{k} \\ a_1 & a_2 & a_3 \\ b_1 & b_2 & b_3 \end{vmatrix} = \hat{\imath}(a_2 b_3 - a_3 b_2) + \hat{\jmath}(a_3 b_1 - a_1 b_3) + \hat{k}(a_1 b_2 - a_2 b_1)$$

Reminder: Evaluating small determinants:

$$|a| = a \qquad \begin{vmatrix} a & b \\ c & d \end{vmatrix} = ad - bc \qquad \begin{matrix} a & b \\ c & d \end{matrix}$$

$$\begin{vmatrix} a & b & c \\ d & e & f \\ g & h & i \end{vmatrix} = aei + bfg + cdh - afh - bdi - ceg$$

$$\begin{matrix} a & b & c & a & b & c \\ d & e & f & d & e & f \\ g & h & i & g & h & i \end{matrix}$$