$$\vec{A} = a_1\hat{x} + a_2\hat{y} + a_3\hat{z}$$
$$\vec{B} = b_1\hat{x} + b_2\hat{y} + b_3\hat{z}$$
$$\vec{C} = c_1\hat{x} + c_2\hat{y} + c_3\hat{z}$$

Unit vec...

$$= 1\,\hat{x}$$
$$= 1\,\hat{y}$$
$$= 1\,\hat{z}$$

$$\hat{x} \curvearrowright \hat{y} \quad \hat{z}$$

$$\vec{A}\times\vec{B} = \begin{vmatrix} \hat{x} & \hat{j} & \hat{z} \\ a_1 & a_2 & a_3 \\ b_1 & b_2 & b_3 \end{vmatrix} = \hat{x}\left[a_2b_3 - a_3b_2\right] - \hat{y}\underbrace{\left[a_1b_3 - a_3b_1\right]}_{\begin{vmatrix} a_1 & a_3 \\ b_1 & b_3 \end{vmatrix}} + \hat{z}\left[a_1b_2 - b_1a_2\right]$$

cover the $\hat{y}$ column

determinant = CROSS product

unit vectors $\vec{A}\times\vec{B}$

$$\vec{A}\times\vec{B} \quad \begin{vmatrix} \hat{x} & \hat{y} & \hat{z} \\ 1 & 0 & 0 \\ 0 & 1 & 0 \end{vmatrix} = \hat{x}\left[\cancelto{0}{0\cdot 0 - 1\cdot 0}\right] - \hat{y}\left[\cancelto{0}{1\cdot 0 - 0\cdot 0}\right] + \hat{z}\left[1\cdot 1 - \cancelto{0}{0\cdot 0}\right] = 1\hat{z}$$

$$C\times B \quad \begin{vmatrix} \hat{x} & \hat{y} & \hat{z} \\ 0 & 0 & 1 \\ 0 & 1 & 0 \end{vmatrix} = \hat{x}\left[0 - 1\cdot 1\right] - \hat{y}\left[0 - \cancelto{0}{0\cdot 1}\right] + \hat{z}\left[\cancelto{0}{1\cdot 0} - 0\right] = -1\hat{x}$$