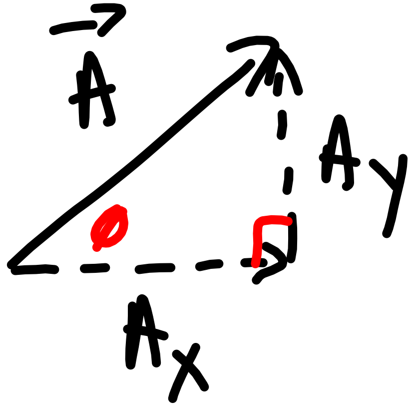
Magnitude



$$a^2 + b^2 = c^2$$

$$(A_x)^2 + (A_y)^2 = (\vec{A})^2$$

$$\sqrt{(A_x)^2 + (A_y)^2} = \vec{A}$$

~ in 3D, we add another dimension: $c^2 + d^2 = e^2$

$c^2 \leftarrow a^2 + b^2$

$$c^2 + d^2 = \boxed{e^2} \rightarrow \text{3D Vector Magnitude}$$

$$\sqrt{\left(\sqrt{a^2+b^2}\right)^{\not 2} + d^2} = \sqrt{e^{\not 2}}$$

$$\sqrt{a^2+b^2} + \sqrt{d^2} = e$$

$$\sqrt{a^2+b^2+d^2} = e$$

or: $\sqrt{A_x^2 + A_y^2 + A_z^2} = e$

or: $\sqrt{\hat{i}^2 + \hat{j}^2 + \hat{k}^2} = e$

ex: $\vec{A} = (3.0)\hat{i} + (4.0)\hat{j} - (6.0)\hat{k}$

magnitude? $\sqrt{(3)^2 + (4)^2 + (-6)^2}$

$\sqrt{9 + 16 + 36} = 7.8$

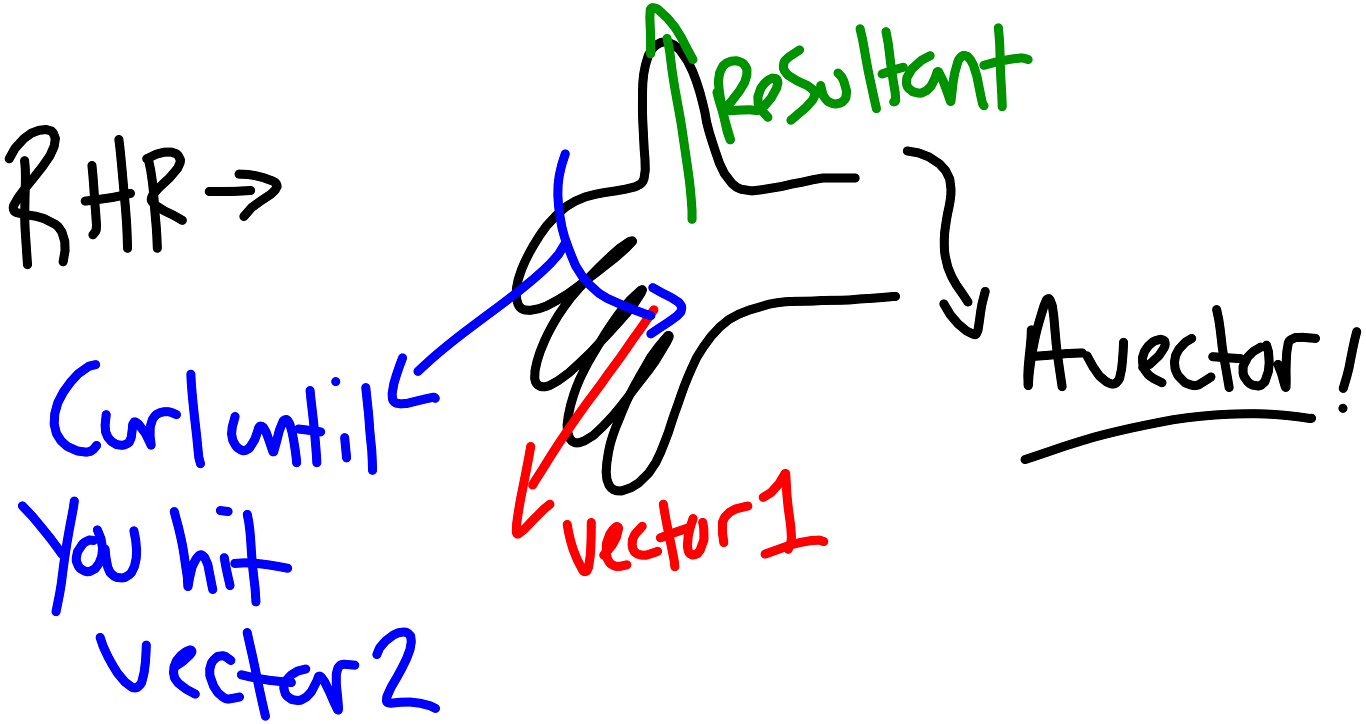
Cross Products

~ multiplying two vectors to get a third vector that is perpendicular to the first two.

~ which way does it point?

↳ RHR

RHR →



Cross product is Anticommutative

$\hat{i} \times \hat{j} = \hat{k}$ $\hat{j} \times \hat{i} = -\hat{k}$

$\hat{j} \times \hat{k} = \hat{i}$ $\hat{k} \times \hat{j} = -\hat{i}$

$\hat{k} \times \hat{i} = \hat{j}$ $\hat{i} \times \hat{k} = -\hat{j}$

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

$$\vec{A} = \left(A_x \hat{i} + A_y \hat{j} + A_z \hat{k}\right)$$

$$\vec{B} = \left(B_x \hat{i} + B_y \hat{j} + B_z \hat{k}\right)$$

$$\left(A_x \hat{i} \times B_x \hat{i}\right)^{\to 0} + \left(A_x \hat{i} \times B_y \hat{j}\right) + \left(A_x \hat{i} \times B_z \hat{k}\right) +$$

$$\left(A_y \hat{j} \times B_x \hat{i}\right) + \left(A_y \hat{j} \times B_y \hat{j}\right)^{\to 0} + \left(A_y \hat{j} \times B_z \hat{k}\right) +$$

$$\left(A_z \hat{k} \times B_x \hat{i}\right) + \left(A_z \hat{k} \times B_y \hat{j}\right) + \left(A_z \hat{k} \times B_z \hat{k}\right)^{\to 0}$$

$$A_x B_y (\hat{i} \times \hat{j}) \to \hat{k} \; + \; A_x B_z (\hat{i} \times \hat{k}) \to -\hat{j} \; +$$

$$A_y B_x (\hat{j} \times \hat{i}) \to -\hat{k} \; + \; A_y B_z (\hat{j} \times \hat{k}) \to \hat{i} \; +$$

$$A_z B_x (\hat{k} \times \hat{i}) \to \hat{j} \; + \; A_z B_y (\hat{k} \times \hat{j}) \to -\hat{i}$$

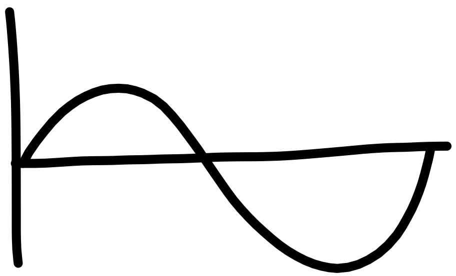
$$\vec{A} \times \vec{B} = (A_y B_z - A_z B_y)\hat{i} +$$
$$(A_z B_x - A_x B_z)\hat{j} +$$
$$(A_x B_y - A_y B_x)\hat{k}$$

what if you only have magnitudes?

$\hat{i} \times \hat{i} = 0$

$\hat{i} \times \hat{j} = 1\hat{k}$

$\hat{i} \times \hat{k} = -1 - \hat{k}$



$\vec{A} \times \vec{B} = |A||B| \sin\theta$

+ RHR