

CONCEPT: VECTOR (CROSS) PRODUCT USING COMPONENTS

- Sometimes you'll need to calculate $\vec{A} \times \vec{B}$ using unit vector components, instead of $|\mathbf{A}||\mathbf{B}|\sin\theta$

- Vector product creates a new vector $\vec{C} \rightarrow$ we need a way to calculate its _____.

Vector Product

$$\vec{A} = A_x \hat{i} + A_y \hat{j} + A_z \hat{k}$$

$$\vec{B} = B_x \hat{i} + B_y \hat{j} + B_z \hat{k}$$

$$\vec{C} = \vec{A} \times \vec{B} = \underline{\hspace{2cm}}$$

Scalar Product

$$\vec{A} = A_x \hat{i} + A_y \hat{j} + A_z \hat{k}$$

$$\vec{B} = B_x \hat{i} + B_y \hat{j} + B_z \hat{k}$$

$$\vec{A} \cdot \vec{B} = (A_x B_x) + (A_y B_y) + (A_z B_z)$$

EXAMPLE: Write $\vec{A} \times \vec{B}$ in terms of its unit vector components, if $\vec{A} = \hat{i} + 2\hat{j}$ and $\vec{B} = -2\hat{i} + 3\hat{j} + 4\hat{k}$

	x	y	z	x	y
$\vec{A}$					
$\vec{B}$					

$$C_x = \underline{\hspace{2cm}} = \underline{\hspace{2cm}} = \underline{\hspace{2cm}}$$

$$C_y = \underline{\hspace{2cm}} = \underline{\hspace{2cm}} = \underline{\hspace{2cm}}$$

$$C_z = \underline{\hspace{2cm}} = \underline{\hspace{2cm}} = \underline{\hspace{2cm}}$$

CROSS PRODUCT USING COMPONENTS

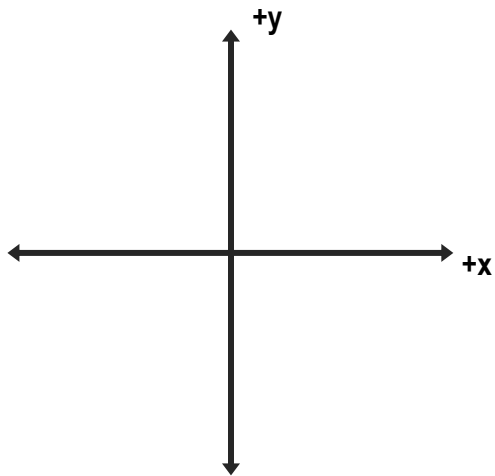
- Build table of $\vec{A}$ & $\vec{B}$'s x,y,z,x,y ($\hat{i}, \hat{j}, \hat{k}$) components
- Write $\mathbf{A} \mathbf{B} - \mathbf{B} \mathbf{A}$ for each component
- Always multiply _____ components diagonally (**CROSS** product), first ____ and then ____

- Putting this all together, you get $\vec{C} = \vec{A} \times \vec{B} = (\underline{\hspace{2cm}})\hat{i} + (\underline{\hspace{2cm}})\hat{j} + (\underline{\hspace{2cm}})\hat{k}$

PROBLEM: Vector $\vec{A} = 4\hat{i} + 3\hat{j}$ and $\vec{B} = -2\hat{i} + 3\hat{j}$.

a) Find the magnitude and direction of $\vec{C} = \vec{A} \times \vec{B}$ using $AB\sin(\theta)$ and the Right-Hand-Rule.

b) Write $\vec{C} = \vec{A} \times \vec{B}$ in terms of unit vector components and calculate the magnitude of $\vec{C}$.



CROSS PRODUCT USING COMPONENTS

- 1) Build table of $\vec{A}$ & $\vec{B}$'s x, y, z, x, y ($\hat{i}, \hat{j}, \hat{k}$) components
- 2) Write $\vec{A} \times \vec{B} - \vec{B} \times \vec{A}$ for each component
- 3) Always multiply "unlike" components diagonally (**CROSS** product), first ↘ and then ↗