

MATH 2E Prep: Product of Vectors

1. Compute $\vec{u} \cdot \vec{v}$, where $\vec{u} = \langle 1, 0, -2 \rangle$, $\vec{v} = \langle x, y, z \rangle$

Solution:

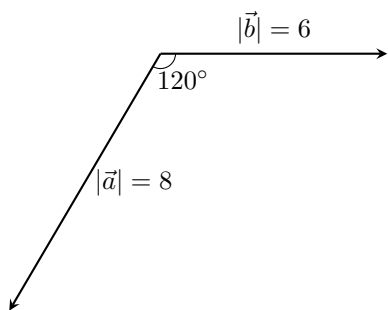
$$\vec{u} \cdot \vec{v} = 1 \times x + 0 \times y + (-2) \times z = x - 2z$$

2. $\vec{u} = \langle 1, 0, -2 \rangle$, $\vec{v} = \langle 3, 4, 0 \rangle$, compute $\vec{u} \times \vec{v}$

Solution:

$$\begin{aligned}\vec{u} \times \vec{v} &= \begin{vmatrix} \mathbf{i} & \mathbf{j} & \mathbf{k} \\ 1 & 0 & -2 \\ 3 & 4 & 0 \end{vmatrix} \\ &= \begin{vmatrix} 0 & -2 \\ 4 & 0 \end{vmatrix} \mathbf{i} - \begin{vmatrix} 1 & -2 \\ 3 & 0 \end{vmatrix} \mathbf{j} + \begin{vmatrix} 1 & 0 \\ 3 & 4 \end{vmatrix} \mathbf{k} \\ &= 8\mathbf{i} - 6\mathbf{j} + 4\mathbf{k} \\ &= \langle 8, -6, 4 \rangle\end{aligned}$$

3. Use the following figure to find $|\vec{a} \times \vec{b}|$, and determine whether $\vec{a} \times \vec{b}$ is directed into the page or out of the page.



Solution:

$$|\vec{a} \times \vec{b}| = |\vec{a}||\vec{b}| \sin \theta = 8 \times 6 \times \sin(120^\circ) = 48 \times \frac{\sqrt{3}}{2} = 24\sqrt{3},$$

and the right hand rule shows that $\vec{a} \times \vec{b}$ is directed out of the page.