

Topic: Cross products**Question:** Find the cross product $\vec{a} \times \vec{b}$.

$$\vec{a} = (1, -1, 1)$$

$$\vec{b} = (-2, 1, 2)$$

Answer choices:

A $\vec{a} \times \vec{b} = (3, -4, 1)$

B $\vec{a} \times \vec{b} = (-3, -4, -1)$

C $\vec{a} \times \vec{b} = (-3, 4, -1)$

D $\vec{a} \times \vec{b} = (3, 4, 1)$



Solution: B

The cross product $\vec{a} \times \vec{b}$ of $\vec{a} = (1, -1, 1)$ and $\vec{b} = (-2, 1, 2)$ is given by

$$\vec{a} \times \vec{b} = \begin{vmatrix} \mathbf{i} & \mathbf{j} & \mathbf{k} \\ 1 & -1 & 1 \\ -2 & 1 & 2 \end{vmatrix}$$

$$\vec{a} \times \vec{b} = \mathbf{i} \begin{vmatrix} -1 & 1 \\ 1 & 2 \end{vmatrix} - \mathbf{j} \begin{vmatrix} 1 & 1 \\ -2 & 2 \end{vmatrix} + \mathbf{k} \begin{vmatrix} 1 & -1 \\ -2 & 1 \end{vmatrix}$$

Calculate the 2×2 determinants using the $ad - bc$ pattern.

$$\vec{a} \times \vec{b} = \mathbf{i} [(-1)(2) - (1)(1)] - \mathbf{j} [(1)(2) - (1)(-2)] + \mathbf{k} [(1)(1) - (-1)(-2)]$$

$$\vec{a} \times \vec{b} = \mathbf{i}(-2 - 1) - \mathbf{j}(2 + 2) + \mathbf{k}(1 - 2)$$

$$\vec{a} \times \vec{b} = -3\mathbf{i} - 4\mathbf{j} - \mathbf{k}$$

$$\vec{a} \times \vec{b} = (-3, -4, -1)$$



Topic: Cross products**Question:** Find the cross product $\vec{a} \times \vec{b}$.

$$\vec{a} = (4, 2, 0)$$

$$\vec{b} = (-1, -3, 1)$$

Answer choices:

A $\vec{a} \times \vec{b} = (-2, 4, 10)$

B $\vec{a} \times \vec{b} = (-2, -4, 10)$

C $\vec{a} \times \vec{b} = (2, 4, -10)$

D $\vec{a} \times \vec{b} = (2, -4, -10)$



Solution: D

The cross product $\vec{a} \times \vec{b}$ of $\vec{a} = (4, 2, 0)$ and $\vec{b} = (-1, -3, 1)$ is given by

$$\vec{a} \times \vec{b} = \begin{vmatrix} \mathbf{i} & \mathbf{j} & \mathbf{k} \\ 4 & 2 & 0 \\ -1 & -3 & 1 \end{vmatrix}$$

$$\vec{a} \times \vec{b} = \mathbf{i} \begin{vmatrix} 2 & 0 \\ -3 & 1 \end{vmatrix} - \mathbf{j} \begin{vmatrix} 4 & 0 \\ -1 & 1 \end{vmatrix} + \mathbf{k} \begin{vmatrix} 4 & 2 \\ -1 & -3 \end{vmatrix}$$

Calculate the 2×2 determinants using the $ad - bc$ pattern.

$$\vec{a} \times \vec{b} = \mathbf{i} [(2)(1) - (0)(-3)] - \mathbf{j} [(4)(1) - (0)(-1)] + \mathbf{k} [(4)(-3) - (2)(-1)]$$

$$\vec{a} \times \vec{b} = \mathbf{i}(2 - 0) - \mathbf{j}(4 - 0) + \mathbf{k}(-12 + 2)$$

$$\vec{a} \times \vec{b} = 2\mathbf{i} - 4\mathbf{j} - 10\mathbf{k}$$

$$\vec{a} \times \vec{b} = (2, -4, -10)$$



Topic: Cross products

Question: Find the cross product $\vec{a} \times \vec{b}$.

$$\vec{a} = (6, 7, -5)$$

$$\vec{b} = (8, 7, -11)$$

Answer choices:

A $\vec{a} \times \vec{b} = (-42, -22, -14)$

B $\vec{a} \times \vec{b} = (-112, 106, 98)$

C $\vec{a} \times \vec{b} = (-42, 26, -14)$

D $\vec{a} \times \vec{b} = (-112, -106, 98)$



Solution: C

The cross product $\vec{a} \times \vec{b}$ of $\vec{a} = (6, 7, -5)$ and $\vec{b} = (8, 7, -11)$ is given by

$$\vec{a} \times \vec{b} = \begin{vmatrix} \mathbf{i} & \mathbf{j} & \mathbf{k} \\ 6 & 7 & -5 \\ 8 & 7 & -11 \end{vmatrix}$$

$$\vec{a} \times \vec{b} = \mathbf{i} \begin{vmatrix} 7 & -5 \\ 7 & -11 \end{vmatrix} - \mathbf{j} \begin{vmatrix} 6 & -5 \\ 8 & -11 \end{vmatrix} + \mathbf{k} \begin{vmatrix} 6 & 7 \\ 8 & 7 \end{vmatrix}$$

Calculate the 2×2 determinants using the $ad - bc$ pattern.

$$\vec{a} \times \vec{b} = \mathbf{i} [(7)(-11) - (-5)(7)] - \mathbf{j} [(6)(-11) - (-5)(8)] + \mathbf{k} [(6)(7) - (7)(8)]$$

$$\vec{a} \times \vec{b} = \mathbf{i}(-77 + 35) - \mathbf{j}(-66 + 40) + \mathbf{k}(42 - 56)$$

$$\vec{a} \times \vec{b} = -42\mathbf{i} + 26\mathbf{j} - 14\mathbf{k}$$

$$\vec{a} \times \vec{b} = (-42, 26, -14)$$

