

Trig 8.4 $\vec{a} \cdot \vec{b} = 0$

Find the inner product of two vectors

Find the cross product of two vectors

Determine whether two vectors are perpendicular

$$\vec{a} \times \vec{b}$$

Quiz 8.3-8.4 is Wed.

MCT 8.1-8.4 Thurs.

\perp to both

Is $\vec{a} \cdot \vec{b} = \vec{b} \cdot \vec{a}$?

Is $\vec{a} \times \vec{b} = \vec{b} \times \vec{a}$?

whiteboards

Find each inner product and state whether the vectors are perpendicular. Write *yes* or *no*.

11. $\langle 4, 8 \rangle \cdot \langle 6, -3 \rangle$

12. $\langle 3, 5 \rangle \cdot \langle 4, -2 \rangle$

13. $\langle 5, -1 \rangle \cdot \langle -3, 6 \rangle$

14. $\langle 7, 2 \rangle \cdot \langle 0, -2 \rangle$

15. $\langle 8, 4 \rangle \cdot \langle 2, 4 \rangle$

16. $\langle 4, 9, -3 \rangle \cdot \langle -6, 7, 5 \rangle$

Find each cross product. Then verify that the resulting vector is perpendicular to the given vectors.

21. $\langle 0, 1, 2 \rangle \times \langle 1, 1, 4 \rangle$

22. $\langle 5, 2, 3 \rangle \times \langle -2, 5, 0 \rangle$

$$\begin{array}{ccc} \vec{i} & \vec{j} & \vec{k} \\ 0 & 1 & 2 \\ 1 & 1 & 4 \end{array}$$

Is $\mathbf{a} \times \mathbf{b} = \mathbf{b} \times \mathbf{a}$?
no

Find a vector perpendicular to the plane containing the given points.

29. $(0, -2, 2)$, $(1, 2, -3)$, and $(4, 0, -1)$

3 Points in the plane form vectors

$(0, -2, 2)$

(multiple answers are possible...
depends on how you set it up)

Diagram showing points A, B, and C forming a triangle. Vectors \vec{r} and \vec{q} are drawn from point A to points B and C respectively.

Coordinates: $A(0, -2, 2)$, $B(1, 2, -3)$, $C(4, 0, -1)$

Calculation of the cross product $\vec{q} \times \vec{r}$ using a determinant:

$$\vec{q} \times \vec{r} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 1 & 4 & -5 \\ 4 & 2 & -3 \end{vmatrix}$$

Expansion of the determinant:

$$= \hat{i} \begin{vmatrix} 4 & -5 \\ 2 & -3 \end{vmatrix} - \hat{j} \begin{vmatrix} 1 & -5 \\ 4 & -3 \end{vmatrix} + \hat{k} \begin{vmatrix} 1 & 4 \\ 4 & 2 \end{vmatrix}$$

Calculating the 2x2 determinants:

- $\begin{vmatrix} 4 & -5 \\ 2 & -3 \end{vmatrix} = 4(-3) - (-5)(2) = -12 + 10 = -2$
- $\begin{vmatrix} 1 & -5 \\ 4 & -3 \end{vmatrix} = 1(-3) - (-5)(4) = -3 + 20 = 17$
- $\begin{vmatrix} 1 & 4 \\ 4 & 2 \end{vmatrix} = 1(2) - 4(4) = 2 - 16 = -14$

Resulting vector components:

$$-2\hat{i} - 17\hat{j} - 14\hat{k}$$

Final answer (written in purple):

$$2\hat{i} + 17\hat{j} + 14\hat{k}$$

