

## Three-Dimensional Vector Cross Products

Find the cross product of the given vectors.

1)  $\vec{a} \times \vec{b}$   
 $\vec{a} = \langle -9, 5, -3 \rangle$   
 $\vec{b} = \langle 2, 9, 2 \rangle$

2)  $\overrightarrow{AB} \times \overrightarrow{CD}$   
Given:  $A = (-6, -2, 6)$   $B = (-5, -5, -3)$   
 $C = (8, 7, -6)$   $D = (-5, -4, -1)$

Find a vector that is perpendicular to the given vectors.

3)  $\vec{u} = \langle -5, 6, 7 \rangle$   
 $\vec{v} = \langle 1, -9, 0 \rangle$

4)  $\overrightarrow{RS}$  and  $\overrightarrow{RT}$   
Given:  $R = (3, 7, 2)$   $S = (1, 7, -7)$   
 $T = (-1, -5, 6)$

Find the area of a triangle with the given vectors as two adjacent sides.

5)  $\vec{a} = \langle 9, -2, 9 \rangle$   
 $\vec{b} = \langle 4, 9, -2 \rangle$

6)  $\vec{u} = \langle 0, 2, -1 \rangle$   
 $\vec{v} = \langle -3, 6, 8 \rangle$

**Find the area of a triangle with the given vertices.**

7)  $R = (3, -2, 7)$   
 $S = (0, -7, 9)$   
 $T = (6, -7, 9)$

8)  $A = (6, 9, -8)$   
 $B = (0, -9, -1)$   
 $C = (-8, -9, 2)$

**Find the area of a parallelogram with the given vectors as two adjacent sides.**

9)  $\vec{u} = \langle -7, 1, 0 \rangle$   
 $\vec{v} = \langle 7, -5, -1 \rangle$

10)  $\overrightarrow{AB}$  and  $\overrightarrow{AC}$   
Given:  $A = (-8, 5, -8)$   $B = (4, 8, -8)$   
 $C = (6, -3, 8)$

**Find the volume of a parallelepiped with the given vectors as adjacent edges.**

11)  $\vec{u} = \langle -6, 4, -9 \rangle$   
 $\vec{v} = \langle 2, -5, 8 \rangle$   
 $\vec{w} = \langle 0, -4, 8 \rangle$

12)  $\overrightarrow{TX}$ ,  $\overrightarrow{TY}$ , and  $\overrightarrow{TZ}$   
Given:  $T = (0, -4, -8)$   $X = (8, 1, -9)$   
 $Y = (-1, -5, -2)$   $Z = (0, -8, 3)$

## Three-Dimensional Vector Cross Products

Find the cross product of the given vectors.

$$1) \vec{a} \times \vec{b}$$

$$\vec{a} = \langle -9, 5, -3 \rangle$$

$$\vec{b} = \langle 2, 9, 2 \rangle$$

$$\langle 37, 12, -91 \rangle$$

$$2) \overrightarrow{AB} \times \overrightarrow{CD}$$

$$\text{Given: } A = (-6, -2, 6) \quad B = (-5, -5, -3)$$

$$C = (8, 7, -6) \quad D = (-5, -4, -1)$$

$$\langle -114, 112, -50 \rangle$$

Find a vector that is perpendicular to the given vectors.

$$3) \vec{u} = \langle -5, 6, 7 \rangle$$

$$\vec{v} = \langle 1, -9, 0 \rangle$$

$$\langle -63, -7, -39 \rangle$$

$$4) \overrightarrow{RS} \text{ and } \overrightarrow{RT}$$

$$\text{Given: } R = (3, 7, 2) \quad S = (1, 7, -7)$$

$$T = (-1, -5, 6)$$

$$\langle 108, -44, -24 \rangle$$

Find the area of a triangle with the given vectors as two adjacent sides.

$$5) \vec{a} = \langle 9, -2, 9 \rangle$$

$$\vec{b} = \langle 4, 9, -2 \rangle$$

$$\frac{\sqrt{16766}}{2} \approx 64.742 \text{ units}^2$$

$$6) \vec{u} = \langle 0, 2, -1 \rangle$$

$$\vec{v} = \langle -3, 6, 8 \rangle$$

$$\frac{23}{2} = 11.5 \text{ units}^2$$

**Find the area of a triangle with the given vertices.**

7)  $R = (3, -2, 7)$   
 $S = (0, -7, 9)$   
 $T = (6, -7, 9)$

$3\sqrt{29} \approx 16.155 \text{ units}^2$

8)  $A = (6, 9, -8)$   
 $B = (0, -9, -1)$   
 $C = (-8, -9, 2)$

$\sqrt{6274} \approx 79.209 \text{ units}^2$

**Find the area of a parallelogram with the given vectors as two adjacent sides.**

9)  $\vec{u} = \langle -7, 1, 0 \rangle$   
 $\vec{v} = \langle 7, -5, -1 \rangle$

$\sqrt{834} \approx 28.879 \text{ units}^2$

10)  $\vec{AB}$  and  $\vec{AC}$

Given:  $A = (-8, 5, -8)$   $B = (4, 8, -8)$   
 $C = (6, -3, 8)$

$42\sqrt{33} \approx 241.272 \text{ units}^2$

**Find the volume of a parallelepiped with the given vectors as adjacent edges.**

11)  $\vec{u} = \langle -6, 4, -9 \rangle$   
 $\vec{v} = \langle 2, -5, 8 \rangle$   
 $\vec{w} = \langle 0, -4, 8 \rangle$

$56 \text{ units}^3$

12)  $\vec{TX}$ ,  $\vec{TY}$ , and  $\vec{TZ}$

Given:  $T = (0, -4, -8)$   $X = (8, 1, -9)$   
 $Y = (-1, -5, -2)$   $Z = (0, -8, 3)$

$155 \text{ units}^3$