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Worksheet 4

Exercise 1. Determine the magnitude of the cross product of $u = \langle 2, 1, 4 \rangle$ and $v = \langle -1, -0.5, -2 \rangle$.

$$\begin{array}{l} 2 \\ 1 \\ 4 \end{array} \begin{array}{l} -1 \\ -0.5 \\ -2 \end{array} \left\{ \begin{array}{l} 2(-1) + (1 \times -0.5) + (4 \times -2) \\ -2 - 0.5 - 8 = -10.5 = |u||v|\cos\theta \end{array} \right.$$

$$|v| = \sqrt{1 + \frac{1}{4} + 4}$$

$$4 = \sqrt{4 + 1 + 16}$$

$$\sqrt{21} \cdot \sqrt{5.5}$$

$$\langle -2 - 2, -4 - 4, -1 - 1 \rangle = \langle 0, 0, 0 \rangle \left\{ \begin{array}{l} \theta = 180 \\ \sin(180) = 0 \end{array} \right.$$

$$\boxed{|u \times v| = 0}$$

Exercise 2. Find the following cross products:

a) $i \times j = k$

b) $k \times i = j$

c) $i \times k = -j$

d) $j \times j = 0$

a: $\langle i, 0, 0 \rangle, \langle 0, 1, 0 \rangle$

$$\begin{array}{cc} 1 & 0 \\ 0 & 1 \\ 0 & 0 \end{array} = \langle 0, 0, 1 \rangle$$

b: $\langle 0, 0, 1 \rangle, \langle 1, 0, 0 \rangle$

$$\begin{array}{cc} 0 & 1 \\ 0 & 0 \\ 1 & 0 \end{array} = \langle 0, 1, 0 \rangle$$

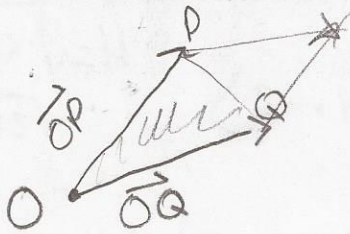
c: $\langle 1, 0, 0 \rangle, \langle 0, 0, 1 \rangle$

$$\begin{array}{cc} 1 & 0 \\ 0 & 0 \\ 0 & 1 \end{array} = \langle 0, -1, 0 \rangle$$

d: $\langle 0, 1, 0 \rangle, \langle 0, 1, 0 \rangle$

$$\begin{array}{cc} 0 & 1 \\ 1 & 1 \\ 0 & 0 \end{array} = \langle 0, 0, 0 \rangle$$

Exercise 3. Determine the area of the triangle with vertices $O(0,0,0)$, $P(2,3,4)$, and $Q(3,2,0)$.



$$\vec{OP} = \langle 2, 3, 4 \rangle$$

$$\vec{OQ} = \langle 3, 2, 0 \rangle$$

$$\vec{OP} \times \vec{OQ} = \begin{vmatrix} 2 & 3 & 4 \\ 3 & 2 & 0 \end{vmatrix}$$

$$\langle 0-8, 4-9, 4-9 \rangle$$

$$\langle -8, 12, -5 \rangle$$

$$\sqrt{64 + 144 + 25}$$

$$\boxed{\frac{\sqrt{233}}{2} = \text{Area}}$$