

Fill in the blanks.

SCORE: _____ / 4 PTS

[a] If $\vec{u} \times \vec{v} = \langle 3, -2, -5 \rangle$, then $\vec{v} \times \vec{u} = \underline{\langle -3, 2, 5 \rangle}$ ^① = $-(\vec{u} \times \vec{v})$

[b] If $(\vec{u} \times \vec{v}) \cdot \vec{w} = -6$, then $\vec{u} \cdot (\vec{v} \times \vec{w}) = \underline{-6}$ ^① = $(\vec{u} \times \vec{v}) \cdot \vec{w}$

[c] If \vec{u} , \vec{v} and \vec{x} are adjacent edges of a parallelepiped, and $\vec{u} \times \vec{v} = \langle -3, 2, -5 \rangle$ and $\vec{x} = \langle 1, 3, 3 \rangle$,

then the volume of the parallelepiped is $\underline{12}$ ^② = $|(\vec{u} \times \vec{v}) \cdot \vec{w}| = |-3 + 6 - 15|$

SCORE: ____ / 3 PTS

Suppose that \vec{b} is a vector of magnitude 3, and \vec{d} is a vector of magnitude 4, and the angle between \vec{b} and \vec{d} is $\frac{2\pi}{3}$ radians. Fill in the blanks.

[a] $\|\vec{b} \times \vec{d}\| = \boxed{6\sqrt{3}}$ ② = $\|\vec{b}\| \|\vec{d}\| \sin\theta = 3 \cdot 4 \sin\frac{2\pi}{3}$

[b] $\vec{d} \times \vec{d} = \boxed{\vec{0}}$ ① ← MUST BE A VECTOR, NOT A NUMBER

Fill in the blanks.

GRADED BY ME

SCORE: ____ / 6 PTS

NOTE: For each part (ie. [a], [b], [c]), you must fill in all blanks correctly to receive any credit.

[a] If line l_1 is parallel to line l_2 , then the DIRECTION vector of line l_1 is PARALLEL to the DIRECTION vector of line l_2 .

[b] If line l is parallel to plane \wp , then the DIRECTION vector of line l is PERPENDICULAR to the NORMAL vector of plane \wp .

[c] If plane \wp_1 is perpendicular to plane \wp_2 , then the NORMAL vector of plane \wp_1 is PERPENDICULAR to the NORMAL vector of plane \wp_2 .

Let P be the point $(-1, -5, 3)$.

Let Q be the point $(1, -4, 4)$.

Let R be the point such that $\vec{PR} = 3\vec{i} + 2\vec{k}$.

ALL ITEMS

① POINT

UNLESS OTHERWISE NOTED

SCORE: ____ / 17 PTS

[a] Find a vector of magnitude 3 perpendicular to both \vec{PQ} and \vec{PR} .

$$\vec{PQ} = \langle 2, 1, 1 \rangle$$

$$\vec{PQ} \times \vec{PR} = \begin{vmatrix} \vec{i} & \vec{j} & \vec{k} \\ 2 & 1 & 1 \\ 3 & 0 & 2 \end{vmatrix} = \langle 2, -1, -3 \rangle$$

CHECK

$$\begin{aligned} \langle 2, -1, -3 \rangle \cdot \langle 2, 1, 1 \rangle &= 4 - 1 - 3 = 0 \\ \langle 2, -1, -3 \rangle \cdot \langle 3, 0, 2 \rangle &= 6 - 6 = 0 \end{aligned}$$

$$\frac{3}{\|\langle 2, -1, -3 \rangle\|} \langle 2, -1, -3 \rangle = \frac{3}{\sqrt{14}} \langle 2, -1, -3 \rangle$$

[b] S is a point such that $PQSR$ is a parallelogram. Find the area of parallelogram $PQSR$.

$$\|\vec{PQ} \times \vec{PR}\| = \|\langle 2, -1, -3 \rangle\| = \sqrt{14}$$

[c] Find the standard (point-normal) equation of the plane which is parallel to both \vec{PQ} and \vec{PR} , and also contains P .

$$\vec{n} = \vec{PQ} \times \vec{PR} = \langle 2, -1, -3 \rangle$$

$$2(x+1) - (y+5) - 3(y-3) = 0$$

[d] Find the angle between the plane in part [c] and the plane $x + 3y + 2z = 7$.

$$\cos^{-1} \frac{|\vec{n}_1 \cdot \vec{n}_2|}{\|\vec{n}_1\| \|\vec{n}_2\|} = \cos^{-1} \frac{|\langle 2, -1, -3 \rangle \cdot \langle 1, 3, 2 \rangle|}{\|\langle 2, -1, -3 \rangle\| \|\langle 1, 3, 2 \rangle\|} = \cos^{-1} \frac{|2 - 3 - 6|}{\sqrt{14} \sqrt{14}}$$

$$= \cos^{-1} \frac{7}{14} = \cos^{-1} \frac{1}{2} = \frac{\pi}{3}$$

[e] Find parametric equations for the line which is parallel to $\frac{x+4}{2} = y-3 = \frac{5-z}{6}$, and also contains Q .

$$\begin{cases} x = 1 + 2t \\ y = -4 + t \\ z = 4 - 6t \end{cases}$$

$$\frac{x+4}{2} = \frac{y-3}{1} = \frac{z-5}{-6} \quad \vec{d} = \langle 2, 1, -6 \rangle$$