FILL IN THE BLANKS using "a scalar", "a vector", or "undefined". SCORE: _____ / 3 PTS

NOTE: You must get at least 2 out of 3 answers correct to earn any points.

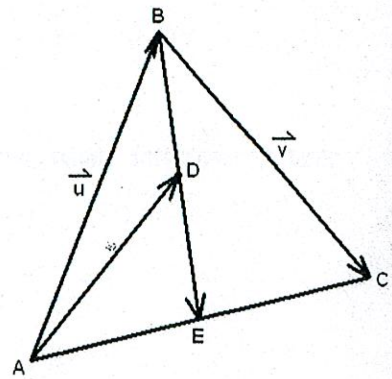
If $\vec{u}$, $\vec{v}$ and $\vec{w}$ are vectors in three dimensions, then $(\vec{u}-\vec{v})\times(\vec{u}\cdot\vec{w})$ is UNDEFINED,

GRADED BY ME

$(\vec{u}\cdot\vec{v})(\vec{u}\cdot\vec{w})$ is A SCALAR and

$(\vec{u}\times\vec{v})(\vec{u}\times\vec{w})$ is UNDEFINED.

In the diagram on the right, E is the midpoint of AC, and D is the midpoint of BE. SCORE: _____ / 5 PTS



[a] Find an expression for vector $\overrightarrow{AC}$ in terms of $\vec{u}$ and $\vec{v}$.

$\overrightarrow{AB}+\overrightarrow{BC} = \underline{\vec{U}+\vec{V}}$ ($\frac{1}{2}$)

[b] Find an expression for vector $\overrightarrow{BE}$ in terms of $\vec{u}$ and $\vec{v}$.

$\overrightarrow{BA}+\overrightarrow{AE} = -\overrightarrow{AB}+\frac{1}{2}\overrightarrow{AC}$

$= \underline{-\vec{U}+\frac{1}{2}(\vec{U}+\vec{V})} = \underline{\frac{1}{2}\vec{V}-\frac{1}{2}\vec{U}}$ (1) (1)

[c] Find an expression for vector $\overrightarrow{AD}$ in terms of $\vec{u}$ and $\vec{v}$.

$\overrightarrow{AB}+\overrightarrow{BD} = \overrightarrow{AB}+\frac{1}{2}\overrightarrow{BE}$

$= \underline{\vec{U}+\frac{1}{2}(\frac{1}{2}\vec{V}-\frac{1}{2}\vec{U})} = \underline{\frac{3}{4}\vec{U}+\frac{1}{4}\vec{V}}$ ($1\frac{1}{2}$) (1)

Let P be the point $(-3, 2, -1)$, and Q be the point $(1, -2, -7)$. SCORE: _____ / 5 PTS

[a] Find the symmetric equation of the line through P and Q.

DIRECTION VECTOR $\langle 4,-4,-6\rangle$ OR $\langle 2,-2,-3\rangle$

(1) (1)

$$\frac{x+3}{2} = \frac{y-2}{-2} = \frac{z+1}{-3}$$

(OTHER VARIATIONS POSSIBLE)

TALK TO ME

[b] Find the parametric equation of the line through Q and parallel to the line $\dfrac{6-z}{2} = 4+x = \dfrac{y-3}{5}$.

$x = 1+t$ (1)

$y = -2+5t$ (1)

$z = -7-2t$ (1)

(OTHER VARIATIONS POSSIBLE)

TALK TO ME

$$\frac{x-(-4)}{1} = \frac{y-3}{5} = \frac{z-6}{-2}$$

DIRECTION VECTOR $\langle 1,5,-2\rangle$

Use the properties of the cross product to simplify the expression $(\vec{b}+\vec{n})\times(\vec{b}-2\vec{n})$. **SCORE: _____ / 4 PTS**

Write your final answer **without negatives**.

$$\vec{b}\times\vec{b}+\vec{n}\times\vec{b}-\vec{b}\times 2\vec{n}-\vec{n}\times 2\vec{n}$$

GRADED BY ME

$$= \vec{0}+\vec{n}\times\vec{b}-2(\vec{b}\times\vec{n})-2(\vec{n}\times\vec{n})$$

$$= \vec{n}\times\vec{b}+2(\vec{n}\times\vec{b})-2(\vec{0}) = 3(\vec{n}\times\vec{b})$$

Let $\vec{u} = \langle 2, -1, -3\rangle$ and $\vec{q} = \langle -1, 4, 5\rangle$. **SCORE: _____ / 13 PTS**

[a] Find the (vector) projection of $\vec{q}$ onto $\vec{u}$.

$$\frac{\vec{q}\cdot\vec{u}}{\vec{u}\cdot\vec{u}}\vec{u} = \frac{-2-4-15}{4+1+9}\langle 2,-1,-3\rangle$$

1

$$= \boxed{\frac{-21}{14}}\langle 2,-1,-3\rangle$$ 1

$$= -\frac{3}{2}\langle 2,-1,-3\rangle = \underline{\left\langle -3, \frac{3}{2}, \frac{9}{2}\right\rangle}$$ 1

[b] Find the area of the triangle with vectors $\vec{u}$ and $\vec{q}$ as 2 of its sides.

$$\frac{1}{2}\|\vec{u}\times\vec{q}\| = \frac{1}{2}\|\langle -5+12, -(10-3), 8-1\rangle\|$$

$$= \frac{1}{2}\|\underline{\langle 7,-7,7\rangle}\|$$ 2

$$= \frac{7}{2}\|\langle 1,-1,1\rangle\|$$

$$= \frac{\boxed{7\sqrt{3}}}{\boxed{2}}$$ 1 1

[c] Find the angle between the vectors $\vec{u}$ and $\vec{q}$.

$$\cos^{-1}\frac{\vec{u}\cdot\vec{q}}{\|\vec{u}\|\|\vec{q}\|} = \underline{\cos^{-1}}\boxed{\frac{-21}{\sqrt{14}\sqrt{42}}}$$ 1 1

$$= \cos^{-1}\frac{-7\cdot 3\sqrt{3}}{\sqrt{2}\sqrt{7}\sqrt{2}\sqrt{3}\sqrt{7}}$$

$$= \cos^{-1}\boxed{-\frac{\sqrt{3}}{2}} = \underline{\frac{5\pi}{6} \text{ or } 150^\circ}$$ 1 1

[d] Find a unit vector perpendicular to both $\vec{u}$ and $\vec{q}$.

$$\frac{\vec{u}\times\vec{q}}{\|\vec{u}\times\vec{q}\|} = \boxed{\frac{\langle 7,-7,7\rangle}{7\sqrt{3}}} = \underline{\left\langle \frac{1}{\sqrt{3}}, -\frac{1}{\sqrt{3}}, \frac{1}{\sqrt{3}}\right\rangle}$$

1 1