Fill in the blanks. The correct answer in each case is either "*a scalar*", "*a vector*" or "*not valid*". **SCORE: _____ / 4 PTS**

[a] $(\vec{u}\cdot\vec{v})\times\vec{w}$ is NOT VALID

SCALAR × VECTOR

[b] $(\vec{u}\cdot\vec{v})\vec{w}$ is A VECTOR

SCALAR VECTOR

[c] $(\vec{u}\times\vec{v})\cdot\vec{w}$ is A SCALAR

VECTOR · VECTOR

[d] $(\vec{u}\times\vec{v})\cdot(\vec{u}\cdot\vec{w})$ is NOT VALID

VECTOR · SCALAR

Fill in the blanks. GRADED BY ME SCORE: _____ / 6 PTS

NOTE: For each part (ie. [a], [b], [c]), you must fill in at least 2 blanks correctly to receive any credit.

[a] 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 $\wp_2$.

[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 $\wp$ is perpendicular to line ℓ, then the NORMAL vector of plane $\wp$ is PARALLEL to the DIRECTION vector of line ℓ.

Fill in the blanks. SCORE: _____ / 3 PTS

$-(\vec{t} \times \vec{b})$

[a] If $\vec{t} \times \vec{b} = \langle 4, -7, 2 \rangle$, then $\vec{b} \times \vec{t} =$ $\boxed{\langle -4, 7, -2 \rangle}$ ①.

[b] $\vec{w} \times \vec{w} =$ $\boxed{\vec{0}}$ ① ← MUST BE A VECTOR.

[c] If $\vec{m}$ is a vector of magnitude 4, and $\vec{c}$ is a vector of magnitude 14, and the angle between $\vec{m}$ and $\vec{c}$ is $\frac{2\pi}{3}$ radians,

then the magnitude of $\vec{c} \times \vec{m} =$ $\boxed{28\sqrt{3}}$ ①. $\|\vec{c}\|\|\vec{m}\| \sin\theta = (14)(4)\sin\frac{2\pi}{3} = (14)(4)\left(\frac{\sqrt{3}}{2}\right)$

Let P be the point $(-2, -1, 5)$.

Let R be the point $(-5, 2, -3)$.

Let Q be the point such that $\overrightarrow{PQ} = \vec{i} + 2\vec{k}$.

SCORE: ____ / 17 PTS

[a] Find symmetric equations for the line which is parallel to $x = -5$, $y = 4t - 2$, $z = 3 - t$, and also contains R.

$\vec{d} \parallel \vec{d}_1 = \langle 0, 4, -1 \rangle$ LET $\vec{d} = \vec{d}_1$

$x = -5, \; \frac{y-2}{4} = \frac{z+3}{-1} \longrightarrow x = -5, \; \frac{y-2}{4} = -z-3$

(1) (2)

[b] Find the area of the parallelogram with P, Q and R as 3 of its 4 vertices.

$\overrightarrow{PR} = \langle -3, 3, -8 \rangle$ (1)

$\overrightarrow{PQ} \times \overrightarrow{PR} = \begin{vmatrix} \vec{i} & \vec{j} & \vec{k} \\ 1 & 0 & 2 \\ -3 & 3 & -8 \end{vmatrix} = \langle -6, 2, 3 \rangle$ (3)

SANITY CHECK: ($\frac{1}{2}$)

$\langle -6, 2, 3 \rangle \cdot \langle 1, 0, 2 \rangle = -6 + 0 + 6 = 0$

$\langle -6, 2, 3 \rangle \cdot \langle -3, 3, -8 \rangle = 18 + 6 - 24 = 0$ ($\frac{1}{2}$)

$\|\overrightarrow{PQ} \times \overrightarrow{PR}\| = \sqrt{36 + 4 + 9} = \sqrt{49} = 7$ (2)

[c] Find parametric equations for the line which is perpendicular to $2z - x = 3$, and also contains P.

$\vec{d} \parallel \vec{n} = \langle -1, 0, 2 \rangle$ LET $\vec{d} = \vec{n}$

$x = -2 - t$

$y = -1$

$z = 5 + 2t$

(2) POINTS IF YOU GOT ALL 3 RIGHT

(1) POINT IF YOU GOT 2 RIGHT

(0) POINTS IF YOU GOT 0 OR 1 RIGHT

[d] Find a vector of magnitude 35 perpendicular to both $\overrightarrow{PQ}$ and $\overrightarrow{PR}$.

$\frac{35}{\|\overrightarrow{PQ} \times \overrightarrow{PR}\|} \overrightarrow{PQ} \times \overrightarrow{PR} = \frac{35}{7} \langle -6, 2, 3 \rangle$ (1)

$= \langle -30, 10, 15 \rangle$ (1)

[e] Find the standard (point-normal) equation of the plane which contains P, Q and R.

$\vec{n} = \overrightarrow{PQ} \times \overrightarrow{PR}$

(2) $-6(x+2) + 2(y+1) + 3(z-5) = 0$ (1)

OR $-6(x+5) + 2(y-2) + 3(z+3) = 0$