Fill in the blanks. SCORE: ____ / 4 PTS

[a] If $\vec{u} \times \vec{v} = < -3, 2, -5 >$, then $\vec{v} \times \vec{u} =$ $\boxed{\langle 3, -2, 5 \rangle}$. 1 $= -\vec{u} \times \vec{v}$

[b] If $(\vec{u} \times \vec{v}) \cdot \vec{w} = -12$, then $\vec{u} \cdot (\vec{v} \times \vec{w}) =$ $\boxed{-12}$. 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 $\vec{u} \times \vec{v} = < 3, -2, -5 >$ and $\vec{x} = < 1, -3, 3 >$,

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

Suppose that $\vec{b}$ is a vector of magnitude 3, and $\vec{d}$ is a vector of magnitude 2, and the angle between $\vec{b}$ and $\vec{d}$ is $\frac{5\pi}{6}$ radians. Fill in the blanks.

SCORE: _____ / 3 PTS

[a] $\|\vec{b}\times\vec{d}\| = \boxed{3}$ 2 $= \|\vec{b}\|\|\vec{d}\|\sin\theta = 3\cdot 2\sin\frac{5\pi}{6}$

[b] $\vec{b}\times\vec{b} = \boxed{\vec{0}}$ 1 $\leftarrow$ 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 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_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.

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

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

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

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

ALL ITEMS 1 POINT UNLESS OTHERWISE NOTED

SCORE: _____ / 17 PTS

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

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

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

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

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

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

CHECK

$$\boxed{\begin{aligned} \vec{n} \cdot \overrightarrow{PQ} &= 1 - 4 + 3 = 0 \\ \vec{n} \cdot \overrightarrow{PR} &= -6 + 6 = 0 \end{aligned}} \checkmark$$

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

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

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

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

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

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

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

$$\frac{3}{\|\overrightarrow{PQ} \times \overrightarrow{PR}\|}(\overrightarrow{PQ} \times \overrightarrow{PR}) \overset{(2)}{=} \boxed{\frac{3}{\sqrt{14}}}\langle 1,-2,3\rangle$$