Math2210 Quiz 3 (Sections 11.3, 11.4) Summer, 2008 Dylan Zwick

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Instructions: Please show all of your work as partial credit will be given where appropriate, **and** there may be no credit given for problems where there is no work shown. All answers should be completely simplified, unless otherwise stated.

1. If $\boldsymbol{a}=\langle 3,3,1\rangle$, $\boldsymbol{b}=\langle -2,-1,0\rangle$ and $\boldsymbol{c}=\langle -2,-3,-1\rangle$.

(a) find $\boldsymbol{a}\times(\boldsymbol{b}+\boldsymbol{c})$.

$$\vec{b}+\vec{c} = \langle -2+(-2), -1+(-3), 0+(-1)\rangle = \langle -4,-4,-1\rangle$$

$$\vec{a}\times(\vec{b}+\vec{c}) = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 3 & 3 & 1 \\ -4 & -4 & -1 \end{vmatrix} = (-3-(-4))\hat{i} + (-4-(-3))\hat{j} + (-12-(-12))\hat{k}$$

$$= \hat{i} - \hat{j} = \boxed{\langle 1,-1,0\rangle}$$

$\boldsymbol{a}\times(\boldsymbol{b}+\boldsymbol{c}) =$ $\langle 1,-1,0\rangle$

(b) find $\boldsymbol{a}\cdot(\boldsymbol{b}\times\boldsymbol{c})$

$$\vec{b}\times\vec{c} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ -2 & -1 & 0 \\ -2 & -3 & -1 \end{vmatrix} = (1-0)\hat{i} + (0-2)\hat{j} + (6-2)\hat{k}$$

$$= \hat{i} - 2\hat{j} + 4\hat{k} = \langle 1,-2,4\rangle$$

$$\vec{a}\cdot(\vec{b}\times\vec{c}) = \langle 3,3,1\rangle\cdot\langle 1,-2,4\rangle$$

$$= 3-6+4 = \boxed{1}$$

$\boldsymbol{a}\cdot(\boldsymbol{b}\times\boldsymbol{c}) =$ 1

2. Find the equation of the plane passing through P(4, -2, 1) and perpendicular to $n = 2\mathbf{i} - 5\mathbf{j} + 3\mathbf{k}$.

$\vec{n} = \langle A, B, C \rangle = \langle 2, -5, 3 \rangle$

$(x_0, y_0, z_0) = P = (4, -2, 1)$

So, the plane is:

$2(x-4) - 5(y+2) + 3(z-1) = 0$

$\Rightarrow 2x - 8 - 5y - 10 + 3z - 3 = 0$

$\Rightarrow \boxed{2x - 5y + 3z = 21}$

Plane: $2x - 5y + 3z = 21$

3. Find the distance between the parallel planes $5x - 3y - 2z = 5$ and $-5x + 3y + 2z = 7$.

$$L = \frac{|Ax_0 + By_0 + Cz_0 - D|}{\sqrt{A^2 + B^2 + C^2}}$$

where $\langle A, B, C \rangle$ is a normal vector to $-5x + 3y + 2z = 7$ given by $\langle -5, 3, 2 \rangle$ and $D = 7$. (x_0, y_0, z_0) is a point on $5x - 3y - 2z = 5$. Pick point $(1, 0, 0)$ and get

$$L = \frac{|-5(1) + 3(0) + 2(0) - 7|}{\sqrt{25 + 9 + 4}} = \boxed{\frac{12}{\sqrt{38}}}$$

distance: $12/\sqrt{38}$