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MAC 2313.3118
Cyr

Quiz 2

You must show all work to receive full credit!!

Problem 1. (6 pts) Let $\mathbf{u} = \langle 2, -4, 0 \rangle, \mathbf{v} = \langle 2, 0, -2 \rangle$.

(a) Find $\mathbf{u} \times \mathbf{v}$.

$$\vec{u} \times \vec{v} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 2 & -4 & 0 \\ 2 & 0 & -2 \end{vmatrix} = \left[(-4)(-2) - (0)(0)\right]\hat{i} - \left[(2)(-2) - (2)(0)\right]\hat{j} + \left[(2)(0) - (2)(-4)\right]\hat{k}$$

$$= 8\hat{i} + 4\hat{j} + 8\hat{k} = \boxed{\langle 8, 4, 8 \rangle}$$

(b) Use your work from part (a) to find the equation of the plane containing the vectors $\mathbf{u}$ and $\mathbf{v}$ and passing through the point $(0, 4, 0)$. (Write your answer in scalar form.)

Since $\vec{u}$ and $\vec{v}$ lie in the plane, $\vec{u} \times \vec{v}$ is a normal vector.

So $\langle 8,4,8 \rangle \cdot \langle x,y,z \rangle = \langle 8,4,8 \rangle \cdot \langle 0,4,0 \rangle = 16$

$\Rightarrow \quad 8x + 4y + 8z = 16$

OR $\boxed{2x + y + 2z = 4}$

Problem 2. (4 pts) Find the intersection of the line $\mathbf{r}(t) = \langle 1, 0, -1 \rangle + t\langle 4, 9, 2 \rangle$ and the plane $x - z = 6$.

$\vec{r}(t) = \langle 1+4t, 9t, -1+2t \rangle$

Substituting into plane equation gives $(1+4t) - (-1+2t) = 6$

$\Rightarrow \quad 2 + 2t = 6 \quad \Rightarrow \quad 2t = 4$

$\Rightarrow \quad t = 2.$

Then $\vec{r}(2) = \langle 1+4(2), 9(2), -1+2(2) \rangle = \langle 9, 18, 3 \rangle$

Intersection occurs at the point $\boxed{(9, 18, 3)}$.