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MAC 2313.3122
Cyr

Quiz 2
You must show all work to receive full credit!!

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

$$\vec{u} \times \vec{v} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 1 & 0 & 1 \\ 2 & -1 & 0 \end{vmatrix} = \left[(0)(0) - (-1)(1)\right]\hat{i} - \left[(1)(0) - (2)(1)\right]\hat{j} + \left[(1)(-1) - (2)(0)\right]\hat{k}$$

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

(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 $(2, 0, 1)$. (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 $\langle 1, 2, -1 \rangle \cdot \langle x, y, z \rangle = \langle 1, 2, -1 \rangle \cdot \langle 2, 0, 1 \rangle = (1 \cdot 2) + (2 \cdot 0) + (-1 \cdot 1)$

$$\Rightarrow \boxed{x + 2y - z = 1}$$

Problem 2. (4 pts) Find the intersection of the line $\mathbf{r}(t) = \langle 2, -1, -1 \rangle + t\langle 1, 2, -4 \rangle$ and the plane $2x + y = 3$.

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

Substituting into the plane equation yields

$$2(2+t) + (-1+2t) = 3 \Rightarrow 4 + 2t - 1 + 2t = 3 \Rightarrow 4t + 3 = 3$$

$$\Rightarrow 4t = 0 \Rightarrow t = 0.$$

Then $\vec{r}(0) = \langle 2, -1, -1 \rangle$, so they intersect at the point $\boxed{(2, -1, -1)}$.