Name: Solutions

1. Show that the point $P(1, 2, 3)$ lies on the plane defined by $2x + 3y - z = 5$.

$2 \cdot 1 + 3 \cdot 2 - 3 = 2 + 6 - 3 = 5$ ✓

$\langle 2, 3, -1 \rangle$

2. Find the "parametric equation" of the line that passes through $P(1, 2, 3)$ and is perpendicular to the plane from problem 1.

Normal to plane: $\langle 2, 3, -1 \rangle$

Line:

$P\langle x, y, z \rangle + t\langle x_0, y_0, z_0 \rangle$

$\langle 1, 2, 3 \rangle + t\langle 2, 3, -1 \rangle$

$= \boxed{\langle 1 + 2t, 2 + 3t, 3 - t \rangle}$

3. Find a vector perpendicular to the vectors $\mathbf{v} = \langle 1, 2, 1\rangle$ and $\mathbf{w} = \langle 3, 1, 1\rangle$.

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

Just rearrangement

$$= \boxed{\hat{i} + 2\hat{j} - 5\hat{k}}$$

4. Find the equation of a plane that passes through the points $O(0, 0, 0)$, $P(1, 2, 1)$ and $Q(3, 1, 1)$.

$$\left.\begin{aligned}\vec{OP} &= \langle 1, 2, 1\rangle \\ \vec{OQ} &= \langle 3, 1, 1\rangle\end{aligned}\right] \quad \vec{OP}\times\vec{OQ} = \langle 1, 2, -5\rangle$$

from problem 3.

$\vec{OP}\times\vec{OQ} = \langle a_1, a_2, a_3) = 0$

Plane: $\underbrace{1}_{a}\cdot x + \underbrace{2}_{b}\cdot y - \underbrace{5}_{c} z = 0$ ← plane thru origin

5. Find the equation of a plane that is parallel to the plane you found in problem 4 but that passes through the point $R(5, 1, 0)$.

Same normal, different point.

$$\boxed{1\cdot(x-5) + 2(y-1) - 5(z-0) = 0}$$

Plane $a(x-R_1) + b(y-R_2) + c(z-R_3) = 0$