Show all work!

1. Find vector parametric equations for the line through $P(4, -2, 1)$ and perpendicular to the plane $5x + 3y + 7z + 6 = 0$.

2. Find the distance from the point $P(1, 3, 4)$ to the line $\mathbf{r}(t) = (3\mathbf{i} + \mathbf{j} + 2\mathbf{k}) + t(3\mathbf{i} - 4\mathbf{k})$

3. Find an equation for the plane that contains $P(-1, 3, 6)$ $Q(1, 2, 4)$, $R(3, 6, 6)$.

4. Find the distance from the point $P(5, 2, 3)$ to the plane $x - 2y + 2z + 3 = 0$.

5. Find the volume of the parallelepiped that has one vertex at $(0, 0, 0)$ and which has edges given by the vectors $\mathbf{a} = 2\mathbf{i} - \mathbf{j} - 2\mathbf{k}$, $\mathbf{b} = 3\mathbf{i} + 4\mathbf{j}$, $\mathbf{c} = 4\mathbf{i} + 3\mathbf{k}$.

6. Find a unit normal vector to the plane with equation $5x - 13y + 12z + 4 = 0$.

7. Find the cosine of the dihedral angle between the planes $3x - 4y + 6 = 0$, $x + 2y - 2z + 10 = 0$.

8. Find a vector function that traces the circle in the $x - y$ plane, with center $(7, -3)$ and radius 2.