Problem 1: Find the vector, parametric and Cartesian (also called symmetric) equation of the following lines:-

1. The line that passes through the points $(-8, 1, 4)$ and $(3, -2, 4)$.
2. The line that passes through the point $(2, 1, 0)$ and is perpendicular to both $\hat{\imath} + \hat{\jmath}$ and $\hat{\jmath} + \hat{k}$.
3. The line that passes through the point $(-6, 2, 3)$ and is parallel to the line $\frac{x}{2} = \frac{y}{3} = \frac{z+1}{1}$.
4. The line that passes through the point $(1, 0, 6)$ and is perpendicular to the plane $x + 3y + z = 5$.

Problem 2: Determine whether the lines L_1 and L_2 are parallel, skew or intersecting. If they intersect, find the point of intersection.

1. $$L_1 : \frac{x-3}{2} = \frac{y-4}{-1} = \frac{z-1}{3} \quad ; \quad L_2 : \frac{x-1}{4} = \frac{y-3}{-2} = \frac{z-4}{5}$$
2. $$L_1 : x = 5 - 12t, \quad y = 3 + 9t, \quad z = 1 - 3t \quad ; \quad L_2 : x = 3 + 8s, \quad y = -6s, \quad z = 7 + 2s$$
3. $$L_1 : \frac{x-2}{1} = \frac{y-3}{-2} = \frac{z-1}{-3} \quad ; \quad L_2 : \frac{x-3}{1} = \frac{y+4}{3} = \frac{z-2}{-7}$$

Problem 3: Find the vector and Cartesian equation of the following planes.

1. The plane passing through the points $(2, 1, 2)$, $(3, -8, 6)$ and $(-2, -3, 1)$.
2. The plane passing through the point $(2, 0, 1)$ and perpendicular to the line $x = 3t$, $y = 2 - t$, $z = 3 + 4t$.
3. The plane passing through the point $(3, -2, 8)$ and parallel to the plane $z = x + y$.
4. The plane that passes through the point $(3, 5, -1)$ and contains the line $x = 4 - t$, $y = 2t - 1$, $z = -3t$.
5. The plane passing through the point $(1, 5, 1)$ and perpendicular to the planes $2x + y - 2z = 2$ and $x + 3z = 4$.

Problem 4: Consider the planes $P_1 : 3x - 2y + z = 1$, $P_2 : 2x + y - 3z = 3$ and the line $L : x = 2 - 2t$, $y = -15 - t$, $z = 1 + 4t$.

1. Find the points of intersection of L with P_1 and P_2.
2. Find the angle between P_1 and P_2.
3. Find the equation of the line of intersection of P_1 and P_2.