Lines and Planes

1. **Lines**

Ex. 1 Find the parametric equation of the line that passes through the point $(5, 1, 3)$ and is parallel to $\mathbf{i} + 4\mathbf{j} - 2\mathbf{k}$.

Give the symmetric equations for the line described above.

Board Ex. Show that

$$L_1: \quad x = 1 + t \quad y = -2 + 3t \quad z = 4 - t$$
$$L_2: \quad x = 2s \qquad y = 3 + s \qquad z = -3 + 4s$$

are **skew lines** (i.e., that they do not intersect).

2. **More on Planes** . . .

Ex. 2 Find the plane that contains the point $(2, 4, -1)$ and has normal vector $\mathbf{n} = \langle 2, 3, 4 \rangle$.

Board Ex. Find the plane that passes through $P(1, 3, 2)$, $Q(3, -1, 6)$, and $R(5, 2, 0)$.

3. **Note:** Two planes are parallel if their normal vectors are parallel. If two planes are not parallel, then they intersect in a straight line and the angle between the two planes is the acute angle between their normal vectors.

Ex. 3 Find the angle between the planes $x + y + z = 1$ and $x - 2y + 3z = 1$.

Board Ex. Find the symmetric equations for the line of intersection of these two planes.

Board Ex. Find the plane that passes through the point $(-1, 2, 1)$ and contains the line of intersection of the planes $x + y - z = 2$ and $2x - y + 3z = 1$.