4. Find a vector equation and the parametric equations for the line through the point (0, 14, -10) and parallel to the line \( x = -1 + 2t \), \( y = 6 - 3t \), \( z = 3 + 9t \).

The directional vector of the given line is \( \vec{V} = \langle 2, -3, 9 \rangle \),
but for this line \( \vec{r}_0 = \langle 0, 14, -10 \rangle \),
so the vector equation is:

\[
\vec{r} = \vec{r}_0 + t\vec{V} = 14\hat{j} - 10\hat{k} + t(2\hat{i} - 3\hat{j} + 9\hat{k})
\]

\[
\vec{r} = 2t\hat{i} + (14 - 3t)\hat{j} + (10 + 9t)\hat{k}
\]

\[
\vec{r} = \langle 2t, 14 - 3t, -10 + 9t \rangle
\]

And the parametric equations are:

\[
x = 2t, \quad y = 14 - 3t, \quad z = -10 + 9t
\]
6. Find the parametric and symmetric equations for the line through the origin and the point \((4, 3, -1)\).

The vector \( \vec{v} = \langle 4-0, 3-0, -1-0 \rangle = \langle 4, 3, -1 \rangle \)

is parallel to the line.

Letting \( P_0 = (0, 0, 0) \), thus \( \vec{v}_0 = \langle 0, 0, 0 \rangle \),

the parametric equations are:

\[
\begin{align*}
  x &= 0 + 4t, \\
  y &= 0 + 3t, \\
  z &= 0 - t
\end{align*}
\]

and the symmetric equations are:

\[
\begin{align*}
  \frac{x}{4} &= \frac{y}{3} = -2
\end{align*}
\]
28. Find an equation of the plane through \((2, 4, 6)\) parallel to the plane \(z = x+y\).

Since the two planes are parallel, they will have the same normal vectors.

A normal vector for the plane \(z = x+y\) or \(x+y-z = 0\) is \(\vec{n} = \langle 1, 1, -1 \rangle\).

So the equation for the desired plane is:

\[
1(x-2) + 1(y-4) - 1(z-6) = 0
\]

\[
x - 2 + y - 4 - z + 6 = 0
\]

\[
x + y - z = 0
\]

The same plane! That means that the given point is on the given plane.
46. Find the point at which the line \( x = 1 + 2t, \ y = 4t, \ z = 2 - 3t \) intersects the plane \( x + 2y - z + 1 = 0 \).

Substitute the parametric equations of the line into the equation of the plane:

\[
\begin{align*}
(1 + 2t) + 2(4t) - (2 - 3t) + 1 &= 0 \\
1 + 8t - 2 + 3t + 1 &= 0 \\
13t &= 0 \\
t &= 0
\end{align*}
\]

Therefore, the point of intersection of the line and the plane is given by

\[
\begin{align*}
x &= 1 + 2(0) = 1 \\
y &= 4(0) = 0 \\
z &= 2 - 3(0) = 2
\end{align*}
\]

\( \Rightarrow (1, 0, 2) \)