lines in space...

Vector form

\[ \vec{r} = \vec{r}_0 + t \vec{v} \]

expand

\[ \langle x, y, z \rangle = \langle x_0, y_0, z_0 \rangle + t \langle a, b, c \rangle \]

Parametric form:

\[ \langle x, y, z \rangle = \langle x_0 + at, y_0 + bt, z_0 + ct \rangle \]

give \( x = x_0 + at, \quad y = y_0 + bt, \quad z = z_0 + ct \)

Symmetric form

\[ t = \frac{x-x_0}{a}, \quad t = \frac{y-y_0}{b}, \quad t = \frac{z-z_0}{c} \]

so \[ \frac{x-x_0}{a} = \frac{y-y_0}{b} = \frac{z-z_0}{c} \]

(Unless \( b = 0 \) then write)

\[ \frac{x-x_0}{a} = \frac{z-z_0}{c} \quad \text{and} \quad y = y_0 \]
Plane:

Vector form

\[ \mathbf{n} \cdot (\mathbf{r} - \mathbf{r}_0) = 0 \]

(or \[ \mathbf{n} \cdot \mathbf{r} = \mathbf{n} \cdot \mathbf{r}_0 \])

Plane through \( \mathbf{r}_0 \) to \( \mathbf{n} \) which is called the normal to the plane
So \( \vec{n} \cdot (\vec{r} - \vec{r}_0) = 0 \)