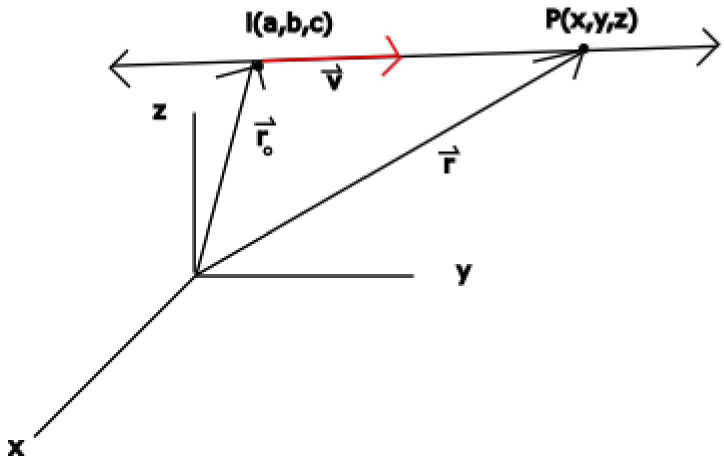
1 Equations of Lines and Planes



$$\boxed{\vec{r} = \vec{r_0} + t\vec{v}}$$

t is the paramater of the equation.

Reiterate: $\vec{r} = \vec{r_0} + ti\vec{P}$

Let $\vec{v} =< a, b, c >$

then $< x, y, z >=< x_0, y_0, z_0 > +t < a, b, c >$

$< x, y, z >=< x_0 + ta, y_0 + tb, z_0 + tc >$

So the parametric equations for a line are as follows:

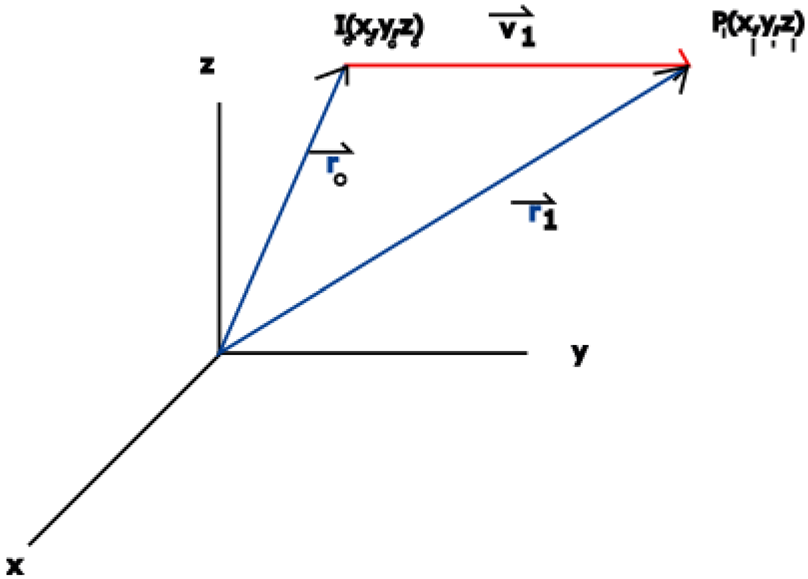
- $x = x_0 + ta$
- $y = y_0 + tb$
- $z = z_0 + tc$

When you solve for t, you get the symmetric equations.

$t = \frac{x-x_0}{a} = \frac{y-y_0}{b} = \frac{z-z_0}{c}$

If $b = 0$, then you get:

$\frac{x-x_0}{a} = \frac{z-z_0}{c}, y = y_0$



Planes can be parallel, intersecting, or skew.
The figure above demonstrates $\vec{v_1}$ which travels from $I(x, y, z)$ to $P(x, y, z)$

incomplete do later

Ex. Find where line L intersects plane $5x - 2y + 4z = 18$
$L : x = -4t,\ y = 5 + t,\ z = 2 + 3t$

$$5(-4t) - 2(5 + t) + 4(2 + 3t) = 18 \tag{1}$$
$$-20t - 10 - 2t + 8 + 12t = 18 \tag{2}$$
$$-10t = 20 \tag{3}$$
$$t = -2 \tag{4}$$

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1. Two planes are parallel if their normal vectors are parallel.
2. Two planes that are not parallel intersect along a line
3. The angle between intersecting planes is the angle between their normal vectors

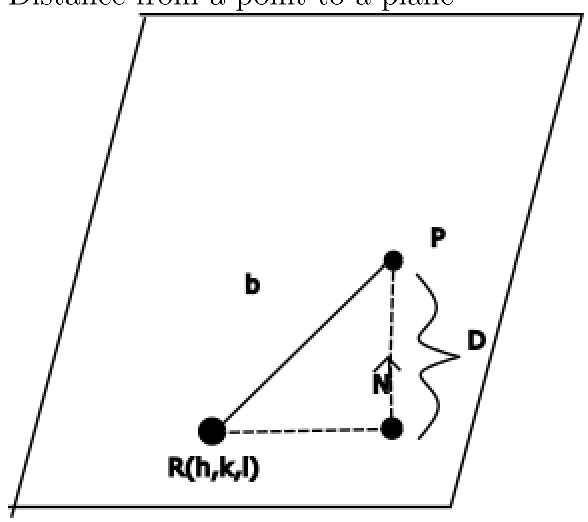
Ex.: Consider planes $x + y + z = 1$ and $3x + y - 2z = 1$
a) Find the angle between the planes

1.1 Continued

$$\vec{n_1} = < 1, 1, 1 >, \vec{n_2} = < 3, 1, -2 > \tag{1}$$

$$\vec{n_1} \cdot \vec{n_2} = |\vec{n_1}||\vec{n_2}| \cos\theta \tag{2}$$

Use the equations of two planes to describe a line
Distance from a point to a plane



$P_1(x_1, y_1, z_1)$
$ax + by + cz + d = 0$

EX: Find the distance between the parallel planes

1.2 E

x: Find the distance between the lines L_1 and L_2

The distance between L_1 and L_2 is teh same as teh distance between the two parallel planes that contain these lines.
The normal vector $\vec{n}$ for these two planes must be orthogonal to $\vec{v_1}$ and $\vec{v_2}$