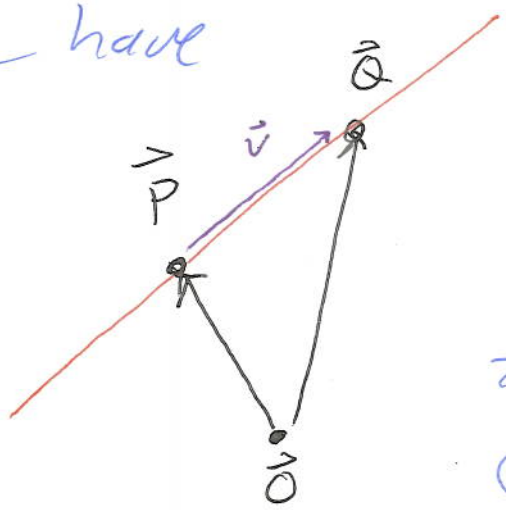
MATH 105: LINES IN SPACES.

The following might help look at generalizing equations of lines. In three dimensional space we have

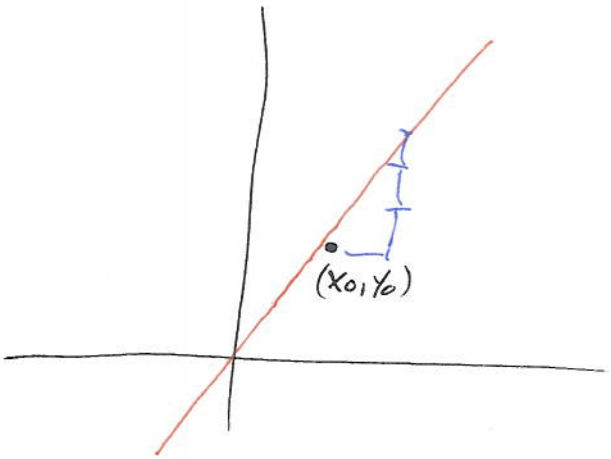


The direction of the line is $\vec{v} = \vec{Q} - \vec{P}$

The equation of the line is

$(x, y, z) = \vec{P} + t\vec{v}$

Some people have had some trouble seeing this as a generalization of the standard line in the plane, so I thought I'd provide another attempt at explaining it.



Here is a line going through the point (x_0, y_0) with slope 3. We may write this as

$y - y_0 = 3(x - x_0)$

We note that this line is in the direction $(1,3)$; for every one unit of x we move, we go three units in the y-direction.

In our notation, we have the anchor point (x_0, y_0) with direction $(1,3)$ (which is like a slope of 3)

$$(x, y) = (x_0, y_0) + t(1,3)$$

$$(x, y) = (x_0 + t, y_0 + 3t)$$

Note: two equations: $x = x_0 + t$

$$y = y_0 + 3t$$

subtracting: $x - x_0 = t$

$$y - y_0 = 3t$$

Thus $y - y_0 = 3(x - x_0)$,

the old equation for the line!