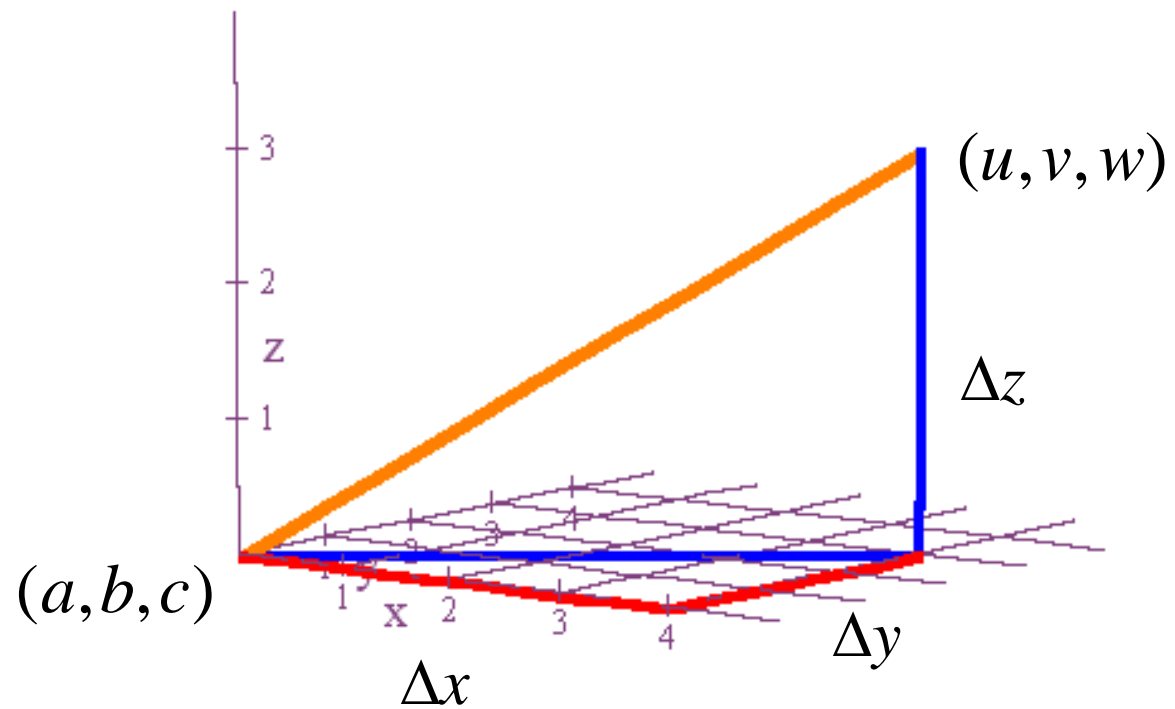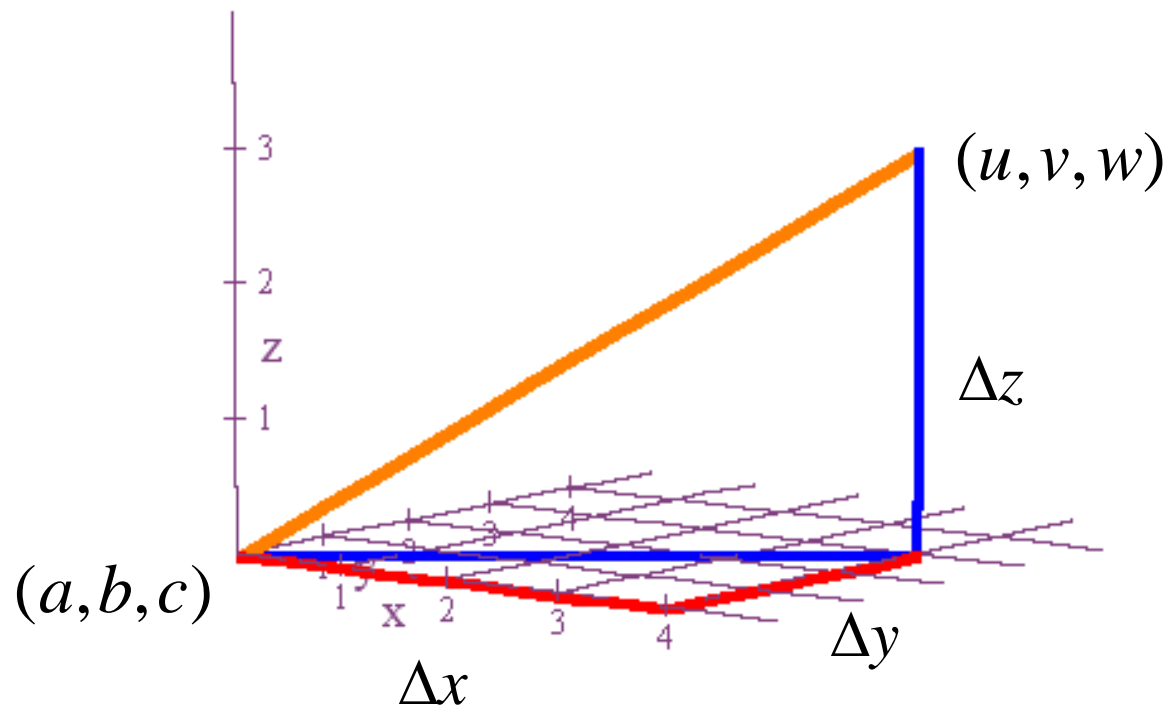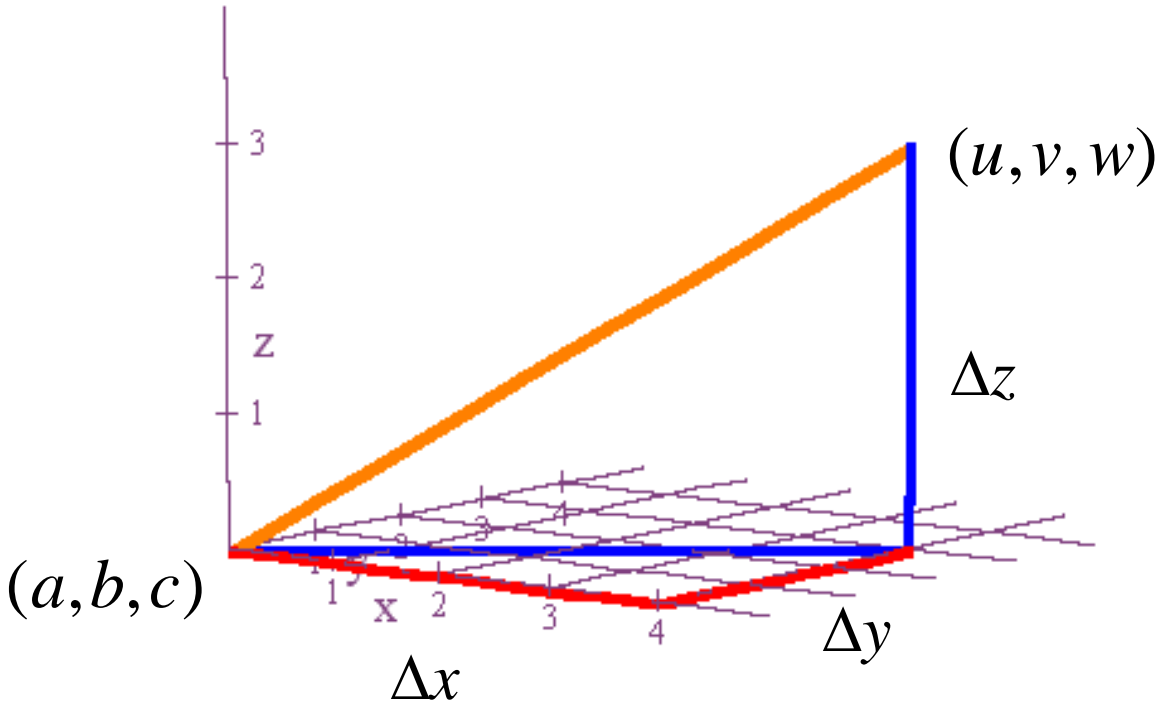# PARAMETRIC EQUATIONS FOR A LINE
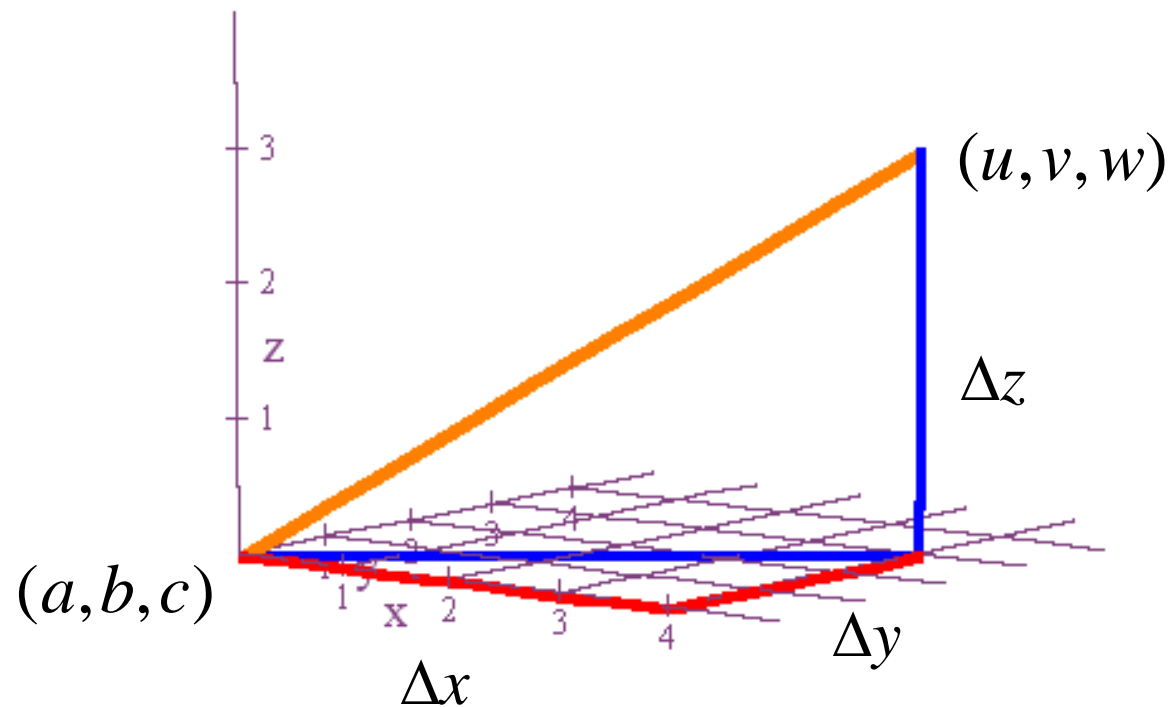
Suppose you want to define a line segment parametrically that starts at *(a,b,c)* and ends at *(u,v,w).*

Whatcha gonna do?
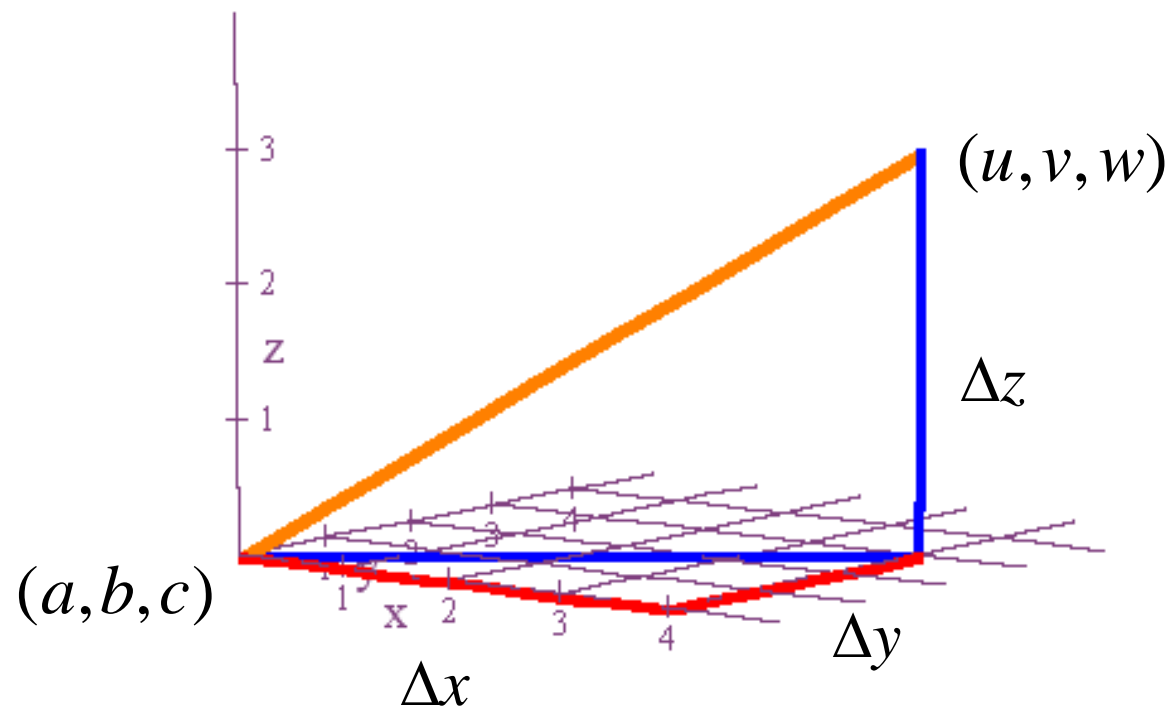

(u, v, w)

Δz

(a, b, c)

Δy

Δx

As you move from one point to the next, there will be a change in *x*, a change in *y*, and a change in *z*.

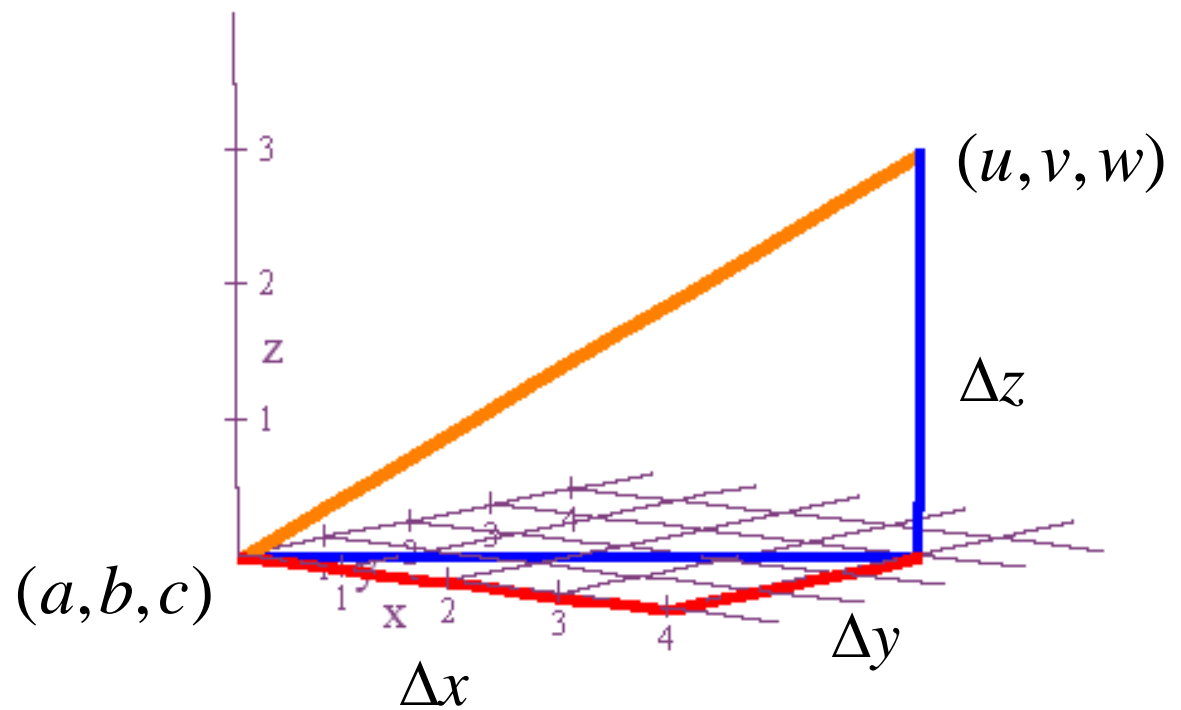**All of these changes will be linear functions of our parameter, *t*.**

Hence,

$x = a + \Delta x \cdot t$

$y = b + \Delta y \cdot t$

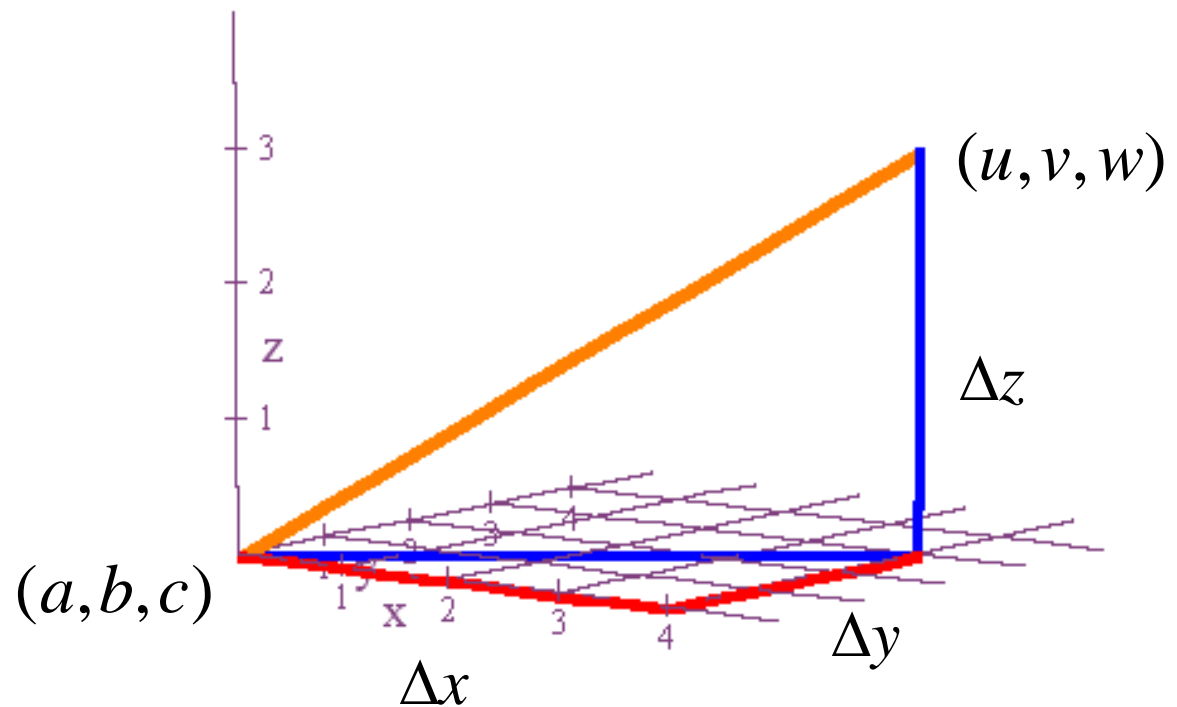$z = c + \Delta z \cdot t$

$0 \leq t \leq 1$

To extend the line, just change the range of values for *t*.

$$x = a + \Delta x \cdot t$$

$$y = b + \Delta y \cdot t$$

$$z = c + \Delta z \cdot t$$

$$-\infty < t < \infty$$

(u, v, w)

Δz

(a, b, c)
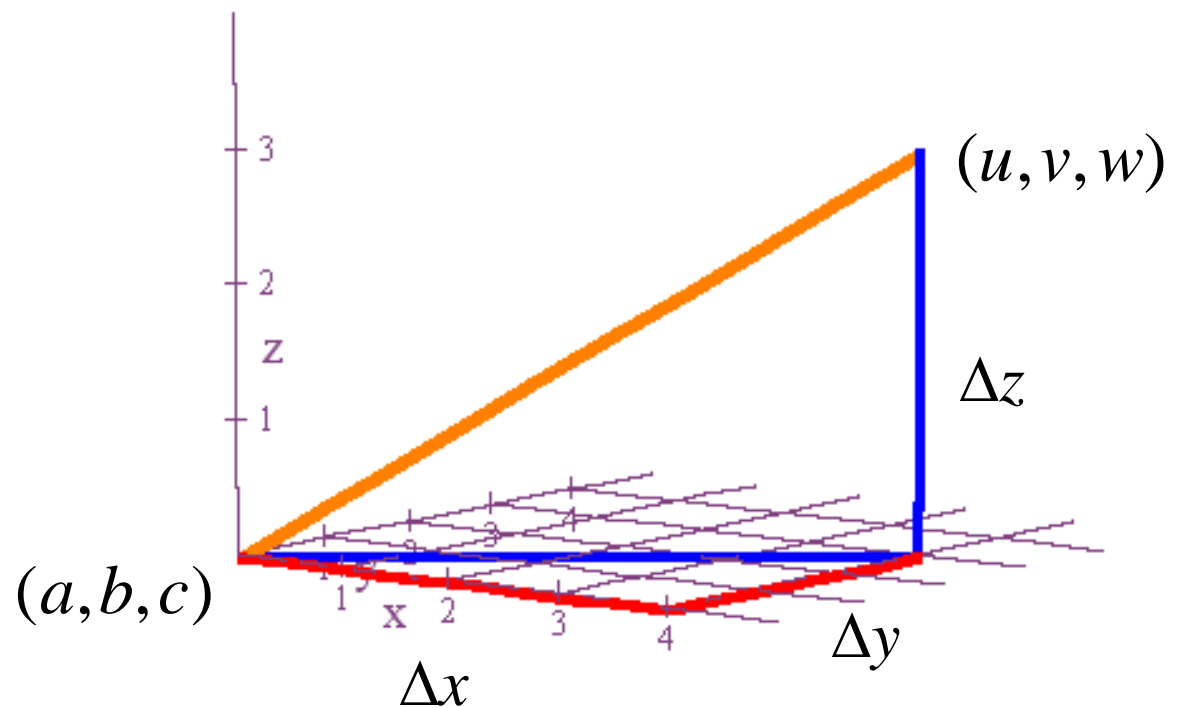
Δy

Δx

When we get into vectors, we'll see another way to develop this formula.

$$x = a + \Delta x \cdot t$$

$$y = b + \Delta y \cdot t$$

$$z = c + \Delta z \cdot t$$

$$-\infty < t < \infty$$

Problem: Find parametric equations for the line segment from *(1,2,3)* to *(4,7,5).*

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$$\Delta x = 4 - 1 = 3$$

$$\Delta y = 7 - 2 = 5$$

$$\Delta z = 5 - 3 = 2$$

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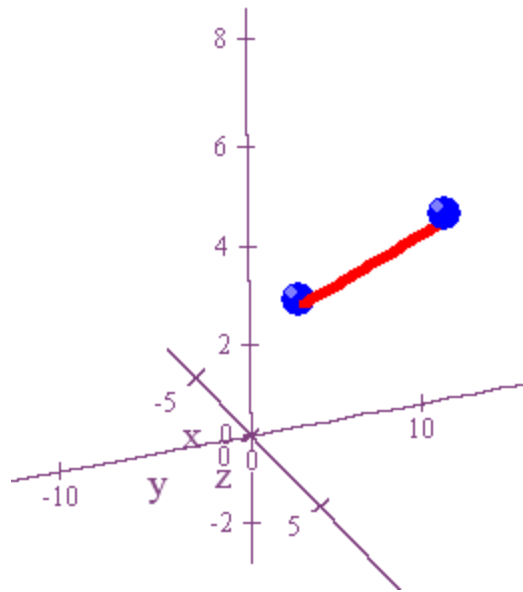$$x = 1 + 3t$$

$$y = 2 + 5t$$

$$z = 3 + 2t$$

$$0 \le t \le 1$$

Problem: Find parametric equations for the line segment from *(1,2,3)* to *(4,7,5).*

$$x = 1 + 3t$$

$$y = 2 + 5t$$

$$z = 3 + 2t$$

$$0 \le t \le 1$$

And now, extend the line.

$$x = 1 + 3t$$

$$y = 2 + 5t$$

$$z = 3 + 2t$$

$$-\infty < t < \infty$$