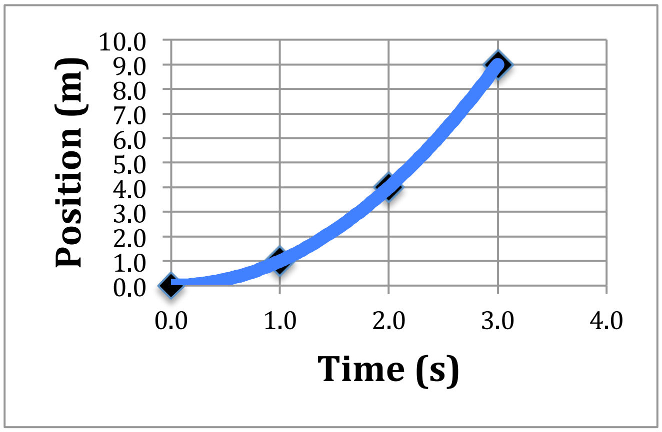
Flipping Physics Lecture Notes:
Graphical UAM Example Problem

Example Problem: Assuming an initial position of zero, complete the empty graphs. (assume 2 sig figs)
(please note: in the problem, only the velocity versus time graph was given, the other two were blank)



We know the acceleration is constant (and this is a graph of Uniformly Accelerated Motion) because the slope of the velocity vs. time graph is constant and the slope of a velocity vs. time graph is acceleration.

$$a = \frac{\Delta v}{\Delta t} = \frac{v_f - v_i}{\Delta t} \Rightarrow a\Delta t = v_f - v_i \Rightarrow v_f = v_i + a\Delta t$$

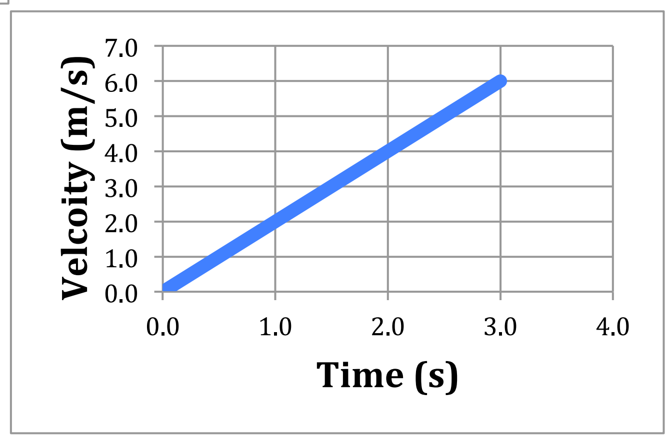
Therefore the equation definition of acceleration: $a = \frac{\Delta v}{\Delta t}$

And the UAM equation: $v_f = v_i + a\Delta t$

Are equivalent and we can use either to find acceleration.

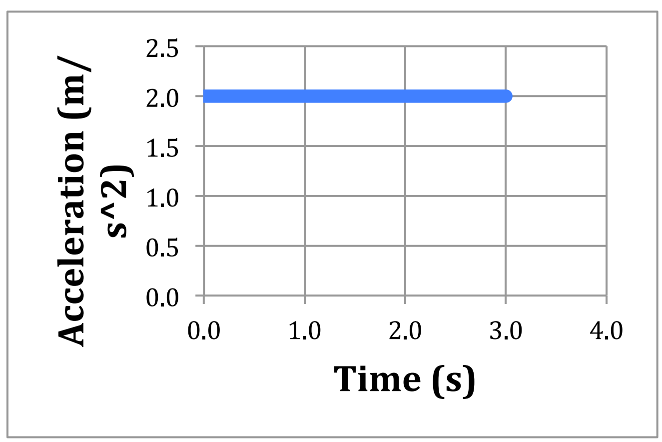
$$a = \frac{\Delta v}{\Delta t} = \frac{v_f - v_i}{t_f - t_i} = \frac{6-0}{3-0} = 2.0\frac{m}{s^2}$$

Therefore on the acceleration vs. time graph we draw a horizontal line with a slope of zero at a value of 2.0 m/s^2.



The position as a function of time graph is slightly more complicated. We know:
- The initial position is zero, because it was stated in the problem.
- The slope of the line should increase as time increases because the velocity increases. In other words, it is an upward sloping curve.
- The slope of the position vs. time graph starts at zero because the initial velocity is zero.
- We can use a UAM equation because the acceleration is constant.

Now we need to pick some times and start determining displacements.



$$\Delta x = \frac{1}{2}\left(v_f + v_i\right)\Delta t = \frac{1}{2}\left(v_f + v_i\right)\left(t_f - t_i\right)$$

$$\Delta x_{0-1} = \frac{1}{2}\left(v_1 + v_0\right)\left(t_1 - t_0\right) = \frac{1}{2}(2+0)(1-0) = 1.0m$$

$$\Delta x_{0-2} = \frac{1}{2}\left(v_2 + v_0\right)\left(t_2 - t_0\right) = \frac{1}{2}(4+0)(2-0) = 4.0m$$

$$\Delta x_{0-3} = \frac{1}{2}\left(v_3 + v_0\right)\left(t_3 - t_0\right) = \frac{1}{2}(6+0)(3-0) = 9.0m$$

After you determine your displacement, plot the points and then add the upward sloping curve to connect the points.

Sorry about the typo in the video. The UAM equation is $\Delta x = \frac{1}{2}\left(v_f + v_i\right)\Delta t$ ***not*** $\Delta x = \frac{1}{2}\left(v_f - v_i\right)\Delta t$.