Flipping Physics Lecture Notes:
Understanding Uniformly Accelerated Motion

We usually look at the dimensions for acceleration as: $a = \frac{\Delta v}{\Delta t} \Rightarrow \frac{m}{s^2}$

Today we are going to look at the dimensions for acceleration as: $a = \frac{\Delta v}{\Delta t} \Rightarrow \frac{m/s}{s}$ *or* $\frac{m}{s}$ *every second*

Example #1: A ball is released from rest and has an acceleration of 2 meters per second every second. (a) What is the velocity of the ball at t = 1, 2, 3, 4 and 5 seconds? (b) If the initial position of the ball is zero, what is the position of the ball at t = 1, 2, 3, 4 and 5 seconds?

Part (a): If the initial velocity of the ball is zero and the acceleration is $2\frac{m}{s}$ every second, then the velocity will increase by $2\frac{m}{s}$ every second. At t = 0 s, v = $0\frac{m}{s}$; at t = 1 s, v = $2\frac{m}{s}$; at t = 2 s, v = $4\frac{m}{s}$; at t = 3 s, v = $6\frac{m}{s}$; at t = 4 s, v = $8\frac{m}{s}$ & at t = 5 s v = $10\ \frac{m}{s}$.

Part (b): $\Delta x = v_i \Delta t + \frac{1}{2} a \Delta t^2 = (0)\Delta t + \frac{1}{2}(2)\Delta t^2$

$\Rightarrow \Delta x = \Delta t^2 \Rightarrow \Delta x_1 = 1^2 = 1m\,;\ \Delta x_2 = 2^2 = 4m$

$\Delta x_3 = 3^2 = 9m\,;\ \Delta x_4 = 4^2 = 16m\,;\ \Delta x_5 = 5^2 = 15m$

t (s)	x (m)	v (m/s)	a (m/s each s)
0	0	0	2
1	1	2	2
2	4	4	2
3	9	6	2
4	16	8	2
5	25	10	2

Example #2: A ball is given an initial velocity of -10 m/s and has an acceleration of 2 meters per second every second. (a) What is the velocity of the ball at t = 1, 2, 3, 4 and 5 seconds? (b) If the initial position of the ball is 25 meters, what is the position of the ball at t = 1, 2, 3, 4 and 5 seconds?

Part (a): If the initial velocity of the ball is $-10\frac{m}{s}$ and the acceleration is $2\frac{m}{s}$ every second, then the velocity will increase by $2\frac{m}{s}$ every second. At t = 0 s, v = $-10\frac{m}{s}$; at t = 1 s, v = $-8\frac{m}{s}$; at t = 2 s, v = $-6\frac{m}{s}$; at t = 3 s, v = $-4\frac{m}{s}$; at t = 4 s, v = $-2\frac{m}{s}$ & at t = 5 s v = $0\ \frac{m}{s}$.

t (s)	x (m)	v (m/s)	a (m/s each s)
0	25	-10	2
1	16	-8	2
2	9	-6	2
3	4	-4	2
4	1	-2	2
5	0	0	2

Part (b): $\Delta x = x_f - x_i = v_i \Delta t + \frac{1}{2} a \Delta t^2$

$\Rightarrow x_f - (25) = (-10)\Delta t + \frac{1}{2}(2)\Delta t^2$

$\Rightarrow x_f = 25 + (-10)\Delta t + \Delta t^2 \Rightarrow x_{1f} = 25 + (-10)(1) + 1^2 = 16m\,;\ x_{2f} = 25 + (-10)(2) + 2^2 = 9m$

$x_{3f} = 25 + (-10)(3) + 3^2 = 4m\,;\ x_{4f} = 25 + (-10)(4) + 4^2 = 1m\,;\ x_{5f} = 25 + (-10)(5) + 5^2 = 0m$