Displacement, Speed, Velocity, and Acceleration

$\Delta x = x_2 - x_1$ (similarly for Δy, etc.)

$\bar{v}_x = \dfrac{\Delta x}{\Delta t} = \dfrac{x_2 - x_1}{t_2 - t_1}$ (similarly for $\bar{v}_y$, etc.)

$\bar{s} = \dfrac{\text{total distance}}{\Delta \text{t}}$

$s = \sqrt{v_x^2 + v_y^2}$

v_x = slope of x vs t plot

$\bar{a} = \dfrac{\Delta v}{\Delta t}$

a = slope of v vs t plot

Gravity

$g = +9.8\ \text{m/s}^2 = +32.2\ \text{ft/s}^2$

Constant Acceleration

$x_f = x_i + v_{ix}\Delta t + \dfrac{1}{2}a_x \Delta t^2$

$v_{fx} = v_{ix} + a_x \Delta t$

$v_{fx}^2 = v_{ix}^2 + 2a_x\left(x_f - x_i\right)$

$x_f = x_i + \dfrac{1}{2}\left(v_{ix} + v_{fx}\right)\Delta t$

Projectile Motion

(assumes + y is upwards)

$a_x = 0$

$a_y = -g$

$\tan\theta_0 = \dfrac{v_{0y}}{v_{0x}}$

$v_{0x} = \left|v_0\right|\cos\theta_0$

$v_{0y} = \left|v_0\right|\sin\theta_0$

$y = y_0 + \left(x - x_0\right)\left(\dfrac{v_{0y}}{v_{0x}}\right) - \dfrac{g\left(x - x_0\right)^2}{2v_{0x}^2}$

or

$y = y_0 + \left(x - x_0\right)\tan\theta_0 - \dfrac{g\left(x - x_0\right)^2}{2\left(v_0\cos\theta_0\right)^2}$

$R = \dfrac{v_0^2}{g}\sin(2\theta_0)$

(destination and source at same height)

Vectors

$\vec{A} = A_x\hat{x} + A_y\hat{y} + A_z\hat{z}$

$A = \left|\vec{A}\right| = \sqrt{A_x^2 + A_y^2 + A_z^2}$

$\theta = \arctan\left(\dfrac{A_y}{A_x}\right)$

$A_x = A\cos\theta$

$A_y = A\sin\theta$

Forces

Name an object or group of objects!!!!

$\Sigma F_x = ma_x, \quad \Sigma F_y = ma_y$

$W = mg$ (down)

$f_{s,\max} = \mu_s N$

$f_k = \mu_k N$