Equations for Uniformly Accelerated Motion

In the X-direction | **Free Fall - Y-direction**

$x \rightarrow y,\ a \rightarrow -g,\ g = 9.8\ \frac{m}{s^2}$

$$x - x_0 = \Delta x = v_{avg}t$$
$$v_{avg} = \tfrac{1}{2}(v + v_0)$$
$$v = v_0 + at$$
$$v_{avg} = v_0 + \tfrac{1}{2}at$$
$$\Delta x = v_0 t + \tfrac{1}{2}at^2$$
$$\Delta x = vt - \tfrac{1}{2}at^2$$
$$2a\Delta x = v^2 - v_0^2$$

$$\Delta y = v_{avg}t$$
$$v_{avg} = \tfrac{1}{2}(v_y + v_{oy})$$
$$v_y = v_{0y} - gt$$
$$v_{avg} = v_{oy} - \tfrac{1}{2}gt$$
$$\Delta y = v_{0y}t - \tfrac{1}{2}gt^2$$
$$\Delta y = v_y t + \tfrac{1}{2}gt^2$$

Equations for Projectile Motion

In the X-direction | **In the Y direction**

$$a_x = 0$$
$$v_{0x} = v_0 \cos\theta_0 = v_x$$
$$\Delta x = v_{0x}t$$
$$R = \frac{v_0^2 \sin(2\theta_0)}{g}$$
$$T = \frac{R}{v_{0x}}$$
$$t_{\frac{1}{2}} = \frac{T}{2}$$

$$a_y = -g$$
$$v_{0y} = v_0 \sin\theta_0$$
$$v_y = v_{0y} - gt$$
$$\Delta y = v_{avg}t = \tfrac{1}{2}(v_y + v_{0y})t$$
$$\Delta y = v_{0y}t - \tfrac{1}{2}gt^2$$
$$\Delta y = \frac{v_y^2 - v_{0y}^2}{-2g}$$
$$H = y_{max} = \frac{v_{0y}^2}{2g},\quad t_{\frac{1}{2}} = \frac{v_{0y}}{g}$$
$$\Delta y = \Delta x(\tan\theta_0) - \frac{g}{2}\left(\frac{\Delta x}{v_{0x}}\right)^2$$
$$\Delta y = \Delta x(\tan\theta_0) - \frac{g}{2}\left[\frac{\Delta x}{v_0}\right]^2(1 + \tan^2\theta_0)$$