Equations for Projectile Motion

In the X-direction

$$a_x = 0$$

$$v_{0x} = v_0 \cos\theta_0 = v_x$$

$$\Delta x = v_{0x} t$$

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

$$T = \frac{R}{v_{0x}}$$

In the Y direction

$$a_y = -g = -9.8\frac{m}{s^2} = -32\frac{ft}{s^2}$$

$$v_y = v_{0y} \sin\theta_0$$

$$v_y = v_{0y} - gt$$

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

$$\Delta y = v_{0y} t - \tfrac{1}{2} g t^2$$

$$\Delta y = \frac{{v_y}^2 - {v_{0y}}^2}{-2g}$$

$$t_{1/2} = \frac{v_{0y}}{g}$$

$$T = 2t_{1/2} = \frac{2v_{0y}}{g} = \frac{R}{v_{0x}}$$

$$H = y_{max} = \frac{{v_{0y}}^2}{2g}$$

$$\Delta y = \Delta x(\tan\theta_0) - \frac{g}{2}\left(\frac{\Delta x}{v_{0x}}\right)^2$$

$$\Delta y = \Delta x(\tan\theta_0) - \frac{g}{2{v_0}^2}(1 + \tan^2\theta_0)(\Delta x)^2$$