Displacement

$$\Delta x \equiv x_{\mathsf{f}} - x_{\mathsf{i}}$$

Average Velocity

$$v_{x,\mathsf{avg}} \equiv \frac{\Delta x}{\Delta t}$$

Average Speed

$$v_{\mathsf{avg}} \equiv \frac{d}{\Delta t}$$

Instantaneous Velocity

$$v_x \equiv \lim_{\Delta t \to 0} \frac{\Delta x}{\Delta t} = \frac{dx}{dt}$$

Average Acceleration

$$a_{x,\mathsf{avg}} \equiv \frac{\Delta v_x}{\Delta t} = \frac{v_{x\mathsf{f}} - v_{x\mathsf{i}}}{t_{\mathsf{f}} - t_{\mathsf{i}}}$$

Instantaneous Acceleration

$$a_x \equiv \lim_{\Delta t \to 0} \frac{\Delta v_x}{\Delta t} = \frac{dv_x}{dt}$$

Kinematic Equations

$$\begin{aligned} v_{x\mathsf{f}} &= v_{x\mathsf{i}} + a_x t \\ x_{\mathsf{f}} &= x_{\mathsf{i}} + \frac{1}{2}(v_{x\mathsf{i}} + v_{x\mathsf{f}})t \\ x_{\mathsf{f}} &= x_{\mathsf{i}} + v_{x\mathsf{i}}t + \frac{1}{2}a_x t^2 \\ v_{x\mathsf{f}}^2 &= v_{x\mathsf{i}}^2 + 2a_x(x_{\mathsf{f}} - x_{\mathsf{i}}) \end{aligned}$$

For a vector $\mathbf{A} = A_x\mathbf{i} + A_y\mathbf{j}$ making an angle θ with the x axis:

$$\begin{aligned} A_x &= A\cos\theta \\ A_y &= A\sin\theta \\ A &= \sqrt{A_x^2 + A_y^2} \\ \theta &= \tan^{-1}\left(\frac{A_y}{A_x}\right) \end{aligned}$$

Projectile Max Height

$$h = \frac{v_{\mathsf{i}}^2 \sin^2\theta_{\mathsf{i}}}{2g}$$

Projectile Range

$$R = \frac{v_{\mathsf{i}}^2 \sin 2\theta_{\mathsf{i}}}{g}.$$

Uniform Circular Motion

$$\begin{aligned} a_c &= \frac{v^2}{r} \\ T &= \frac{2\pi r}{v} \end{aligned}$$