

Key Equations

$$x = x_0 + \int_{t_0}^t v_x dt \quad v_x = \frac{dx}{dt} \quad v_{x,avg} = \frac{\Delta x}{\Delta t}$$
$$v_x = v_{x0} + \int_{t_0}^t a_x dt \quad a_x = \frac{dv_x}{dt} \quad a_{x,avg} = \frac{\Delta v_x}{\Delta t}$$

$$v_x = v_{x0} + a_x \Delta t$$

$$x = x_0 + v_{x0} \Delta t + \frac{1}{2} a_x (\Delta t)^2$$

$$v_x^2 = v_{x0}^2 + 2a_x \Delta x$$

$$a_{rad} = \frac{v^2}{R}$$

$$\vec{F}_{net} = m\vec{a}$$

$$w = mg$$

$$f_s \leq \mu_s n$$

$$f_k = \mu_k n$$

$$f_r = \mu_r n$$

$$f_{drag} = kv \quad (\text{low speed}) \quad \text{OR} \quad f_{drag} = Dv^2 \quad (\text{high speed})$$

Similar equations apply for motion along y and z.

Useful Constants

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

Algebra and trigonometry you may need

$$ax^2 + bx + c = 0 \quad \Rightarrow \quad x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$a^2 = b^2 + c^2$$

