Equations

Pythagorean Theorem and Trigonometry

$$r^2 = x^2 + y^2$$

$$\sin\theta = \frac{y}{r} \qquad \cos\theta = \frac{x}{r} \qquad \tan\theta = \frac{y}{x}$$

Vectors

$$A_x = A\cos\theta \qquad A_y = A\sin\theta$$

$$\tan\theta = \frac{A_y}{A_x} \qquad A^2 = A_x^2 + A_y^2$$

Definitions of Displacement

$$\Delta\vec{\mathbf{r}} = \vec{\mathbf{r}}_f - \vec{\mathbf{r}}_\mathbf{i}$$

$$\Delta x = x_f - x_i \qquad \Delta y = y_f - y_i$$

Vector Addition

$$\vec{\mathbf{R}} = \vec{\mathbf{A}} + \vec{\mathbf{B}}$$

$$R_x = A_x + B_x \qquad R_y = A_y + B_y$$

Definitions Average v and a

$$\vec{\mathbf{v}}_{\text{av}} \equiv \frac{\Delta\vec{\mathbf{r}}}{\Delta t} \quad v_{x,\text{av}} \equiv \frac{\Delta x}{\Delta t} \quad v_{y,\text{av}} \equiv \frac{\Delta y}{\Delta t}$$

$$\vec{\mathbf{a}}_{\text{av}} \equiv \frac{\Delta\vec{\mathbf{v}}}{\Delta t} \quad a_{x,\text{av}} \equiv \frac{\Delta v_x}{\Delta t} \quad a_{y,\text{av}} \equiv \frac{\Delta v_y}{\Delta t}$$

Projectile Motion

$$a_x = 0 \qquad a_y = -g$$

Uniformly Accelerated Motion

$$\Delta x = v_{0x}t + \frac{1}{2}a_x t^2 \quad \Delta y = v_{0y}t + \frac{1}{2}a_y t^2$$

$$v_x = v_{0x} + a_x t \quad v_y = v_{0y} + a_y t$$

$$v_x^2 = v_{0x}^2 + 2a_x(\Delta x) \quad v_y^2 = v_{0y}^2 + 2a_y(\Delta y)$$

Relative Velocity

$$\vec{\mathbf{v}}_{\text{AB}} = \vec{\mathbf{v}}_{\text{AE}} - \vec{\mathbf{v}}_{\text{BE}}$$

Quadratic Formula

For: $Ax^2 + Bx + C = 0$

$$x = \frac{-B \pm \sqrt{B^2 - 4AC}}{2A}$$

Newton's Laws

$$\sum \vec{F} = m\vec{a} \qquad \vec{F}_{12} = -\vec{F}_{21}$$

$$\sum F_x = ma_x \qquad \sum F_y = ma_y$$

Newton's Universal Law of Gravitation

$$F_g = G\frac{m_1 m_2}{r^2} \qquad (\text{weight: } w = mg)$$

Friction

$$f_s \le \mu_s n \qquad f_k = \mu_k n$$

Constants

$$g = 9.80\ \text{m/s}^2$$

$$G = 9.67 \times 10^{-11}\ \text{N}\cdot\text{m}^2/\text{kg}^2$$