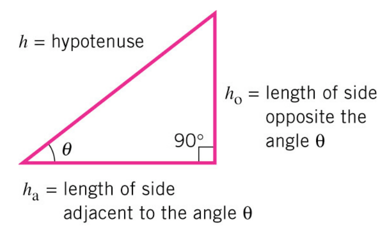
PHYSICS 201 — FORMULA SUMMARY — MODULE 1

Quadratic Equation

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

Trigonometry

$$\sin\theta = \frac{h_o}{h} \quad \cos\theta = \frac{h_a}{h} \quad \tan\theta = \frac{h_o}{h_a} \qquad h^2 = h_a^2 + h_o^2$$



Scalar Components of a Vector

$$A_x = |\vec{A}|\cos\theta \quad \text{and} \quad A_y = |\vec{A}|\sin\theta$$

Magnitude / Direction of a Vector

$$|\vec{A}| = \sqrt{A_x^2 + A_y^2} \qquad \theta = \tan^{-1}\left(\frac{|A_y|}{|A_x|}\right)$$

Vector Addition

$$\vec{C} = \vec{A} + \vec{B} \quad \Rightarrow \quad C_x = A_x + B_x \quad \text{and} \quad C_y = A_y + B_y$$

Kinematic Displacement

$$\Delta\vec{r} = \vec{r}_{\text{final}} - \vec{r}_{\text{initial}} = (\Delta r_x)\hat{x} + (\Delta r_y)\hat{y} = (\Delta x)\hat{x} + (\Delta y)\hat{y} = \left(x(t) - x_o\right)\hat{x} + \left(y(t) - y_o\right)\hat{y}$$

Kinematic Velocity / Kinematic Acceleration

$$\vec{v}_{\text{average}} = \frac{\Delta\vec{r}}{\Delta t} \qquad \vec{v}_{\text{instantaneous}} = \lim_{\Delta t \to 0} \frac{\Delta\vec{r}}{\Delta t} \qquad \vec{a}_{\text{average}} = \frac{\Delta\vec{v}}{\Delta t} \qquad \vec{a}_{\text{instantaneous}} = \lim_{\Delta t \to 0} \frac{\Delta\vec{v}}{\Delta t}$$

Motion with Constant Acceleration

$$v_x(t) = v_{ox} + a_x \cdot t$$
$$x(t) = x_o + \frac{1}{2}(v_{ox} + v_x) \cdot t$$
$$x(t) = x_o + v_{ox} \cdot t + \frac{1}{2} a_x \cdot t^2$$
$$v_x{}^2(x) = v_{ox}{}^2 + 2a_x \cdot (x - x_o)$$

$$v_y(t) = v_{oy} + a_y \cdot t$$
$$y(t) = y_o + \frac{1}{2}(v_{oy} + v_y) \cdot t$$
$$y(t) = y_o + v_{oy} \cdot t + \frac{1}{2} a_y \cdot t^2$$
$$v_y{}^2(y) = v_{oy}{}^2 + 2a_y \cdot (y - y_o)$$

Acceleration due to the Earth's Gravity

$$g = 9.80\ m/s^2$$

Newton's Second Law of Motion

$$\vec{\boldsymbol{a}} = \frac{\sum \vec{\boldsymbol{F}}}{m} \quad \text{or} \quad \sum \vec{\boldsymbol{F}} = m\vec{\boldsymbol{a}}$$

Dynamic Equilibrium

$$\sum F_x = 0 \quad \text{and} \quad \sum F_y = 0$$

Force Exerted by an Ideal Spring

$$\vec{\boldsymbol{F}}_{\text{spring}} = -k\Delta\vec{\boldsymbol{r}} \quad \text{or} \quad F_x = -kx$$

Static / Kinetic Friction

$$\left|\vec{\boldsymbol{f}}_s^{\text{ maximum}}\right| = \mu_s|\vec{\boldsymbol{n}}| \quad \text{and} \quad \left|\vec{\boldsymbol{f}}_k\right| = \mu_k|\vec{\boldsymbol{n}}|$$