Mechanics

velocity

$$\bar{v} = \frac{\Delta s}{\Delta t}$$

$$\mathbf{v} = \frac{d\mathbf{s}}{dt}$$

Acceleration

$$\bar{\mathbf{a}} = \frac{\Delta \mathbf{v}}{\Delta t}$$

$$\mathbf{a} = \frac{d\mathbf{v}}{dt}$$

Equations Of Motion

$$v = v_0 + at$$

$$x = x_0 + v_0 t + \tfrac{1}{2} a t^2$$

$$v^2 = v_0^2 + 2a(x - x_0)$$

$$\bar{v} = \tfrac{1}{2}(v + v_0)$$

Newton's 2nd Law

$$\sum \mathbf{F} = m\,\mathbf{a}$$

$$\sum \mathbf{F} = \frac{d\mathbf{p}}{dt}$$

Weight

$$\mathbf{W} = m\,\mathbf{g}$$

Dry Friction

$f \leq \mu N$

Centripetal Accel.

$a_c = \frac{v^2}{r}$

$\mathbf{a}_c = -\omega^2 \mathbf{r}$

Momentum

$\mathbf{p} = m\mathbf{v}$

Impulse

$\mathbf{J} = \overline{\mathbf{F}}\Delta t$

$\mathbf{J} = \int \mathbf{F}\, dt$

Impulse-Momentum

$\overline{\mathbf{F}}\Delta t = m\Delta\mathbf{v}$

$\int \mathbf{F}\, dt = \Delta\mathbf{p}$

Work

$W = \overline{\mathbf{F}}\Delta s \cos\theta$

$W = \int \mathbf{F} \cdot d\mathbf{s}$

Work-Energy

$\bar{\mathbf{F}}\Delta s \cos\theta = \Delta E$

$$\int \mathbf{F} \cdot d\mathbf{s} = \Delta E$$

Kinetic Energy

$K = \frac{1}{2}mv^2$

General Potential Energy

$$\Delta U = -\int \mathbf{F} \cdot d\mathbf{s}$$

$\mathbf{F} = -\nabla U$

Gravitational Potential Energy

$\Delta U_g = mg\Delta h$

Efficiency

$$\eta = \frac{W_{out}}{E_{in}}$$

Power

$$\bar{P} = \frac{\Delta W}{\Delta t}$$

$$P = \frac{dW}{dt}$$

Power-Velocity

$\bar{P} = \bar{\mathbf{F}} v \cos\theta$

$P = \mathbf{F} \cdot \mathbf{v}$

Angular Velocity

$\bar{\boldsymbol{\omega}} = \frac{\Delta \boldsymbol{\theta}}{\Delta t}$

$\boldsymbol{\omega} = \frac{d\boldsymbol{\theta}}{dt}$

$\mathbf{v} = \boldsymbol{\omega} \times \mathbf{r}$

Angular Acceleration

$\bar{\boldsymbol{\alpha}} = \frac{\Delta \boldsymbol{\omega}}{\Delta t}$

$\boldsymbol{\alpha} = \frac{d\boldsymbol{\omega}}{dt}$

$\mathbf{a} = \boldsymbol{\alpha} \times \mathbf{r} - \omega^2 \mathbf{r}$

Equations Of Rotation

$\omega = \omega_0 + \alpha t$

$\theta = \theta_0 + \omega_0 t + \frac{1}{2}\alpha t^2$

$\omega^2 = \omega_0^2 + 2\alpha(\theta - \theta_0)$

$\bar{\omega} = \frac{1}{2}(\omega + \omega_0)$

Newton's second law of rotational motion

$\sum \boldsymbol{\tau} = I\,\boldsymbol{\alpha}$

$\sum \boldsymbol{\tau} = \frac{d\mathbf{L}}{dt}$