Newton's Second Law:
$\vec{F}_{\text{net}} = m_{\text{sys}}\vec{a} = \dfrac{d\vec{p}}{dt}$
Newton's Third Law:
$\vec{F}_{a\to b} = -\vec{F}_{b\to a}$
Definitions of Displacement, Velocity, and Acceleration:
$\Delta x = x_f - x_i$
$\vec{v} = \dfrac{\Delta x}{\Delta t}$
$\vec{a} = \dfrac{\Delta \vec{v}}{\Delta t}$
Displacement with Constant Acceleration:
$x_f = x_i + \vec{v}_x \Delta t + \dfrac{\vec{a}_x (\Delta t)^2}{2}$
Velocity with Constant Acceleration:
$\vec{v}_{xf} = \vec{v}_{xi} + \vec{a}_x \Delta t$
Velocity-Displacement Relation with Constant Acceleration:
$\vec{v}_{xf}^2 = \vec{v}_{xi}^2 + 2\vec{a}_x \Delta x$
Vector Equations:
$\vec{A}_x = \vec{A}\cos\theta$
$\vec{A}_y = \vec{A}\sin\theta$
$\vec{A} = \sqrt{\vec{A}_x^2 + \vec{A}_y^2}$
$\theta = \arctan\dfrac{\vec{A}_y}{\vec{A}_x}$
Center of Mass:
$x_{cm} = \dfrac{\sum m_i x_i}{\sum m_i}$
Definition of Weight:
$\vec{F}_w = m(g + \vec{a}_y) = -\vec{F}_n$
Maximum Static Friction:
$\vec{F}_{\text{sf max}} = \mu \vec{F}_n$
Kinetic Friction:
$\vec{F}_{\text{kf}} = \mu_k \vec{F}_n$
Hooke's Law:
$\vec{F}_{\text{sp x}} = -k\Delta x$
Newton's Law of Gravitation:
$\vec{F}_g = \dfrac{Gm_1 m_2}{r^2}$
Kepler's Third Law:
$t^2 = \dfrac{4\pi^2 R^3}{MG}$
Time to Orbit:
$t = \dfrac{2\pi r}{\vec{v}}$
Minimum Velocity to Orbit:
$\vec{v}_{\min} = \sqrt{gr}$
Circular Acceleration:
$\vec{a}_c = \dfrac{\vec{v}^2}{r}$
Work:
$w = \vec{F} d\cos\theta$
Translational Kinetic Energy:
$k = \dfrac{m\vec{v}^2}{2}$
Gravitational Potential Energy:
$U_g = mgy$
Elastic Potential Energy:
$U_s = \dfrac{k\Delta x^2}{2}$
Work-Energy Theorem:
$w = \Delta k$
Definition of Power:
$P = \dfrac{\Delta E}{\Delta t} = \dfrac{w}{\Delta t} = \vec{F}\vec{v}\cos\theta$
Definition of Impulse:
$\vec{J} = \vec{F}_{\text{avg}} \Delta t$
Definition of Momentum:
$\vec{p} = m\vec{v}$
Conservation of Momentum:
$\vec{p}_f - \vec{p}_i = 0$
Impulse-Momentum Theorem:
$\vec{J} = \Delta\vec{p} = m\Delta\vec{v} = \vec{F}\Delta t$
Orbital Velocity:
$\vec{v} = \sqrt{\dfrac{Gm}{r}}$
Orbital Gravitational Potential Energy:
$U_g = \dfrac{-Gm_1 m_2}{r}$
Escape Velocity:
$\vec{v}_{\text{esc}} = \sqrt{\dfrac{2GM}{r}}$
Period of a Pendulum:
$t_p = 2\pi\sqrt{\dfrac{l}{g}}$
Period of a Spring:
$t_s = 2\pi\sqrt{\dfrac{m}{k}}$