Mass-Energy Equivalence:
$E = mc^2$

Newtonian Mechanics

Newton's Second Law:
$\vec{F}_{\text{net}} = m_{\text{sys}}\vec{a} = \frac{d\vec{p}}{dt}$
Newton's Third Law:
$\vec{F}_{a\to b} = -\vec{F}_{b\to a}$
Definitions of Displacement, Velocity, and Acceleration:
$\Delta x = x_f - x_i$
$\vec{v} = \frac{\Delta x}{\Delta t}$
$\vec{a} = \frac{\Delta \vec{v}}{\Delta t}$
Displacement with Constant Acceleration:
$x_f = x_i + \vec{v}_x\Delta t + \frac{\vec{a}_x(\Delta t)^2}{2}$
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:
$\vec{A}_x = \vec{A}\cos\theta$
$\vec{A}_y = \vec{A}\sin\theta$
$\vec{A} = \sqrt{\vec{A}_x^2 + \vec{A}_y^2}$
$\theta = \arctan\frac{\vec{A}_y}{\vec{A}_x}$
Center of Mass:
$x_{cm} = \frac{\sum m_i x_i}{\sum m_i}$
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:
$\vec{F}_g = \frac{Gm_1m_2}{r^2}$
Kepler's Third Law:
$t^2 = \frac{4\pi^2R^3}{MG}$
Time to Orbit:
$t = \frac{2\pi r}{\vec{v}}$
Minimum Velocity to Orbit:
$\vec{v}_{\text{min}} = \sqrt{gr}$
Circular Acceleration:
$\vec{a}_c = \frac{\vec{v}^2}{r}$
Work:
$w = \vec{F}d\cos\theta$
Translational Kinetic Energy:
$k = \frac{m\vec{v}^2}{2}$
Gravitational Potential Energy:
$U_g = mgy$
Elastic Potential Energy:
$U_s = \frac{k\Delta x^2}{2}$
Work-Energy Theorem:
$w = \Delta k$
Definition of Power:
$P = \frac{\Delta E}{\Delta t} = \frac{w}{\Delta t} = \vec{F}\vec{v}\cos\theta$
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:
$\vec{v} = \sqrt{\frac{Gm}{r}}$
Orbital Gravitational Potential Energy:
$U_g = \frac{-Gm_1m_2}{r}$
Escape Velocity:
$\vec{v}_{\text{esc}} = \sqrt{\frac{2GM}{r}}$
Period of a Pendulum:
$t_p = 2\pi\sqrt{\frac{l}{g}}$

Period of a Spring:
$t_s = 2\pi\sqrt{\frac{m}{k}}$

Rotational Mechanics

Definitions of Angular Displacement, Velocity, and Acceleration:
$\theta = \frac{s}{r}$
$\Delta\theta = \theta_f - \theta_i$
$\vec{\omega}_{\text{avg}} = \frac{\Delta\theta}{\Delta t}$
$\vec{\alpha}_{\text{avg}} = \frac{\Delta\vec{\omega}}{\Delta t}$
Angular Velocity with Constant Acceleration:
$\vec{\omega}_f = \vec{\omega}_i + \vec{\alpha}\Delta t$
Angular Displacement with Constant Acceleration:
$\theta_f = \theta_i + \vec{\omega}_i\Delta t + \frac{\vec{\alpha}\Delta t^2}{2}$
Angular Velocity-Displacement Relation with Constant Acceleration:
$\vec{\omega}_f^2 = \vec{\omega}_i^2 + 2\vec{\alpha}\Delta\theta$
Angular to Linear Motion:
$\Delta x = r\Delta\theta$
$\vec{v} = r\vec{\omega}$
$\vec{a}_T = r\vec{\alpha}$
Torque:
$\vec{\tau} = r\vec{F}\sin\theta$
Archimedes's Law of Levers:
$\frac{\vec{F}_2}{\vec{F}_1} = \frac{D_1}{D_2}$
Moment of Inertia:
$I = Cmr^2$
$I_{\text{sys}} = \sum C_i m_i r_i^2$
Parallel Axis Theorem:
$I' = I_{\text{cm}} + mx^2$
Newton's Second Law for Rotational Motion:
$\vec{\alpha} = \frac{\vec{\tau}_{\text{net}}}{I_{\text{sys}}}$
Newton's Third Law for Rotational Motion:
$\Delta\vec{L}_{a\to b} = -\Delta\vec{L}_{b\to a}$
Rotational Kinetic Energy:
$k_{\text{rot}} = \frac{I\vec{\omega}^2}{2}$
Rotational Work:
$w = \vec{\tau}\Delta\theta$
Rotational Work-Energy Theorem:
$w = \Delta k_{\text{rot}}$
Angular Momentum:
$\vec{L} = I\vec{\omega}$
Orbital Angular Momentum:
$\vec{L} = rm\vec{v}\sin\theta$
Angular Impulse-Momentum Theorem:
$\Delta\vec{L} = I\Delta\vec{\omega} = \vec{\tau}\Delta t$
Conservation of Angular Momentum:
$\vec{L}_f - \vec{L}_i = 0$

Fluid Mechanics

Fluid Pressure:
$P = P_{\text{atm}} + dgy$
Buoyant Force:
$\vec{F}_b = d_{\text{fluid}}V_{\text{disp}}g$
Fluid Flow Rate:
$Q = \frac{V}{t}$
Bernoulli's Equation:
$P_1 + dgy_1 + \frac{d\vec{v}_1^2}{2} = P_2 + dgy_2 + \frac{d\vec{v}_2^2}{2}$
Torricelli's Theorem:
$\vec{v}_2 = \sqrt{2g\Delta y}$