Equations and Trig Function Values

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

$\Delta x = vt + \frac{1}{2}at^2$

$\vec{F} = \frac{d\vec{p}}{dt} \approx m\vec{a}$

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

$W = \int \vec{F} \cdot d\vec{s} \approx \vec{F} \cdot \Delta\vec{s} = Fs\cos\theta = \Delta K$

Elastic Collisions
B initially stationary:

$v_{A2} = \frac{m_A - m_B}{m_A + m_B} v_{A1}$ $\quad$ $v_{B2} = \frac{2m_A}{m_A + m_B} v_{A1}$

CM Frame:

$v_{A2} = -v_{A1}$ $\quad$ $v_{B2} = -v_{B1}$

Universal gravitation

$F = \frac{Gm_1m_2}{r^2}, U = -\frac{GMm}{r}$

Kepler $T^2 \propto r^3$

$\vec{p} \equiv m\vec{v}$

$\vec{J} = \int \vec{F}dt \approx \vec{F}\Delta t = \Delta\vec{p}$

$I = \sum m_i r_i^2$

$\vec{r}_{cm} = \frac{\sum m_i \vec{r}_i}{\sum m_i}$

$U = mgh . \because \frac{1}{2}kx^2$

SHM $\omega = 2\pi f = 2\pi / T$

$\omega = \sqrt{\frac{k}{m}}$ $\quad$ $\omega = \sqrt{\frac{g}{L}}$ $\quad$ $\omega = \sqrt{\frac{mgd}{I}}$

Fluids – at rest $p = p_0 + \rho gh$

Bernoulli $p + \rho gy + \frac{1}{2}\rho v^2 = const.$

Waves

$y = A\cos(kx \pm \omega t)$

$k = 2\pi / \lambda$ $\quad$ $\omega = 2\pi / T$

$v = \frac{\omega}{k} = \sqrt{\frac{T_0}{\mu}}$

$I = \sum m_i r_i^2$

Rod:
$I_{cm} = \frac{1}{12}ML^2$ $\quad$ $I_{end} = \frac{1}{3}ML^2$

Solid Sphere: $I_{cm} = \frac{2}{5}ML^2$

Par Axis Thm: $I = I_{cm} + Md^2$

Rotation/ Translation Analogues

θ	x
ω	v
α	a
τ	F
L	p
I	m

$\sin 30° = \cos 60° = \frac{1}{2}$

$\cos 30° = \sin 60° = \frac{\sqrt{3}}{2}$

$\sin 45° = \cos 45° = \frac{\sqrt{2}}{2}$