The Equations

1-D Kinematics → Static Equilibrium

$$\Delta x = x - x_0$$
$$\bar{v} = \frac{x - x_0}{t}$$
$$a = \frac{v - v_0}{t}$$
$$\bar{v} = \frac{v_0 + v}{2}$$

$$v = v_0 + at$$
$$\Delta x = vt - \tfrac{1}{2}at^2$$
$$\Delta x = v_0 t + \tfrac{1}{2}at^2$$
$$\Delta x = \tfrac{1}{2}(v + v_0)t$$
$$v^2 = v_0^2 + 2a\Delta x$$
$$\Delta x = v_{0x}t$$

$$v_y = v_{0y} - gt$$
$$\Delta y = v_{0y}t - \tfrac{1}{2}gt^2$$
$$v_y^{\,2} = v_{0y}^2 - 2g\Delta y$$
$$\Delta y = v_y t + \tfrac{1}{2}gt^2$$
$$y = \tan\theta x - \frac{g}{2v_0^2\cos^2\theta}x^2$$

$$\Sigma F = ma$$
$$G = mg$$
$$f = \mu_{s,k}N$$

$$F = -G\frac{m_1 m_2}{r^2}$$
$$a_R = \frac{v^2}{r}$$
$$ma_R = m\frac{v^2}{r}$$

$$f = \frac{1}{\tau}$$
$$v = \frac{2\pi r}{\tau}$$
$$v = 2\pi r f$$

$$F = k\frac{q_1 q_2}{r^2}$$
$$P = \frac{F}{A}$$

$$W = Fd\cos\phi$$
$$W = -\Delta U$$
$$F_s = -kx$$
$$P_{avg} = \frac{W}{\Delta t} = F\bar{v}$$

$$W = \Delta K$$
$$K = \tfrac{1}{2}mv^2$$
$$U_G = mgh$$
$$U_S = \tfrac{1}{2}kx^2$$

$$\Sigma E_0 = \Sigma E_1$$
$$K_0 + U_{S0} + U_{G0} = K_1 + U_{S1} + U_{G1}$$
$$W_{\text{NC}} = \Delta K + \Delta U$$

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$$\vec{\mathbf{p}} = m\vec{\mathbf{v}}$$
$$\Sigma\vec{\mathbf{F}} = \frac{\Delta\vec{\mathbf{p}}}{\Delta t}$$
$$\vec{\mathbf{F}}\Delta t = \Delta\vec{\mathbf{p}}$$
$$e = \frac{v_B' - v_A'}{v_A - v_B} = \sqrt{\frac{h'}{h}}$$

$$m_A\vec{\mathbf{v}}_A + m_B\vec{\mathbf{v}}_B = m_A\vec{\mathbf{v}}_A' + m_B\vec{\mathbf{v}}_B'$$
$$\tfrac{1}{2}m_A v_A^2 + \tfrac{1}{2}m_B v_B^2 = \tfrac{1}{2}m_A v_A'^2 + \tfrac{1}{2}m_B v_B'^2$$
$$x_{\text{CM}} = \frac{m_A x_A + m_B x_B + \cdots}{m_A + m_B + \cdots}$$

$$l = r\theta$$
$$\bar{\omega} = \frac{\Delta\theta}{\Delta t}$$
$$\bar{\alpha} = \frac{\Delta\omega}{\Delta t}$$
$$T = 1/f$$

$$\upsilon = r\omega$$
$$a = r\alpha$$
$$a_R = \omega^2 r$$
$$f = \frac{\omega}{2\pi}$$

$$\omega = \omega_0 + \alpha t$$
$$\Delta\theta = \omega_0 t + \tfrac{1}{2}\alpha t^2$$
$$\Delta\theta = \omega t - \tfrac{1}{2}\alpha t^2$$
$$\Delta\theta = \tfrac{1}{2}(\omega + \omega_0)t$$
$$\omega^2 = \omega_0^2 + 2\alpha\Delta\theta$$

$$\tau = r \times F$$
$$\tau = mr^2\alpha$$
$$\sum\tau = \sum(mr^2)\alpha$$
$$I = \sum mr^2$$

$$\sum F_{equilibrium} = 0$$
$$\sum \tau_{equilibrium} = 0$$
$$W = \tau\Delta\omega$$
$$L = I\omega$$

$$K_{Rotational} = \tfrac{1}{2}I\omega^2$$
$$K = \tfrac{1}{2}M\upsilon_{\text{CM}}^2 + \tfrac{1}{2}I_{\text{CM}}\omega^2$$

The Constants

1-D Kinematics → Static Equilibrium

$$g_{Earth's\ Surface} = 9.802\ \text{m/s}^2$$

$m_{Earth} = 5.98 \text{ x } 10^{24}$ kg | $r_{Earth} = 6.38 \text{ x } 10^{6}$ m | $d_{Earth-Moon} = 3.84 \text{ x } 10^{8}$ m

$m_{Moon} = 7.35 \text{ x } 10^{22}$ kg | $r_{Moon} = 1.74 \text{ x } 10^{6}$ m | $d_{Earth-Sun} = 1.496 \text{ x } 10^{11}$ m

$m_{Sun} = 1.99 \text{ x } 10^{30}$ kg | $r_{Sun} = 6.96 \text{ x } 10^{8}$ m | $G = 6.67 \text{ x } 10^{-11}\ \frac{N \bullet m^2}{kg^2}$

$$k = 8.988 \text{ x } 10^{9}\ \frac{N \bullet m^2}{C^2}$$