Useful Equations

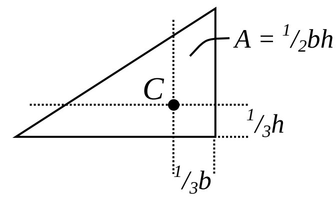
$$\cos\alpha = \frac{A_x}{A} \quad \cos\beta = \frac{A_y}{A} \quad \cos\gamma = \frac{A_z}{A} \qquad \cos^2\alpha + \cos^2\beta + \cos^2\gamma = 1$$

$$F = ks \qquad \sum \vec{F}_i = 0 \qquad \sum \vec{M}_{Oi} = 0 \qquad \hat{u} = \frac{\vec{R}}{\left|\vec{R}\right|} \qquad \vec{A}\cdot\vec{B} = \left|\vec{A}\right|\left|\vec{B}\right|\cos\theta = A_x B_x + A_y B_y + A_z B_z$$

$$\vec{F} = \vec{F}_{\parallel} + \vec{F}_{\perp} \qquad \vec{M}_O = \vec{R}_{OF} \times \vec{F} = \begin{vmatrix} i & j & k \\ R_x & R_y & R_z \\ F_x & F_y & F_z \end{vmatrix} \qquad M_u = \hat{u}\cdot\left(\vec{R}_{OF} \times \vec{F}\right) = \begin{vmatrix} u_x & u_x & u_x \\ R_x & R_y & R_z \\ F_x & F_y & F_z \end{vmatrix}$$

$$\vec{M}_{Couple} = \vec{d}_{\perp} \times \vec{F} \qquad \left|\vec{R}\right| = \sqrt{R_x^2 + R_y^2 + R_z^2}$$

$$\bar{x} = \frac{\int_L x\,w(x)\,dx}{\int_L w(x)\,dx}$$



$$\sum_i \vec{F}_i = m\vec{a} \qquad f_s^{Max} = \mu_s N \qquad f_k = \mu_k N \qquad y = (x\tan\theta) - \left(\frac{gx^2}{2v_0^2}\right)(1 + \tan^2\theta)$$

$$v = \frac{ds}{dt} \qquad a = \frac{dv}{dt} \qquad a\,ds = v\,dv \qquad ds = \sqrt{1 + \left(\frac{dy}{dx}\right)^2}\,dx$$

$$a_t = \dot{v} \qquad a_n = \frac{v^2}{\rho} \qquad \tan\theta = \frac{dy}{dx} \qquad \rho = \frac{\left[1 + \left(\frac{dy}{dx}\right)^2\right]^{\frac{3}{2}}}{\left|\frac{d^2y}{dx^2}\right|}$$

$$\vec{v} = \dot{r}\,\mathbf{u}_r + r\dot{\theta}\,\mathbf{u}_\theta + z\,\mathbf{u}_z \qquad \vec{a} = \left(\ddot{r} - r\dot{\theta}^2\right)\mathbf{u}_r + \left(r\ddot{\theta} + 2\dot{r}\dot{\theta}\right)\mathbf{u}_\theta + \ddot{z}\,\mathbf{u}_z \qquad \tan\psi = \frac{r}{dr/d\theta}$$

$$\vec{r}_B = \vec{r}_A + \vec{r}_{B/A} \qquad \vec{v}_B = \vec{v}_A + \vec{v}_{B/A} \qquad \vec{a}_B = \vec{a}_A + \vec{a}_{B/A}$$

$$\frac{dx^n}{dx} = nx^{n-1} \quad \frac{d}{dx}\tan x = \frac{1}{\cos^2 x} \quad \frac{d}{dx}\sin x = \cos x \quad \frac{d}{dx}\cos x = -\sin x \quad \frac{d}{dx}\ell n x = \frac{1}{x}$$

$$\frac{df}{d\theta} = \frac{df}{dx}\frac{dx}{d\theta}$$