$$C = \sqrt{A^2 + B^2 - 2ABcos(c)}$$

$$\vec{A}\times\vec{B} = -\vec{B}\times\vec{A} \qquad a(\vec{A}\times\vec{B}) = (a\vec{A})\times\vec{B} = (\vec{A}\times\vec{B})a = \vec{A}\times(a\vec{B}) \qquad \vec{A}\times(\vec{B}+\vec{D}) = \vec{A}\times\vec{B} + \vec{A}\times\vec{D}$$

$$F_x = Fcos(\alpha) \qquad F_y = Fcos(\beta) \qquad F_z = Fcos(\gamma)$$

$$F^2 = F_x^2 + F_y^2 + F_z^2$$

$$\frac{F_x}{\cos(\alpha)} = \frac{F_y}{cos(\beta)} = \frac{F_y}{\cos(\gamma)} = F$$

$$1 = \cos^2(\alpha) + \cos^2(\beta) + \cos^2(\gamma)$$

$$\vec{r}_{AB} = \vec{r}_B - \vec{r}_A = (x_B - x_A)\hat{\imath} + (y_B - y_A)\hat{\jmath} + (z_B - z_A)\hat{k}$$

$$r_{AB} = \sqrt{(x_B - x_A)^2 + (y_B - y_A)^2 + (z_B - z_A)^2}$$

$$\hat{U}_{AB} = \frac{(x_B - x_A)\hat{\imath}}{r_{AB}} + \frac{(y_B - y_A)\hat{\jmath}}{r_{AB}} + \frac{(z_B - z_A)\hat{k}}{r_{AB}}$$

$$A_xB_x + A_yB_y + A_zB_z = \vec{A}\cdot\vec{B} = ABcos(\theta)$$

$$F = kx$$

$$\Sigma F_{x,y,z} = 0$$

$$\vec{M}_o = \vec{r}\times\vec{F} = \begin{vmatrix} \hat{\imath} & \hat{\jmath} & \hat{k} \\ r_x & r_y & r_z \\ F_x & F_y & F_z \end{vmatrix} = (r_yF_z - r_zF_y)\hat{\imath} - (r_xF_z - r_zF_x)\hat{\jmath} - (r_xF_y - r_yF_x)\hat{k}$$

$$M_o = Fd$$

$$\vec{M}_a = \begin{vmatrix} U_{ax} & U_{ay} & U_{az} \\ r_x & r_y & r_z \\ F_x & F_y & F_z \end{vmatrix} = (r_yF_z - r_zF_y)U_{ax} - (r_xF_z - r_zF_x)U_{ay} - (r_xF_y - r_yF_x)U_{az}$$

$$\Sigma F_{x,y,z} = 0$$

$$\Sigma M_{x,y,z} = 0$$

$$M = 2J - 3$$

$$\frac{dv}{dx} = w(x)$$

$$\frac{dm}{dx} = v(x)$$

$$\Delta v_{AB} = \int_A^B w(x)dx$$

$$\Delta m_{AB} = \int_A^B v(x)dx$$

$$\deg(m(x)) = \deg(v(x)) + 1$$

$$v_f = m_f = 0$$

$$F_s = \mu_s N$$

$$F_k = \mu_k N$$

$$\bar{x} = \frac{\Sigma \tilde{x} w}{\Sigma w}$$

$$\bar{x} = \frac{\int \tilde{x} dw}{\int dw}$$

$$\bar{x} = \frac{\Sigma \tilde{x} V}{\Sigma V}$$

$$\bar{x} = \frac{\int \tilde{x} dv}{\int dv}$$

$$\bar{x} = \frac{\Sigma \tilde{x} A}{\Sigma A}$$

$$\bar{x} = \frac{\int \tilde{x} dA}{\int dA}$$

$$\bar{x} = \frac{\Sigma \tilde{x} L}{\Sigma L}$$

$$\bar{x} = \frac{\int \tilde{x} dl}{\int dl}$$

$$I_x = \int_A y^2 dA$$

$$I_x = \bar{I}_{x'} + A\left(d_y\right)^2$$

$$I_y = \int_A x^2 dA$$

$$I_y = \bar{I}_{y'} + A(d_x)^2$$

$$J_o = \int_A r^2 dA$$

$$J_o = \bar{J}_c + A(d_c)^2$$

$$I_{xy} = \int_A xydA$$

$$I_{xy} = \bar{I}_{x'y'} + Ad_x d_y$$

$$K_x = \sqrt{\frac{I_x}{A}}$$

$$K_y = \sqrt{\frac{I_y}{A}}$$

$$I_u = \frac{I_x + I_y}{2} + \frac{I_x - I_y}{2}\cos(2\theta) - I_{xy}\sin(2\theta)$$

$$I_v = \frac{I_x + I_y}{2} - \frac{I_x - I_y}{2}\cos(2\theta) + I_{xy}\sin(2\theta)$$

$$I_{uv} = \frac{I_x - I_y}{2}\sin(2\theta) + I_{xy}\cos(2\theta)$$

$$J_o = I_u + I_v = I_x + I_y$$

$$I_x = \int_A y^2 dm$$

$$I_y = \int_A x^2 dm$$

$$I_G = \int_A r^2 dm$$

$$I = I_G + md^2$$