Formula Sheet

$x(t) = Ae^{-\beta t}\cos(\omega_1 t - \delta)$ $\omega_1 = \sqrt{\omega_o{}^2 - \beta^2}$

$x(t) = e^{-\beta t}(A_1 e^{\omega_2 t} + A_2 e^{-\omega_2 t})$ $\omega_2 = \sqrt{\beta^2 - \omega_o{}^2}$

$x(t) = (A + Bt)e^{-\beta t}$ $\omega_o = \beta_c$

$x_p(t) = D\cos(\omega t - \delta)$ $D = \dfrac{A}{\sqrt{(\omega_o{}^2 - \omega^2)^2 + 4\omega^2\beta^2}}$

$\Phi = -G\int \frac{\rho}{r}dv$ or $\Phi = -G\int \frac{\sigma}{r}dA$ or $\Phi = -G\int \frac{\lambda}{r}dl$

$g = -G\int \frac{\rho}{r^2}dv$ or $g = -G\int \frac{\sigma}{r^2}dA$ or $g = -G\int \frac{\lambda}{r^2}dl$

$\oint \vec{g}\cdot d\vec{A} = -4\pi G M_{encl}$

$\frac{\partial f}{\partial y_i} = \frac{d}{dx}(\frac{\partial f}{\partial y'_i}) = 0 \qquad i = 1, 2, 3..., n \qquad ; \qquad \frac{\partial f}{\partial x} - \frac{d}{dx}(f - y'\frac{\partial f}{\partial y'}) = 0$

$L = K - U \quad ; \quad \frac{\partial L}{\partial q_i} - \frac{d}{dt}\frac{\partial L}{\partial \dot{q}_i} = 0 \quad ; \quad H = \sum_i p_i\dot{q}_i - L \quad ; \quad p_k = \frac{\partial L}{\partial \dot{q}_k}$

$\dot{q}_k = \frac{\partial H}{\partial p_k} \quad ; \quad \frac{\partial H}{\partial q_k} = -\dot{p}_k \quad ; \quad -\frac{\partial L}{\partial t} = \frac{\partial H}{\partial t} \quad ; \quad \frac{d^2}{d\theta^2}(\frac{1}{r}) + \frac{1}{r} = -\frac{\mu r^2}{l^2}F(r)$

$E = K + U$ $\vec{F} = -\vec{\nabla}U$ $l = mr^2\dot{\theta} = const$

$\vec{a}\times\vec{b} = ab\sin\theta \qquad \vec{a}\cdot\vec{b} = ab\cos\theta$

$\vec{a}\cdot(\vec{b}\times\vec{c}) = \vec{c}\cdot(\vec{a}\times\vec{b})$

$\vec{F} = m\dfrac{d\vec{p}}{dt} \qquad W = \int \vec{F}\cdot d\vec{r} = \Delta K \qquad K = \dfrac{1}{2}mv^2$

Thrust$= -u\dfrac{dm}{dt} = u\alpha$

$ds^2 = dr^2 + r^2 d\phi^2 + dz^2$ (cylindrical coordinates)

$ds^2 = dr^2 + r^2 d\theta^2 + r^2\sin^2\theta d\phi^2$ (spherical coordinates)