

Formula Sheet

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

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

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

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

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

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

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

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

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

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

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