PHYSICS 211

Formula Sheet **Spring 2004**

$$v = \frac{dx}{dt} \qquad a = \frac{dv}{dt}$$

$$x = x_0 + v_0 t + \frac{1}{2}at^2 \qquad v = v_0 + at \qquad v^2 = v_0^2 + 2a(x - x_0)$$

$$\vec{\mathbf{r}} = x\hat{\mathbf{i}} + y\hat{\mathbf{j}} + z\hat{\mathbf{k}} \qquad \vec{\mathbf{v}} = \frac{d\vec{\mathbf{r}}}{dt} \qquad \vec{\mathbf{a}} = \frac{d\vec{\mathbf{v}}}{dt}$$

$$\vec{\mathbf{r}} = \vec{\mathbf{r}}_0 + \vec{\mathbf{v}}_0 t + \frac{1}{2}\vec{\mathbf{a}}t^2 \qquad \vec{\mathbf{v}} = \vec{\mathbf{v}}_0 + \vec{\mathbf{a}}t$$

$$ax^2 + bx + c = 0 \qquad x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$\vec{\mathbf{a}} \bullet \vec{\mathbf{b}} = a\ b\ \cos\phi \qquad \cos(90^\circ + \phi) = -\sin\phi \qquad a_R = \frac{v^2}{r}$$

$$\sum \vec{\mathbf{F}} = m\vec{\mathbf{a}} \qquad \vec{\mathbf{F}}_{12} = -\vec{\mathbf{F}}_{21} \qquad \vec{\mathbf{F}}_G = m\vec{\mathbf{g}}$$

$$F_{fr} = \mu_k F_N \qquad F_{fr} \le \mu_s F_N \qquad a_{\tan} = \frac{dv}{dt}$$

$$F = G\frac{m_1 m_2}{r^2} \qquad \vec{\mathbf{F}}_{12} = -G\frac{m_1 m_2}{r_{21}^2}\hat{\mathbf{r}}_{21}$$

$$W = \vec{\mathbf{F}} \bullet \vec{\mathbf{d}} = \int \vec{\mathbf{F}} \bullet d\vec{\ell} \qquad F_S = -kx \qquad W_s = \tfrac{1}{2}kx_i^2 - \tfrac{1}{2}kx_f^2$$

$$K = \frac{1}{2}mv^2 \qquad W_{net} = \tfrac{1}{2}mv_2^2 - \tfrac{1}{2}mv_1^2$$

$$U = mgy \qquad U = \frac{1}{2}kx^2$$

$$\Delta U = U_2 - U_1 = -W = -\int_1^2 \vec{\mathbf{F}} \bullet d\vec{\ell} \qquad F(x) = -\frac{dU(x)}{dx}$$

$$E = K + U \qquad K_2 + U_2 = K_1 + U_1 \qquad \Delta K + \Delta U = W_{NC}$$

$$U = -\frac{Gm_1 m_2}{r} \qquad \mathcal{P} = \frac{dW}{dt} = \vec{\mathbf{F}} \bullet \vec{\mathbf{v}}$$

$$\vec{\mathbf{p}} = m\vec{\mathbf{v}} \qquad \sum \vec{\mathbf{F}} = \frac{d\vec{\mathbf{p}}}{dt} \qquad \Delta\vec{\mathbf{p}} = \vec{\mathbf{p}}_f - \vec{\mathbf{p}}_i = \int_{t_i}^{t_f} \vec{\mathbf{F}}dt = \vec{\mathbf{J}}$$

$$\vec{\mathbf{p}}_1 + \vec{\mathbf{p}}_2 = \vec{\mathbf{p}}_1' + \vec{\mathbf{p}}_2' \qquad \frac{d\vec{\mathbf{P}}}{dt} = \sum \vec{\mathbf{F}}_{\text{ext}}$$

$$x_{\text{CM}} = \frac{1}{M}\sum_{i=1}^{n} m_i x_i = \frac{1}{M}\int x dm \qquad M\vec{\mathbf{a}}_{\text{CM}} = \sum \vec{\mathbf{F}}_{\text{ext}}$$