$$dW = F_T \, ds = m \frac{dv}{dt} ds = mv \, dv$$

$$L_{peso}: \quad L = \int_A^B m\vec{g} \cdot d\vec{s} = m\vec{g} \cdot \int_A^B d\vec{l} = m\vec{g} \cdot \Delta\vec{R} = \dots \vec{r}_B \cdot ns$$

$$L = mg(z_A - z_B) = E_{PA} - E_{PB} = -\Delta E_P$$

$$L_{\text{forza elastica}} \atop 1D : \quad L = \int_A^B -Kx \, dx = -K \frac{x^2}{2} \Big|_A^B = -\Delta E_P$$

$$\underset{A \quad\quad B}{\circ \longrightarrow \longrightarrow}$$

$$L_{\text{forza attrito}} . \quad L = \int_A^B \vec{f} \cdot d\vec{s} = \int \mu_d N \hat{u}_v \cdot d\vec{s} = \mu_d N \int \dots$$

$$dW = \vec{F} \cdot d\vec{s} = F_x dx + F_y dy + F_z dz = -dE_P \quad \text{se } F \dots$$

$$\oint dW = 0 \implies \exists \, f(x,y,z) \ t.c. \quad F_x = -\frac{\partial f}{\partial x}, \quad F_y = -\frac{\partial f}{\partial y}, \quad F_z \dots$$

$$\vec{F} = -\vec{\nabla} E_P \quad \longrightarrow F = mg \implies \frac{dE_P}{dz} = F = mg \quad E_P = \int mg \, dz \dots$$

$$\longrightarrow F = -Kx \implies \frac{dE_P}{dx} = -Kx \quad E_P = \int -Kx \, dx = \dots$$

$$\vec{L}_o = \vec{r}_o \times \vec{P} = \vec{r}_o \times m\vec{v} \qquad \vec{r}_o = \vec{OO'} + \vec{r}_{c'} \implies \vec{L}_{ct} = \vec{cc'} \times \vec{P} + \vec{r}_o \times \vec{P} \dots$$

$$\vec{L}_{ct} = \vec{CO'} \times \vec{P} + \vec{L}_{c'}$$

$$\vec{L} = \vec{r} \times m(\vec{v}_r + \vec{v}_o) = \vec{r} \times m\vec{v}_o$$

$$\vec{M}_o = \vec{r}_o \times \vec{F} \quad \vec{M}_{o'} = \vec{M}_o + \vec{o'o} \times \vec{F} \qquad \vec{M} = \sum \vec{r}_i \times \vec{F}_i = \vec{r} \times \sum \vec{F}_i = \vec{r} \times \vec{R}$$

$$\frac{d\vec{L}}{dt} = \frac{d\vec{r}}{dt} \times \vec{P} + \vec{r} \times \frac{d\vec{P}}{dt} = \vec{v} \times m\vec{v} + \vec{r} \times \vec{F} = \vec{M}$$

$$\vec{v} = \frac{d\vec{r}}{dt} = \frac{dr}{dt} \hat{u}_r + r \frac{d\hat{u}_r}{dt} = v \hat{u}_r + r \frac{d\theta}{dt} \hat{u}_\theta \qquad \vec{L} = \vec{r} \times mr \frac{d\theta}{dt} \hat{u}_\theta$$

$$\text{Se } O \ \text{sta nel piano del moto}, \qquad \vec{r} \perp \hat{u}_\theta \implies L = mr^2 \frac{d\theta}{dt}$$

$$F \text{ centrale} \implies \vec{L} = cost. \implies \frac{1}{2} r^2 \frac{d\theta}{dt} = cost. \qquad \frac{dA}{dt} = \frac{1}{2} r^2 \frac{d\theta}{dt}$$

$$dA = \frac{1}{2} r \, rd\theta \quad \frac{dA}{dt} = cost. \qquad \frac{dA}{dt} = \frac{L}{2m} \quad \int_{A_{eo}} dA = \int_0^T \frac{L}{2m} dt$$

$$A = \frac{L}{2m} T \quad \text{periodo}: T = \frac{2mA}{L}$$

$$\text{Lavoro forze centrali}: \quad L = \int_A^B \vec{F} \cdot d\vec{s} = \int_A^B F(r) \hat{u}_r \cdot d\vec{s}$$

$$ds \cos\theta = dr \implies \hat{u}_r \cdot d\vec{s} = dr \implies L = \int_A^B F(r) dr = f(r_o) - f(r_A)$$

$$d\vec{r} = rd\theta \, \hat{u}_\theta \quad |d\vec{r}| = rd\theta = dr$$

$$\vec{r} = \vec{r}_o' + \vec{r}'$$

$$\vec{v} = \frac{d\vec{r}}{dt} = \frac{d\vec{r}_o'}{dt} + \frac{dx'}{dt}\hat{x}' + \frac{dy'}{dt}\hat{y}' + \frac{dz'}{dt}\hat{z}' + x'\frac{d\hat{x}'}{dt} + y'\frac{d\hat{y}'}{dt} + z'\frac{d\hat{z}'}{dt}$$

$$= \vec{v}_o' + \vec{v}' + \vec{\omega} \times (x'\hat{x}' + y'\hat{y}' + z'\hat{z}') = \vec{v}_o' + \vec{v}' + \vec{\omega} \times \vec{r}'$$