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

$$L_{peso}: \quad L = \int_A^B m\vec{g} \cdot d\vec{s} = \ldots$$

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

$$L \text{ forza elastica} \quad L = \int_{1D} -kx \, dx = -k \frac{x^2}{2} \Big|_A^B \ldots$$

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

$$dL = \vec{F} \cdot d\vec{s} = F_x \, dx + F_y \, dy + F_z \, dz = -dE_p \ldots$$

$$\oint dL = 0 \implies \exists \, f(x,y,z) \quad F_x = -\frac{\partial f}{\partial x} \quad F_y = \ldots$$

$$\vec{F} = -\vec{\nabla} E_p \longrightarrow F = -mg \implies \frac{dE_p}{dz} = E = g \ ; = mg \ldots$$
$$\longrightarrow F = -kx \implies \frac{dE_p}{dx} = -kx \quad E_p = \ldots$$

$$\vec{L}_O = \vec{r} \times \vec{p} = \vec{r} \times m\vec{v} \qquad \vec{r}_c = \vec{CO'} + \vec{r}_{c'} \implies \vec{L}_{cO} = \ldots$$

$$\vec{L}_{cO} = \vec{CO'} \times \vec{p} + \vec{L}_{O'}$$

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

$$\vec{M}_O = \vec{r}_c \times \vec{F} \qquad \vec{M}_{O'} = \vec{M}_O + \vec{O'O} \times \vec{F} \qquad \vec{M} = \sum \vec{r}_B \times \vec{F}_i = \vec{r} \times \sum \vec{F}_i \ldots$$

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

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

$$\text{se } \theta = 0 \quad \text{sta nel piano del moto}, \quad \vec{r} \perp \hat{u}_\theta \implies L = m r^2 \frac{d\varphi}{dt}$$

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

$$dA = \frac{1}{2} r \, rd\varphi \quad \frac{dA}{dt} = \cos t. \quad \frac{dA}{dt} = \frac{L}{2m} \quad \int dA = \int \frac{L}{2m} dt$$

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

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

$$ds \cos\theta = dr \implies \hat{u}_r \cdot d\vec{s} = dr$$
$$\vec{r} = r d\theta \, \hat{u}_\theta \quad |d\vec{r}| = r d\theta = dr \implies L = \int_A^B F(r)dr = -f(r) \ldots$$

$$\vec{r} = \vec{r}_c + \vec{r}'$$
$$\vec{v} = \frac{d\vec{r}}{dt} = \frac{d\vec{r}_c}{dt} + \frac{dx'}{dt}\hat{x}' + \frac{dy'}{dt}\hat{y}' \ldots + x'\frac{d\hat{x}'}{dt} + y'\frac{d\hat{y}'}{dt} + z'\frac{d\hat{z}'}{dt} =$$
$$= \vec{v}_c + \vec{v}' + \vec{\omega} \times (x'\hat{x}' + y'\hat{y}' + z'\hat{z}') = \vec{v}_c + \vec{v}' + \ldots$$