No. ....

Date

Proof of Kepler's Law III

$$T\frac{l}{2} = \pi ab$$

$$= \pi a\sqrt{a\alpha} \qquad (b(a, \alpha))$$

$$\therefore T^2\frac{l^2}{4} = \pi^2 a^3 \alpha$$

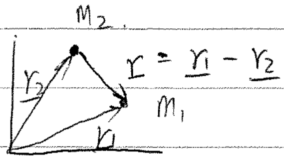
$$= \pi^2 a^3 \frac{ml^2}{k} \qquad (\alpha(m, l, k))$$

$$\therefore T^2 = \frac{4\pi^2 m}{k} a^3$$

$$= \frac{4\pi^2}{GM_\odot} a^3 \quad . \square$$

two body problems

central force



$$\begin{cases} m_1 \ddot{\underline{r_1}} = f(r)\, \hat{\underline{r}} \\ m_2 \ddot{\underline{r_2}} = -f(r)\, \hat{\underline{r}} \end{cases}$$

$$\ddot{\underline{r}} = \left(\frac{1}{m_1} + \frac{1}{m_2}\right) f(r)\, \hat{\underline{r}}$$

$$\Leftrightarrow \frac{m_1 m_2}{m_1 + m_2} \ddot{\underline{r}} = f(r)\, \hat{\underline{r}}$$

$\mu \ddot{\underline{r}} = f(r)\, \hat{\underline{r}}$, $\mu = \frac{m_1 m_2}{m_1 + m_2}$, reduced ma

Potential energy

1° two particles

$\underline{F_{12}} = \underline{F_{12}}(\underline{r_1} - \underline{r_2})$ $\underline{F_{12}} = -\underline{F_{21}}$

$\underline{F_{12}}$ be conservative $\Leftrightarrow$ $\nabla_1 \times \underline{F_{12}} = 0$.

$\underline{F_{12}} = -\nabla_1 U(\underline{r_1})$

$\underline{F_{12}} = -\nabla_1 U(\underline{r_1} - \underline{r_2})$

$\because \nabla_1 U(\underline{r_1} - \underline{r_2}) = -\nabla_2 U(\underline{r_1} - \underline{r_2})$ (chain rule)

$\therefore \underline{F_{21}} = -\nabla_2 U(\underline{r_1} - \underline{r_2})$

$$\begin{cases} dE = 0 \\ E = T + U = T_1 + T_2 + U \end{cases}$$

2° N particles

$$U = U^{int} + U^{ext} = \sum_{\alpha} \sum_{\beta > \alpha} U_{\alpha\beta} + \sum_{\alpha} U_{\alpha}^{ext}$$

$$-\nabla_\alpha U = \sum_{\beta \neq \alpha} \underline{F}_{\alpha\beta} + \underline{F}_{\alpha}^{ext}$$

$$E = T + U = \sum T_\alpha + U$$