Concepts

① $\vec{V}_{com} = \dfrac{m_1\vec{v}_1 + m_2\vec{v}_2 ---- + m_n\vec{v}_n}{m_1 + m_2 + ---- m_n}$

$\vec{a}_{com} = \dfrac{m_1\vec{a}_1 + m_2\vec{a}_2 + ---- m_n\vec{a}_n}{m_1 + m_2 + ------ m_n}$

② $\vec{P}$ = momentum

$\vec{P}_{com} = m_{Total}\vec{V}_{com} = m_1\vec{v}_1 + m_2\vec{v}_2 + --- m_n\vec{v}_n$

③ $\vec{F} = \dfrac{d\vec{P}}{dt}$

$\vec{F} = m\dfrac{d\vec{v}}{dt} + \vec{v}\dfrac{dm}{dt}$

↳ If mass changes with time

④ $KE_{Total} = \frac{1}{2}\mu(V_{rel})^2 + \frac{1}{2}m_{Total}(V_{com})^2$

μ = Reduced Mass = $\dfrac{m_1 m_2}{m_1 + m_2}$

$\frac{1}{2}\mu(V_{rel})^2$ is KE with respect to COM