# Kepler's Laws

First Law: Shape of Orbits

P: perihelion, small radius of ellipse

A: aphelion, big radius of ellipse, semi-major axis

$R = \dfrac{a+p}{2}$

Second Law: Area & Time If $A_1 = A_2$,

$t_1 = t_2$

$\vec{L}_0 = \vec{L}_f$

$v_1 > v_2$

$KE_1 > KE_2$

$U_2 > U_1$

Third Law: Comparing Orbits

$R_E = 1$ AU

$T_E = 1$ year

$R^3 = kT^2$

$\left(\dfrac{R_v}{R_E}\right)^3 = \dfrac{k}{k}\left(\dfrac{T_v}{T_E}\right)^2$

$k = \dfrac{Gm_c}{4\pi^2}$