

Earth: $r = 1 \text{ AU}$, $v = 30 \text{ km/s}$, $a = 900 \text{ (km/s)}^2/\text{AU}$

Jupiter: $r = 5 \text{ AU}$, $v = 13.42 \text{ km/s}$, $a = 180 \text{ (km/s)}^2/\text{AU}$

Neptune: $r = 30 \text{ AU}$, $v = 5.48 \text{ km/s}$, $a = 1 \text{ (km/s)}^2/\text{AU}$

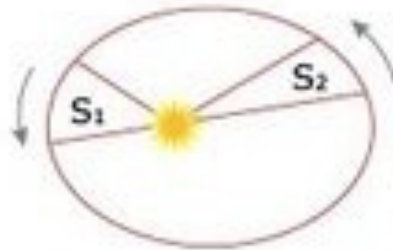
$$a_{\text{earth}} / a_{\text{jupiter}} = 25 = 5^2 = (r_{\text{earth}} / r_{\text{jupiter}})^2$$

$$a_{\text{earth}} / a_{\text{neptune}} = 900 = 30^2 = (r_{\text{earth}} / r_{\text{neptune}})^2$$

1st Law

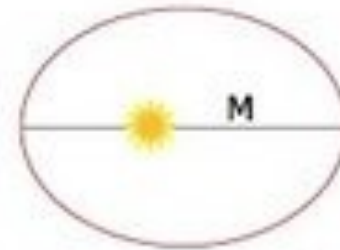


2nd Law



Equal area in the same time
area $S_1 =$ area S_2

3rd Law



P: period (the time for one cycle)
M: length of the major axis

P^2/M^3 is the same for all planets