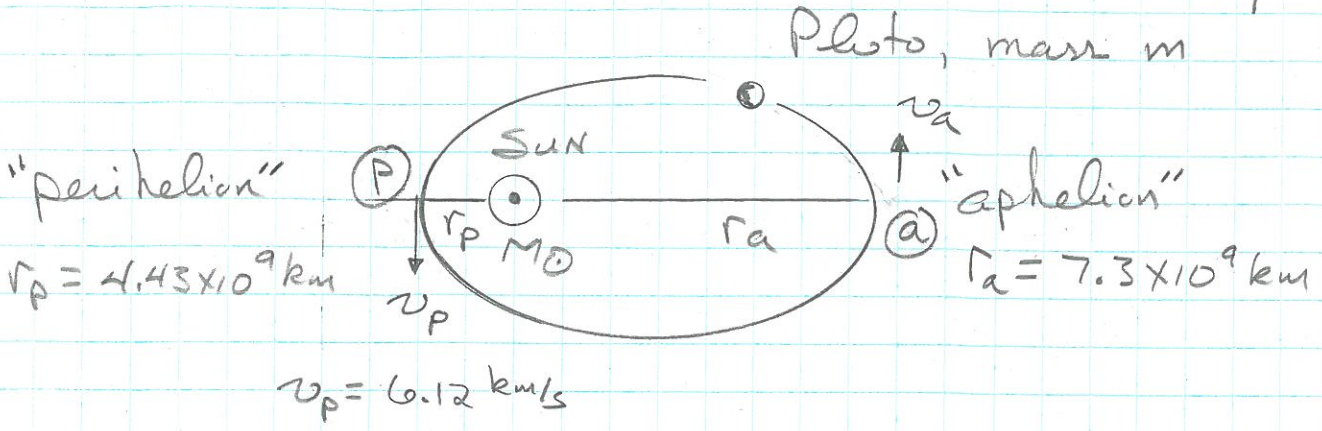


Find v_a:

The hard way: Conserve Energy:

$$E_p = E_a$$

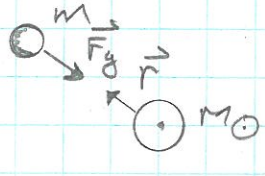
$$\frac{1}{2} m v_p^2 - \frac{GmM_\odot}{r_p} = \frac{1}{2} m v_a^2 - \frac{GmM_\odot}{r_a}$$

$$v_a = \left\{ v_p^2 - 2GM_\odot \left(\frac{1}{r_p} - \frac{1}{r_a} \right) \right\}^{1/2}$$

— Convert every thing to m and m/s.

$$v_a = 3.73 \text{ km/s}$$

Easy Way: Gravity is a centrally directed force



Torque on m, $\vec{\tau} = \vec{r} \times \vec{F} = 0$

So, angular momentum is conserved.

So, for Pluto:

$$m r_p v_p = m r_a v_a \Rightarrow v_a = \frac{r_p}{r_a} v_p = 3.72 \frac{\text{km}}{\text{s}}$$