$$V_{esc} = \sqrt{\frac{2GM}{r}}$$

$$V_{orb} = \sqrt{\frac{GM}{r}} \quad \text{or} \quad \sqrt{rg} \quad \underline{\text{IF}} \text{ you know 'g' at radial altitude}$$

$$F_g = \frac{GM_1M_2}{r^2} \qquad g = \frac{GM}{r^2}$$

$$F_R = \frac{mv^2}{r}$$

$$\frac{T^2}{r^3} = \frac{4\pi^2}{GM_e}$$

$$\frac{T_1^2}{r_1^3} = \frac{T_2^2}{r_2^3}$$ (may use any units, such as T in years, r in AU.

$1\ AU = 1.496 \times 10^{11}\ m = r_{es}$

$1\ year = 3.15 \times 10^7\ s$

$M_e = 5.98 \times 10^{24}\ kg$

$r_e = 6.37 \times 10^6\ m$

$r_{es} = 1.496 \times 10^{11}\ m$

$G = 6.67 \times 10^{-11}\ \frac{Nm^2}{kg^2}$

$M_S = 1.991 \times 10^{30}\ kg$

$r = r_e + h$ "h" is altitude above ground

How to find the mass of the sun!

$$M_S = \frac{4\pi^2 r_{es}^3}{GT^2}$$

$$= \frac{4\pi^2 (1.5 \times 10^{11}\ m)^3}{6.67 \times 10^{-11}\ \frac{Nm^2}{kg^2} (3.15 \times 10^7\ s)^2}$$

$$M_S = 2 \times 10^{30}\ kg$$