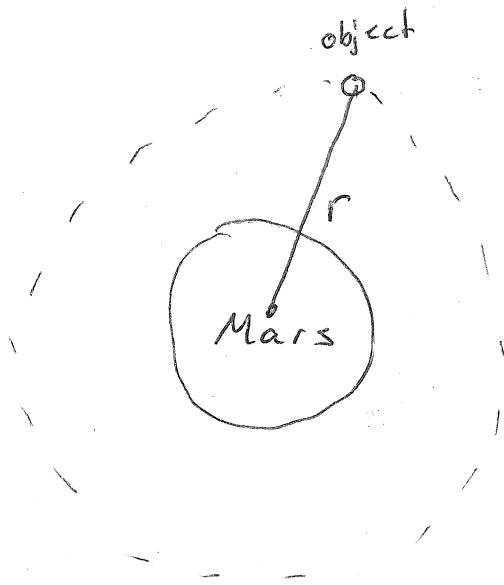


①

An object of mass  $m$  orbits ~~the~~ Mars at radius  $r$ .

- 1) Determine the speed of the object
- 2) Write an expression for total mechanical energy and show that the total mechanical energy is  $(-1)$  times the kinetic energy.



Let the orbit be circular

Then  $F_c = F_g$

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

$$v = \sqrt{\frac{GM_m}{r}}$$

$$E_{Total} = E_g + E_k = -\frac{GmM_m}{r} + \frac{1}{2}mv^2$$

$$E_{Total} = -\frac{GmM_m}{r} + \frac{1}{2}m\left(\frac{GM_m}{r}\right)$$

$$= -\frac{1}{2}m\left(\frac{GM_m}{r}\right) = \boxed{-\frac{1}{2}mv^2}$$