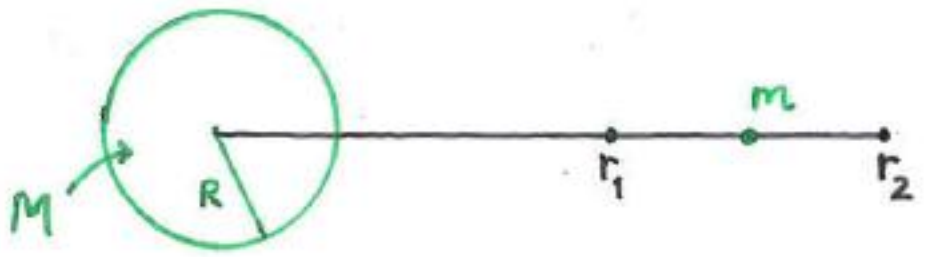
Escape Velocity



Work done in moving mass m from r_1 to r_2

= change in gravitational potential energy

$$\Delta U = -\int_{r_1}^{r_2} \vec{F}_G \cdot d\vec{r} = \int_{r_1}^{r_2} \frac{GMm}{r^2}\, dr$$

$$= GMm \int_{r_1}^{r_2} \frac{dr}{r^2} = GMm \left[-\frac{1}{r}\right]_{r_1}^{r_2}$$

$$U_2 - U_1 = \frac{GMm}{r_1} - \frac{GMm}{r_2}$$

We define $U_2 = 0$ when $r_2 \to \infty$

$\Rightarrow$ at surface of planet $\quad U = -\frac{GMm}{R}$

Suppose we launch a projectile vertically upwards from the planet's surface, with velocity $\vec{v}_0$

Initial Kinetic Energy, $\quad K = \frac{1}{2} m v_0^2$

(m: mass of projectile)