$$E = KE_i + GPE_i = KE_f + GPE_f$$

$$\frac{1}{2}mv_i^2 + \frac{-GM_Em}{R_E} = \frac{1}{2}mv_f^2 + \frac{-GM_Em}{R_f}$$

$$\frac{1}{2}mv_i^2 - \frac{GM_Em}{R_E} = \frac{1}{2}m0^2 - \frac{GM_Em}{\infty}$$

$$\frac{1}{2}mv_i^2 - \frac{GM_Em}{R_E} = 0 - 0$$

$$\frac{1}{2}mv_i^2 - \frac{GM_Em}{R_E} = 0$$

$$\frac{1}{2}mv_{esc}^2 = \frac{GM_Em}{R_E}$$

$$v_{esc} = \sqrt{\frac{2GM_E}{R_E}}$$