$$F = -\frac{GMm}{R^2 + A^2}$$

$$E_{\mathrm{tot}} = -\frac{GMm}{R} + \frac{1}{2}mv^2$$

$$\text{If} \quad R < R_{\mathrm{crit}}, \qquad \begin{aligned} y_{i+1} &= -y_i \\ v_{i+1} &= v_i \end{aligned}$$