

[mex126] Angle between apsidal vectors for nearly circular orbits

Consider a particle of mass m and angular momentum ℓ subject to a central force $F(r) = -V'(r)$ and moving in a stable circular orbit of radius $r = R$. Show that nearly circular orbits in the immediate vicinity have an apsidal angle

$$\Delta\vartheta = \pi \sqrt{\frac{V'(R)}{3V'(R) + RV''(R)}}.$$

Solution: