Elevation Angle Based Problems

Problem No. 01

A **meteor** is sighted approaching **earth** at 92,000 km altitude with a 'v' of **9150 m/s** & 'ϕ'of -80^{o}.

Determine **trajectory**, along with time and **altitude** at the point of **closest** passage. (R_E = 6,378 km, $\mu = 3.986 \times 10^{14}$ m^3/s^2).

Elevation Angle Based Δt Example

The **applicable** solution parameters are as **follows**.

$$\phi = \cos^{-1}\left(\frac{h}{rv}\right) = -80^{o}; \quad h = rv\cos\phi = 15.6\times10^{10}\, m^2/s, \quad \varepsilon = 3.78\times10^{7}\, m^2/s^2$$

$$e = 3.55, \quad a = -5.27\times10^{6}\, m; \quad r_p = 13.44\times10^{6}\, m, \quad v_p = 11,610 m/s; \quad h_p = 7,062 km$$

$$p = -a\left(e^2 - 1\right) = 61.1\times10^{6}\, m, \quad \theta = \cos^{-1}\left[\frac{1}{3.55}\left(\frac{61.1\times10^{6}}{98.37\times10^{6}} - 1\right)\right] = 1.68 rad = 96.2^{o}$$

$$F = \cosh^{-1}\frac{3.55 + \cos 96.2^{o}}{1 + 3.55\times\cos 96.2^{o}} = 2.41 rad, \quad M = 17.19 rad; \quad \Delta t_{Perigee} = \sqrt{\frac{(-a)^3}{\mu}}M = 10416 s$$