$\mu_m = \frac{\mu_\oplus}{81.3}$

$\varepsilon_2 = \phi_1 - \gamma_1$ why?

$M_{moon} = \frac{1}{81.3} M_\oplus$

$R_S = 66{,}300$ km

From $R_S = D\left(\frac{M_{moon}}{M_\oplus}\right)^{2/5}$

$= 10.3950$ DU

R_S moon

$D = 60.27\, r_\oplus = 60.27$ DU $= 384{,}400$ KM

ang speed of moon

$\omega_m = 2.649 \times 10^{-6}$ rad/sec

$= 2.137 \times 10^{-3}$ rad/TU

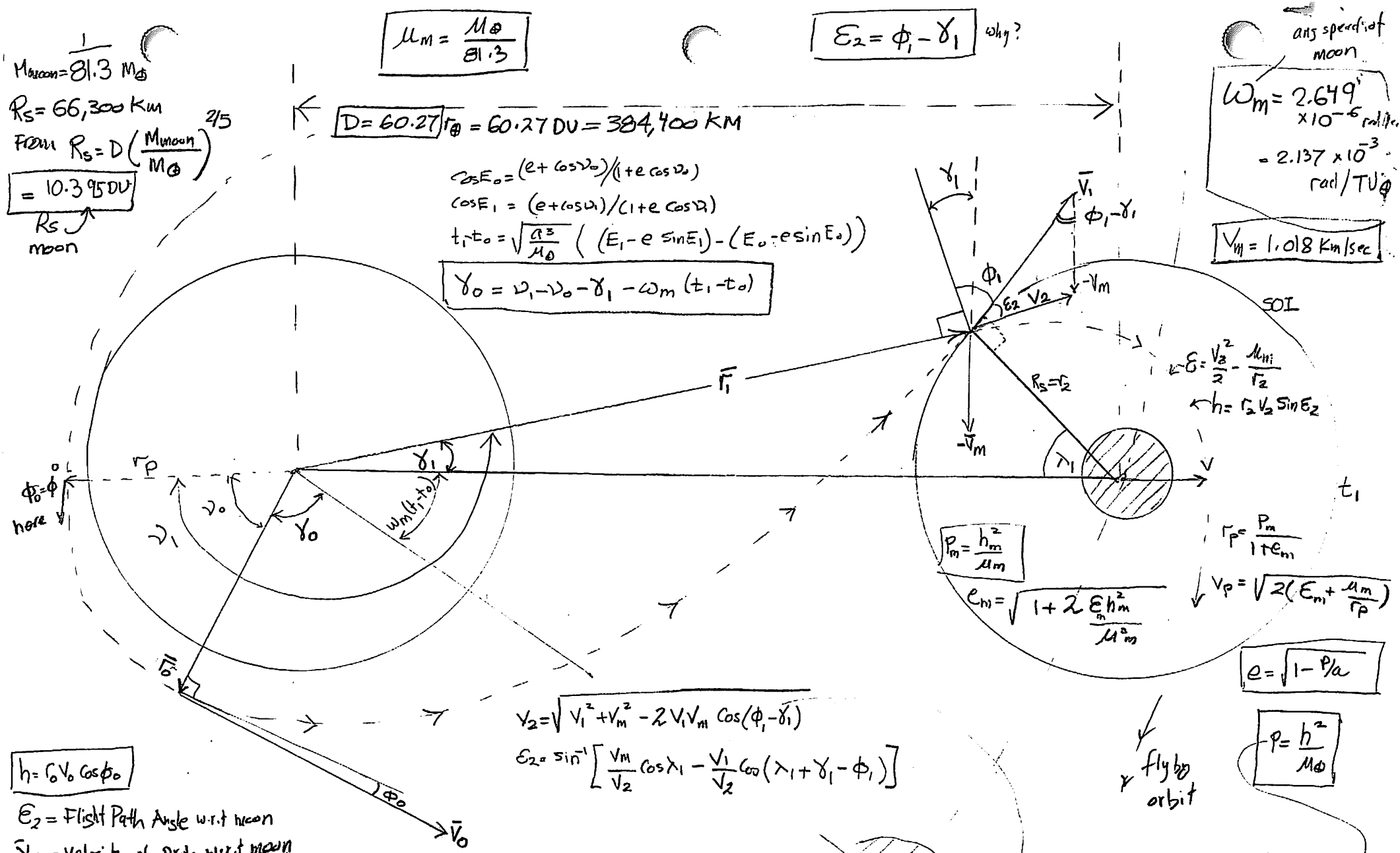
$V_m = 1.018$ Km/sec

$\cos E_0 = (e + \cos\nu_0)/(1 + e\cos\nu_0)$

$\cos E_1 = (e + \cos\nu_1)/(1 + e\cos\nu_1)$

$t_1 - t_0 = \sqrt{\frac{a^3}{\mu_\oplus}}\left((E_1 - e\sin E_1) - (E_0 - e\sin E_0)\right)$

$\gamma_0 = \nu_1 - \nu_0 - \gamma_1 - \omega_m(t_1 - t_0)$



$P_m = \frac{h_m^2}{\mu_m}$

$e_m = \sqrt{1 + 2\frac{\varepsilon_m h_m^2}{\mu_m^2}}$

$r_p = \frac{P_m}{1 + e_m}$

$V_p = \sqrt{2\left(\varepsilon_m + \frac{\mu_m}{r_p}\right)}$

$e = \sqrt{1 - P/a}$

$P = \frac{h^2}{\mu_\oplus}$

$V_2 = \sqrt{V_1^2 + V_m^2 - 2V_1 V_m \cos(\phi_1 - \gamma_1)}$

$\varepsilon_2 = \sin^{-1}\left[\frac{V_m}{V_2}\cos\lambda_1 - \frac{V_1}{V_2}\cos(\lambda_1 + \gamma_1 - \phi_1)\right]$

$h = r_0 V_0 \cos\phi_0$

ε_2 = Flight Path Angle w.r.t moon

$\bar{V}_2$ = Velocity of prob w.r.t moon

given: $\bar{r}_0, \bar{V}_0, \phi_0, \lambda_1$

Find: $\gamma_0, r_1, V_1, \phi_1$

$r_1 = \sqrt{D_1^2 + R_S^2 - 2D_1 R_S \cos\lambda_1}$

$a = \frac{-\mu_\oplus}{2\varepsilon}$

$V_1 = \sqrt{2\left(\varepsilon + \frac{\mu_\oplus}{r_1}\right)}$; $\varepsilon = \frac{V_0^2}{2} - \frac{\mu_\oplus}{r_0}$; $\phi_1 = \cos^{-1}\left(\frac{h}{r_1 V_1}\right)$

γ_1 is Found From $\sin\gamma_1 = \frac{R_S}{r_1}\sin\lambda_1$

flyby orbit

From Pdar eq. of Conic

$r = \frac{P}{1 - e\cos\nu}$

$\cos\nu_0 = \frac{P - r_0}{r_0 e}$

$\cos\nu_1 = \frac{P - r_1}{r_1 e}$