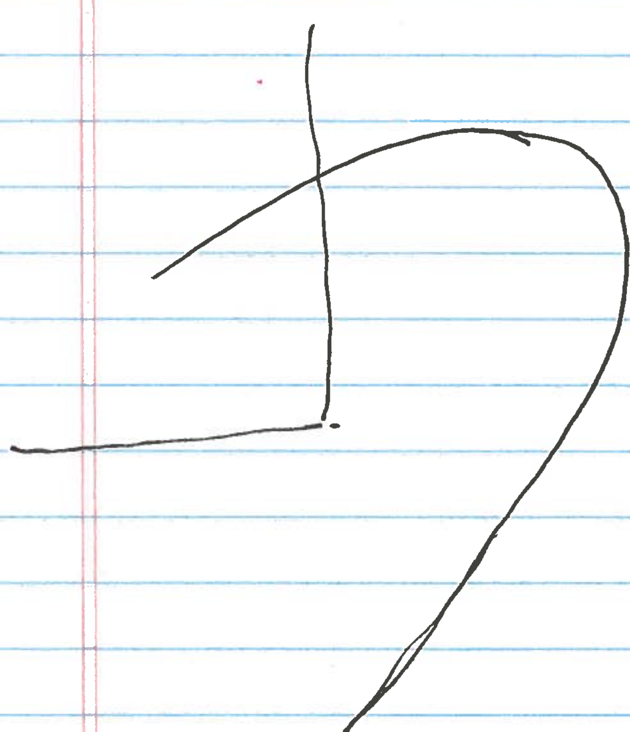
1) Classic orbit Elements
(Revisit)

2) Lambert's Problem

3) Grand Canyon Problem
final comments

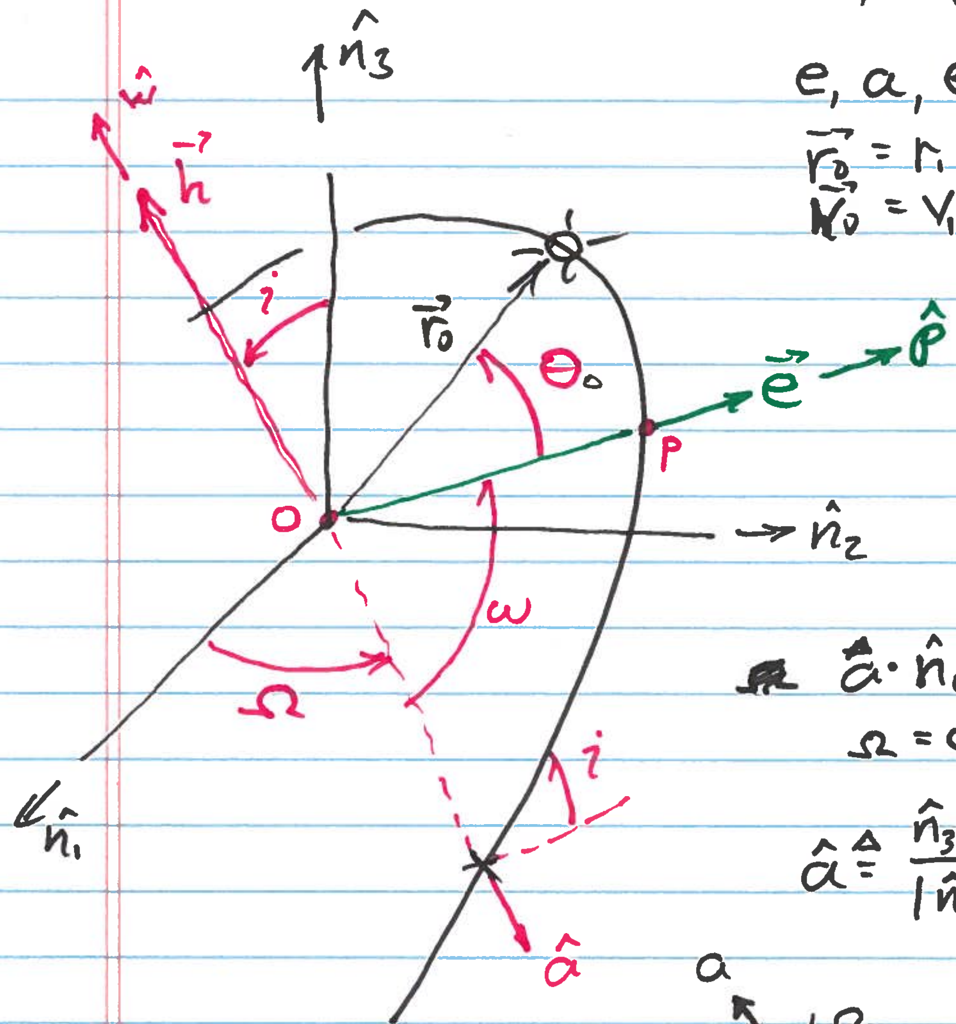


$\vec{r}_0, \vec{v}_0$

$e, a, \Theta_0, \Omega, i, \omega$

$\vec{r}_0 = r_1\hat{n}_1 + r_2\hat{n}_2 + r_3\hat{n}_3$

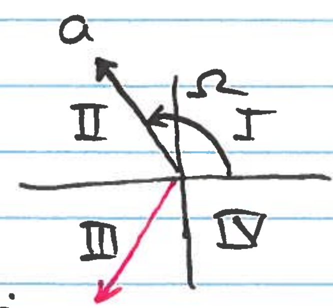
$\vec{v}_0 = v_1\hat{n}_1 + v_2\hat{n}_2 + v_3\hat{n}_3$



$\hat{a}\cdot\hat{n}_1 = \cos\Omega$

$\Omega = \cos^{-1}\{\hat{a}\cdot\hat{n}_1\}$

$$\hat{a} \triangleq \frac{\hat{n}_3\times\vec{h}}{|\hat{n}_3\times\vec{h}|} = \overbrace{\cos\Omega}^{a_x}\hat{n}_1 + \underbrace{\sin\Omega}_{a_y}\hat{n}_2$$



$\Omega = \underbrace{\mathrm{ATAN}_2}_{\mathrm{ATAN2}}(a_y, a_x)$

$\hat{n}_3\cdot\vec{h} = \underbrace{|\hat{n}_3|}_{1}|\vec{h}|\cos i$

$$i = \mathrm{ACOS}\left(\frac{\hat{n}_3\cdot\vec{h}}{h}\right)$$

$\omega = \quad \Rightarrow \quad \hat{a}\cdot\vec{e} = \underbrace{|\hat{a}|}_{1}\underbrace{|\vec{e}|}_{e}\cos\omega$

$\omega = \cos^{-1}\left(\frac{\hat{a}\cdot\vec{e}}{e}\right)$ FINE if $\vec{e}\cdot\hat{n}_3 = e_3 > 0$

$\omega = 2\pi - \omega$ if $e_3 < 0$

Θ_0

$\vec{r}_0 \cdot \vec{v}_1 > 0$? outbound

< 0 INCOMING

$$\vec{r}_0 \cdot \vec{e} = |\vec{r}_0||\vec{e}| \cos \theta_0$$

$$\theta_0 = A\cos\left(\frac{\vec{r}_0 \cdot \vec{e}}{r_0 e}\right)$$ FINE IF

$$r(\theta) = \frac{h^2}{\mu(1 + e\cos\theta)}$$

outbound $\Rightarrow 180 \geq \theta > 0$

INBOUND $\Rightarrow 360 > \theta > 180$

Lambert's Problem