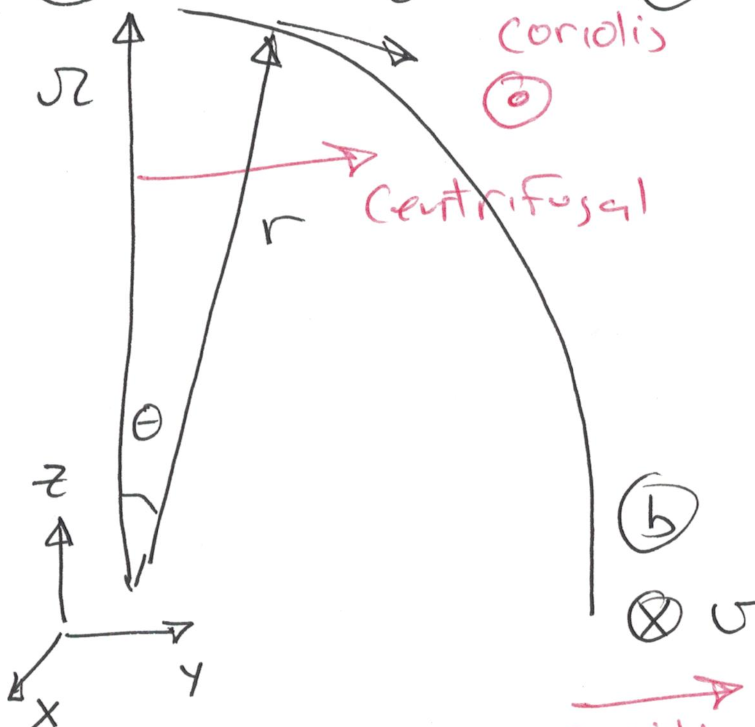
#1

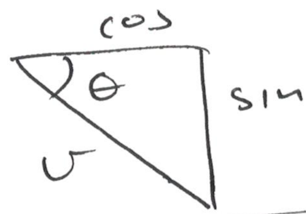


(a)

$$\vec{\Omega} = \Omega(0\ 0\ 1) \quad \text{(x y z)}$$

$$\vec{r} = r(0, \sin\theta, \cos\theta)$$

$$\vec{v} = v_0(0, +\cos\theta, -\sin\theta)$$



(b)

⊗ v

coriolis

centrifugal

$$\vec{\Omega} = \Omega(0\ 0\ 1)$$

$$\vec{r} = r(0\ 1\ 0)$$

$$\vec{v} = v(-1, 0\ 0)$$

(c)

$$\vec{\Omega} = \Omega(0\ 0\ 1)$$

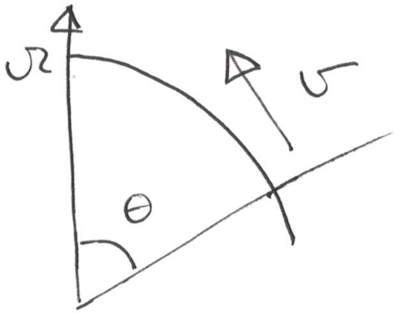
$$\vec{r} = r(0\ 1\ 0)$$

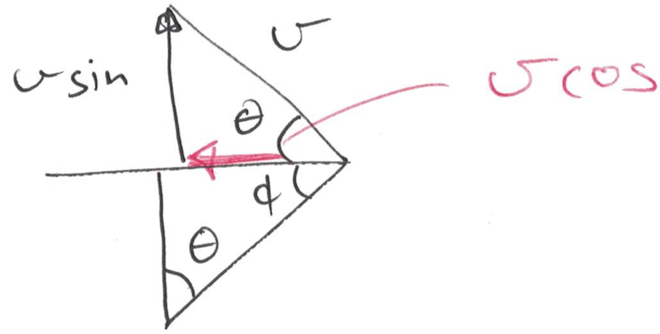
$$\vec{v} = v(0\ 0\ -1)$$

coriolis = 0

centrifugal

#2





$\vec{\Omega} = \Omega(0\,0\,1)$

$\vec{v} = v(0, -\cos\theta, +\sin\theta)$

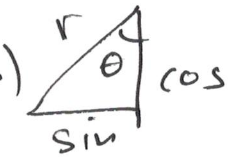
Coriolis $= m\vec{v} \times \vec{\Omega} = -m v \Omega \cos\theta \ \hat{x}$

$-x$ ⊗ East

#3

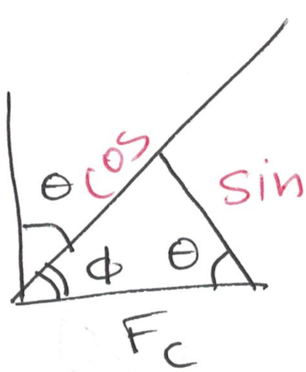
$\vec{\Omega} = \Omega(0\,0\,1)$

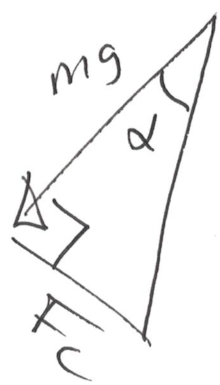
$\vec{r} = r(0, \sin, \cos)$



F_c = Centrifugal $= m(\Omega \times r) \times \Omega$

+y direction →



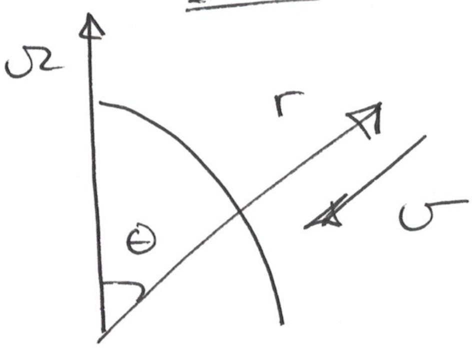


$$\tan\alpha = \frac{F_c}{mg} = \frac{r\Omega^2 \sin(2\theta)}{2g}$$

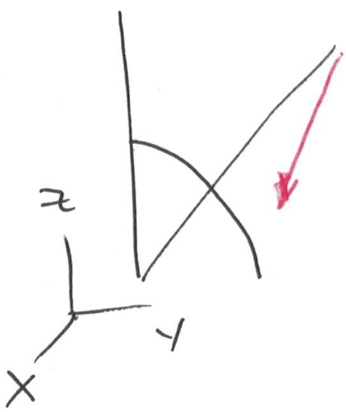
#4 | 9.27

Coriolis $= \vec{v} \times \vec{\Omega} = \otimes$ East

Cent. $= \underbrace{(\Omega \times r)}_{\otimes} \times \Omega = \rightarrow$ UP and south

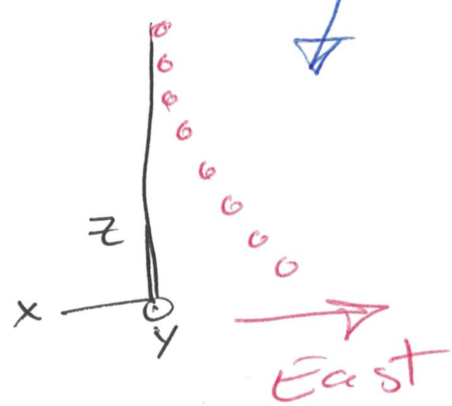


Note: Coriolis $\sim v$
so starts as zero



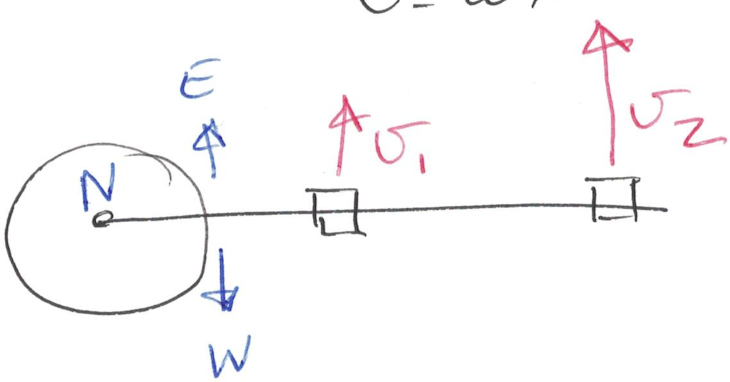
deflection due to cent

constant



Why East

$v = \omega \times r$



Find Eigen Values + Eigen Vectors

$$A = \begin{pmatrix} \cos & \sin \\ -\sin & \cos \end{pmatrix}$$

$$Av = \lambda v \implies |A - \lambda \mathbb{I}| = 0$$

$$\begin{vmatrix} (c-\lambda) & s \\ -s & (c-\lambda) \end{vmatrix} = (c-\lambda)^2 + s^2 = \lambda^2 - 2c\lambda + 1$$

$$\lambda = 2c \pm \sqrt{4c^2 - 4} \,/\!/\, 2 = c \pm \sqrt{-\sin^2}$$

$$\lambda = c \pm is = e^{\pm i\theta}$$

Eigenvectors.

$\lambda = c + is \quad : \quad Av = \lambda v$

$$\begin{pmatrix} c & s \\ -s & c \end{pmatrix}\begin{pmatrix} a \\ b \end{pmatrix} = (c+is)\begin{pmatrix} a \\ b \end{pmatrix}$$

$$\left.\begin{aligned} ca + sb &= (c+is)a \\ -sa + cb &= (c+is)b \end{aligned}\right\} \quad b = ia$$

$$v = \frac{1}{\sqrt{2}}\begin{pmatrix} 1 \\ i \end{pmatrix}$$

$\lambda = c - is \qquad Av = \lambda v$

$$\begin{pmatrix} c & s \\ -s & c \end{pmatrix}\begin{pmatrix} a \\ b \end{pmatrix} = (c-is)\begin{pmatrix} a \\ b \end{pmatrix}$$

$$b = -ia$$

$$\left.\begin{aligned} ca + sb &= (c-is)a \\ -sa + cb &= (c-is)b \end{aligned}\right\} \quad v = \frac{1}{\sqrt{2}}\begin{pmatrix} 1 \\ -i \end{pmatrix}$$