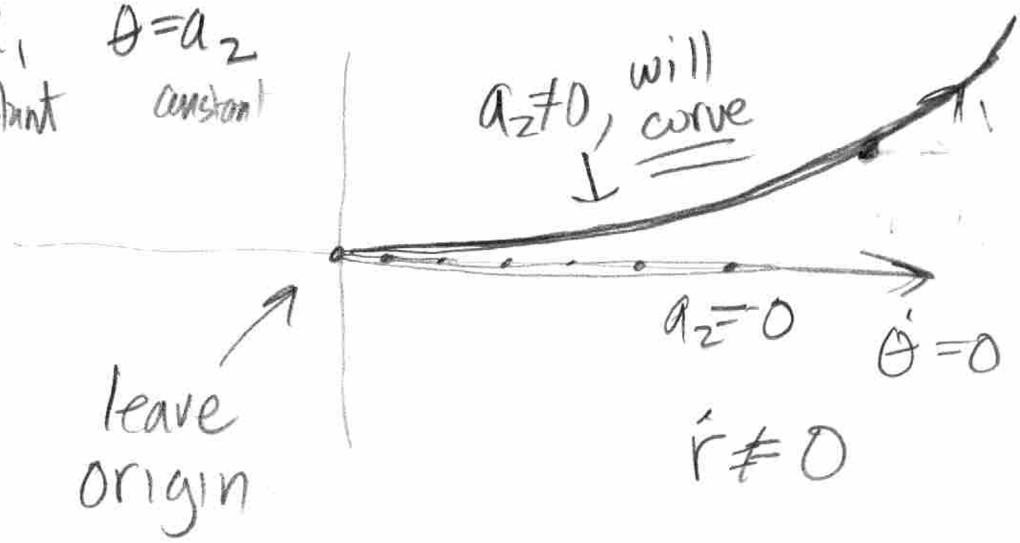
Coriolis: when $\dot{r}$ and $\dot{\theta}$ non-zero.

$\dot{r} = a_1$ constant $\dot{\theta} = a_2$ constant

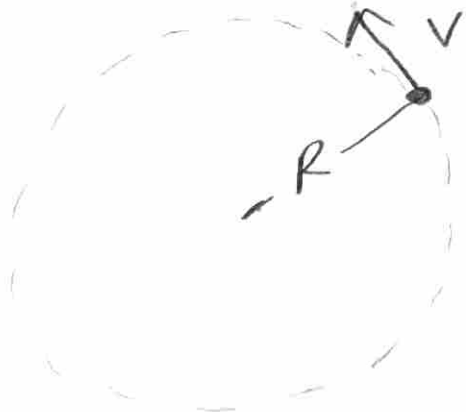


because $v_\theta = r\dot{\theta} = r a_2$

as r grows, v_θ must too.

back to math.

Block on a string: not on earth



$$\boxed{\dot\theta = \frac{v}{R}}$$

$\hat r$ direction:

$$\underbrace{-T}_{\sum \text{forces}} = m(\ddot r - r\dot\theta^2)$$

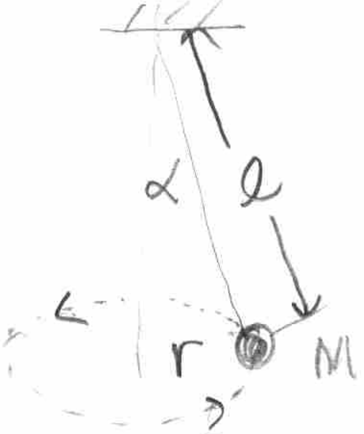
$$\ddot r = 0 \quad (r = R)$$

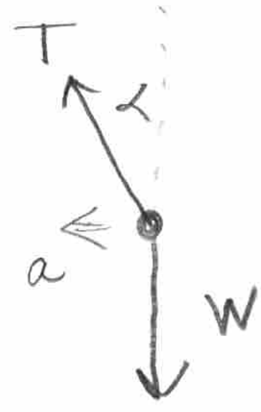
$$\dot\theta = \frac{v}{R}$$

$$-T = -mR\cdot\frac{v^2}{R^2}$$

$$\boxed{T = -m\frac{v^2}{R}}$$

Conical Pendulum





$$\dot\theta = \omega = \frac{v}{r}$$

$$r = l\sin\alpha$$

$$T\cos\alpha - W = 0$$

$$T\cos\alpha = W$$

$$-T\sin\alpha = m(\overset{0}{\cancel{\ddot r}} - r\dot\theta^2)$$

$$-T\sin\alpha = -Mr\omega^2$$

$$r = l \sin\alpha$$

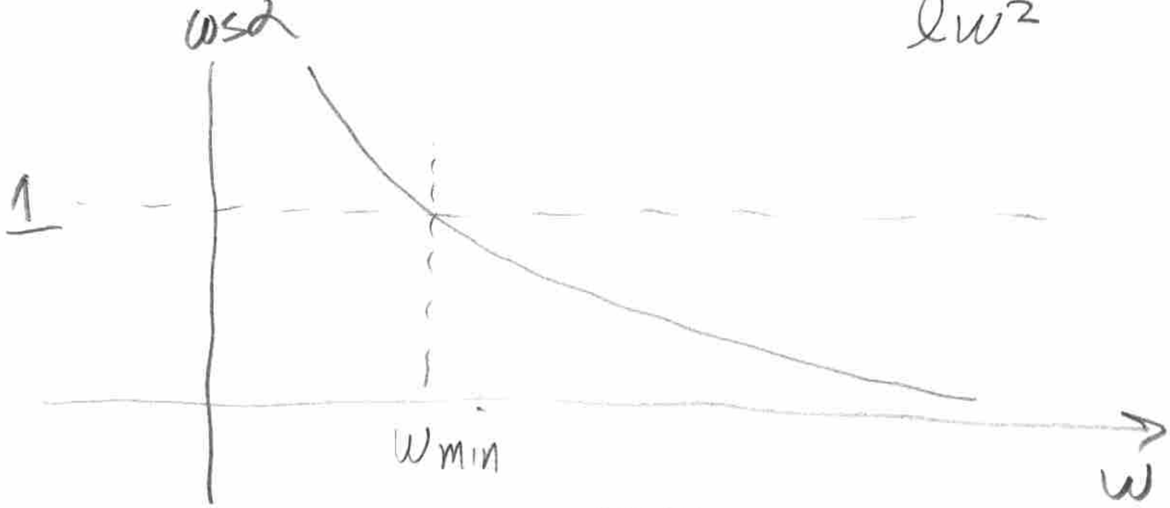
$$T \cancel{\sin\alpha} = M l \cancel{\sin\alpha}\, \omega^2$$

if not $\alpha = 0$

$$T = M l \omega^2$$

check back $\quad \cancel{M} l\omega^2 \cos\alpha = W = \cancel{M} g$

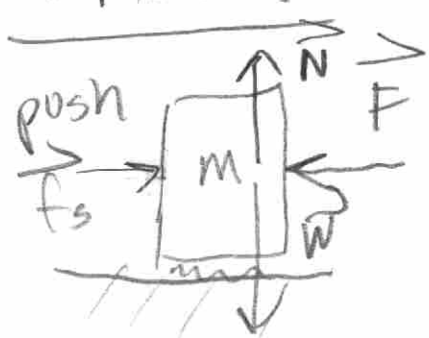
$$\cos\alpha = \frac{g}{l\omega^2}$$



$$\omega_{min} = \sqrt{\frac{g}{l}}$$

"Sleeps" need pendulum motion to get going

Friction follow RHK4 Ch6 pp. 104 – 108



$\vec{f}_s$: static friction pushes back, up to a maximum