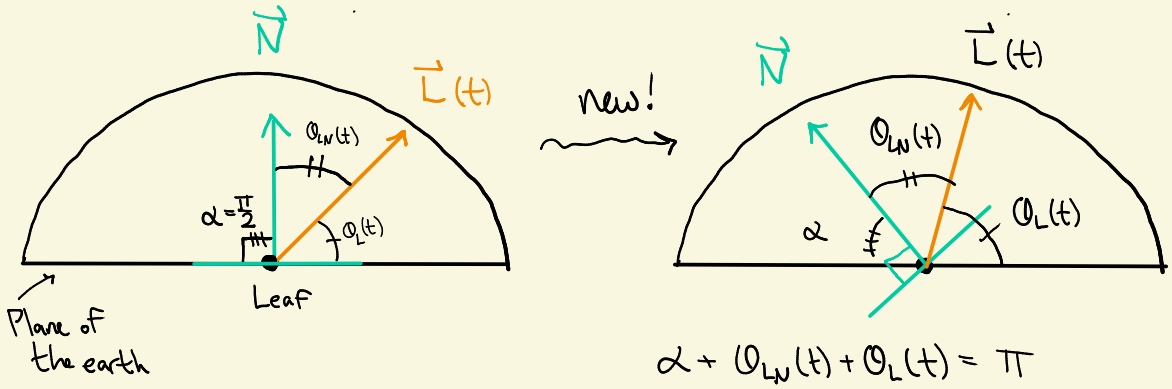
Project 3 (Review + Example Calculation)



$$\alpha + \theta_{LN}(t) + \theta_L(t) = \pi$$

Have a function

$$\Rightarrow \theta_{LN}(t) = (\pi - \alpha) - \theta_L(t).$$

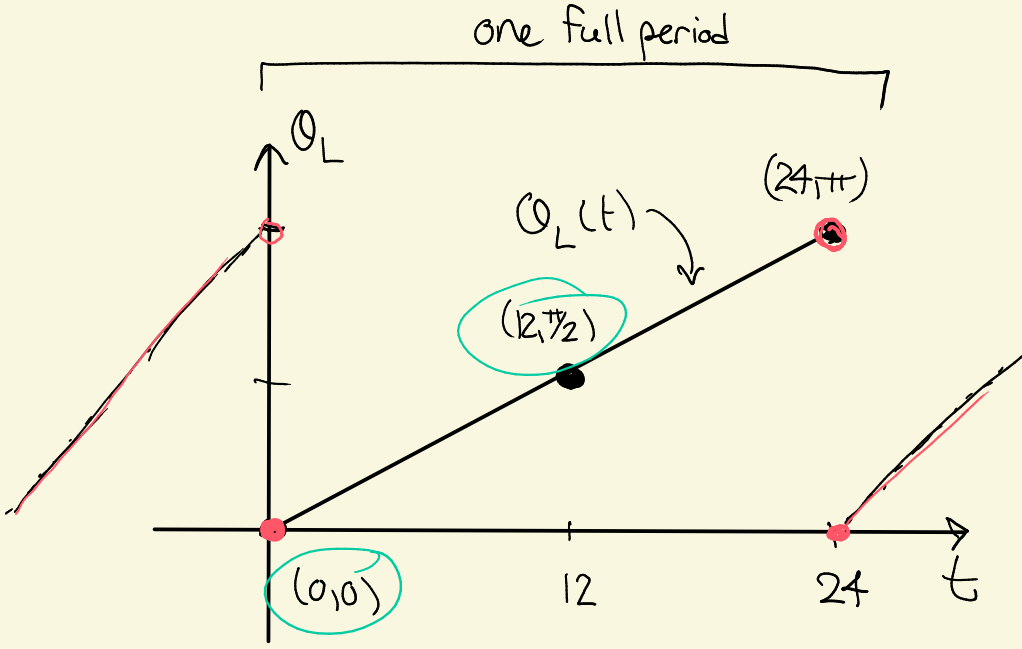
$= ?$

$\theta_L(t) = f(t) = ?$

- $\theta_L(0) = 0$ ✓
- $\theta_L(12) = \pi/2$ ✓
- $\theta_L(24) = \pi$ ✓

+ Periodic, so

- $\theta_L(t) = \theta_L(24+t)$



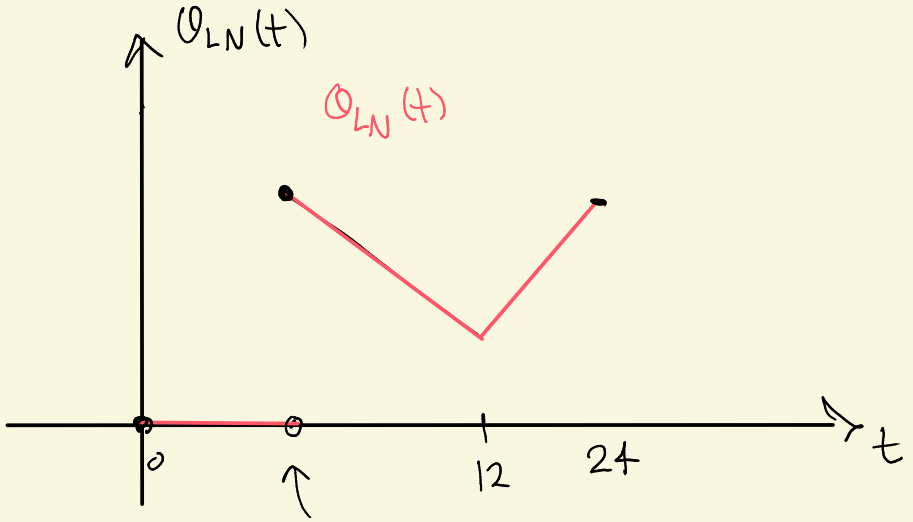
$f(t) = ?$ Use point-slope!

$$m = \frac{\Delta y}{\Delta x} = \frac{\pi/2}{12} = \boxed{\frac{\pi}{24}}, \quad \boxed{b = 0}$$

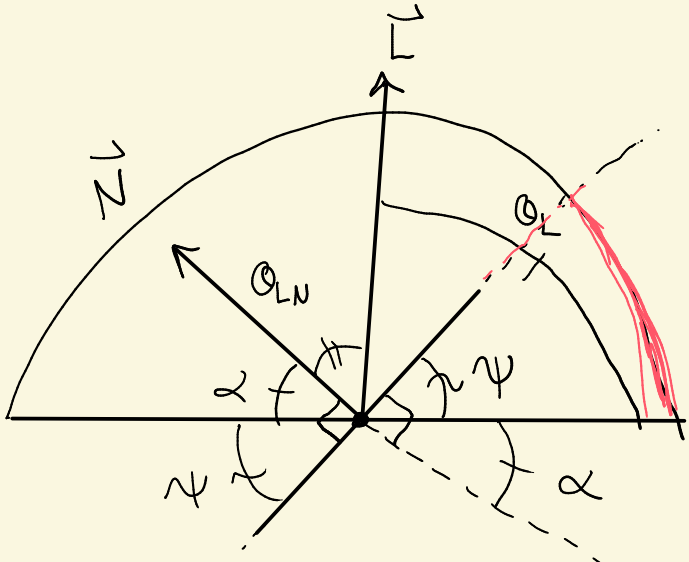
$$\boxed{\theta_L(t) = \left(\frac{\pi}{24}\right)t.} \leftarrow \text{radians}$$

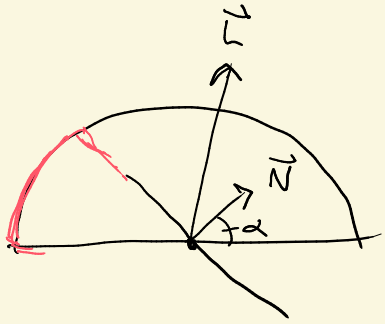
$\Rightarrow \theta_{LN}(t) = (\pi - \alpha) - \theta_L(t)$

$$\Rightarrow \theta_{LN}(t) = (\pi - \alpha) - \left(\frac{\pi}{24}\right) t_0$$



What is this time?



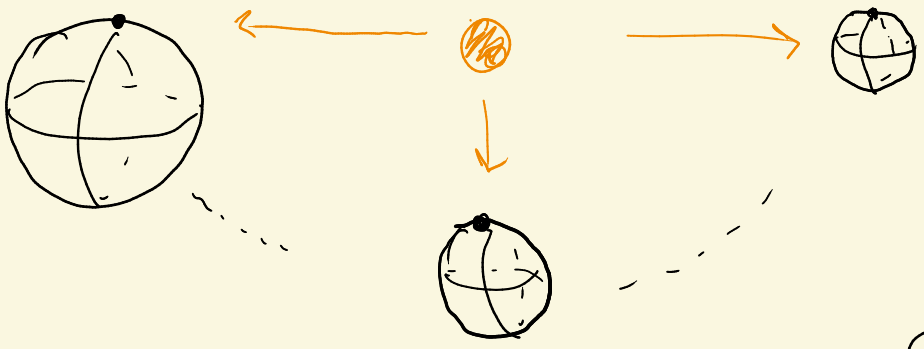


No energy for $\theta_L < \psi$

$$\alpha + \psi = \pi/2 \Rightarrow \psi = \pi/2 - \psi$$

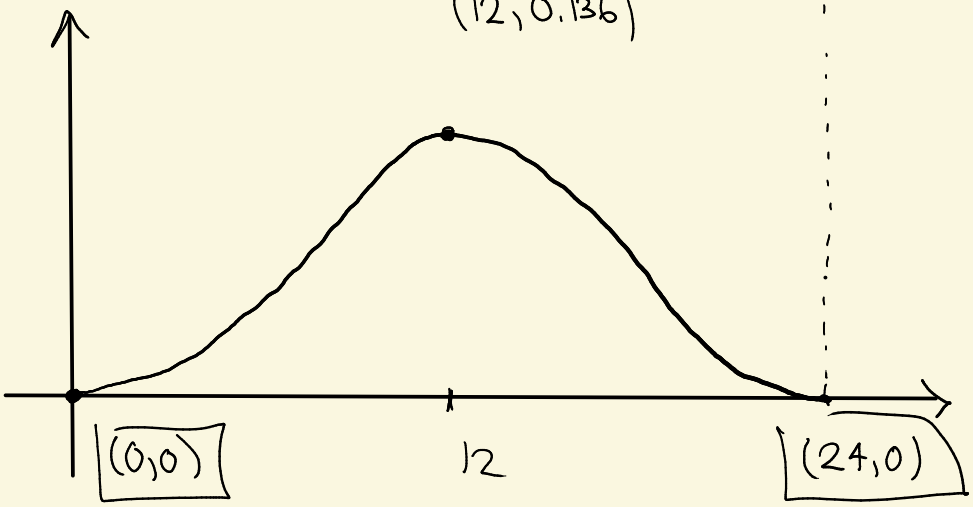
Solve for t in $\theta_L(t) = \psi$. $\rightsquigarrow t_0$

Energy Density (Independent of the leaf)

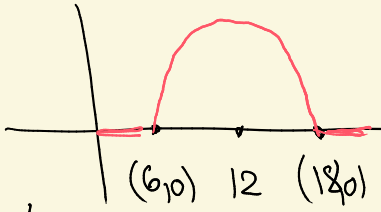


(12, 0.136)

Periodic

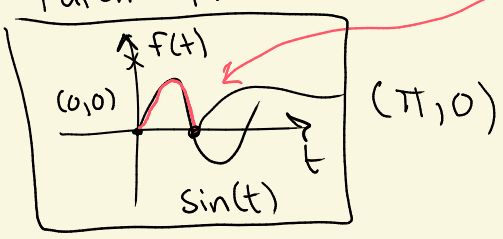


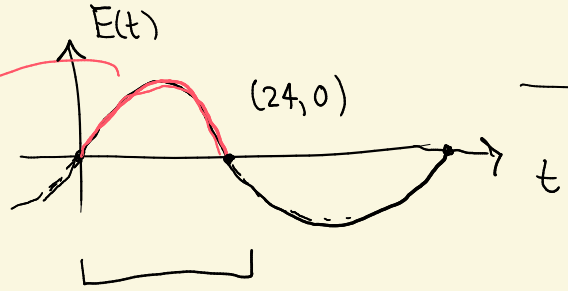
⚠ Caveat: You may need to shrink!



Idea: fit a sine wave

Parent fn





Conclude: $E(t)$ is a half-period of a sine wave

$$E(t) = A \sin(\omega(t-\varphi)) + \delta \qquad T = 2\pi/\omega$$

- $A = 0.136$
- $\varphi = 0$
- $\delta = 0$

- Period $= 48 = 2\pi/\omega$

$\Rightarrow \omega = \pi/24$

$$\Rightarrow \quad E(t) = (0.136) \cdot \sin\left(\frac{\pi}{24} \cdot t\right)$$ on $[0, 24)$

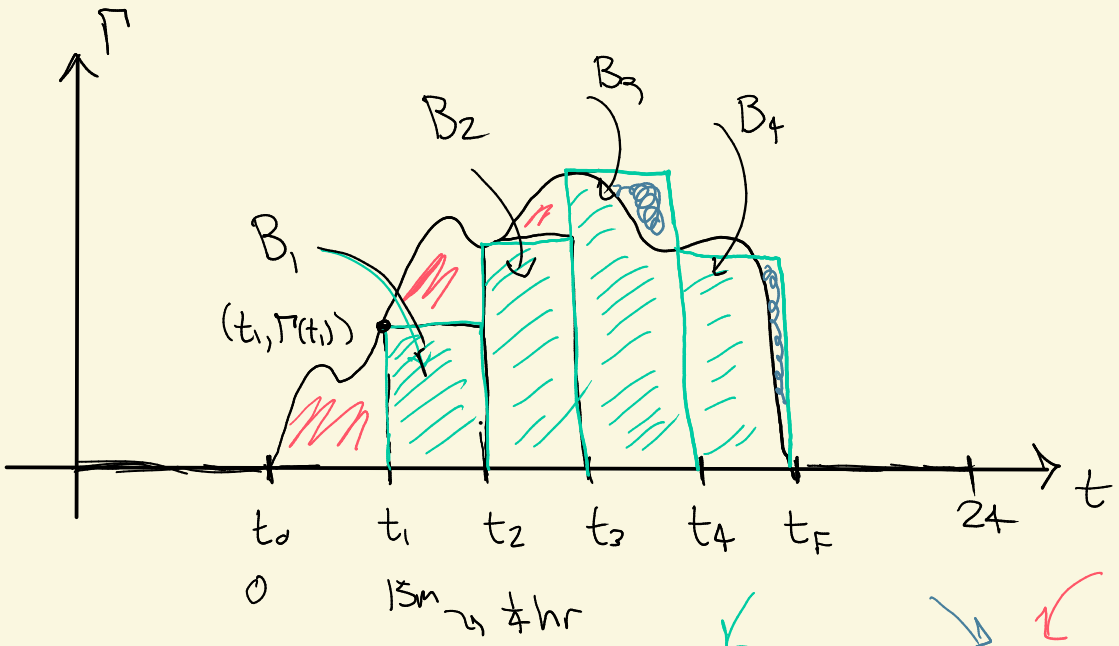
Total Energy

You estimate! (cm^2)

$$\Gamma(t) = \|\vec{L}_y(t)\| \cdot \text{Area}$$

$$= E(t) \sin(\theta_{LN}(t)) \cdot A$$

$$\Rightarrow \Gamma(t) = (0.136) \sin\left(\frac{\pi}{24} t\right) \sin\left(\frac{\pi}{24} t + (\pi - \alpha)\right) \cdot A$$



Total Energy = Total Area = Area of rect + error(n)

t in hours — 15 min

$$\text{Area}(B_1) = \Gamma(t_1)(t_2 - t_1) = \Gamma(t_1) \Delta t \cdot \left(\frac{s}{n}\right)$$

$$+ \quad \text{Area}(B_2) = \Gamma(t_2)(t_3 - t_2)$$