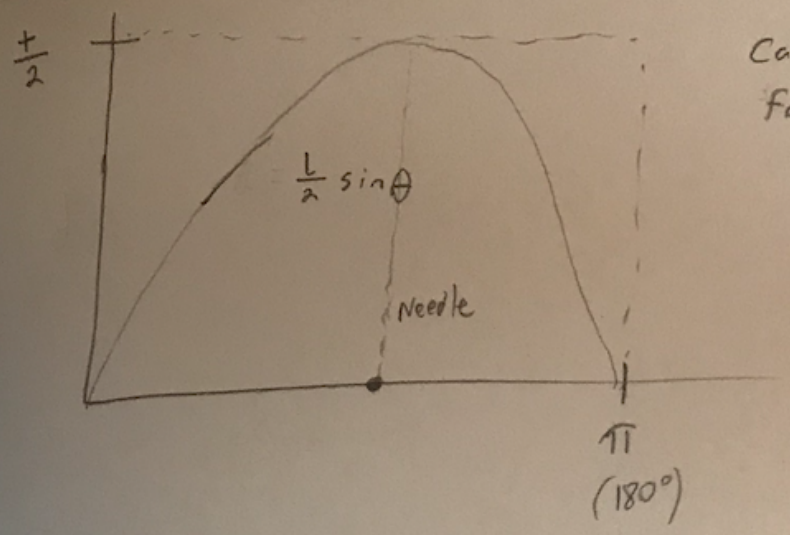
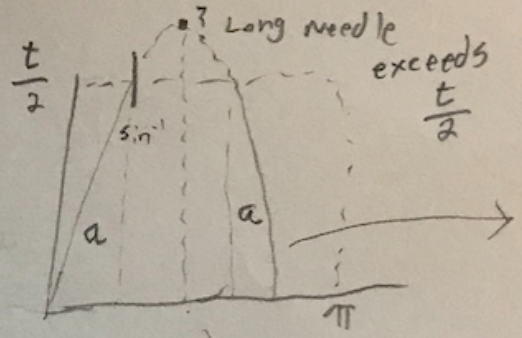
Case 1



Can I generalize for $l \leq t$?

$$P(l,t) = \frac{2l}{\pi t} \quad \text{or} \quad x = \frac{l}{t} \Rightarrow P(x) = \frac{2x}{\pi}$$

Case 2



$\frac{ex}{t}$ width = 1

l needle = 2

$$x = \frac{t}{l} = \frac{1}{2} \rightarrow \sin^{-1}\left(\frac{1}{2}\right) = 30^\circ \left(\frac{\pi}{6}\right)$$

$$\int_0^{\sin^{-1}x} \frac{l}{2}\sin\theta \, d\theta = -l\cos\theta \Big|_0^{\sin^{-1}x}$$

↳ can we just use l?

Trig Property: $\cos(\sin^{-1}x) = \sqrt{1-x^2}$

$$= -l\cos(\sin^{-1}x - 0)$$

Find added area when $l > t$

$$= -l\left(\sqrt{1-x^2} - 1\right)$$

$$a = l\left(1 - \sqrt{1-x^2}\right)$$

$$2a = 2l\left(1 - \sqrt{1-x^2}\right)$$