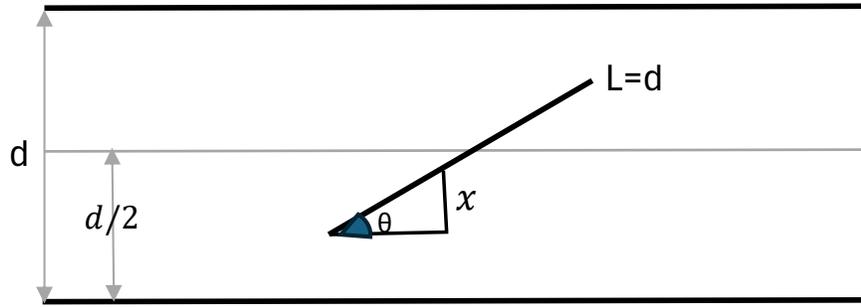# Buffon's Needle Problem Solution
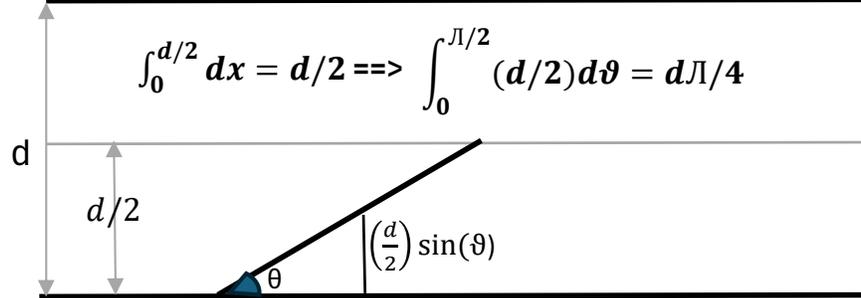
What is the probability that the needle will cross a line?
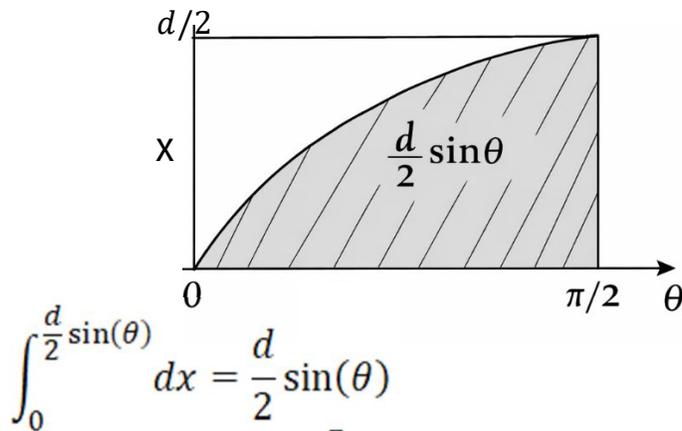
L=d

d

d/2

x

θ

1. we will look at $0 \leq x \leq d/2$
2. We will then consider $0 \leq \theta \leq \text{Л}/2$

$d/2$

dЛ/4

Л/2
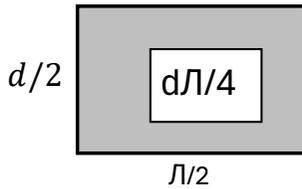
All possible positions for the needle given the conditions (1) and (2)

$$\int_0^{d/2} dx = d/2 \implies \int_0^{\text{Л}/2} (d/2)d\vartheta = d\text{Л}/4$$

d

d/2

$\left(\dfrac{d}{2}\right)\sin(\vartheta)$

θ

All possible positions for the needle to cross the bottom line.

d/2

X

$\dfrac{d}{2}\sin\theta$

0

$\pi/2$ θ

$$\int_0^{\frac{d}{2}\sin(\theta)} dx = \frac{d}{2}\sin(\theta)$$

$$Crossing\ drops = \int_0^{\frac{\pi}{2}} \frac{d}{2}\sin(\theta)d\theta = d/2\int_0^{\frac{\pi}{2}}\sin(\theta)d\theta = \mathbf{d/2}$$

Prob Crossing =(d/2)/(dЛ/4)=2d/dЛ=2/Л~=2/3

In General L < d Prob Crossing =(L/2)/(dЛ/4)=**2L/dЛ**