

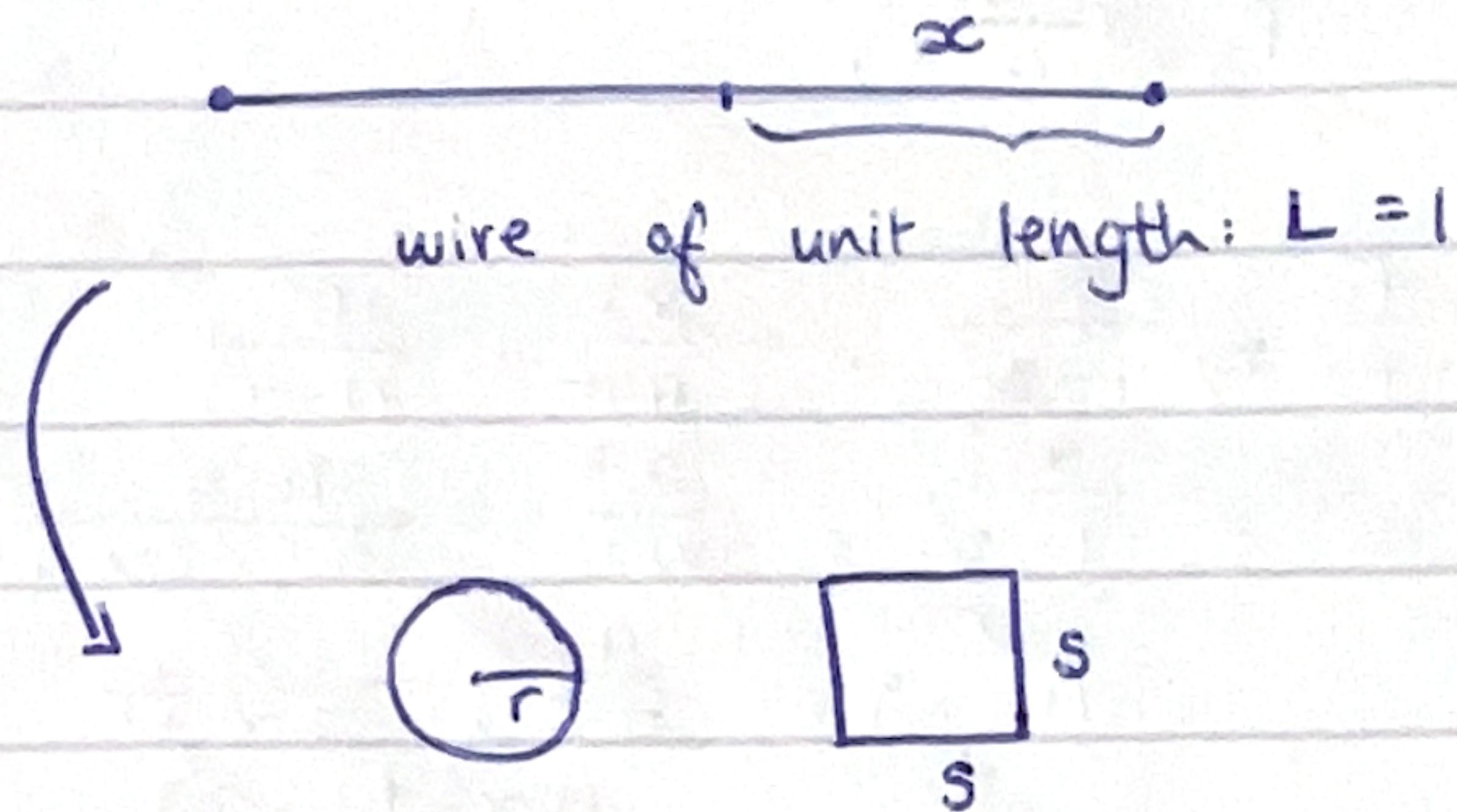
Solo Project - Circle + Square.

Area of circle = πr^2

Perimeter of circle = $2\pi r$

Area of square = s^2

Perimeter of square = $4s$



$\rightarrow P_c = 2\pi r = x$

$r = \frac{x}{2\pi}$

$A_c = \pi r^2$

$= \pi \left(\frac{x}{2\pi}\right)^2$

$= \pi \frac{x^2}{4\pi^2} = \frac{x^2}{4\pi}$

$\rightarrow P_s = 4s = (1-x)$

$s = \frac{1-x}{4}$

$A_s = s^2$

$= \left(\frac{1-x}{4}\right)^2$

$= \frac{(1-x)^2}{16}$

 $\rightarrow A_c + A_s$ is minimum

@ $\frac{A_c}{A_s} = \frac{P_c}{P_s}$

minimum $\Rightarrow \frac{d}{dx}() = 0$

$$\begin{aligned} \frac{d}{dx} \left(\frac{x^2}{4\pi} + \frac{(1-x)^2}{16} \right) &= 0 \\ \frac{dA_c}{dx} = \frac{2x}{4\pi} + \frac{d}{dx} \left(\frac{x^2 - 2x + 1}{16} \right) &= 0 \\ = \frac{2x}{4\pi} + \frac{1}{16} (2x - 2) &= 0 \\ = \frac{2x}{4\pi} + \frac{x-1}{8} &= 0 \\ = \frac{8(2x) + 4\pi(x-1)}{32\pi} &= 0 \\ = \frac{16x + 4\pi x - 4\pi}{32\pi} &= 0 \\ = \frac{4x + \pi x - \pi}{8\pi} &= 0 \\ = \frac{x(4+\pi)}{8\pi} - \frac{\pi}{8\pi} &= 0 \\ x \frac{4+\pi}{8\pi} &= \frac{1}{8} \end{aligned}$$

$x = \frac{\pi}{4+\pi}$

①

$$x = \frac{\pi}{4+\pi}$$

$$\frac{A_c}{A_s} = \frac{P_c}{P_s}$$

$$A_c = \frac{\pi x^2}{4\pi}$$

$$P_c = \alpha$$

$$A_s = \frac{(1-x)^2}{16}$$

$$P_s = (1-\alpha)$$

$$\begin{aligned}\frac{A_c}{A_s} &= \frac{P_c}{P_s} \Rightarrow \frac{x}{1-\alpha} = \frac{\pi x^2}{4\pi} \cdot \frac{16}{(1-\alpha)^2} \\ &= \frac{x}{1-\alpha} = \frac{\pi x^2}{4\pi} \cdot \frac{16}{x^2 - 2x + 1} \\ \frac{x}{1-\alpha} &= \frac{4x^2}{\pi(x^2 - 2x + 1)} \\ \frac{x}{1} &= \frac{4x^2(1-\alpha)}{\pi(1-\alpha)(1-\alpha)} \\ x &= \frac{4x^2}{\pi(1-\alpha)}\end{aligned}$$

$$x\pi(1-\alpha) = 4x^2$$

$$x\pi - \alpha x\pi = 4x^2$$

$$x\pi = 4x^2 + \pi x^2$$

$$\alpha x\pi = x^2(4+\pi)$$

$$x = \frac{\pi}{4+\pi} \quad \textcircled{2}$$

□

① = ②

$$r = \frac{x}{2\pi} = \frac{\pi}{4+\pi} \cdot \frac{1}{2\pi}$$

$$= \frac{1}{8+2\pi}$$

$$\begin{aligned}s &= \frac{1-x}{4} = \frac{1}{4} \left(1 - \frac{\pi}{4+\pi}\right) \\ &= \frac{1}{4} - \frac{\pi}{16+4\pi} \\ &= \frac{4+4\pi-\pi}{16+4\pi \cdot 4} \\ &= \frac{4+\pi-\pi}{16+4\pi} \\ &= \frac{1}{4+\pi}\end{aligned}$$

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$$\frac{r}{s} = \frac{4+\pi}{8+2\pi}$$

$$\frac{r}{s} = \frac{1}{2}$$

$$r = \frac{1}{2}s$$