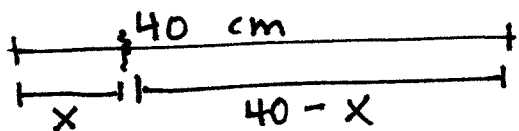


Optimization Day 2

EX 1 piece of wire 40cm long
cut into 2 pieces to form a circle & a square
Find the lengths of each piece that cause
the sum of the area of the circle &
the area of the square to be a minimum.



use x for \bigcirc , use $40-x$ for \square

$$C = x$$

$$2\pi r = x$$

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

$$P = 40 - x$$

$$S = \frac{40-x}{4}$$

$$A = \pi r^2 + S^2 = \pi \left(\frac{x}{2\pi}\right)^2 + \left(\frac{40-x}{4}\right)^2$$

$$= \pi \cdot \frac{x^2}{4\pi^2} + \left(10 - \frac{1}{4}x\right)^2$$

$$A = \frac{1}{4\pi} x^2 + 100 - 5x + \frac{1}{16} x^2$$

$$A' = \frac{1}{2\pi} \cdot 2x - 5 + \frac{1}{8} x = 0$$

$$\frac{1}{2\pi} x + \frac{1}{8} x = 5$$

$$x \left(\frac{1}{2\pi} + \frac{1}{8}\right) = 5$$

$$x = \frac{5}{\frac{1}{2\pi} + \frac{1}{8}} = \frac{5}{\frac{4+\pi}{8\pi}} = \frac{40\pi}{4+\pi}$$

circle: $\frac{40\pi}{4+\pi}$ cm

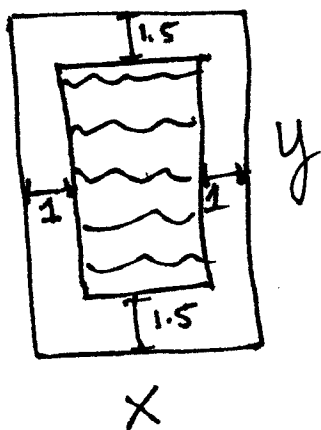
Sq: $\left(40 - \frac{40\pi}{4+\pi}\right)$ cm

$$\frac{40\pi}{4+\pi} \leftarrow \text{min}$$

17.596

EX2 rectangular page is to have 24 in^2 of print.
 top & bottom margins = 1.5 in each
 side margins = 1 in each

Find the dimensions of the page so that the least amount of paper is used.



$$A = xy \text{ minimize}$$

$$A_{\text{print}} = (x-2)(y-3) = 24$$

$$y-3 = \frac{24}{x-2}$$

$$y = 3 + \frac{24}{x-2}$$

$$A = x \left(3 + \frac{24}{x-2} \right) = x \left(\frac{3(x-2) + 24}{x-2} \right) = x \left(\frac{3x-6+24}{x-2} \right)$$

$$A = \frac{3x^2 + 18x}{x-2}$$

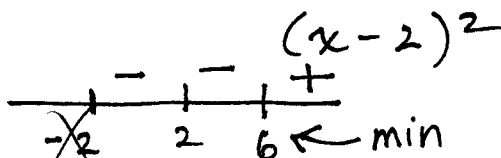
$$A' = \frac{(x-2)(6x+18) - (3x^2+18x)(1)}{(x-2)^2}$$

$$3x^2 - 12x - 36 = 0 = \frac{6x^2 + 6x - 36 - 3x^2 - 18x}{(x-2)^2}$$

$$3(x^2 - 4x - 12) = 0$$

$$3(x-6)(x+2) = 0 = \frac{3x^2 - 12x - 36}{(x-2)^2}$$

$$x = 6, -2$$



undef $x=2$

$$y = 3 + \frac{24}{6-2} = 9$$

6in by 9in