

MATH 1101Y 2009 Quiz 8 (b)

1. A poster is to have a printed area of 180 in^2 with 1-inch margins at the sides and 2-inch margins at the top and bottom. What dimensions will use the least material?

Solution: Let the width of the printed area of the poster be x and the length be y . We have $xy = 180$ and the area of the poster is

$$\begin{aligned} A &= (x + 2)(y + 4) \\ &= (x + 2)\left(\frac{180}{x} + 4\right) \end{aligned}$$

$$\begin{aligned} \frac{dA}{dx} &= \left(\frac{180}{x} + 4\right) + (x + 2)\left(-\frac{180}{x^2}\right) \\ &= \frac{180}{x} + 4 - \frac{180}{x} - \frac{360}{x^2} \\ &= 4 - \frac{360}{x^2}. \end{aligned}$$

Let $\frac{dA}{dx} = 0$. We have

$$\begin{aligned} 4 - \frac{360}{x^2} &= 0 \\ \frac{360}{x^2} &= 4 \\ 4x^2 &= 360 \\ x &= 3\sqrt{10} \approx 9.4868 \\ y &= 6\sqrt{10} \approx 18.974 \end{aligned}$$

The poster with width 11.5 and length 23 will use the least material. □