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# Simple Geometrical Calculus

M. Abdulla
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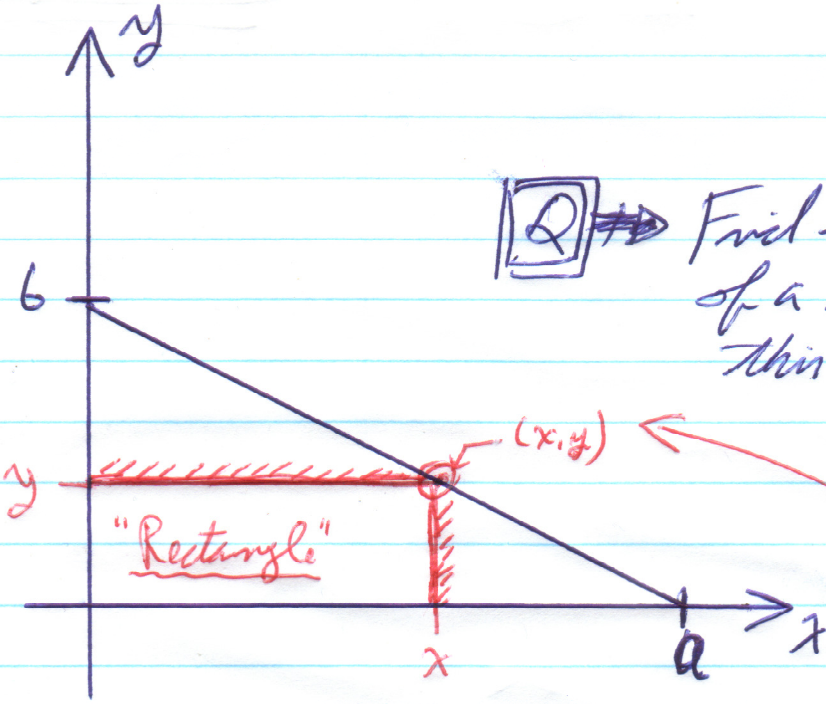


$\boxed{Q}$ ⇒ Find the largest dimension of a rectangular box inside this right triangle.

$$(a,b) \in \mathbb{R}^2_{+,\infty}$$

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1° find equation of line for the hypotenuse of right triangle.

$$y = mx + b. \qquad m \triangleq \text{slope} = \frac{\Delta y}{\Delta x} = \frac{-b}{a}$$

$$b \triangleq y\text{-intercept} = b.$$

$$\therefore \quad \boxed{y} = \frac{-b}{a}x + b = \boxed{b\left(1 - \frac{x}{a}\right)}$$

2° largest rectangle → i.e. look at the "area" of rectangle.

$$\boxed{A_R} = (x)(y) = (x)\, b \left(1 - \frac{x}{a}\right) = \boxed{bx\left(1 - \frac{x}{a}\right)}$$

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## 3° Maximize Area:

$$\max_{x\in\mathbb{R}_+^*}\{A_R(x)\} = \max_{x\in\mathbb{R}_+^*}\left\{bx\left(1-\frac{x}{a}\right)\right\} = ?$$

$$A_R(x) = bx\left(1-\frac{x}{a}\right)$$

$$A_R'(x) = b\left(x-\frac{x^2}{a}\right)' = b\left(1-\frac{2x}{a}\right) = 0.$$

$$b \neq 0. \quad \left(1-\frac{2x}{a}\right) = 0.$$

$$1 = \frac{2x}{a}$$

or $\frac{2x}{a} = 1$

or $\boxed{x_{opt} = \frac{a}{2}}$ [unit]

Answer!

Dimension of largest Rectangle inside △ are
$x = a/2$
$y = b/2$

if $\boxed{x = \frac{a}{2}}$ then

$$\boxed{y_{opt}} = f\left(x=\frac{a}{2}\right) = b\left(1-\frac{1}{\cancel{a}}\frac{\cancel{a}}{2}\right) = b\left(1-\frac{1}{2}\right) = \boxed{\frac{b}{2}}$$ [unit]

or

$$\boxed{\max_{x\in\mathbb{R}_+^*}\{A_R(x)\}} = A_R(x_{opt}) = A_R\left(\frac{a}{2}\right) = b\frac{a}{2}\left(1-\frac{1}{\cancel{a}}\frac{\cancel{a}}{2}\right)$$

$$= \frac{ab}{2}\left(\frac{1}{2}\right) = \boxed{\frac{ab}{4}}$$ [unit²]

Area of red rectangle!

the end!