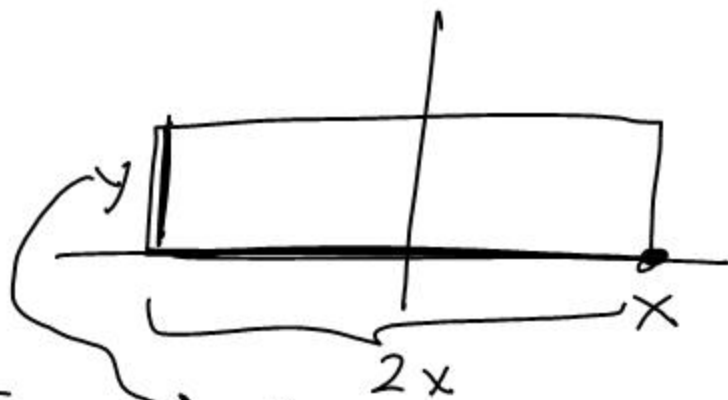


Optimization

#3



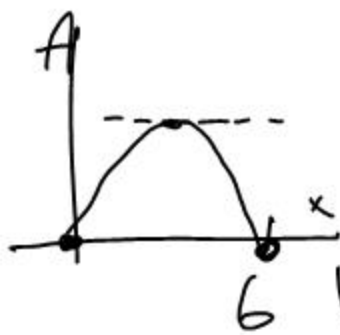
$$A(x) = 2x \cdot \frac{2\sqrt{36-x^2}}{3}$$

$$A(x) = \frac{4x\sqrt{36-x^2}}{3},$$
$$0 < x < 6$$

$$\frac{y^2}{16} = 1 - \frac{x^2}{36}$$

$$y^2 = 16 - \frac{4x^2}{9}$$

$$y = \sqrt{16 - \frac{4x^2}{9}}$$



$$\sqrt{\frac{16 \cdot 9}{9} - \frac{4x^2}{9}}$$

$$\sqrt{\frac{144 - 4x^2}{9}}$$

$$= \frac{\sqrt{144 - 4x^2}}{3}$$

$$= \frac{2\sqrt{36 - x^2}}{3},$$

$$x \in (0, 6)$$

"is an element of"

$$(x)^2$$

$$y = \overbrace{\frac{4}{3}x}^{\text{first}} \cdot \overbrace{\sqrt{36-x^2}}^{\text{second}}$$

$$y' = \frac{4}{3}x \cdot \frac{1}{2}(36-x^2)^{-1/2}(-2x) + (36-x^2)^{1/2} \cdot \frac{4}{3}$$

$$= \frac{4}{3}(36-x^2)^{-1/2}[-x^2 + (36-x^2)]$$

$$= \frac{4}{3}(36-2x^2)$$

$$\frac{4}{3} \frac{(36-2x^2)}{\sqrt{36-x^2}} = 0$$

$$\frac{1.4}{3} = 4.2$$

$$x^2 = 18$$

$$\boxed{x = 3\sqrt{2}} \approx 4.2$$

max

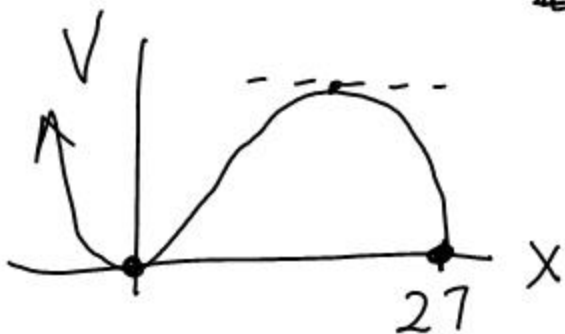
$$A = \frac{12\sqrt{2} \sqrt{36-18}}{3} = \frac{12\sqrt{2} \cdot 3\sqrt{2}}{3}$$

$$\boxed{A = 24}$$

7

$$V = x^2 y \quad \leftarrow \text{maximize this}$$
$$4x + y = 108 \quad \leftarrow \text{equation}$$

$\underbrace{4x + y}_{\text{girth} + \text{length}}$



$$y = 108 - 4x$$

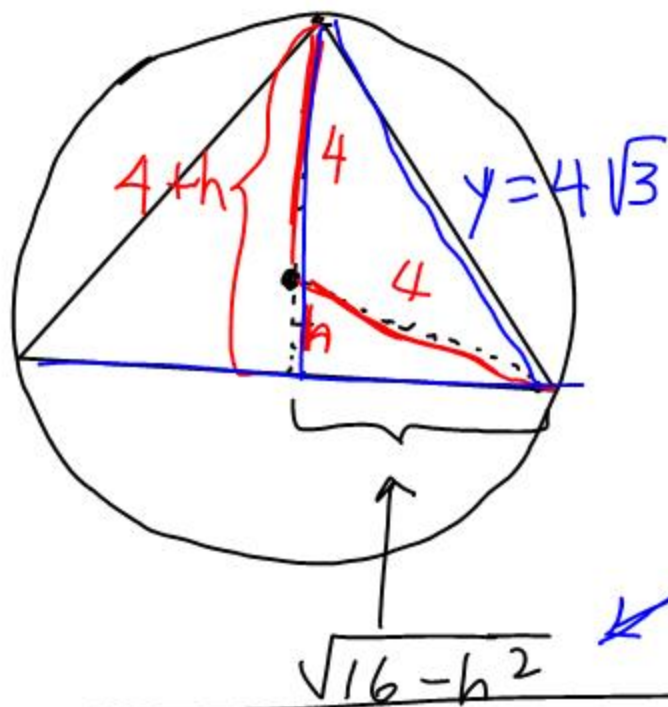
$$V = x^2(108 - 4x) = 108x^2 - 4x^3$$

$$V' = 216x - 12x^2 = 0$$

$$12x(18 - x) = 0$$

~~$x = 0$~~ or $x = 18$

dimensions: $x = 18 \text{ in}$
 $y = 36 \text{ in}$



$$x^2 + h^2 = 4^2$$

$$x^2 = 16 - h^2$$

$$x = \sqrt{16 - h^2}$$

$$6^2 + (2\sqrt{3})^2 = y^2$$

$$\sqrt{16 - h^2}$$

$$A(h) = \sqrt{16 - h^2} (4 + h), \quad 0 < h < 4$$

$$A'(h) = (16 - h^2)^{1/2} + (4 + h) \cdot \frac{1}{2} (16 - h^2)^{-1/2} \cdot -2h$$

$$\cancel{(16 - h^2)^{1/2}} [(16 - h^2) - 4h - h^2] = 0$$

$$16 - 4h - 2h^2 = 0$$

$$8 - 2h - h^2 = 0$$

$$(4 + h)(2 - h) = 0$$

$$\cancel{h = -4} \text{ or } \boxed{h = 2}$$

HW

optimization
4, 5, 8, 10

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