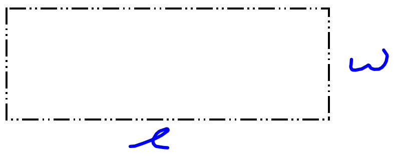
Ex1. Maximize the area of the given pens if 40 m of fencing can be used.

a.



$2l + 2w = 40$

$2w = 40 - 2l$

$w = 20 - l$

$A = lw$

$A(l) = l(20 - l)$

$= 20l - l^2$

$A'(l) = 20 - 2l$

IF $A'(l) = 0$

$\therefore$ $20 = 2l$

$l = 10$

$w = 20 - l$

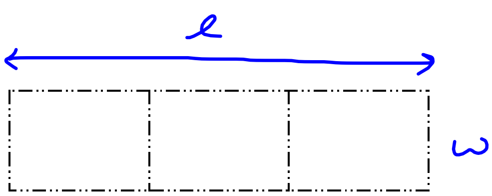
$= 20 - 10$

$= 10$

$\therefore$ Max $A = 10(10)$

$= 100\,m^2$

b.



$2l + 4w = 40$

$2l = 40 - 4w$

$l = 20 - 2w$

$A = lw$

$A(w) = (20 - 2w)(w)$

$= 20w - 2w^2$

$A'(w) = 20 - 4w = 0$

$\therefore$ $4w = 20$

$w = 5$

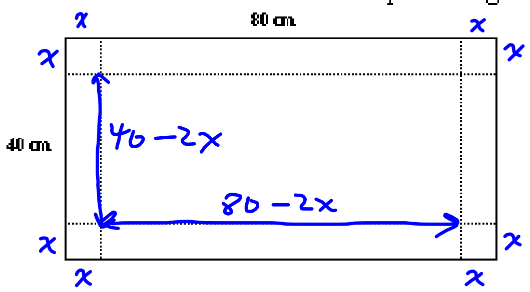
Max $A = (20 - 2w)(w)$

$= (20 - 10)(5)$

$= (10)(5)$

$= 50\,m^2$

Ex2. Maximize the volume of an open box given the net below. The corners are squares.



$$V = lwh$$

$$V(x) = (80-2x)(40-2x)(x)$$

$$= (-2)(x-40)(-2)(x-20)(x)$$

$$= 4x(x-40)(x-20)$$

$$= 4x(x^2-60x+800)$$

$$= 4(x^3-60x^2+800x)$$

$$V'(x) = \cancel{4}(3x^2-120x+800) = 0$$

$$\therefore \quad x = \frac{120 \pm \sqrt{4800}}{6}$$

$$x \doteq \underline{\cancel{31.547}} \text{ or } \underline{8.453}$$

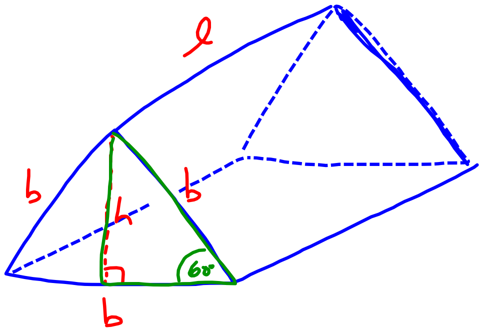
Thus,

Max V

$= (80-2x)(40-2x)(x)$

$\doteq \underline{\underline{12317 \text{ cm}^3}}$

Ex3. Minimize the surface area of a triangular prism open at one end if the volume is 500 cm^3.



$$\sin 60 = \frac{h}{b}$$

$$\frac{\sqrt{3}}{2} = \frac{h}{b}$$

$$h = \frac{\sqrt{3}}{2} b$$

$$BA = \frac{1}{2} bh$$

$$= \frac{1}{2} b \frac{\sqrt{3}}{2} b$$

$$= \frac{\sqrt{3}}{4} b^2$$

$$BA \cdot \ell = 500$$

$$\frac{\sqrt{3}}{4} b^2 \cdot \ell = 500$$

$$\ell = \frac{2000}{\sqrt{3}\, b^2}$$

$$SA = BA + 3b\ell$$

$$= \frac{1}{2} bh + 3b\ell$$

$$= \frac{\sqrt{3}}{4} b^2 + 3b\left(\frac{2000}{\sqrt{3}\, b^2}\right)$$

$$= \frac{\sqrt{3}}{4} b^2 + \frac{6000}{\sqrt{3}} b^{-1}$$

$$\frac{d}{db}(SA) = \frac{\sqrt{3}}{2} b - \frac{6000}{\sqrt{3}} b^{-2} = 0$$

$$\frac{\sqrt{3}\, b}{2} = \frac{6000}{\sqrt{3}\, b^2}$$

$$b^3 = \frac{12000}{3}$$

$$b^3 = 4000$$

$$b = \sqrt[3]{4000}$$

$$\doteq$$

$\therefore$ MIN SA

$$= \frac{\sqrt{3}}{4}(\quad)^2 + \frac{6000}{\sqrt{3}}(\quad)^{-1}$$

$$= \underline{\qquad\qquad\qquad} \text{ cm}^2$$

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