Life is filled with constraints. Please think of a few and write your thoughts below with the Promethean Pen.

Today's learning objective:

By the end of class, I will be able to minimize cost while maximizing utility of everyday geometric objects.

Today's language objective:

Minima
Maxima
Volume
Area

$f'(x)$

Lorena has 200m of chicken wire to make a rectangular enclosure for Gato. If she wants to maximize the area for Gato to play cat games, what are the dimensions of the rectangle?

200

OPTIMIZATION

- max
- min

$2\ell + 2w = 200$

$\ell = 50$

$w = 50$  $w = 50$

$\ell = 50$

$A^{*} = \ell w$

$A = (100 - w)w$

$\ell + \cancel{w} = 100 - w$

$\quad -\cancel{w}$

$\ell = 100 - w$

$A = 100w - w^2$

$A' = 100 - 2w$

$0 = 100 - 2w$

$w = 50$

Find the dimensions of a rectangle whose area is 500 m² where the perimeter is minimized.

$500 = lw \quad w = \frac{500}{l}$

$2l + 2w = P^*$

$2l + \frac{2}{1}\left(\frac{500}{l}\right) = P$

$2l + \frac{1000}{l} = P$

$1000l^{-1}$

$P' = 2 - \frac{1000}{l^2}$

$0 = 2 - \frac{1000}{l^2}$

$l^2 \cdot -2 = \frac{-1000}{l^2} \cdot l^2$

$\frac{2l^2}{2} = \frac{1000}{2}$

$l^2 = 500$

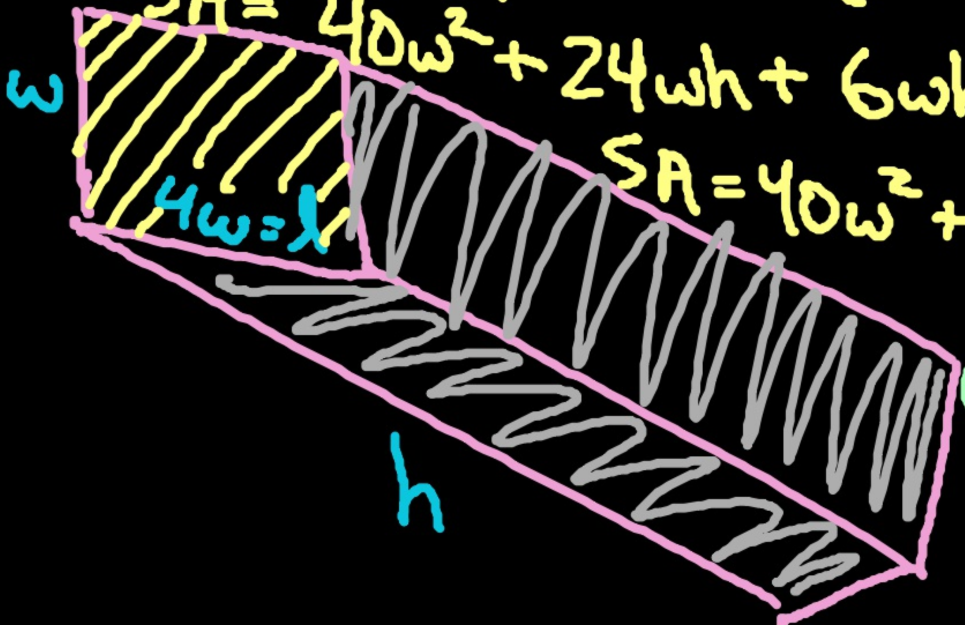
$\boxed{l = 22.4\,m}$

Aidan ______ does holiday shopping early and wants to wrap his mum's present in a rectangular prism-shaped box. The box has a base length that is 4 times its base width and needs to hold at least 110 cm^3 to fit the present inside. The top and bottom pieces of wrapping paper cost \$5/cm^2 while the sides cost \$3/cm^2. What dimensions of the box minimize the cost to wrap it?

$$SA^{*} = (4w^2)2(5) + 4wh(2)(3) + (wh)(2)(3)$$

$$V = lwh$$

$$SA = 40w^2 + 24wh + 6wh$$



$$SA = 40w^2 + 30wh$$

$$\frac{110}{4w^2} = 4w(w)h = \frac{4w^2h}{4w^2}$$

$$CSA = 40w^2 + 30w\left(\frac{110}{4w^2}\right)$$

$$CSA = 40w^2 + \frac{3300w}{4w^2}$$

$$CSA = 40w^2 + 3300/4w$$

Quick preview of spring Calculus units.

$$CSA = 40w^2 + \frac{3300}{4w} = \$568.54 \longrightarrow \frac{3300}{4} \cdot w^{-1}$$

$$CSA' = 80w - \frac{3300}{4w^2}$$

$$0 = 80w - \frac{3300}{4w^2}$$

$$4w^2 \cdot \frac{3300}{4w^2} = 80w \cdot 4w^2$$

$$3300 = 320w^3$$

$$10.3125 = w^3$$

$$\boxed{w = 2.18}$$

$$\boxed{h = \frac{110}{4w^2} = \frac{110}{4(2.18)^2} = 5.79}$$

$$110 = l \cdot 2.18 \cdot 5.79$$

$$\boxed{l = 8.71}$$

$\cancel{f(x)} = 4 - x^{10}$

y

Find maximized area of rectangle and efficiency of space utilization.

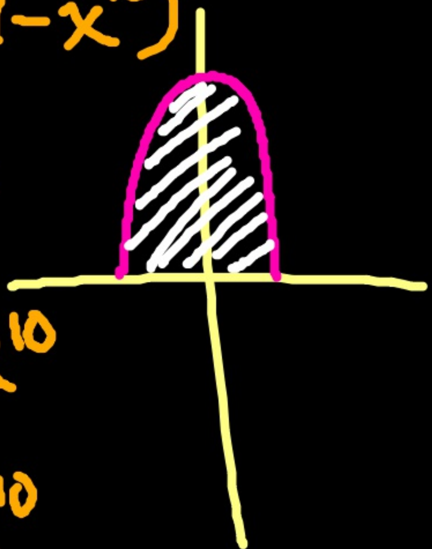
$4 - \frac{4}{11} = \frac{40}{11}$

$x \quad \begin{matrix} -10 \\ 10 \end{matrix}$ $\qquad$ $y \quad \begin{matrix} -10 \\ 10 \end{matrix}$

$A = lw$

$A = 2xy$

$A = 2x(4 - x^{10})$



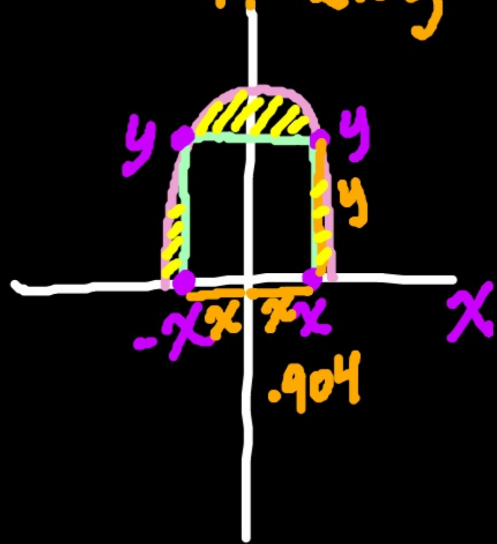
$A = 8x - 2x^{11}$

$A' = 8 - 22x^{10}$

$0 = 8 - 22x^{10}$

$-8 = -22x^{10}$

$\frac{4}{11} = x^{10}$ $\qquad$ $x = .904$



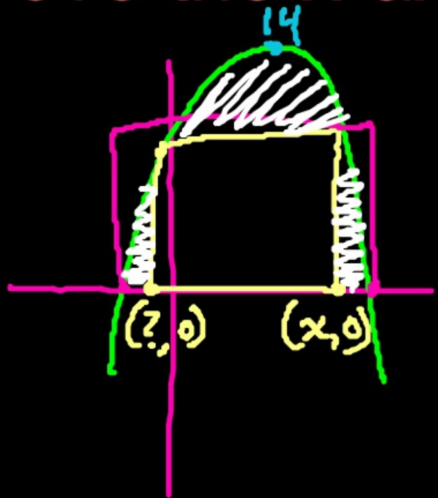
$A = 2 \cdot (.904) \cdot \frac{40}{11} = 6.57$

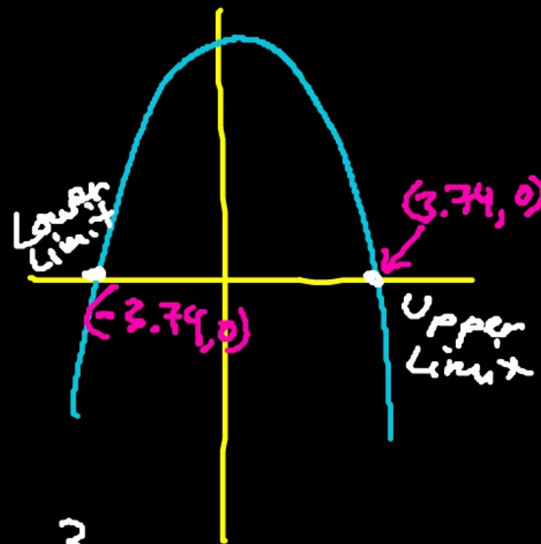
[redacted]

$y = 10 - x^4$

Maximize the area of the rectangle bound by the curve, y and quadrants 1 and 2.

Find the rectangular area maximized with space above the x-axis and below f(x) $Y1$ = 10 + 4x – x^2.





$Y2 = 10 - x^2$

$Y3 = 14 - x^2$

$A = 40.3\ u^2$

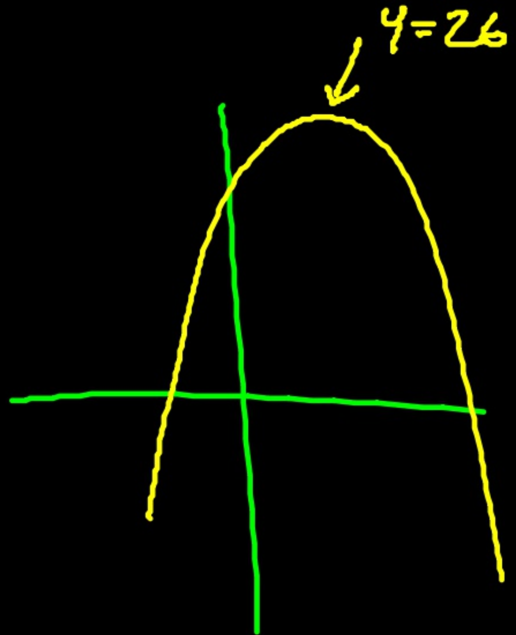
Actual Area $= 69.8\ u^2$

57.7% Efficiency

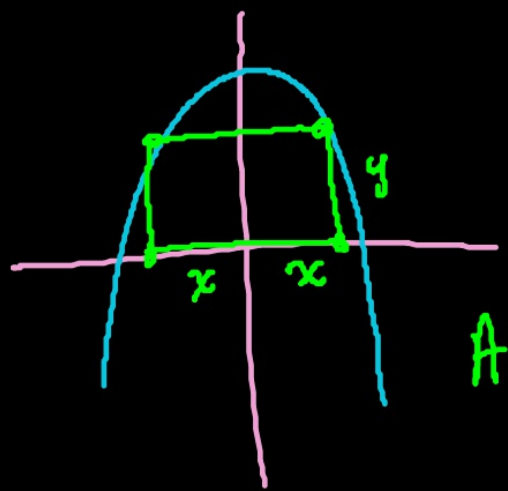
2nd Calc

7 $\int f(x)\,dx$

Find the rectangular area maximized with space above the x-axis and below $f(x) = 10 + 8x - x^2$.



$Y_2 = 26 - x^2$



$A = 2xy$

$A = 2x(26 - x^2)$

$A = 52x - 2x^3$

$A'(x) = 52 - 6x^2$

$0 = 52 - 6x^2$

$6x^2 = 52$

$\sqrt{x^2} = \sqrt{\frac{26}{3}}$

$x = 2.94$

$Y = 26 - \frac{26}{3}$

$y = 17.3$

$A = 2(2.94)(17.3)$

$= \boxed{102\,u^2}$