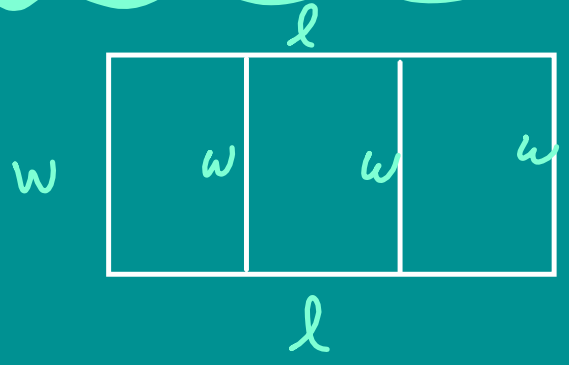
January 5, 2024

# OPTIMIZATION




$A = lw$

$4w + 2l = 3000$

$\frac{2l}{2} = \frac{3000}{2} - \frac{4w}{2}$

$l = 1500 - 2w$

$A = (1500 - 2w)w$

$A = 1500w - 2w^2$

w: $(0, 750)$

$\lim_{w \to 0} 1500w - 2w^2 = 0$

$\lim_{w \to 750} 1500w - 2w^2 = 0$

| | |
|---|---|
| 375 | 281,250 |

$A' = 1500 - 4w = 0$

$1500 = 4w$

$375 = w$

$w = 375$

$l = 1500 - 2(375)$

$= 750$

**375' x 750'**

1) Draw a picture and label
2) Write formula for quantity to be maximized/minimized
3) If 2 variables, write a 2nd eq. with a limitation.
4) Change function into one variable.
5) Find critical points.
6) Build an interval & test end pts & crit pts. for max/min.
7) Calculate & write final solutions.

$[a, b]$

1) Find crit pts.

2)

| crit |
| --- |
| a |
| b |

$(a, b)$

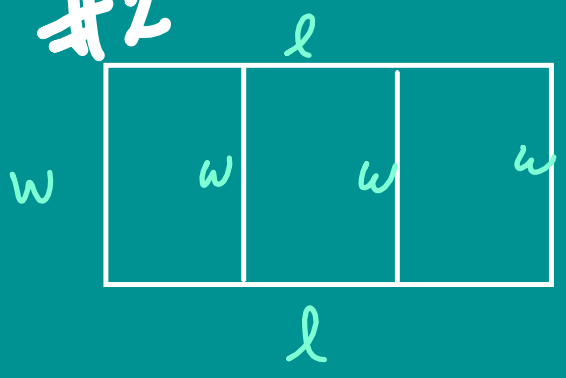
1) $\lim_{x \to a} f(x) =$

$\lim_{x \to b} f(x) =$

2) Find crit pts

| crit pt |
| --- |
| |

# #2




$A = 303{,}750\ ft^2$

Exterior: \$1/ft

Interior = \$0.50

What dimensions to minimize Cost.

$C(x) = \$1(2l + 2w) + 0.5(2w)$

$= 2l + 2w + w$

$C(x) = 2l + 3w$

$w: (0, \infty)$

Let $l = 0$

$\lim_{w \to 0} \frac{607500}{w} + 3w = \infty$

$\infty + 0$

$\lim_{w \to \infty} \frac{607500}{w} + 3w$

$0 + \infty = \infty$

* $lw = 303{,}750$

$l = \frac{303750}{w}$

$C(x) = 2\left(\frac{303750}{w}\right) + 3w$

* $C(x) = 607{,}500w^{-1} + 3w$

| | |
|---|---|
| 450 | \$2700 |

$l = \frac{303750}{450} = 675$

$C'(x) = -\frac{607500}{w^2} + 3$

$0 = -\frac{607{,}500}{w^2} + 3$

$\frac{607500}{w^2} = 3$

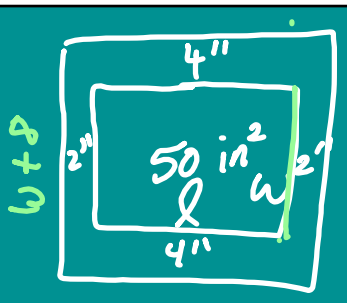
$607500 = 3w^2$

$\sqrt{202{,}500} = \sqrt{w^2}$

$450 = w$

**450' x 675'**

3/




$l+4$

$A = (l+4)(w+8)$

$lw = 50$

$l = \frac{50}{w}$

$A = \left(\frac{50}{w}+4\right)(w+8)$

$A = 50 + \frac{400}{w} + 4w + 32$

$A = \frac{400}{w} + 4w + 82$

$A' = -\frac{400}{w^2} + 4$

$A = lw$

$(l-4)(w-8) = 50$

$l - 4 = \frac{50}{w-8}$

$l = \frac{50}{w-8} + 4$

# Business

$C(x) = 600 + 3x$

$R(x) = 4x - 0.0002x^2$

Profit = Revenue − Cost

$P = 4x - 0.0002x^2 + (600 + 3x)$

$* \quad P = x - 0.0002x^2 - 600$

$[1, 10{,}000]$