151 m
d15

Optimization — MAX / MINS.

Multi-variable function

$f(x, y)$ ← Job depends on Two Things.

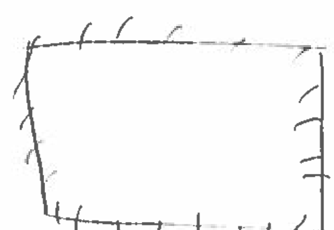
Area of Rectangle.

$A(L, W) = L \times W$

Constraint Equation that relates variables to each other.

Perimeter $= 2L + 2W$

Ex Given 100′ of Fencing, Find maximum area of a rectangular field.



Constraint: $100 = 2L + 2W$

$W = 50 - L$

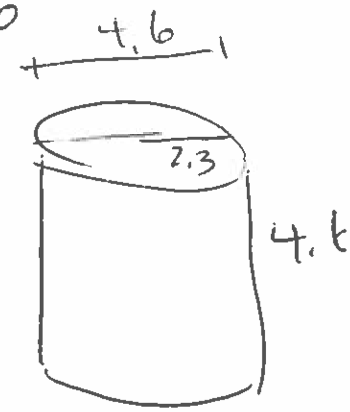
$$V'' = -6\pi r$$

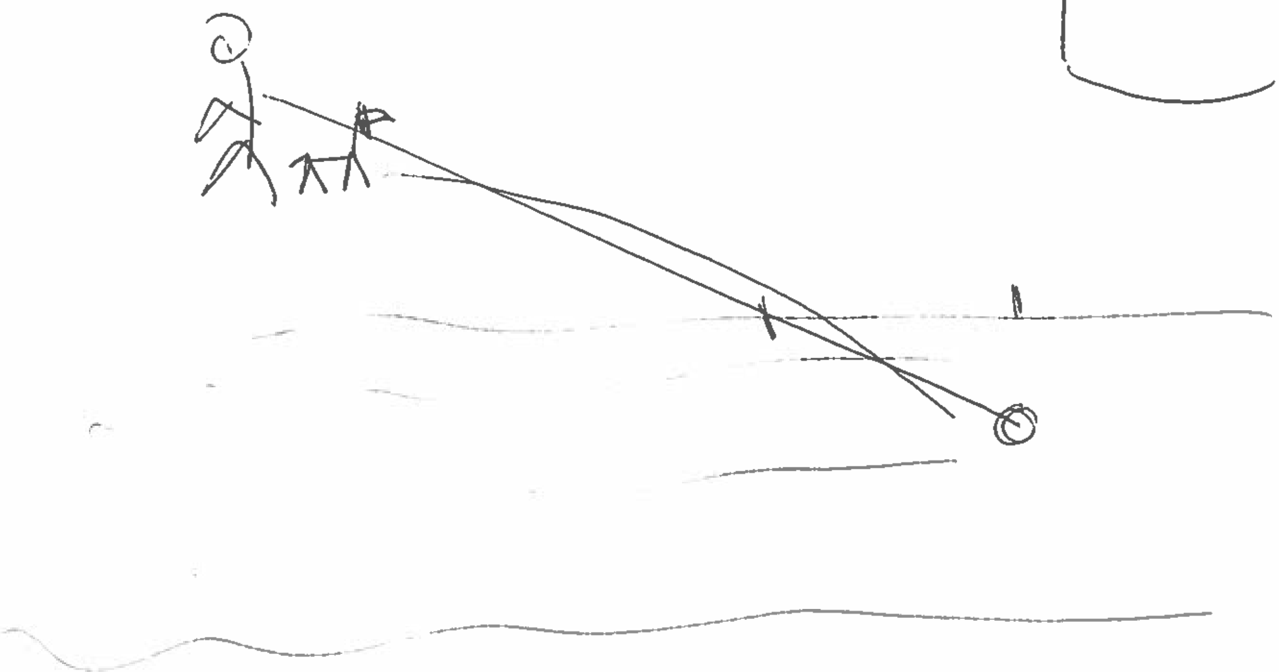
$$V''(2.3) = -6\pi(2.3) = -$$

Concave Down

MAX

$$h = \frac{100 - 2\pi(2.3)^2}{2\pi(2.3)} = 4.6$$

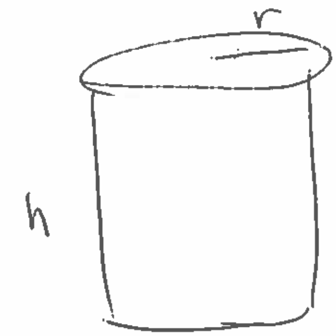




Dog will minimze effort

Constraint: 100 sq in of Metal

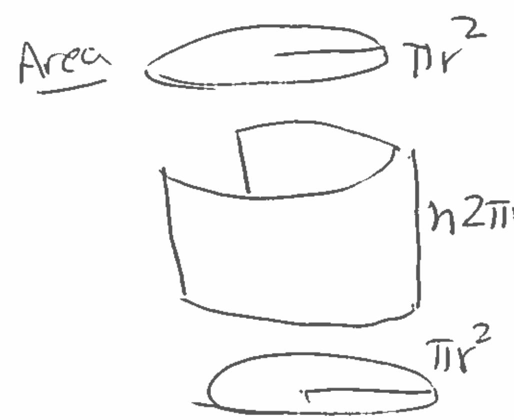
Optimize: Volume



Main Idea

$$V(r,h) = h\pi r^2$$

Constraint



$$\text{Area} = \underbrace{2\pi r^2}_{\text{TOP + BOTTOM}} + \underbrace{2\pi r h}_{\text{SIDE}}$$

$$100 = 2\pi r^2 + 2\pi r h$$

$$\frac{100 - 2\pi r^2}{2\pi r} = h$$

$$V(r) = \left(\frac{100 - 2\pi r^2}{2\pi r}\right)\pi r^2$$

$$= 50r - \pi r^3$$

$$V' = 50 - 3\pi r^2 = 0$$

$$r^2 = \frac{50}{3\pi}$$

$$r = \sqrt{\frac{50}{3\pi}} \approx 2.3$$

$$A(L,W) = L \cdot W$$

$$A(L) = L \cdot (50 - L)$$

$$A(L) = 50L - L^2$$

$$A'(L) = 50 - 2L = 0$$ critical Numbers

$$2L = 50$$

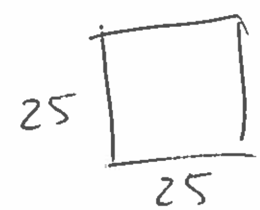
$$L = 25$$

$$A''(L) = -2$$

$$A''(25) = -2$$ Concave Down = MAX

$$W = 50 - \underset{25}{\cancel{L}}$$

$$W = 25, \; L = 25$$



Find the point on the parabola $y = 16 - x^2$ closest to the point $(6, 20)$. Round Intermediate calculations and final answer to 4 Decimal places.

$$D = \sqrt{(x-6)^2 + (y-20)^2}$$

$$D^2 = (x-6)^2 + (y-20)^2$$

$$D^2 = (x-6)^2 + [(16-x^2)-20]^2$$

$$D^2 = \cancel{x^2} - 12x + 36 + 16 - \cancel{x^2} - 20$$

$$D^2 = -12x + 32$$

$$D = \sqrt{-12(6) + 32}$$

$$D =$$

Closest point is (,) with the Distance of ( )

Vinnie Achad Lauren Dobo

$D^2 = (x-6)^2 + (x^2+16-20)^2$

$= x^2 + 36 \qquad x^4$

$(x-6)(x-6) = x^2 - 6x - 6x + 36$

$x^2 - 12x + 36$

$(x^2+16-20)(x^2+16-20)$

$(-x^2-4)(-x^2-4)$

$x^4 + 4x^2 + 4x^2 + 16$

$x^2 - 12x + 36 + x^4 + 8x^2 + 16$

$\cancel{9x^2 + 52}$

$x^4 + 9x^2 - 12x + 52$

$y' = 4x^3 + 18x - 12 = 0$ $\quad 12$

$+12$

$4x^3 + 18x = 12$

$y'' = 12x^2 + 18 = \cancel{0} = 0 \qquad \frac{\cancel{12}x^2}{12} = \sqrt{-\frac{18}{12}}$

GROUP NAME:

Date: 3/26/14 # 9

Student Names (First and Last)

Speaker/Presenter: Christina Trujillo

Writer/Prep: Onur Turkay

Leader/Collaborator:

Independant Variable (x-axis):

Dependant Variable (y-axis):

Conclusion (in words):

x = 2000, max Revenue is 1000

Supporting Work: ⟹ A company's revenue for selling x (thousand) items is given by $R(x) = \frac{8x-x^2}{x^2+8}$. Find the value of x that maximizes the revenue and find the max. revenue

Quotient Rule

$$\frac{(x^2+8)(8-2x)-(8x-x^2)(2x)}{(x^2+8)^2} = 0$$

$$\frac{(x^2+8)(8-2x)-(16x^2-2x^3)}{(x^2+8)^2}$$

$$\frac{8x^2-\cancel{2x^3}+64-16x-16x^2+\cancel{2x^3}}{(x^2+8)^2}$$

$$\frac{-8x^2-16x+64}{(x^2+8)^2} = 0$$

$$x^2+2x-8=0$$

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

$\cancel{-4}$, 2

$$\frac{8(2)-2^2}{2^2+8} = 1$$

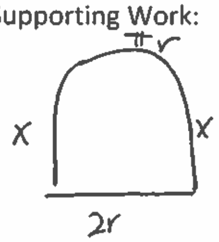
max

$\boxed{x = 2, \text{ Max reven is } \$1}$

GROUP NAME: POLARZBEARZ Date:________	Student Names (First and Last) Speaker/Presenter: Kauselya . M Writer/Prep: Fremiwot B Leader/Collaborator: Sheila
Independant Variable (x-axis):________ Dependant Variable (y-axis):________	

Conclusion (in words):

Supporting Work:



$$\pi r + 2r + 2x = 16 + \pi$$
$$x = 8 + \frac{\pi}{2} - \frac{\pi r}{2} + r$$

constraint

$$\text{area} = \frac{1}{2}\pi r^2 + (x \cdot 2n)$$
$$\frac{1}{2}\pi r^2 + \left[8 + \frac{\pi}{2} - \frac{\pi r}{2} + r\right](2r]$$
$$\frac{1}{2}\pi r^2 + [16r + \pi r - \pi r^2 + 2r^2]$$
$$-\frac{1}{2}\pi r^2 + 16r + \pi r - 2r^2$$
$$-\pi r + 16 + \pi + 4r = 0$$
$$-\pi r + 16 + \pi + 4r = 0$$
$$-\pi r - 4r = \pi + 16$$
$$-3.14r + 4r = 3.14 + 16$$

$$-7.14r = 99.14$$
$$r = \frac{19.14}{-7.14}$$
$$r = -2.68$$

concave down

max

GROUP NAME: Functional Paradigm

Date: 03/26/2014

Independant Variable (x-axis): ______

Dependant Variable (y-axis): ______

Student Names (First and Last)

Speaker/Presenter: Nader Shenouda

Writer/Prep: Karol Zarski

Leader/Collaborator: ______

Conclusion (in words):

Supporting Work:

Find the point of the curve $y = 20x^2$ closest to the point $(0,1)$

$D^2(x,y) = x^2 + (y-1)^2 \quad D^2(x) = x^2 + (20x^2-1)^2$

$y' = 1600x^3 - 80x + 2x$ $\qquad x = 0, \pm\sqrt{\frac{39}{800}}$ min

$y'' = 4400x^2 - 78$

$y' = 1600x^3 - 78x = 0$

$\left(\sqrt{\frac{39}{800}}, \frac{39}{40}\right)$

$\left(-\sqrt{\frac{39}{800}}, \frac{39}{40}\right)$

GROUP NAME: Illuminatti

Date: 3/26/14

Student Names (First and Last)

Speaker/Presenter: Ryan Piotrowski

Writer/Prep: [illegible] Liu

Leader/Collaborator: Danyan Zhou

Independant Variable (x-axis): ______

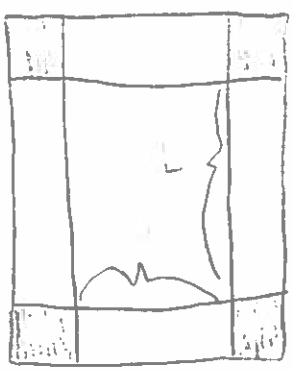
Dependant Variable (y-axis): ______

Conclusion (in words):

Supporting Work:

10"-by-16"

[illegible] in



16 in

L W h

$V = (16-2x)(10-2x)\cdot x$

$(160 - 32x - 20x + 4x^2)x$

$160x - 52x^2 + 4x^3$

$4x^3 - 52x^2 + 160x$

$V' = 12x^2 - 104x + 160 = 0$ critical pts

critical pts $x = \frac{20}{3}$ $x = 2$

$\cancel{6.66}$

2) A sheet of paper 10"-by-16" is made into an open box (there is no top) by cutting x-in. squares out of each corner & folding up the sides. Find the value of x that maximizes the volume of the box.

GROUP NAME: Money Makers

Date: 3/26/2014

Student Names (First and Last)

Speaker/Presenter: Monica K.

Writer/Prep: Edna O.

Leader/Collaborator: Bryan S.

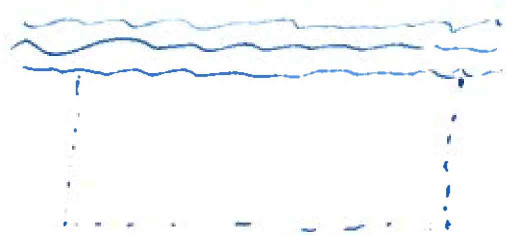
Independant Variable (x-axis):

Dependant Variable (y-axis):

Conclusion (in words):

Supporting Work:

A three-sided fence is to be built next to a straight section of river, which forms the fourth-side of a rectangular region. The enclosed area is to equall 1922 ft². Find the minimum perimeter and the dimensions of the corresponding enclosure.



Constraint ÷ $A(L,W) = L \cdot W$

$1922 = L \cdot W$

Perimiter ÷ $P(L,W) = L + 2W$

$\frac{1922}{w} = L$

$P(w) = \frac{1922}{w} + 2w$

$P(w) = 1922w^{-1} + 2w$

$P'(w) = -1922w^{-2} + 2$

$\frac{-1922w^{-2}}{-1922} = \frac{-2}{-1922}$

$w^{-2} = \frac{1}{961}$

$\frac{1}{w^2} = \frac{1}{961}$

$\sqrt{w^2} = \sqrt{961}$

$w = 31$

$L = 1922/31 = 62$

$P(L,w) = L + 2w$

$62 + 2(31)$

$P(L,w) = 124 \text{ ft}$