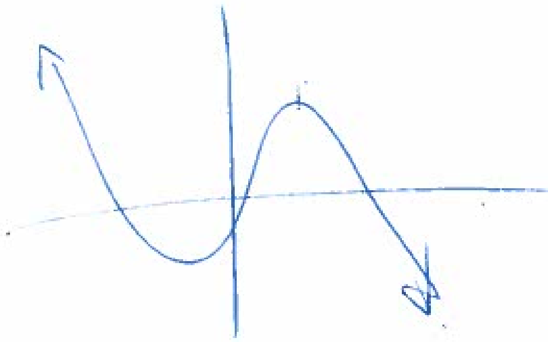
151 h
T 3/24
d15

Analysis of Functions



$f(x)$

$y = ax^3$

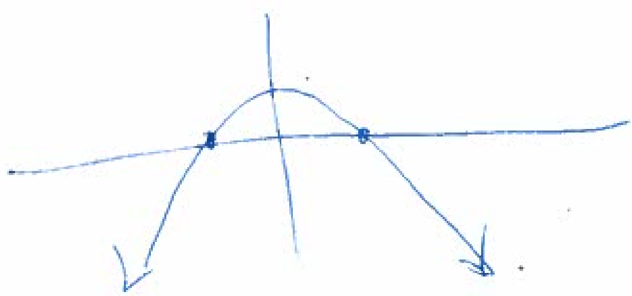
+	0	−	0	+	0	−

$f(x)$

−	0	+	0	−

$f'(x)$

$y' = 3ax^2$



$f'(x)$

+	0	−

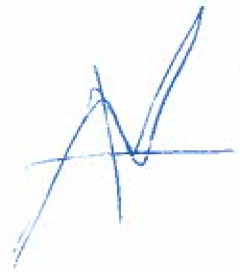
$f''(x)$

$y'' = 6ax$

$f'(x)$

$y''' = 6a$

JERK



Increas — concave up
— Concave Down
— Constant

TEST FOR MAX / MINS

To Find Max/Mins Look for

Critical Points.

$f'(c) = 0$ or $f'(c) = \text{undefined}$.

Then c is a critical ~~Point~~ number

y'

Critial   Crit

First Dervate Test

y' + ϕ −

Inc. MAX Dec

− ϕ +

Dec MIN Inc

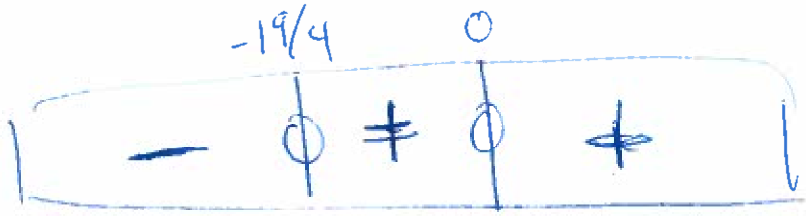
− ϕ −

+ ϕ +

Ex

$$y' = x^2(4x+19)$$

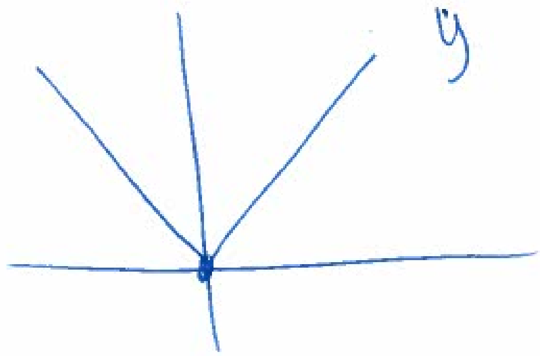
Critical #'s $0, -19/4$



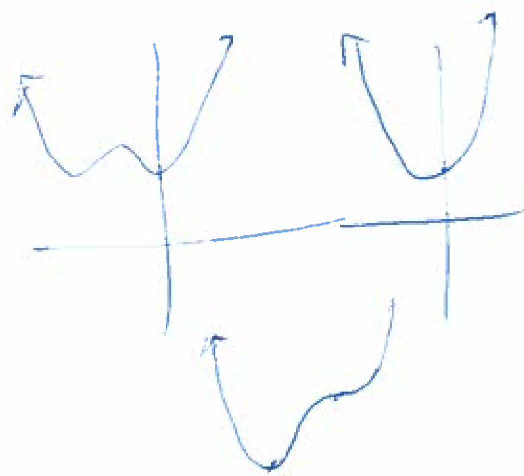
MIN by 1st Deriv. Test

NOT MAX or MIN.

Ex



y' is undefined at $x = 0$.



	2.5	
y'	$-$	$+$
	MIN	

by 1st Der Test

2.5 is a min

2nd Derivate Test

If c is a critical Number,

and $f''(c) < 0$ Concave Down MAX

$f''(c) > 0$ " Up MIN

$f''(c) = 0$ or undefined Inconclusive

Evaluate $Y_3(2.5) > 0$

by 2nd Deriv Test

MIN

GROUP NAME: W. H. O.

Date: 3/25/14

Independant Variable (x-axis): years

Dependant Variable (y-axis): Steroid level in ppm

Student Names (First and Last)

Speaker/Presenter: Jenna, Michael

Writer/Prep: Kathleen, Charles

Leader/Collaborator: Cathryn

Conclusion (in words):

In November of 2001, we find that the max is 9.84 by the First Derivative Test.

Supporting Work:

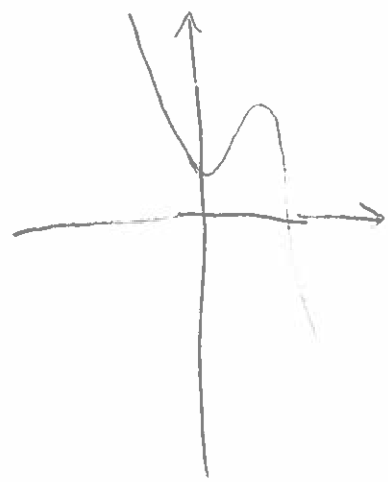
Data

x	y
0.01	122
03	100
06	143
09	200
12	170

Critical number (max): 9.84

Critical number (min): 2.14

Cubic Reg.



First Derivative test

9.84

+	0	−

2.14

−	0	+

Max

$y' = 9.84$

$y'' = -10.85$

2nd derivative test:

$f''(c) < 0$

So, y'' is concave down (max)

Min

$y' = 2.14$

$y'' = 10.57$

2nd derivative test:

$f''(c) > 0$

So, y'' is concave up (min)

1^{st} Deriv Test

y' | + | 0 | − |

INC | DEC

MAX

y' | − | 0 | + |

DEC | INC

MIN

EX $\quad y' = x^2(4x+21)$

y' | − | 0 | + | 0 | + |

$-\frac{21}{4}$ $\quad$ 0

DEC $\quad$ INC

MIN

GROUP NAME: P. minions

Date: Mar. 25, 2014

Independant Variable (x-axis): years

Dependant Variable (y-axis): tuition $

Student Names (First and Last)

Speaker/Presenter: Kero / Dallen

Writer/Prep: Jenn / Jason

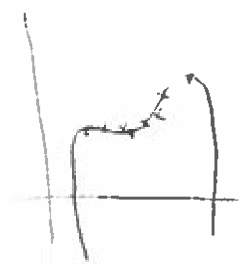
Leader/Collaborator: Daniella

Conclusion (in words):

At the end of 2014 the tuition will reach a max by the 1st derivative test

Supporting Work:

f(x)



	10.18		10.85		14.93	
y'	+	0	-	0	+	0	-
		max		min		max	

by 1st derivative test

y''	-	+	-
	concave down	concave up	concave down

$y_3(10.18) < 0$ concave down

$y_3(10.85) > 0$ concave up

$y_3(14.93) < 0$ concave down

by 2nd derivative test

GROUP NAME: Fluffy Ponies

Date: 3/25/14

Independant Variable (x-axis): income

Dependant Variable (y-axis): crime rate

Student Names (First and Last)

Speaker/Presenter: Milton/Ahmed

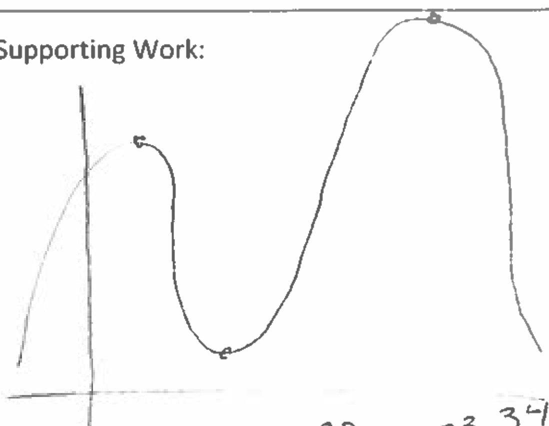
Writer/Prep: Courtney

Leader/Collaborator: Tyler/June

Conclusion (in words):

At $64 K, there is the least amount of crime per thousand dollars per year by first derivative test.

Supporting Work:



-27.38526		64.038433		173.34685		
+	o	−	o	+	o	−

y'

max min max

11.977463		128.0233		
−	o	+	o	−

f''(x)

MAX min max

concave down concave up concave down

f''(x)

f''(

151 n.

T 3/24

Procedure

① Find Main Idea.

function of multiple variable

$f(x,y,z)$

② Find constraints to eliminate other variables

$f(x,y,z)$ two constraint

$f(x,y,z,w)$ three constrants.

etc.

③ $f(x)$ use regular MAX/min procedures

2nd deriv TEST

$$2L + 2W = 40$$

$$W = 20 - L$$

$$A = L(20 - L)$$

$$20L - L^2$$

MAX.

$$A' = 20 - 2L = 0$$

$$\underline{\underline{L = 10}}$$

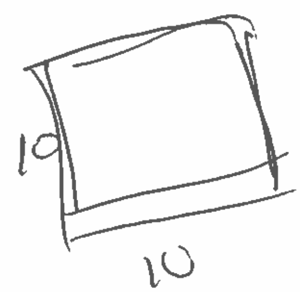
$$A'' = -2$$

$$A''(10) = -2 \quad \underline{\underline{\text{MAX}}}$$

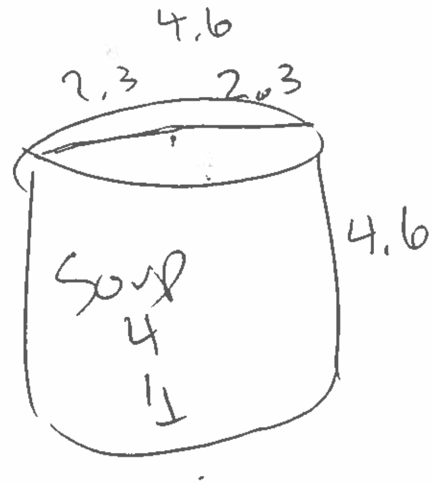
$$W = 20 - L$$

$$20 - 10$$

$$= 10$$



Soup for 1



MAX/MINS (optimization)

Constraints ← EQUATION

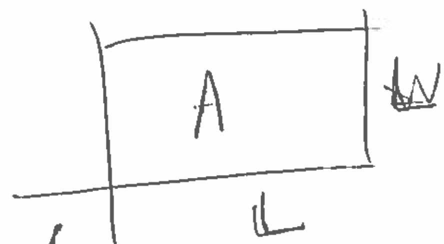
$x + y = 2$

$y = 2 - x$

$f(x, y) \Rightarrow f(x, 2-x)$ – Find MAX/MINS

EX $A = L \times W$

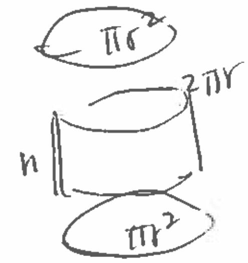
$A(L, W)$



Given Perimeter = 40'

$2L + 2W = 40$

$$\text{Volume} = \pi r^2 h = V(r,h)$$



Constraint.

$$\text{Area} = 100\ cm^2$$

$$\text{Area} = 2\pi r h + \pi r^2 + \pi r^2$$

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

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

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

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

$$= r(50 - \pi r^2)$$

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

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

$$r^2 = \left(\frac{50}{3\pi} \right)$$

$$h = \frac{100 - 2\pi r^2}{2\pi r} = 4.60$$

$$r = \sqrt{\frac{50}{3\pi}} = 2.30$$