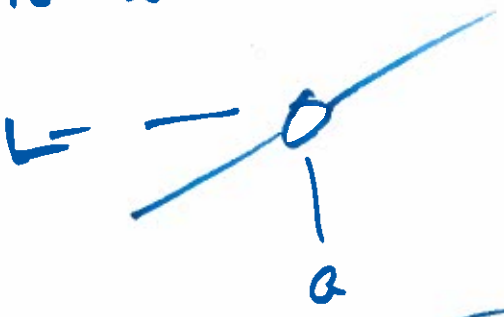
$$\lim_{h \to 0} \frac{h}{h}(2x+h) = 2x$$

↑ has a "hole" at $h=0$



$\varepsilon - \delta$ definition of Limit

Given any $\varepsilon > 0$ (usually very small)
There exists a $\delta > 0$ so that
whenever $|x-a| < \delta$ then
$|f(x) - L| < \varepsilon$

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

Find δ given $\varepsilon = .01$,

Verify ε-δ definition of Limit.

$$\lim_{x \to 2} 3x + 5 = 11$$

$$|f(x) - L| < \varepsilon$$

$$|3x + 5 - 11| < .01$$

$$|3x - 6| < .01$$

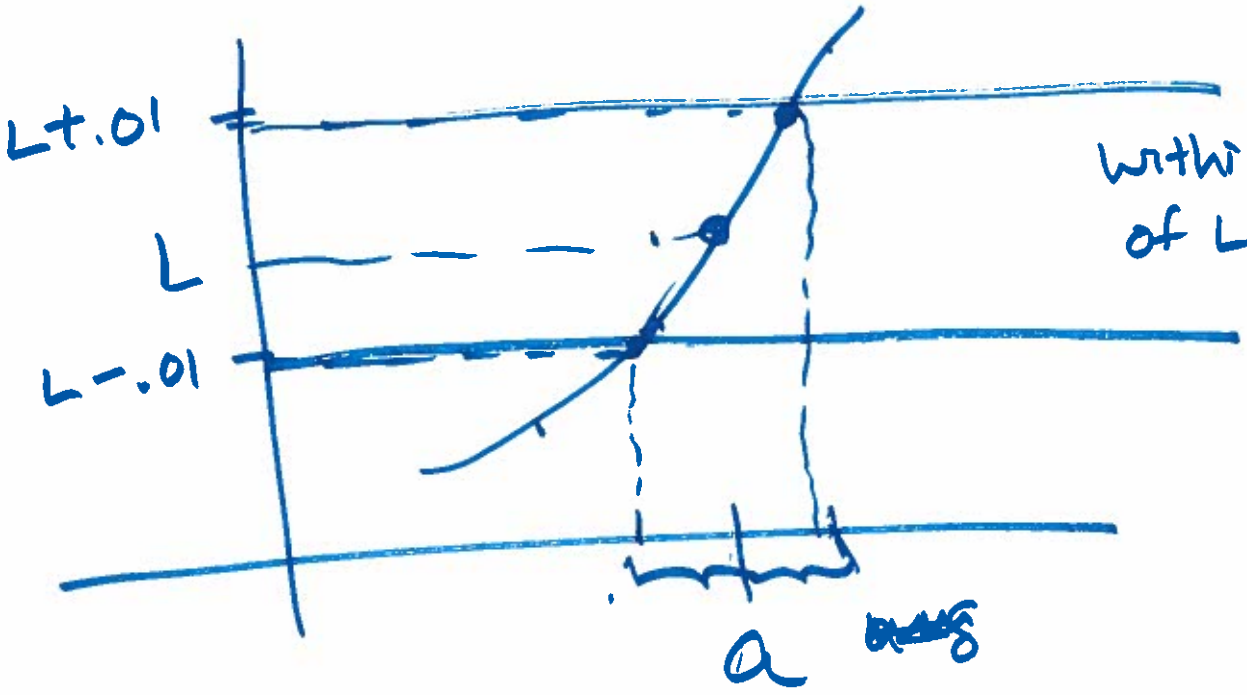
$$3|x - 2| < .01$$

$$|x - 2| < \frac{.01}{3} \approx .003\ldots$$

$$|x - a| < \delta$$

2.003

1.997



Within ε of Limit L

$\varepsilon = .01$

$a-\delta$ $a+\delta$

$1.8 - 2 - 2.1$

$.2$ $.1$ Smaller

$2-.1$ $2+.1$

1.9 2.1

Good range

2nd Trace 5: Intersect

1st Curve : Y_1

2nd Curve : Y_2

Guess : 2

$X = 2.00333\ldots$ $Y = 11.01$

$\delta = .00333\ldots$

2nd Trace 5: Intersect

1st Curve : Y_1

2nd Curve : ⓥ Y_3

Guess : 2

$X = 1.996666\ldots$ $Y: 10.99$

You do This

$Y_1 =$ regl/$(X \leq a)$ + something

$Y_2 =$ reg2/$(X \geq a)$

$Y_3 = L + \varepsilon(.01)$

$Y_4 = L - \varepsilon(.01)$

Calc 5: Intersect

1st Curve Y_1

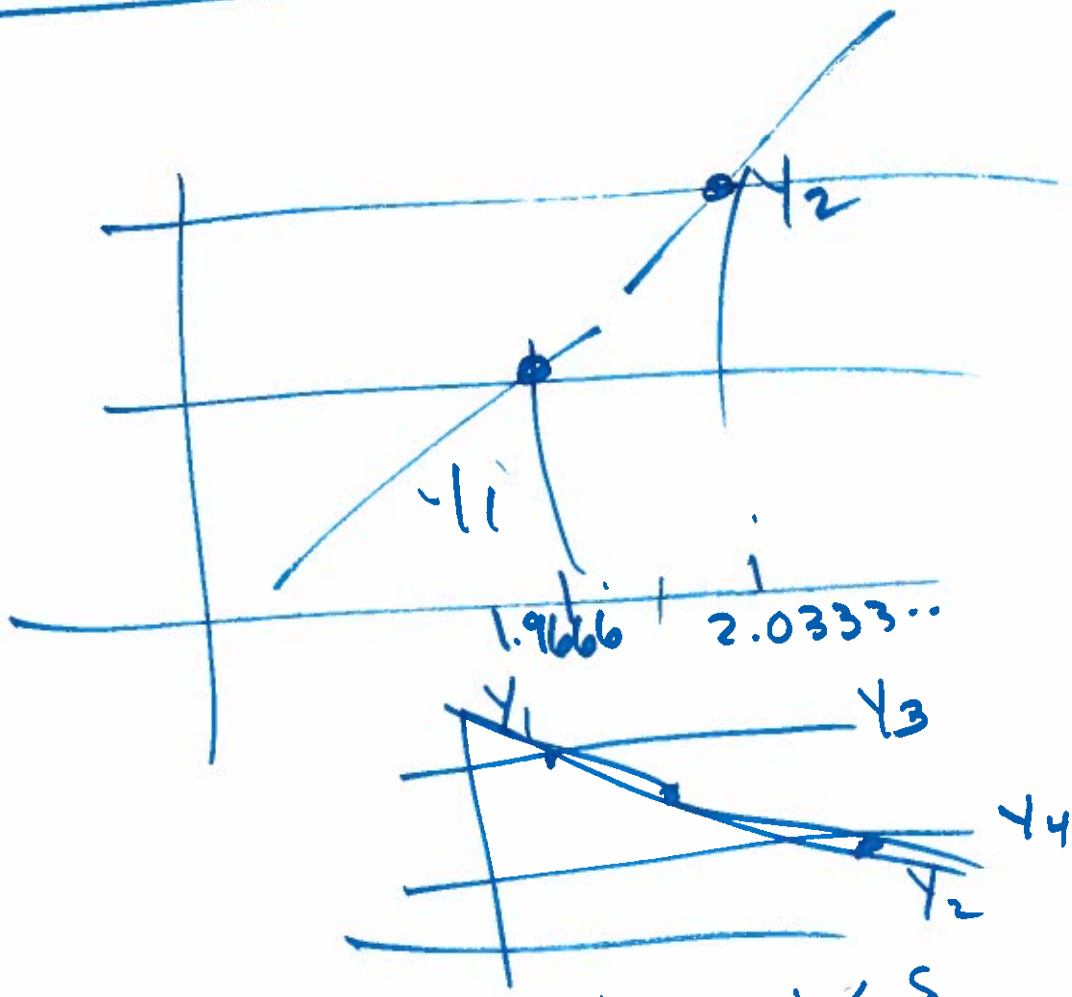
2nd curve: Y_3 or Y_4

Guess.

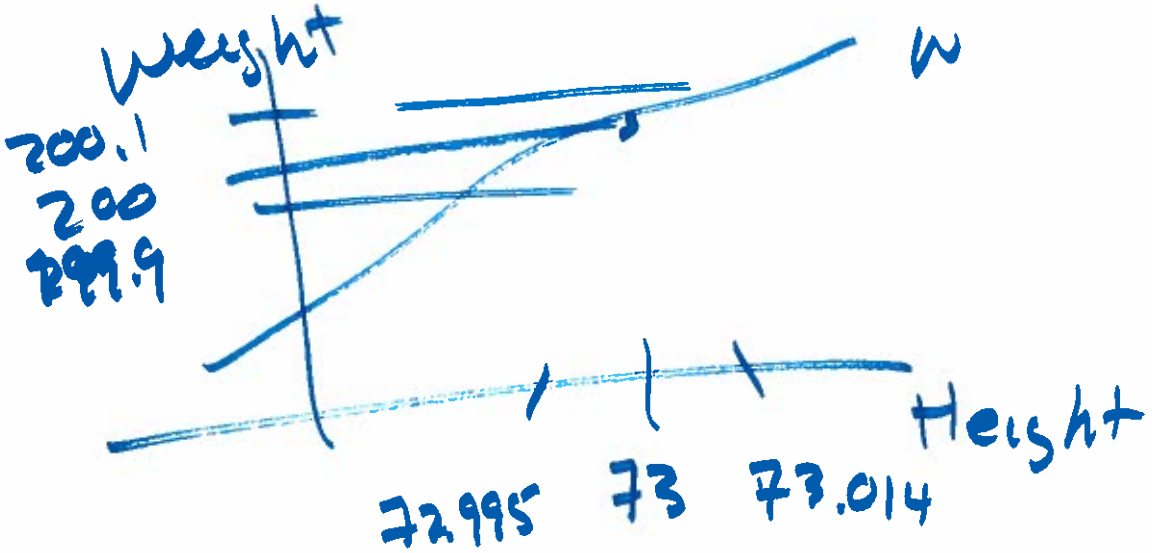
Calc 5: Intersect

1st Curve Y_2

2nd Curve: Y_4 or Y_3



$|2 - 2.031| < \delta$



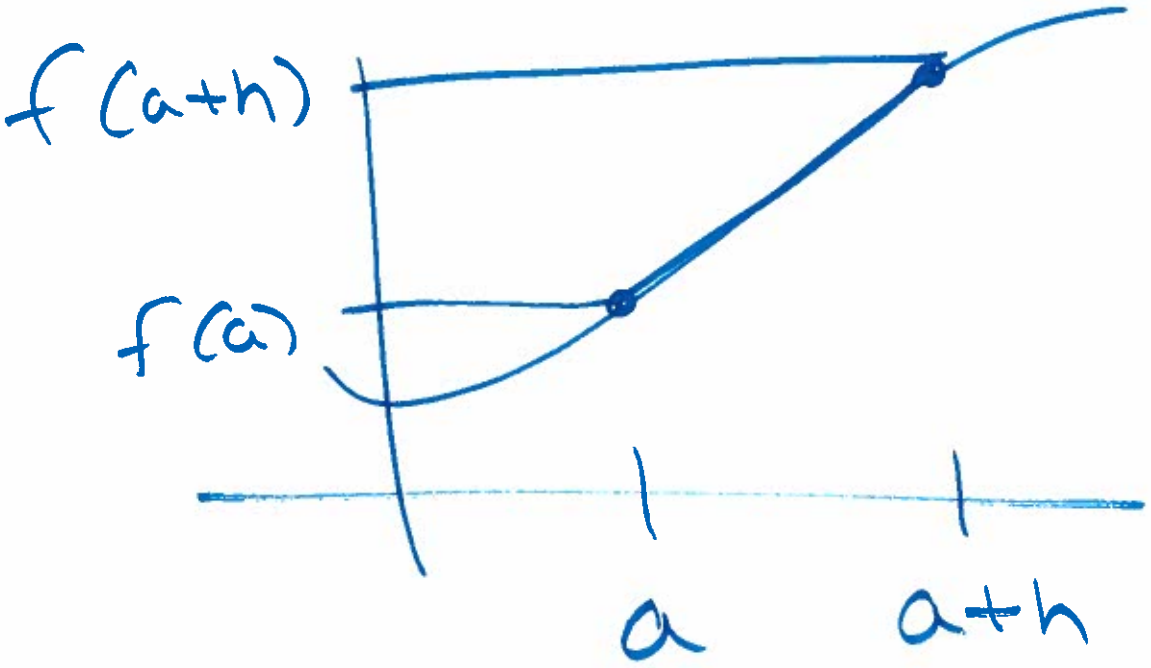
As long as the height is between 72.995 and 73.014 The weight will be with .1 of 200

$$73.014 - 73 = .014 \qquad \begin{array}{r} 73 \\ -\ 72.995 \\ \hline .005 \end{array}$$

$\delta =$

As long as the height is within .005 of 73

Instantaneous Rate of Change

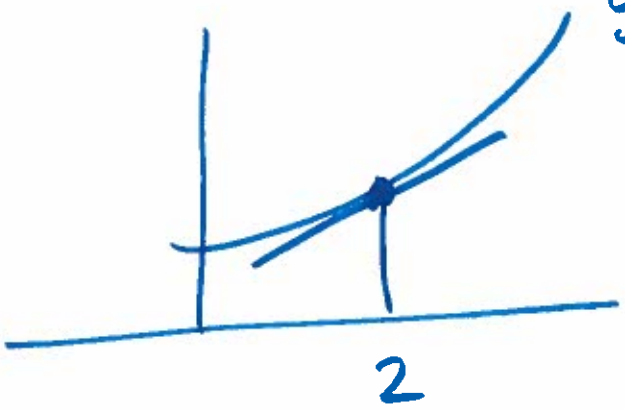


$$m_{sec} = \frac{\Delta y}{\Delta x} = \frac{f(a+h) - f(a)}{h}$$

Definition of Derivative
= Instantaneous rate of change
= slope of Tangent Line

$$\lim_{h \to 0} \frac{f(a+h) - f(a)}{h}$$

Ex



$y = x^2 + 1$

$m_{tan} = 4$

Pt $(2, 5)$

Slope of Tangent line at $x = 2$

$f(x) = x^2 + 1$

$$\lim_{h \to 0} \frac{f(2+h) - f(2)}{h} = m_{tan}$$

$f(2+h) = (2+h)^2 + 1$ $\quad (2+h)(2+h)$ FOIL.

$= 4 + 4h + h^2 + 1$

$f(2) = 4 + 1$

$f(2+h) - f(2) = 4h + h^2$

$$\frac{f(2+h) - f(2)}{h} = \frac{4h + h^2}{h} = \frac{h(4+h)}{h}$$

$$\lim_{h\to 0} \frac{f(2+h)-f(2)}{h} = \lim_{h\to 0} \frac{h(4+h)}{h} = 4$$

Finding

Mtan at a point "a"

Mtan at any point "x"

Mtan = derivative

$\frac{dy}{dx}$ D_x $\frac{d}{dx}f(x)$ $f'(x)$

$\left.\frac{dy}{dx}\right|_{x=a}$ $D_x(a)$ $\frac{d}{dx}f(a)$ $f'(a)$

$$f'(x) = \lim_{h\to 0} \frac{f(x+h)-f(x)}{h}$$

Use definition of derivative to find $f'(x)$ if $f(x) = x^2 - 12x + 3$

$$f(x+h) = (x+h)^2 - 12(x+h) + 3$$

$$= x^2 + 2xh + h^2 - 12x - 12h + 3$$

$$f(x) = x^2 - 12x + 3$$

$$\frac{f(x+h) - f(x)}{h} = \frac{2xh + h^2 - 12h}{h}$$

$$\lim_{h \to 0} \frac{f(x+h) - f(x)}{h} = \lim_{h \to 0} \frac{h(2x + h - 12)}{h}$$

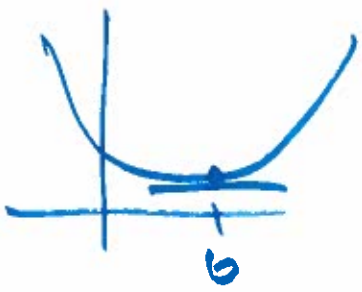
$$\lim_{h \to 0} 2x + h - 12$$

$$f'(x) = 2x - 12$$

$$f'(2) = 2 \cdot 2 - 12 = -8$$

$$f'(5) = 10 - 12 = -2$$

$$f'(6) = 12 - 12 = 0$$



Linear $y = ax + b$ (gives.)

$y_1 = a$

Quadratic $y = ax^2 + bx + c$ (gives)

$y_2 = 2ax^1 + b$

Cubic $y = ax^3 + bx^2 + cx + d$

$y_3 = 3ax^2 + 2bx + c$

Quartic $y = ax^4 + bx^3 + cx^2 \ldots$

$y_4 = 4ax^3 + 3bx^2 + 2cx + d$

GROUP NAME: We Need Extra

Date: 4/2/14

Student Names (First and Last)

Speaker/Presenter: Yasmin Silverio

Writer/Prep: Simar Kalra

Leader/Collaborator:

Independant Variable (x-axis): Year

Dependant Variable (y-axis): Interest Rate of CD

Conclusion (in words): As long as we are in .1257 of 2010, the interest rates would be between .1 of 1.2 E.

Supporting Work:

A = 2010

L = 1.298

ε = 0.10

δ · 2010
- 2009.8743

delta = .1257

δ · 2010
2010.135

-.135

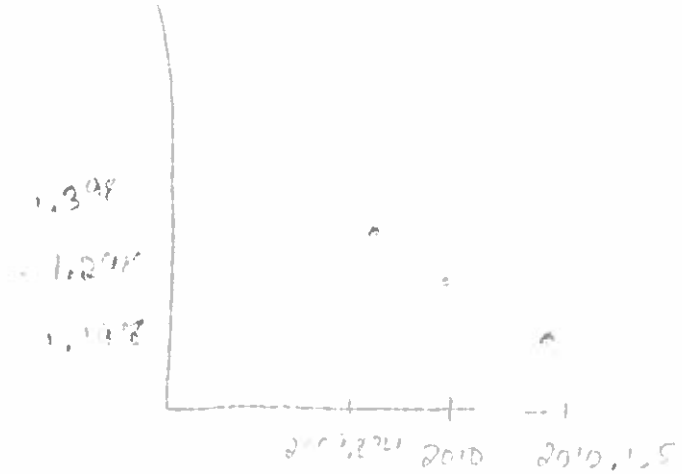
Intersection

y_1 & y_3 x = 2009.8743 y = 1.398

y_2 & y_4 x 2010.135 y = 1.198

y_2 = 1.298 + .1

y_4 = 1.298 - .1



GROUP NAME: Illuminatti

Date: 2/12

Student Names (First and Last)

Speaker/Presenter: Ryan Piotrowski

Writer/Prep: [illegible]

Leader/Collaborator: Bishop Bier

Independant Variable (x-axis): year

Dependant Variable (y-axis): price

Conclusion (in words): as [illegible] the year - 2004.64 & 2005.68

the price is within 2.005 and 2.2059

Supporting Work:

y_1 y_3 $\lim \to 2.1059$

$x = 103.8609$ $y = 2.2059$

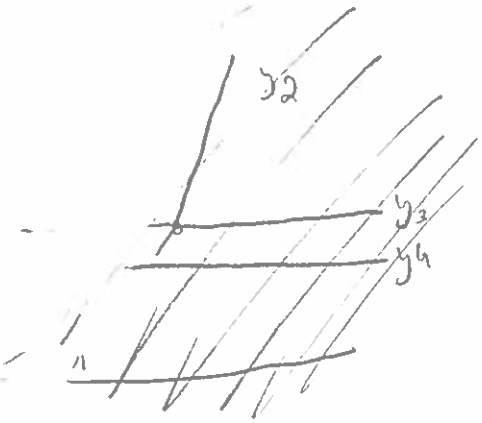
y_1 y_4

$x = 104.36$ $y = 2.005$

y_2 y_3

$x = 105.68$ $y = 2.005$

$\lim = 2.1051$



$y_3 = 2.1059 + .1$

$y_4 = 2.1059 - .1$

y_1, y_4

$x = 102.53$ $y = 2.0059$

2002

y_1, y_3

$x = 105.68$ $y = 2.2059$

2005

GROUP NAME: Money Makers

Date: 2/12/13

Student Names (First and Last)

Speaker/Presenter: Bryan

Writer/Prep: Edna

Leader/Collaborator: Monica

Independant Variable (x-axis): Year

Dependant Variable (y-axis): Crime rate in Detroit

Conclusion (in words):

Between the years 2010.84 and 2011.16 the crime rate will be between .528 and .548

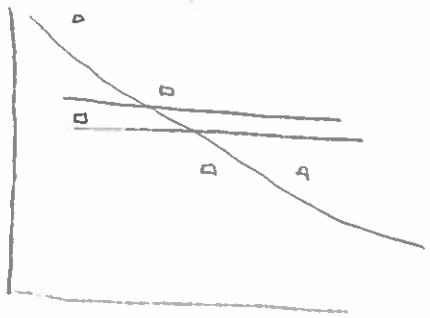
Supporting Work:

Y_1 = QuadReg (x ≤ 2011) +.02

Y_2 = QuadReg (x ≥ 2011)

Y_3 = .5 + .01

Y_4 = .5



Y_1 & Y_2

Intersection

X = 2011 Y = .538

Y_1 & Y_3

X = 2010.84 Y = .548

GROUP NAME: Tirates

Date: 02/12/2013

Student Names (First and Last)

Speaker/Presenter: Sharon Isoe

Writer/Prep: Onur Turkay / Rasul Pate

Leader/Collaborator: George Cumberbatch

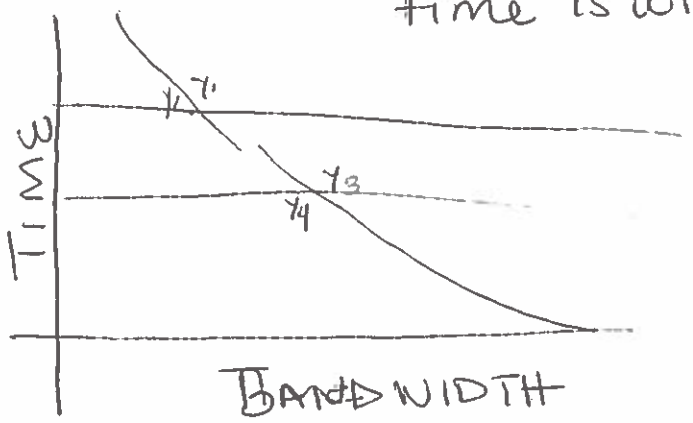
Independant Variable (x-axis): Bandwidth

Dependant Variable (y-axis): Time

Conclusion (in words): As long as your bandwidth ~~setup~~ uph remains between 78.20uph – 82.342uph your download time will be between 40.121min – 42.121min

Supporting Work:

As long as the time is within Δ 2min.



$82.342 - 80 = 2.342$

$78.20 - 80 = -1.8$

$a = 80$

Limit = 40.121min

$\varepsilon_0 = 1$

L1	L2
40	60
60	50
80	40
120	20
160	10

Y_2

$x = 80.342\ldots$

Y_3

$78.2053\ldots$

Y_4

40.121min

Y_1

42.121min

Delta = −1.8

GROUP NAME: BEST FRIENDS

Date: 2/12/2014

Student Names (First and Last)

Speaker/Presenter: [illegible]

Writer/Prep: LAUREN DORO

Leader/Collaborator: Elliott Baez

Independant Variable (x-axis): YEARS

Dependant Variable (y-axis): CAR SALES

Conclusion (in words):

AS LONG AS THE YEAR IS BETWEEN YEAR 2010.9999 AND 2011.0001, THE SALES WILL BE WITHIN 10 CARS OF 323602 CARS.

Supporting Work:

YEAR X	CARS Y
2009	290292
2010	274555
2011	284061
2012	487480
2013	591192

LIN

$y_L = ax + b$

$a = 81672.5$

$b = -163257819$

QUAD

$y = ax^2 + bx + c$

$a = 31051.5$

$b = -124815992.5$

$c = 1.25436 \times 10^{11}$

$L = 323602$

$\varepsilon = 10$

$y_1 = (y_Q)(x \leq a)$

$y_2 = (y_L)(x \geq a)$

$y_3 = L + \varepsilon$

$= (323602) + (10)$

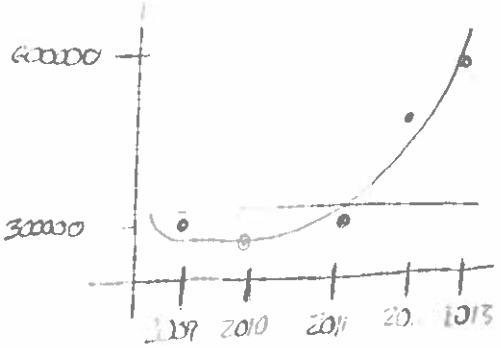
$y_4 = L - \varepsilon$

$= (323602) - (10)$

INT.	x	y
$\rightarrow y_1 \perp y_4$	$2010.\overline{9}999$	323592
$\rightarrow y_2 \perp y_3$	2011.0001	323612
$\rightarrow y_2 \perp y_1$	2011.0001	323612

$\Delta = |2011.0001 - 2011.0000| = 0.0001$

$\Delta = |2010.9999 - 2011| = 0.0001$



GROUP NAME:

Date: 2/12/2014

Student Names (First and Last)

Speaker/Presenter: _____

Independant Variable (x-axis): time (hours)

Dependant Variable (y-axis): disk usage (mB)

Writer/Prep: Karol Zarski

Leader/Collaborator: Nader Shehouda

Conclusion (in words):

As long as the time the computer is used between 1.999 and 2.0002 hours, then the disk usage is between 2500.1 mB and 2499.9 mB.

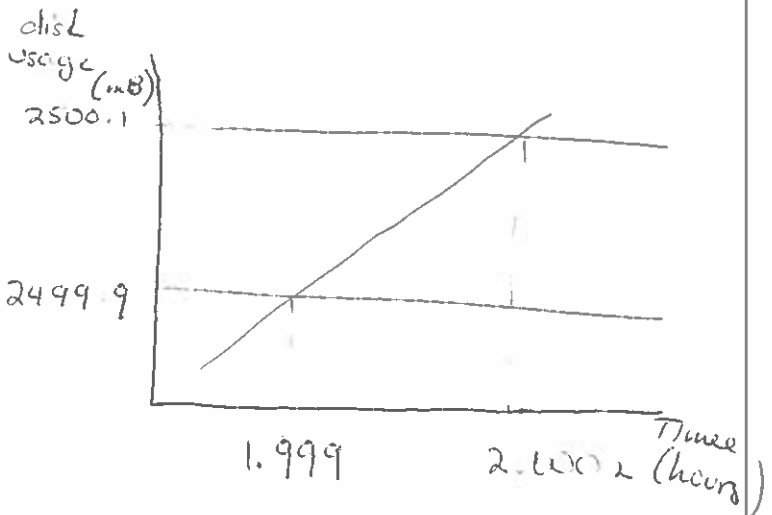
Supporting Work:

Y_1 = Quart Reg / $(x \leq a)$

Y_2 = Quad Reg / $(x \geq a) + 308.6e$

$Y_3 = 2500 + .1$

$Y_4 = 2500 + -.1$



~~1st curve~~

Y_1

Y_4

intersection

$x = 1.999$ $y = 2499.9$

$\varepsilon = .1$

$\gamma = .0002$

Y_2

Y_3

intersection

$x = 2.0002$ $y = 2500.1$

GROUP NAME: Polarz Bearz

Date: _____

Student Names (First and Last) Trey Murrill

Speaker/Presenter: Sara Kawalyca Mannum

Writer/Prep: Sheila MacLean

Leader/Collaborator: Frewinot Bekele

Independant Variable (x-axis): year

Dependant Variable (y-axis): Deaths

Conclusion (in words):

~~Between 2010 and 2011~~ ~~As long as the deaths are~~ Between the year 2010.9241 and 2011.0769 the deaths are between 2.41 and 2.43 million.

Supporting Work:

$y_1 = \text{Reg Expo}/(X \leq 2011) + .0095$

$y_2 = \text{Reg Lin}/(X \geq 2011)$

$y_3 = 2.42 + .01$

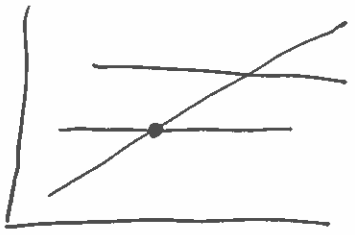
$y_4 = 2.42 - .01$

$L = 2.42$

$a = 2011$

a) 1st curve Y_1 2nd curve Y_4 intersect

Intersection $X = 2010.9241$ $Y = 2.41$



b) 1st curve Y_2 Y_3 Intersection $X = 2011.0769$ $Y = 2.43$

$r = .8472$