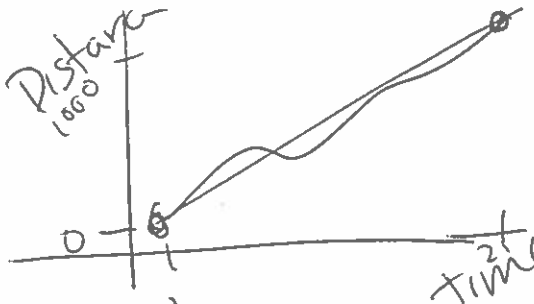
Study of Change

Functions ← Data, Graphs, Equations

Average Rate of Change

2 data Points = slope of Line

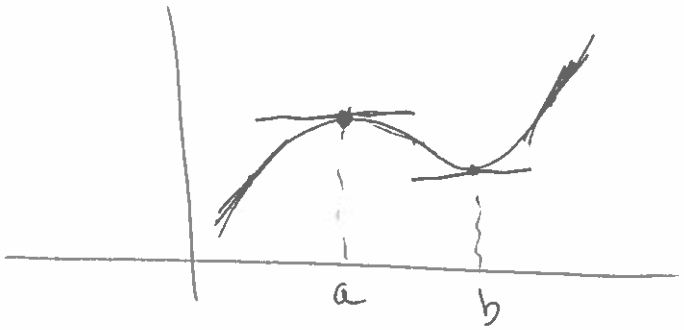


$$\frac{\Delta y}{\Delta x} = \frac{1000 - 0 \text{ mi}}{2 \text{ hr} - 1 \text{ hr}}$$

$$= 50 \text{ mph}$$

Instantaneous Rate of Change

1 data Point = slope of Tangent Line



at "a" } travelling
at "b"

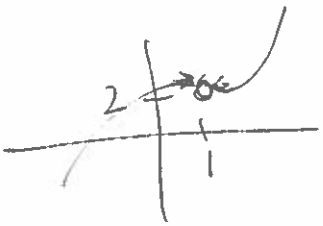
Limits

Oriented 2 points → 1 pt.

$$\lim_{h \to 0} f(h) = f(0)$$

Three ways To Find.

$\lim_{x \to 1} f(x) = 2$



1. Graph
2. Points →

1	2	3	(4)	5	6

3 Algebra

EZ: Plug in $\lim_{x \to 1} \frac{x+1}{x+1} = \frac{1+1}{1+1} = 1$

med: $\lim_{x \to 1} \frac{x^2-1}{x-1} = \frac{0}{0}$

FACTOR $\frac{(x-1)(x+1)}{(x-1)}$

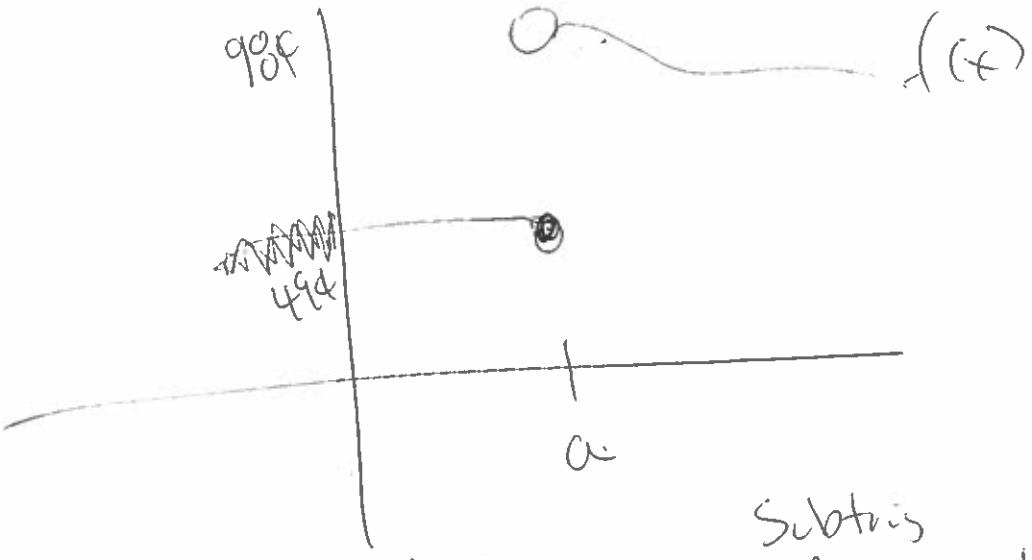
$\lim_{x \to 1} x+1 = 2$

Hard

$\lim_{x \to 1} \frac{\sqrt{x-4}-1}{x-1} =$

Two Sided Limits

$\lim_{x \to a^-} f(x)$ or $\lim_{x \to a^+} f(x)$



Adding to letter to get to "a"

Then you Pay 49¢

Subtris from the letter to get to 102.

Then you Pay 99¢

Put Data In

STAT 1: Edit

Enter Data

L1	L2
1	26
2	16
5	11
21	:
5,	0

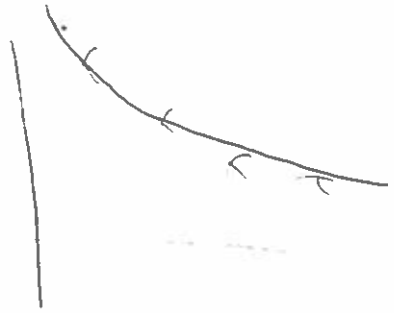
Y= ^ ENTER Zoom 9:

STAT > Calc 0: ExpReg

$Y = 26.4 \cdot .74^{x}$

Y= VARS 5: > > 1:

Graph



$Y_1 =$ Expreg $/(X \leq 3)$

STAT ▷ calc 4: linreg

$Y_2 =$

Y= ▽ VARS 5. ▷ ▷ 1:

$Y_2 =$ linreg $/(X \geq 3)$

2nd Windo ▽ ▽ ▷ ASK ENTER

2nd Graph

$$\lim_{X \to 3^-} R_{exp} = 11.013$$

$$\lim_{X \to 3^+} R_{lim} = 12$$

Right End Behavior

$$\lim_{x \to \infty} \text{RegLin}(x) = -\infty$$

Left End Behavior

$$\lim_{x \to -\infty} \text{RegExp}(x) = \infty$$

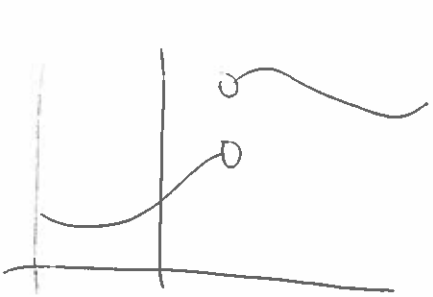
$$\lim_{x \to 3^-} \text{regex}_3(x) = 11.013$$

$$\lim_{x \to 3^+} \text{reglin}(x) = 12$$

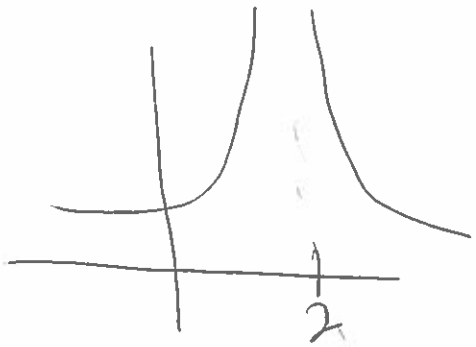
$$\lim_{x \to -\infty} \text{regexp}(x) = \infty$$

$$\lim_{x \to \infty} \text{regln}(x) = -\infty$$

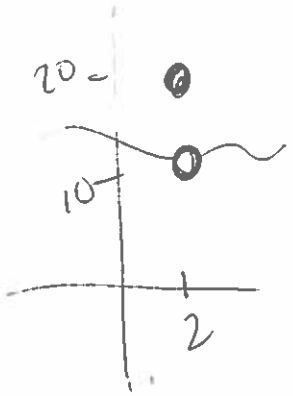
CONTINUITY



JUMP DISCONTINUITY



Asymptote.



Hole

Removable Discont.

↓ Polynomials Continuous Everywhere

Rules

1. Limit exists $\lim_{x \to a} f(x)$
2. $f(a)$ exist.
3. $\lim_{x \to a} f(x) = f(a)$

$y_1 =$ $+ .02$

$y_2 =$

$\lim_{x \to 2011} f(x) = .530$

GROUP NAME: BEST FRIENDS

Date: 2/10/2014

Student Names (First and Last)

Speaker/Presenter: [illegible]

Writer/Prep: LAUREN Dorso

Leader/Collaborator: Elliott BAER

Independant Variable (x-axis): YEAR

Dependant Variable (y-axis): SALES

Conclusion (in words):

LOOKING FOREWARD, WE THOUGHT THE ELECTRIC CAR SALES WOULD BE 323,602, BUT LOOKING BACK, IT WAS 385,717.

Supporting Work:

x	y
2009	290292
2010	274555
2011	284064
2012	487480
2013	592192

QUAD

$y = ax^2 + bx + c$

$a = 31057.5$

$b = -124543542.5$

$c = 1254363711$

$y = ax^2 + bx + c / (x \leq 2011)$

$y_2(2011) = 323602$

LIN

$y = ax + b$

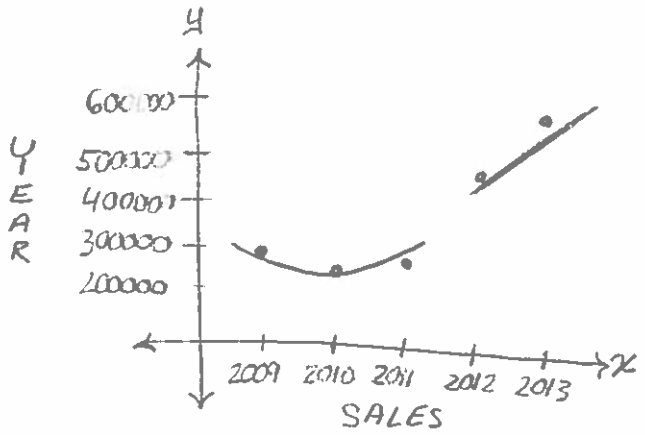
$a = 81677.5$

$b = -163837688.9$

$y = b + ax / (x \geq 2011)$

$y_1(2011) = 385717$

$y_{10} = (b + ax / (x \geq 2011)) - 62115$



$\lim_{x \to 2011^+} (QUAD) = 323602$

$\lim_{x \to 2011^-} (LIN) = 385717$

$\lim_{x \to -\infty} (QUAD) = \infty$

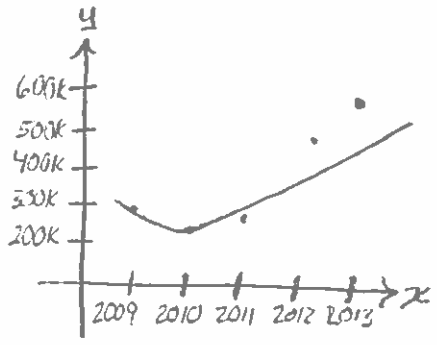
$\lim_{x \to \infty} (LIN) = \infty$

limit

323602

ALTERED

	QUAD	LIN
2011	323602	323602



ALTERED

GROUP NAME: Cha-Ching

Date: 02/10/14

Student Names (First and Last)

Speaker/Presenter: Trey Murrill

Writer/Prep: Sheila Mae Gan

Leader/Collaborator: Tatiana C

Independant Variable (x-axis): Year

Dependant Variable (y-axis): revenue

Conclusion (in words):

ALL THE YEARS BEFORE 2011 WE WERE MAKING 23.17 mil AND ALL THE YEARS AFTER 2011 WE'RE ~~MAKING 24.2 mil~~ EXPECTING TO MAKE ∞

Supporting Work:

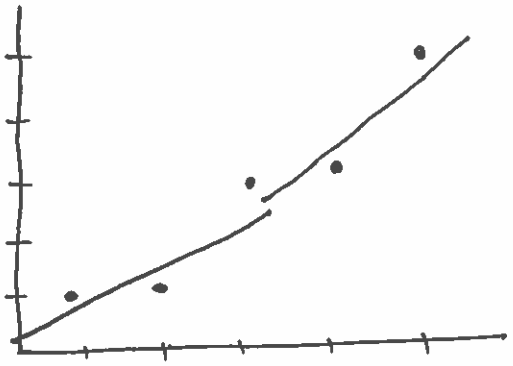
$Y_1 = RegExp/(X \leq 11)$

$Y_2 = RegLin/(X \geq 11)$

DATA

STAT 1: Edit

L_1	L_2
13	35
12	27
11	26
10	17
9	16



$Y_1 = 11^{+}$ Rexp $= 23.17$

$Y_2 = 11^{-}$ Rlin $= 24.2$

1. $\lim_{X=11^{+}} Rexp(x) = 23.17$
2. $\lim_{X=11^{-}} Rlin(x) = 24.2$
3. $\lim_{X=-\infty} Rexp(x) = -\infty$
4. $\lim_{X=\infty} Rlin(x) = \infty$

GROUP NAME: Cha - Ching

Date: 02/10/14

Student Names (First and Last)

Speaker/Presenter: Trey Murrill

Writer/Prep: Sheila Mae Gan

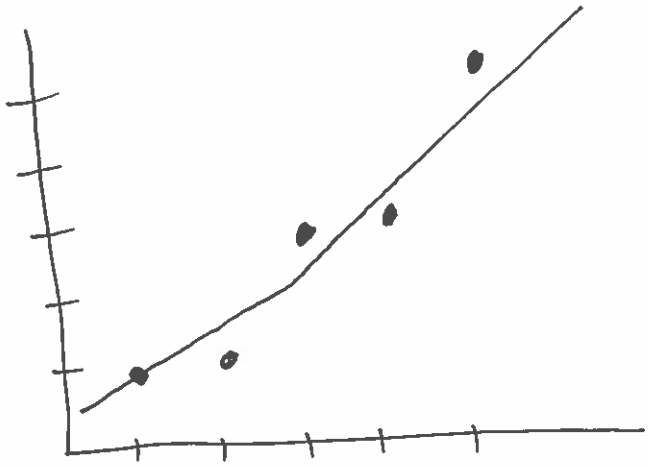
Leader/Collaborator: Tatiana C.

Independant Variable (x-axis): year

Dependant Variable (y-axis): revenue

Conclusion (in words): 2011, revenue goes up 1.026

Supporting Work:



$Y_1 = 11^{+}$ Rexp = 23.17

$Y_2 = 11^{-}$ Rlin = 24.2

Difference is 1.026

GROUP NAME: Functional Paradigm

Date: 2/10/14

Student Names (First and Last)

Speaker/Presenter: _____

Writer/Prep: Karol Zarski

Leader/Collaborator: Nader Shenarda

Independant Variable (x-axis): disk usage in mB

Dependant Variable (y-axis): time in hours

Conclusion (in words):

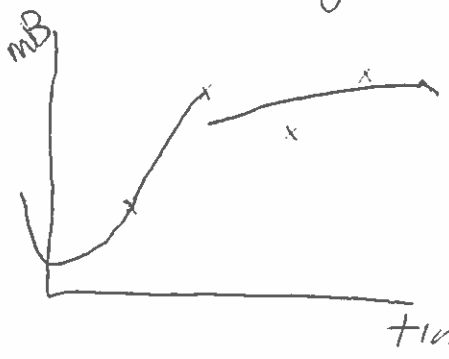
As we approach 2 hours, we expect to be using 2500 mB ~~per hour~~. As we keep using the computer we expect the disk to crash ($-\infty$) because we used a quartratic regression.

Supporting Work:

x	y
0	1000
1	1500
2	2500
3	2250
4	2600

Y_1 = Quart Reg $/(x \leq 2)$

Y_2 = Quad Reg $/(x \geq 2)$



$\lim_{x \to 2^-}$ ~~$f(2) = 2500$~~ Quart Reg $(x) = 2500$

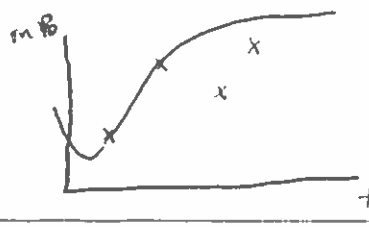
$\lim_{x \to 2^+}$ ~~$f(2) = 2191.4$~~ Quad Reg $(x) = 2191.4$

$\lim_{x \to -\infty}$ Quart Reg $(x) = \infty$

$\lim_{x \to \infty}$ Quad Reg $(x) = -\infty$

Project 3

Y_2 = Quad Reg $/(x \geq 2) + 308$



$\lim_{x \to 2}$ Quad Reg $(x) = 2530$

GROUP NAME: Illuminati

Date: 2/16

Student Names (First and Last)

Speaker/Presenter: Ryan Piotrowski

Writer/Prep: Danyan Zhou

Leader/Collaborator:

Independant Variable (x-axis): year

Dependant Variable (y-axis): prices

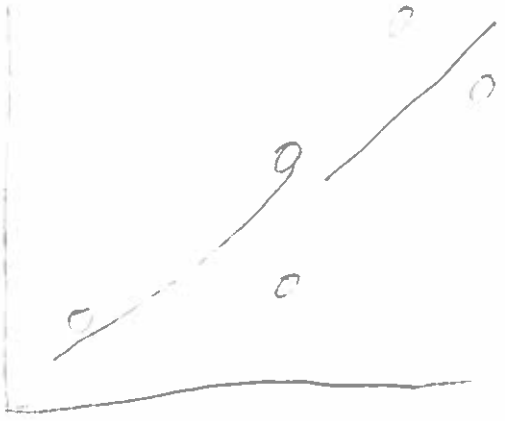
Conclusion (in words): As we approach 2005

Supporting Work:

Y_1 = Linear regression / $(x \leq 105)$

Y_2 = Exponential reg / $(x \geq 105)$

year	y
95	1
102	1.54
105	2.5
112	3.99
114	3.3



x	y_1	b_2
105	2.1059	2.1016

GROUP NAME: Date: 2/10	Student Names (First and Last) Speaker/Presenter: Ryan Piotrowski Writer/Prep: Danyan Zhou Leader/Collaborator:
Independant Variable (x-axis): Dependant Variable (y-axis):	
Conclusion (in words):	

Supporting Work:

$\lim f(x) \to -.27$
$x \to 105$

	Y_1	Y_2
105	2.1059	2.1016

GROUP NAME: Money Makers

Date: 2/10/14

Student Names (First and Last)

Speaker/Presenter: Bryan .S

Writer/Prep: Echa Onyuke

Leader/Collaborator: Monica Koncanar

Independant Variable (x-axis): Year

Dependant Variable (y-axis): crime rate

Conclusion (in words):

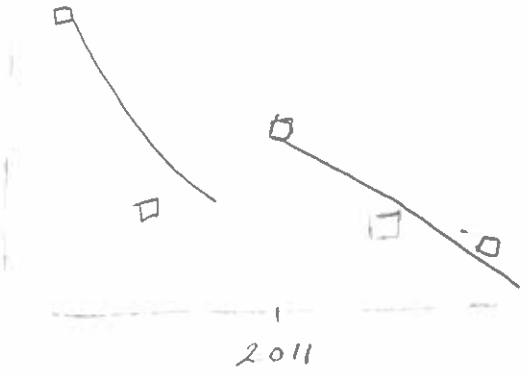
As we approach 2011 the rate is expected to be 0.538 or 54 to

Supporting Work:

x	y
[illegible]	.75
[illegible]	.52
[illegible]	.59
2012	.44
2013	.39

Y_1 = Reg Exp / (x ≤ 2011)

Y_2 = reg lin / (x ≥ 2011)



$\lim_{x \to 2011^-} = 0.518$

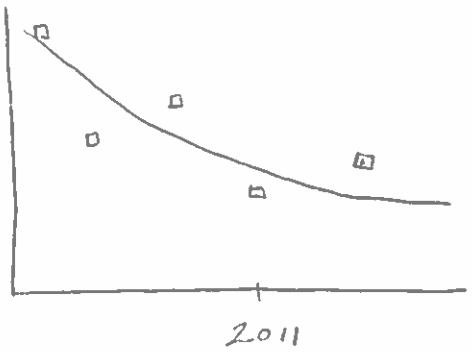
$Y_1 = .01x^2 + -40.3x + 40602.67 / (x \leq 2011) + .02$

$\lim_{x \to 2011^+} = 0.538$

$Y_2 = -.02x + 161.418 / (x \geq 2011)$

$\lim_{x \to -\infty} =$ [illegible]

$\lim_{x \to \infty} =$ [illegible]



$\lim_{x \to 2011} = 0.538$ continuous

GROUP NAME: 11 rates

Date: 02|10|2014

Student Names (First and Last)

Speaker/Presenter: Shanon Isoe

Writer/Prep: Onur Turkay

Leader/Collaborator: Fuad

Independant Variable (x-axis): bandwidth

Dependant Variable (y-axis): time

Conclusion (in words): - the av. time limit with $\lim_{x \to 80^-}$ is 35.953 min

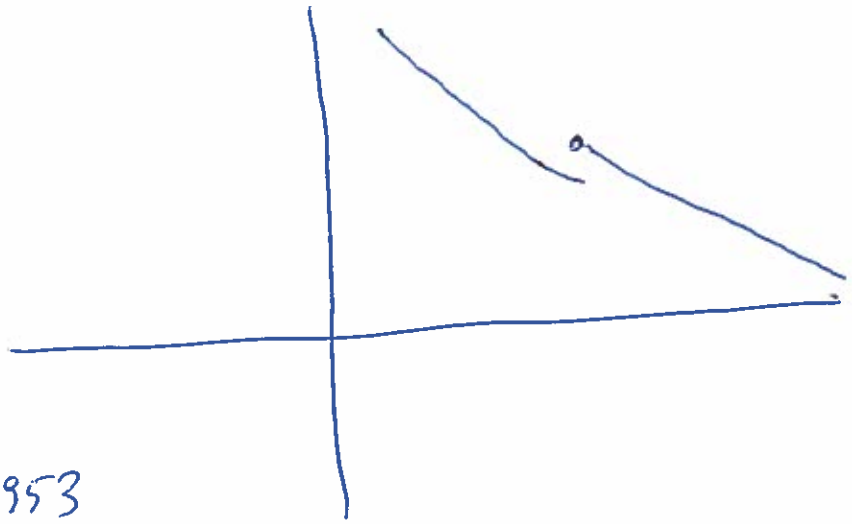
$\lim_{x \to 80^+}$ is 41.121 min

Supporting Work:

GB	time
40	60
60	50
80	40
120	20
160	10

$Y_1 = \text{expo reg } / (x \leq 80)$

$Y_2 = \text{lin reg } / (x \geq 80)$



$\lim_{x \to 80^-} \text{reg exp} = 35.953$

$\lim_{x \to 80^+} \text{reg ln}(x) = 41.121$

$\lim_{x \to -\infty} \text{reg exp}(x) = +N$

-95

$\lim_{x \to \infty} \text{reg ln}(x) = -\infty$

9999

- Continuous

Limit exists

$\lim_{x \to a} f(x) = 5.168$

GROUP NAME: Tl rates

Date: 02/10/2014

Student Names (First and Last)

Speaker/Presenter: Sharon Isoe

Writer/Prep: Onur Turkan

Leader/Collaborator: Puraw Patel

Independant Variable (x-axis): bandwidth

Dependant Variable (y-axis): time

Conclusion (in words): - limit only exits continous ~~get~~

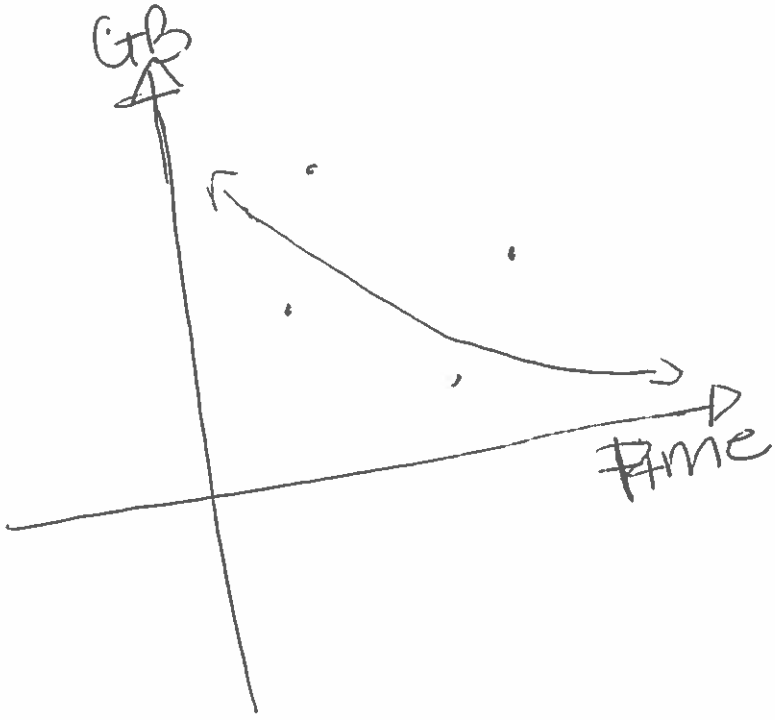
Speed of 5.168 min

Supporting Work:

$Y = expReg / (x \leq 80) + 5.168$

x	Y1	Y2
80	41.121	35.953

$$\begin{array}{r} 41.121 \\ -\ 35.953 \\ \hline 5.168 \end{array}$$



Exp = +5.168.

Speed of 41.121 min

GROUP NAME: Polar Bears

Date: 2/10/14

Student Names (First and Last)

Speaker/Presenter: Natalie Castillo

Writer/Prep: Kavisalya Manivannan

Leader/Collaborator: Fremont Rokele

Independant Variable (x-axis): Year

Dependant Variable (y-axis): deaths due to AIDS

Conclusion (in words):

As we increase the year to 20[illegible] the deaths are 2.42 million. As we go [illegible] time there will be no deaths

Supporting Work:

x	y
2009	2.1
2010	2.3
2011	2.6
2012	2.4
2013	2.7

$y_1 = \text{expo}(x, y) / x \leq$

$y_2 = \text{li}(x, y) / x \geq 2$

$\frac{1}{2}$

$f(x) = 0.45$

$x \to 2011$

$x \to$

$x \to$

GROUP NAME: PD [illegible] Bearz Date: 2/1/14	Student Names (First and Last) Speaker/Presenter: [illegible] Writer/Prep: Kawsiya Mannu Leader/Collaborator: [illegible]
Independant Variable (x-axis): year Dependant Variable (y-axis): deaths	

Conclusion (in words):

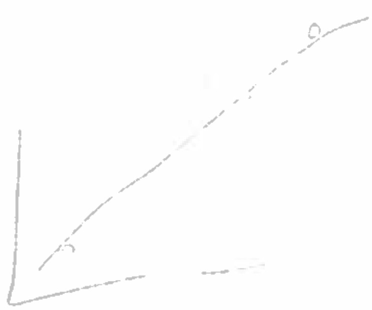
As x approach 2011 there is 0045 deaths due to [illegible]

Supporting Work:

— 0015

lim f(x) = 0.0045
x→2011

20 2 100 42



GROUP NAME: We Mean Business

Date: 2/6/14

Student Names (First and Last)

Speaker/Presenter: Christina Trujillo

Writer/Prep: Yasmin Silverio

Leader/Collaborator: Simar Kalra

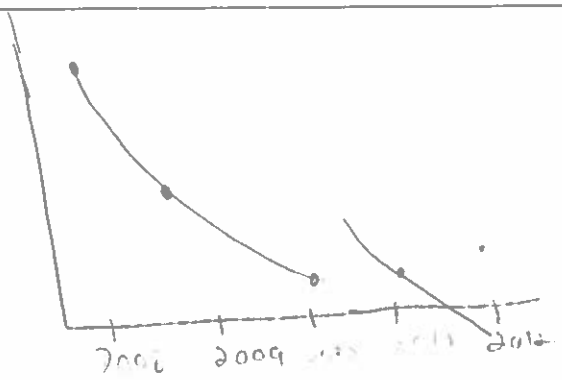
Independant Variable (x-axis): Years

Dependant Variable (y-axis): Interest Rate

Conclusion (in words):

Supporting Work:

X	Y
2006	3.711
2009	1.53
2010	.29
2011	.38
2012	.58



Y_1 = RegQuad /(X ≤ 2010) Y_1= .435x^2 + −1749.411x + 1758933.338 /(X≤2010

Y_2 = Reglin /(X ≤ 2010) Y_2= 435x^2 + −1749.411x + 1758933.338 /(X≤2010

X	Y_1	Y_2
2010	.428	1.298

Conclusion

The limit as you progress to 2010 by looking at Quad regression gives us .428% interest rate for the CD

$\lim_{x \to 2010} Rquad = .428$

The limit for linear regression as we approach 2010 From the right the interest rate is 1.298

$\lim_{x \to 2010} Rlin = 1.298$

$\lim_{x \to -\infty}$ (illegible) $= \infty$

$\lim_{x \to -\infty} Rlin = -\infty$ In a billion years interest rate

Continuous Limit

Linear fit

GROUP NAME: Up Man Rules

Date: 2/10/14

Student Names (First and Last)

Speaker/Presenter: Christina Trujillo

Writer/Prep: Yolanda Silveria

Leader/Collaborator: Limor Kalya

Independant Variable (x-axis): Years

Dependant Variable (y-axis): Interest Rate

Conclusion (in words): Added .87 to limit $\lim_{x \to 2010}$ Equals .128 Continuous

Supporting Work:

Continuous Limit

$\lim_{x \to 2010} f(x) = 1.298$