Agenda

Review Quiz A,B - ALEKS Test

Lecture epsilon delta

Groupwork

Review

Quiz A

Question	Answered Correctly
1. Using a graphing calculator to find local extrema of a polynomial function	72%
2. Union and intersection of intervals	69%
3. Finding limits for a piecewise-defined function	69%
4. Finding a limit by using the limit laws: Problem type 3	67%
5. Determining a parameter to make a function continuous	67%
Average (36 Quiz Reports)	69%

Quiz B

Question	Answered Correctly
1. Finding limits from a graph	100%
2. Finding limits for a piecewise-defined function	92%
3. Finding a limit by using the limit laws: Problem type 1	96%
4. Limits at infinity and graphs	96%
5. Infinite limits and graphs	96%
Average (24 Quiz Reports)	96%

Practice ALEKS test

View: Student Scores | Per Question Results | Detailed Student Results

All Q#1 Q#2 Q#3 Q#4 Q#5 Q#6 Q#7 Q#8 Q#9 Q#10

Question		Answered Correctly
1.	Using a graphing calculator to find local extrema of a polynomial function	75%
2.	Evaluating functions: Absolute value, rational, radical	83%
3.	Union and intersection of intervals	75%
4.	Finding limits for a piecewise-defined function	92%
5.	Finding a limit by using the limit laws: Problem type 2	92%
6.	Determining a parameter to make a function continuous	92%
7.	Finding limits from a graph	92%
8.	Limits at infinity and graphs	92%
9.	Infinite limits and graphs	92%
10.	Infinite limits and graphs	92%
Average (12 Quiz Reports)		88%

Connect is Next!

Lecture : Epsilon Delta

What is Math?

What is Calculus?

What are the two rates of change?

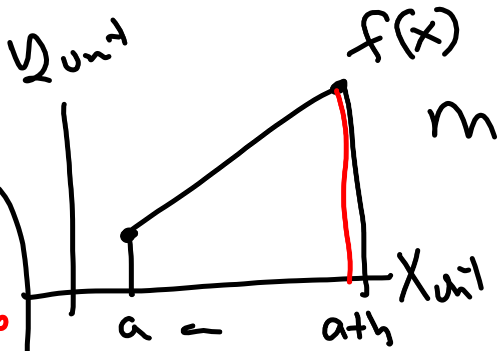
How do we get from two points to one point?

What is math = Language

calculus = Study Change

Rates of Change = instan. v. ave.

1pt 2pts

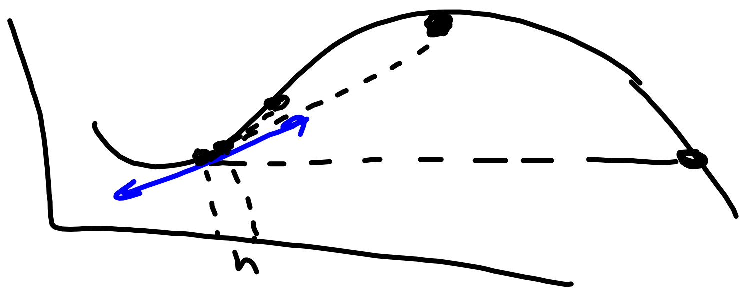


$m =$ rate of change

$\dfrac{y_{\text{unit}}}{x_{\text{unit}}}$

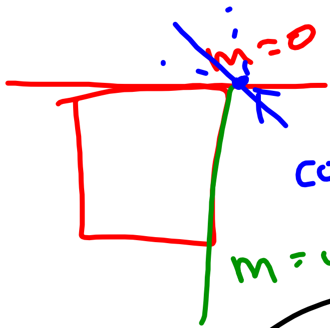
Definition of Derivative

$$\lim_{h \to 0} \frac{f(a+h) - f(a)}{h} = f'(a) = \left.\frac{df}{dx}\right|_{x=a}$$



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

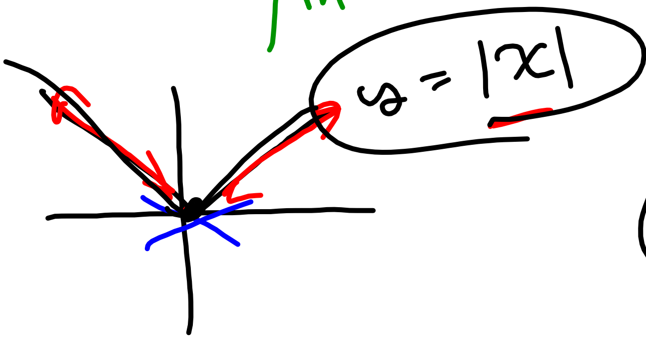
Differentiability

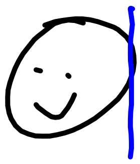


Tangent Line at a Point

corner

No Tangent Line





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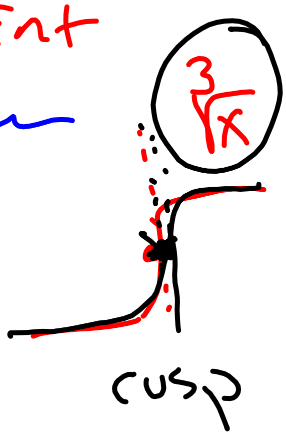
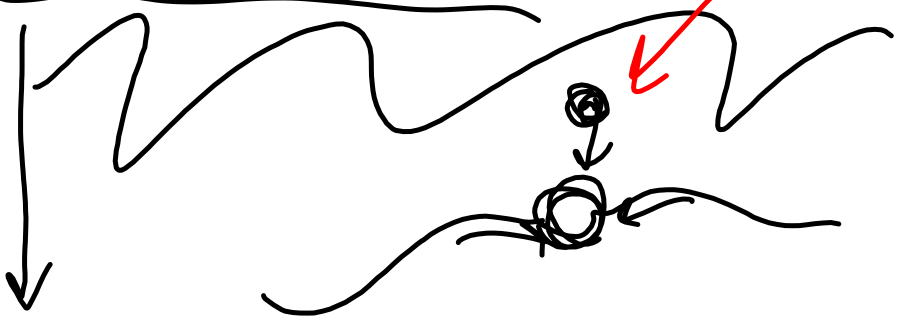


Continuity

Removable Discontinu



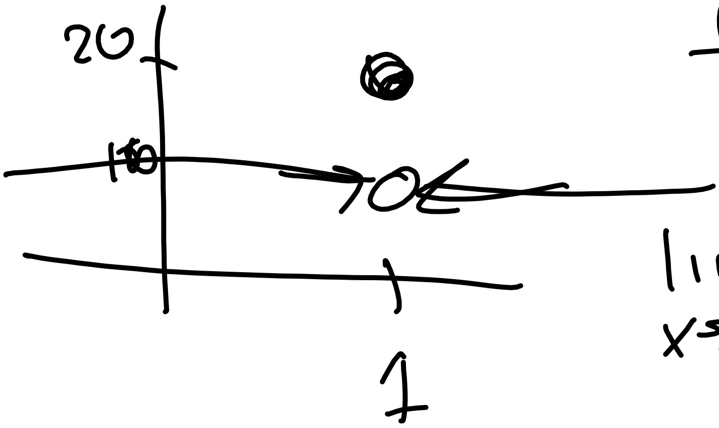
1. limit Exists
2. function Exist
3. limit = Function

Limit

Limit $\lim_{x \to 4} \left(\frac{x-4}{x-4} \right) = 1$

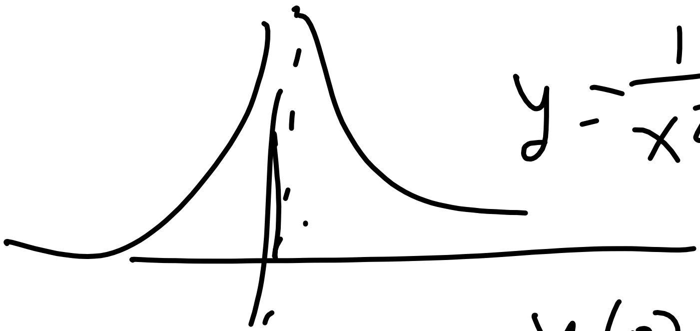
Allows

Note



$f(1) = 20$

$\lim_{x \to 1} f(x) = 10$



$$y = \frac{1}{x^2}$$

$y(0) = \text{DNE}$

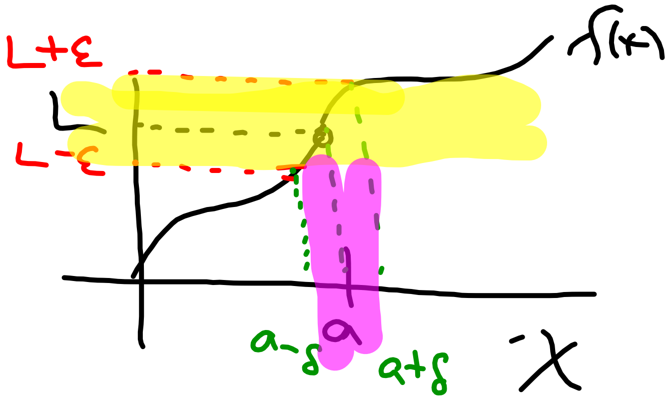
$$\lim_{x \to 0} \frac{1}{x^2} = \infty$$

ε - δ definition of Limit

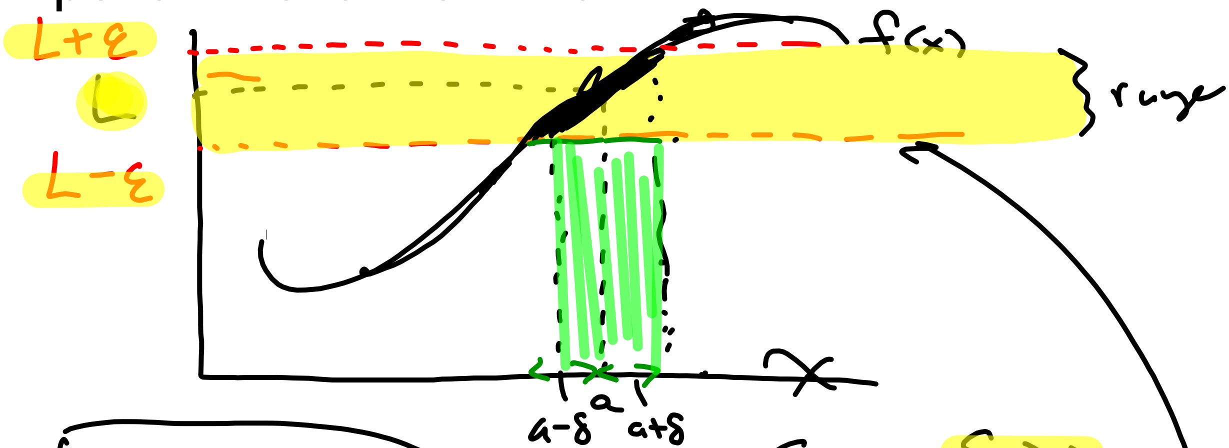
$$\lim_{x \to a} f(x) = L$$

Given any $\varepsilon > 0$ (usually small) you can find a $\delta > 0$ so that

$$|f(x) - L| < \varepsilon \quad \text{whenever} \quad |x - a| < \delta$$



Epsilon Delta Definition



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

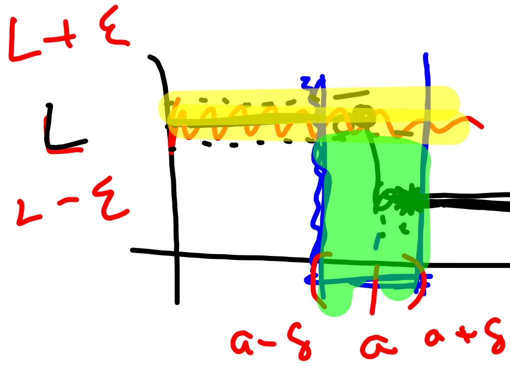
Given $\varepsilon > 0$

Find $\delta > 0$

So that f(x) is in the yellow

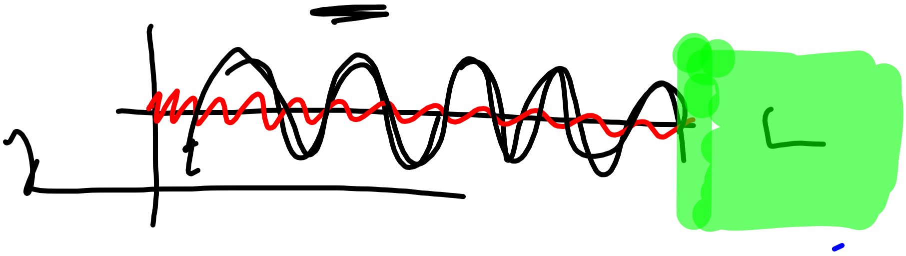
When $|x-a| < \delta$

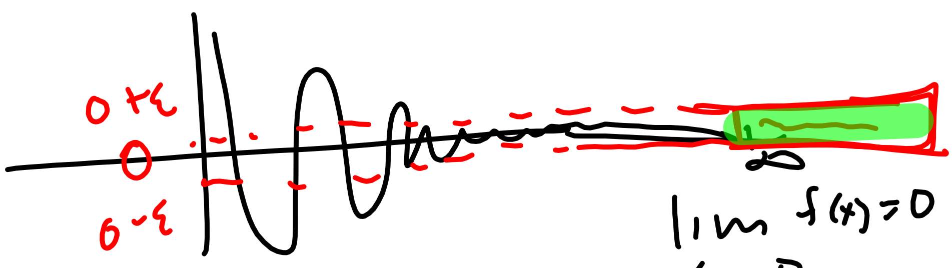
or. x is in green



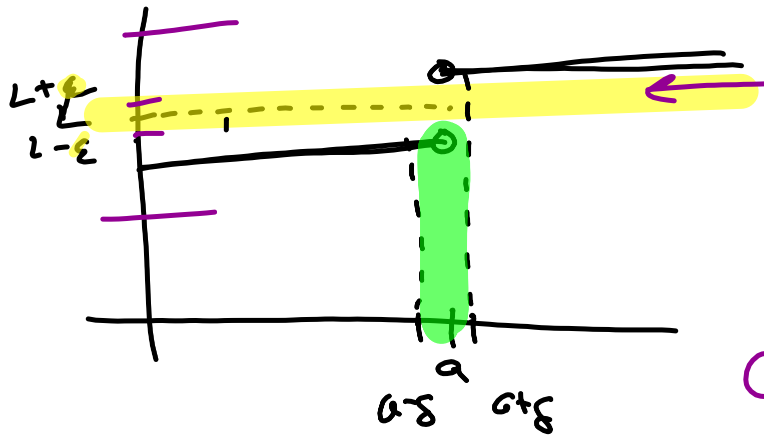
$\lim_{x\to a} f(x) = L$

Limits at infinity





$\lim_{x\to\infty} f(x) = 0$



Jump

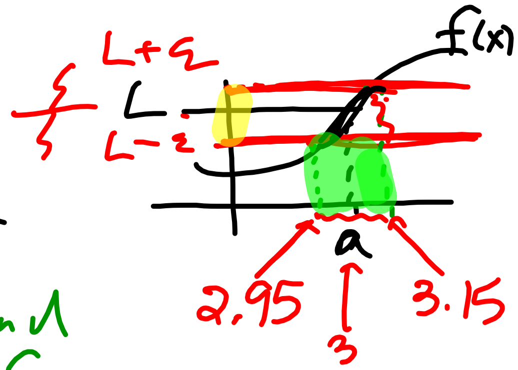
Not covered by $\varepsilon-\delta$

Can't find δ

Given $\varepsilon = .01$

ε - δ

Epsilon delta



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

Can Find a δ = ______

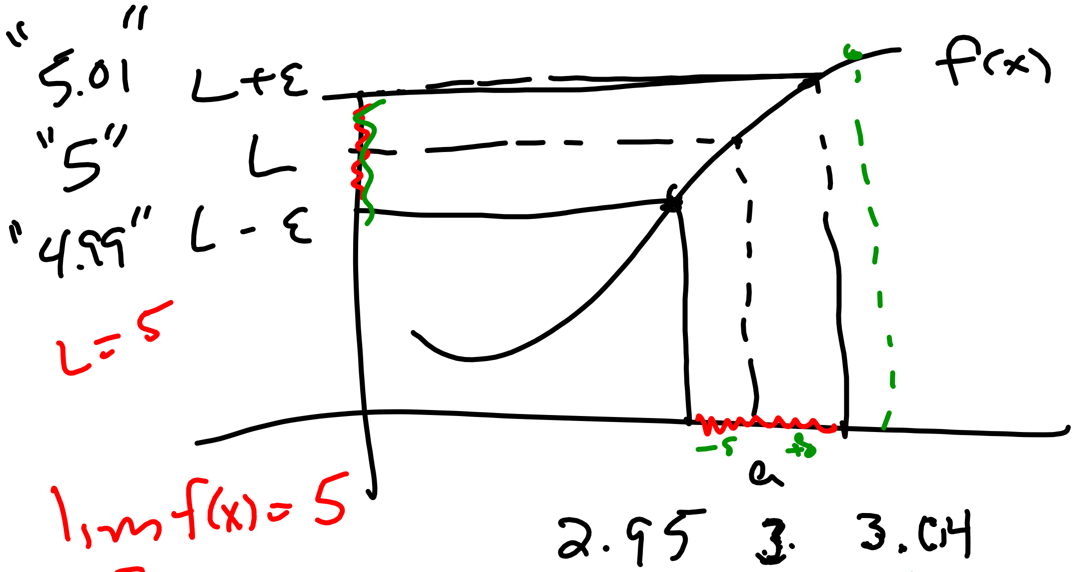
.05 .15

So that

If $|x - a| < \delta$

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

In Red Range. $\Leftarrow$ distance between f(x) and L value is less than ε



.05 .04

$\lim_{x \to 3} f(x) = 5$

$f(2.95) = 4.99$ $f(3.04) = 5.01$

Given $\varepsilon = .01$

Find $\delta = .04$

$f(3 \pm .04) = 4.99 - 5.01$

$f(3 \pm .05) =$ $f(3.05) =$

$f(3 \pm .03) \Rightarrow 4.99 - 5.01$

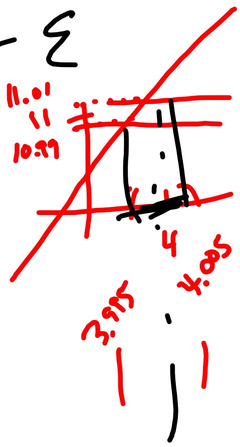
Given $\varepsilon = .01$

$f(x) = 2x+3$

Find δ for $a = 4$

$\lim_{x \to 4} 2x+3 = 11$

$$\boxed{\lim_{x \to 4} f(x) = 11} \leftarrow L$$



$|f(x) - 11| < .01 \leftarrow \varepsilon$

$f(x) \quad L \quad \varepsilon$

$|2x+3-11| < .01$

$|2x-8| < .01$

$2|x-4| < .01$

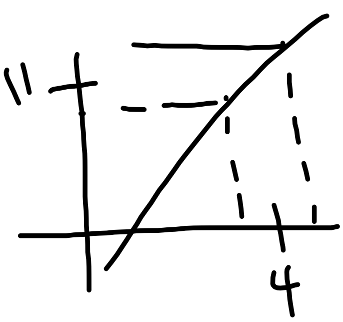
$|x-4| < \frac{.01}{2} = .005 = \delta$

$|x-a| \quad \delta$

As long as x is betwix 3.995 and 4.005

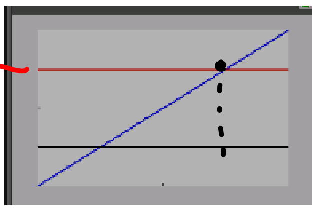
$4-\delta \quad 4+\delta$

Your y-value is betwix 10.99 and 11.01



$L+\varepsilon$

$L-\varepsilon$



Given $\varepsilon = .03$

$f(x) = 2x - 5$

$\lim_{x \to 12} 2x - 5 = 19$

Find δ

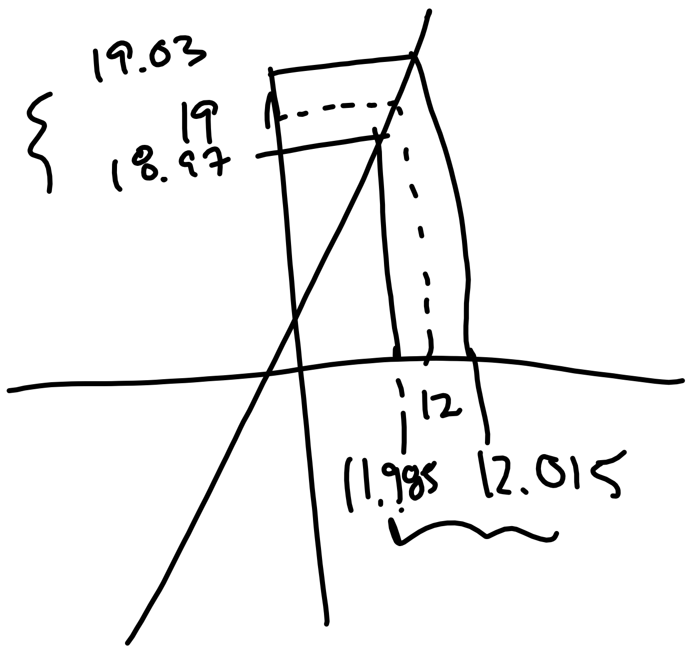
$$|f(x) - L| < \varepsilon$$

$$|2x - 5 - 19| < .03$$

$$|\underbrace{2x - 24}| < .03$$

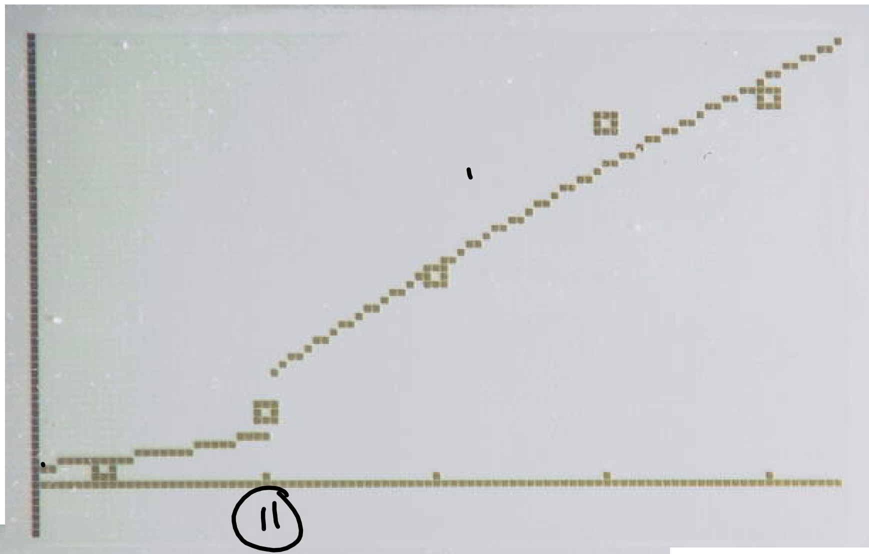
$$2\,|x - 12| < .03$$

$$\underbrace{|x - 12|} < .03/2$$


19.03
19
18.97
12
11.985
12.015

Project

Project epsilon Delta- disc

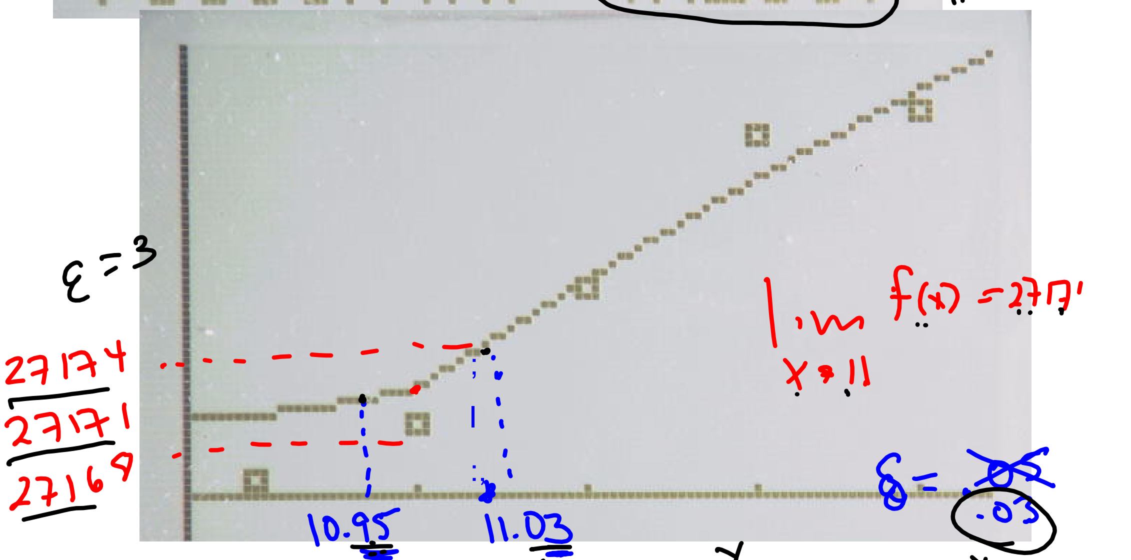


$Y_2(11) - Y_1(11)$ =14574.46...

Plot1 Plot2 Plot3

\Y1 = .96129924517059*2.3676061244206^X/(X≤11)+14574.46729

\Y2 = -717189.18888321+310422.44977583ln(X)/(X≥11)+#

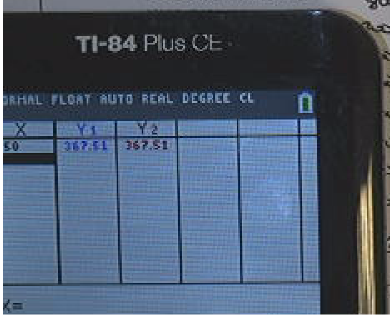


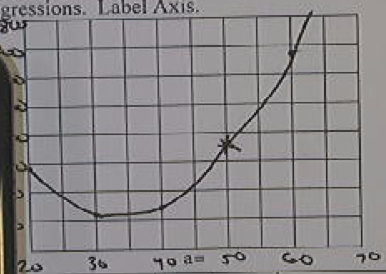
What is f(11) =

X	Y1	Y2
10	19895	ERROR
11	27171	27171
12	ERROR	54182

At 50,000 cases of fracking, there are about 367.56 earthquakes. This data is due to global warming and an increase in obesity (which causes more pressure on the earth's surface).

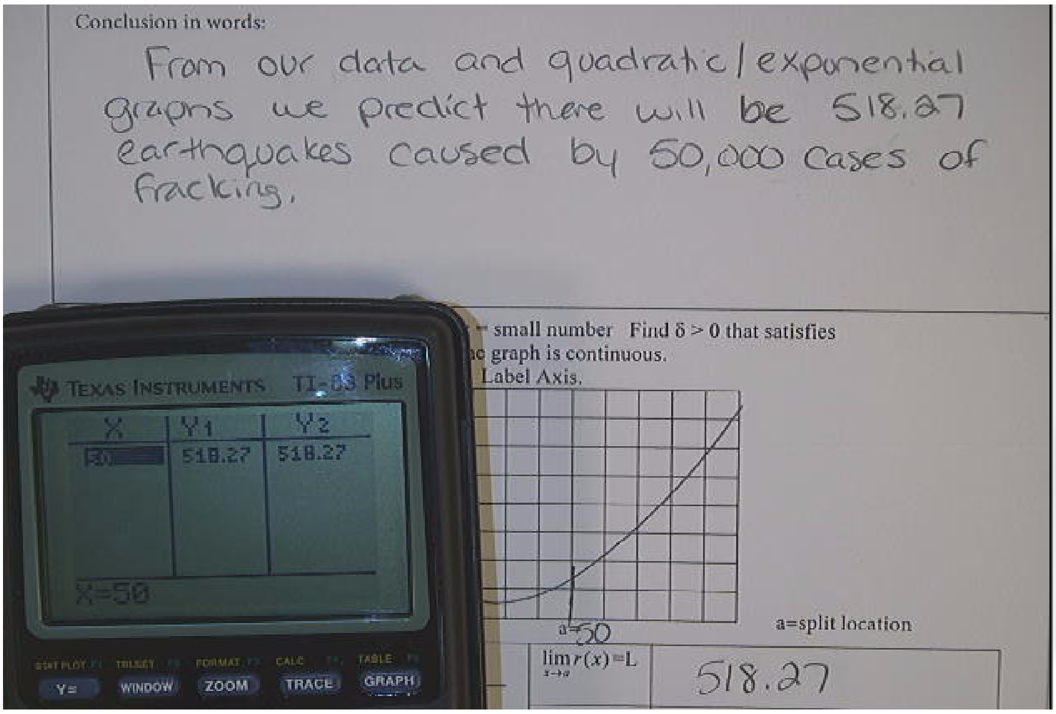
4. For a continuous regression: Given ε = small number Find δ > 0 that satisfies
Roughly adjust the regressions so the graph is continuous.
Plot data and graph the regressions. Label Axis.





a=split location

continuity____	$\lim_{x\to a} r(x)=L$	367.51


Conclusion in words:
From our data and quadratic/exponential graphs we predict there will be 518.27 earthquakes caused by 50,000 cases of fracking.
Texas Instruments TI-83 Plus
X
Y1
Y2
518.27
518.27
X=50
Y=
WINDOW
ZOOM
TRACE
GRAPH
small number Find δ > 0 that satisfies
graph is continuous.
Label Axis.
a=50
a=split location
lim r(x)=L
518.27

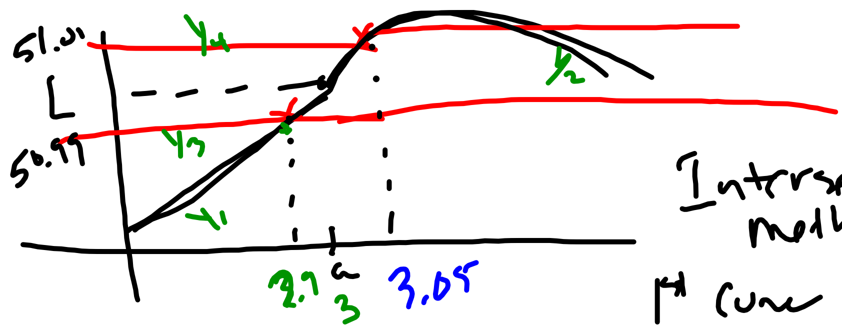
$$Y_1 = res1/(x \leq a)$$

$$Y_2 = res2/(x \geq a)$$

$$Y_3 = 51 - .01$$

$$Y_4 = 51 + .01$$

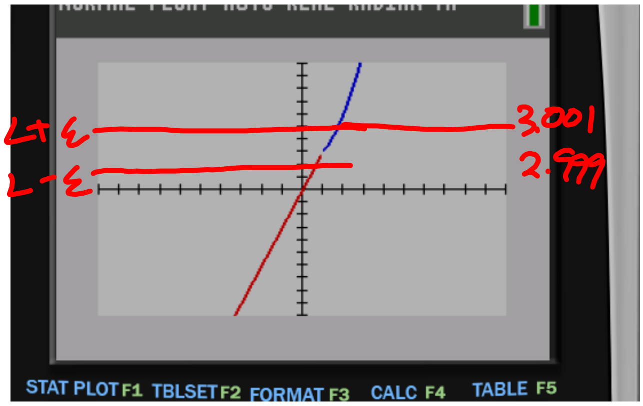
Graph



Intersection method

1st curve	Y_1	Y_2
2nd curve	Y_3	Y_4
guess	2.9	3.1

$$\lim_{x \to 1} S(x) = 3$$



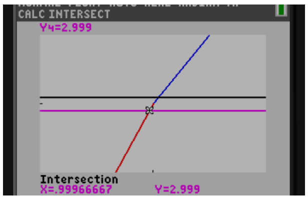
$S(x)$

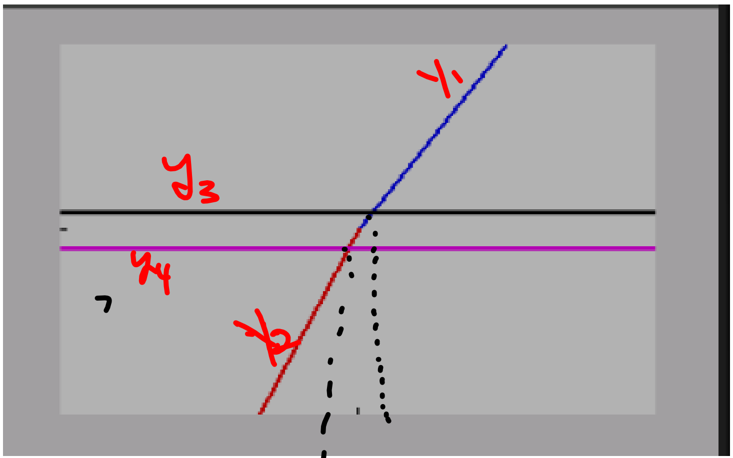
Given $\varepsilon = .001$

Find δ so that

whenever $|S(x) - 3| < .001$

$|x - 1| < \delta$





If $\varepsilon = .001$

$\delta = .0003$

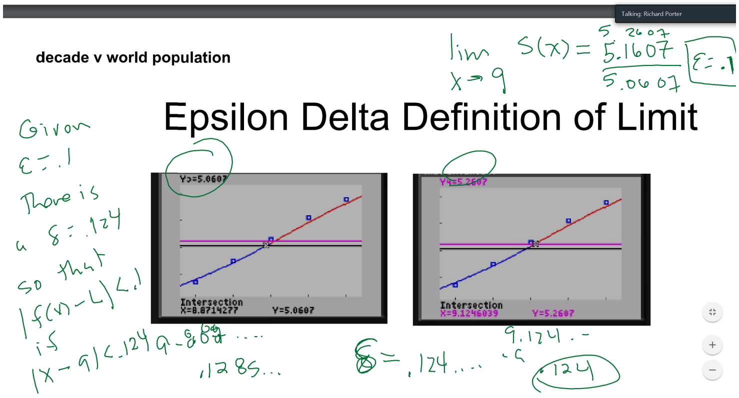
$\delta = .02$

1.0004999

$1.0004999 - 1 = .0004999$

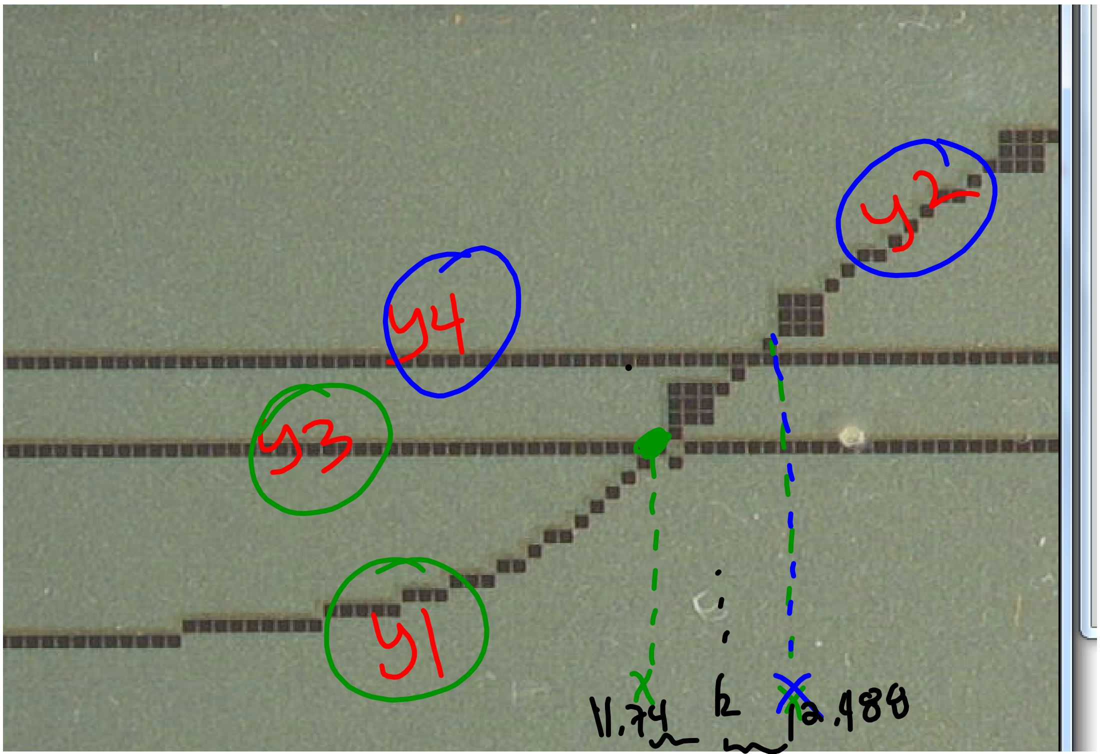
$1 - .99966667 = .00033333$

.99966667



As the decades approach 90's

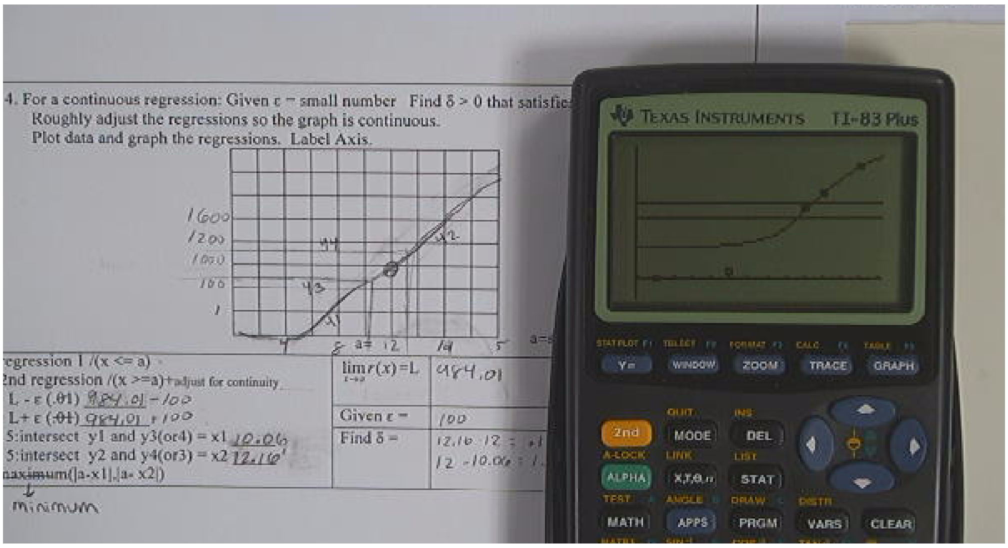
The world population quickly approaches 5.16 Billion people



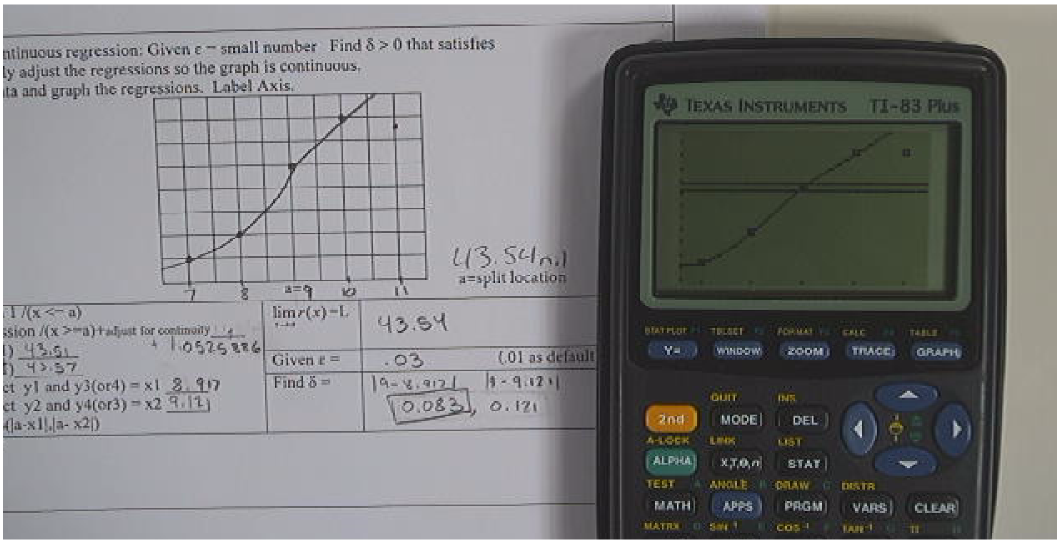
$(11.74,\ 12.488)$

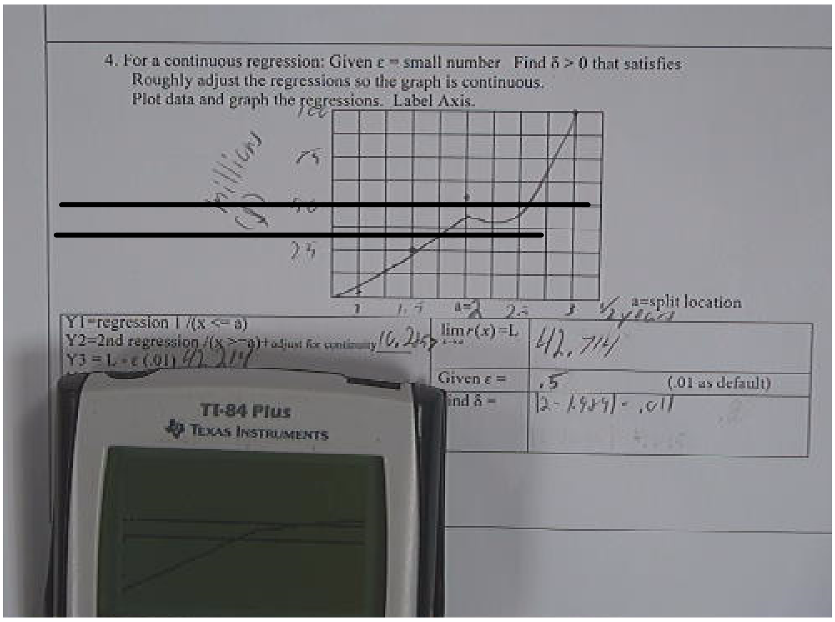
$12 - .26 \qquad 12 \qquad 12 + .488$

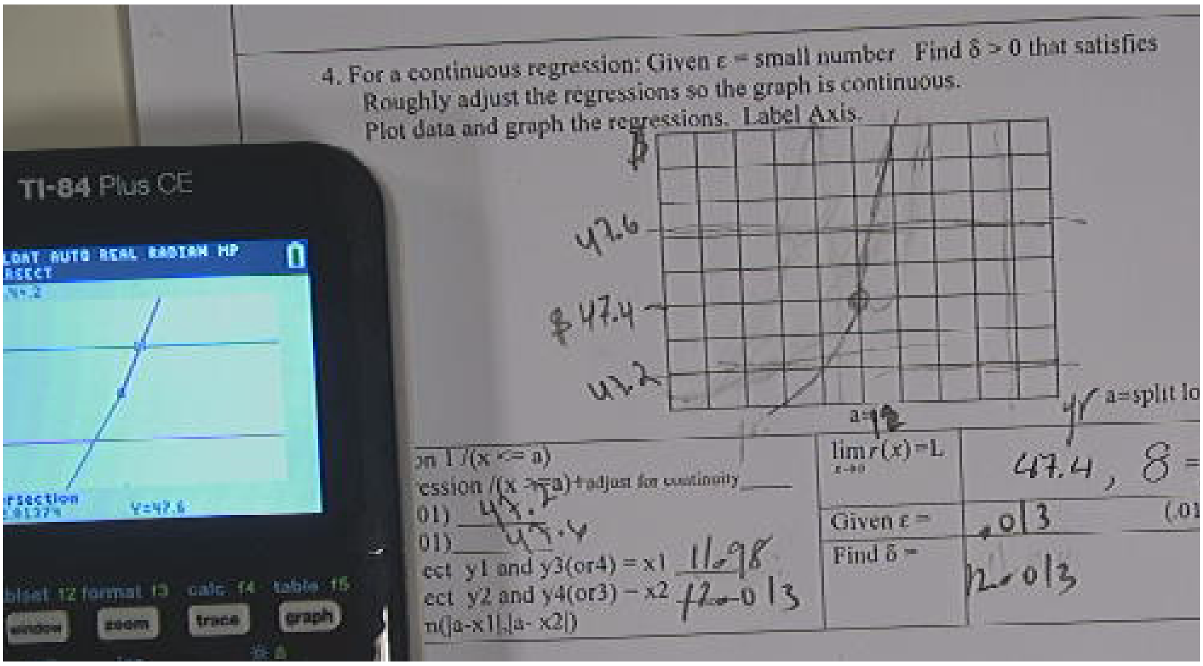
As long as X is with .26 of 12,
My f(x) is with ε of L

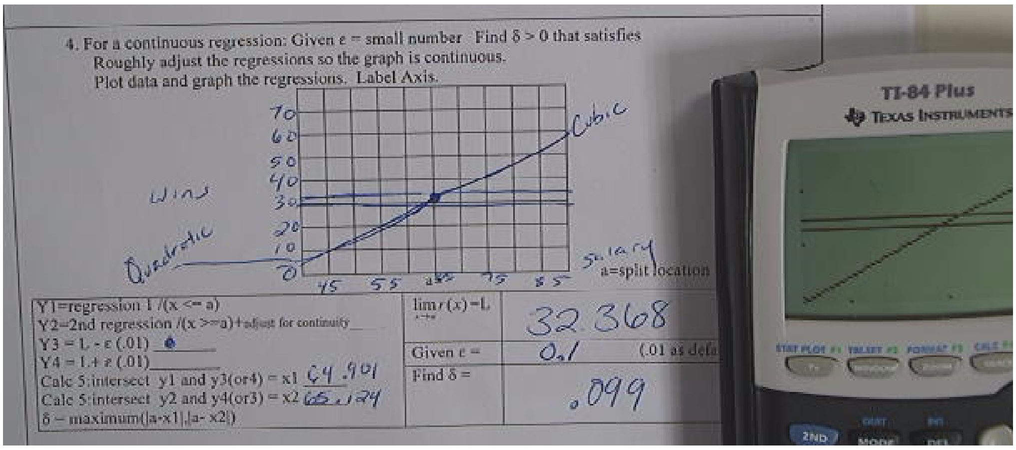


4. For a continuous regression: Given ε = small number Find δ > 0 that satisfie
Roughly adjust the regressions so the graph is continuous.
Plot data and graph the regressions. Label Axis.
1600
1200
1000
100
1
y4
y3
y2
y1
4
8
a= 12
14
egression 1 /(x <= a)
2nd regression /(x >=a)+adjust for continuity
L - ε (.01) 984.01 - 100
L+ ε (.01) 984.01 + 100
5:intersect y1 and y3(or4) = x1 10.06
5:intersect y2 and y4(or3) = x2 12.16
maximum(|a-x1|,|a- x2|)
minimum
lim r(x)=L
984.01
Given ε =
100
Find δ =
12.16 - 12
12 - 10.06
TEXAS INSTRUMENTS TI-83 Plus
STAT PLOT
TBLSET
FORMAT
CALC
TABLE
Y=
WINDOW
ZOOM
TRACE
GRAPH
QUIT
INS
2nd
MODE
DEL
A-LOCK
LINK
LIST
ALPHA
STAT
TEST
ANGLE
DRAW
DISTR
MATH
APPS
PRGM
VARS
CLEAR

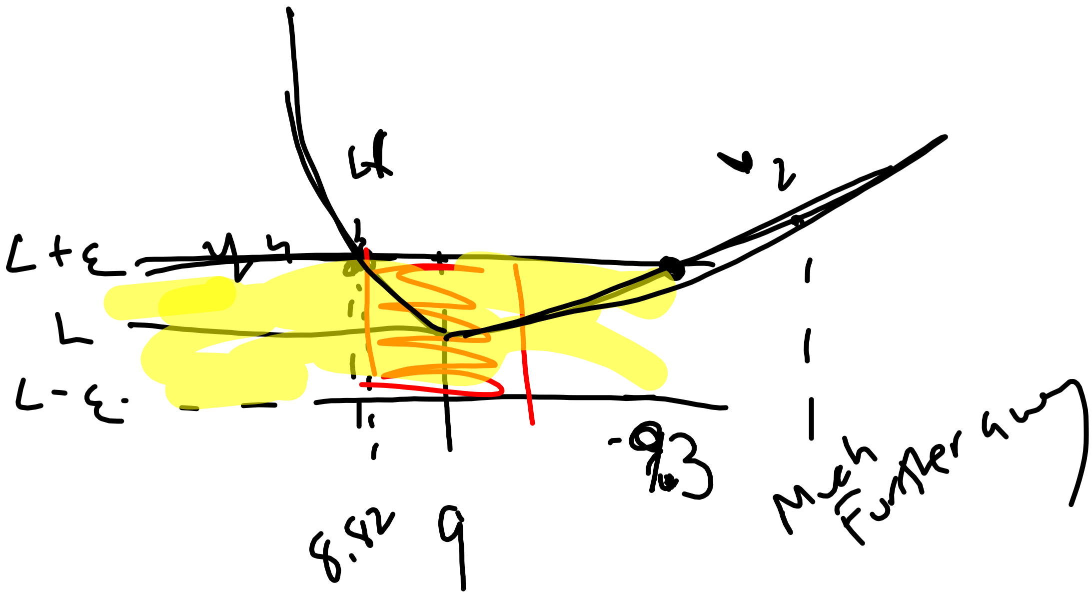

ntinuous regression: Given ε = small number Find δ > 0 that satisfies
ly adjust the regressions so the graph is continuous.
ita and graph the regressions. Label Axis.
43.54n.l
a=split location
Given ε =
.03
(.01 as default
Find δ =
0.083
0.121
TEXAS INSTRUMENTS TI-83 Plus


4. For a continuous regression: Given ε = small number Find δ > 0 that satisfies
Roughly adjust the regressions so the graph is continuous.
Plot data and graph the regressions. Label Axis.
100
75
50
25
millions
1
1.5
a=2
2.5
3
a=split location
Y1=regression 1 /(x <= a)
Y2=2nd regression /(x >= a)+adjust for continuity 16.265
Y3 = L - ε (.01) 42.214
lim f(x) = L
42.714
Given ε =
.5
(.01 as default)
Find δ =
|2 - 1.989| = .011
TI-84 Plus
Texas Instruments

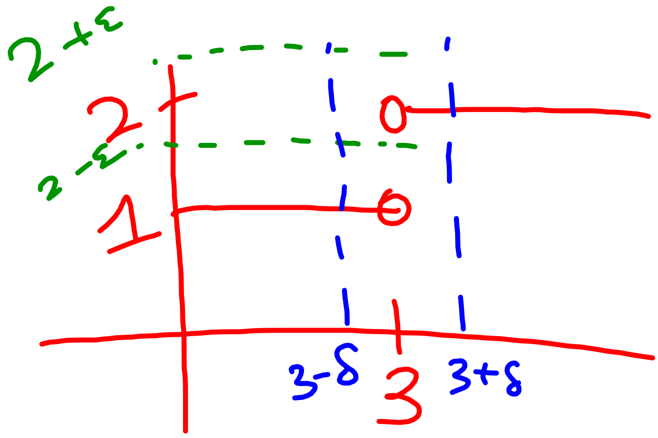

TI-84 Plus CE
4. For a continuous regression: Given ε = small number Find δ > 0 that satisfies
Roughly adjust the regressions so the graph is continuous.
Plot data and graph the regressions. Label Axis.
47.6
47.4
47.2
a=12
a=split lo
lim r(x)=L
47.4, 8 =
Given ε =
.013
Find δ =
12-.013
ect y1 and y3(or4) = x1 11.98
ect y2 and y4(or3) = x2 12-.013
n(|a-x1|,|a- x2|)
window
zoom
trace
graph
Y=47.6



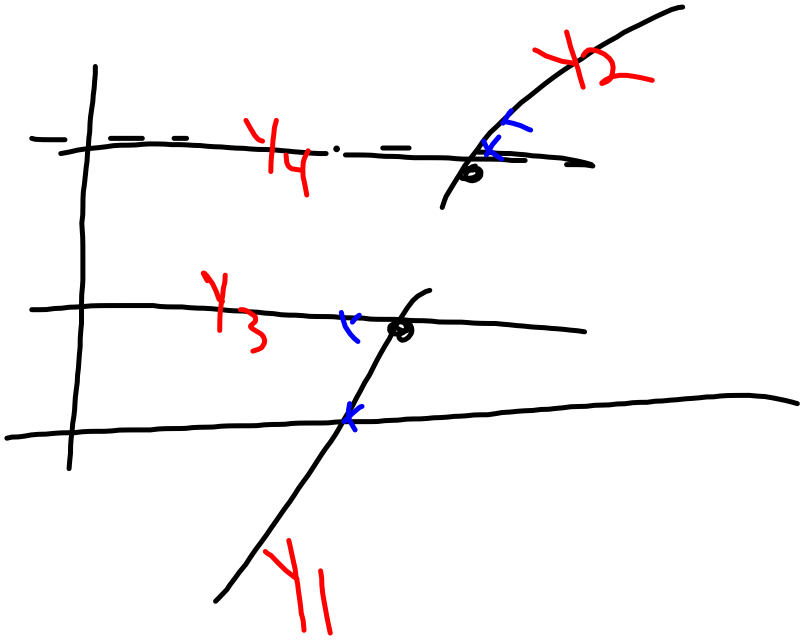
"as long as the salary is within.099 of 65K, the number ofwinsis within .1 of 32.368"



δ = .18 much



$$\lim_{x \to 3} f(x) = 2$$



Y_2
Y_4
Y_3
Y_1

Project Presentations

Week 1: Average Rate of Change