

1. Roughly plot data and regression. Label Axis.


Regression used:	
First x (a)	
Last x (b)	

Find the average rate of change between the first and last x-values using regression

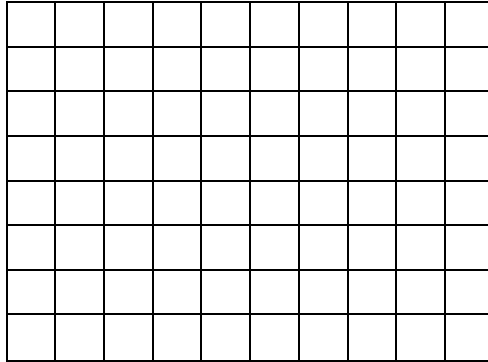
$\{Y1(b)-Y1(a)\}/\{b - a\}$	Average Rate of Change	
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2. Roughly split the graph into two regions and perform different regressions on each side.

Plot data and regressions. Label Axis.

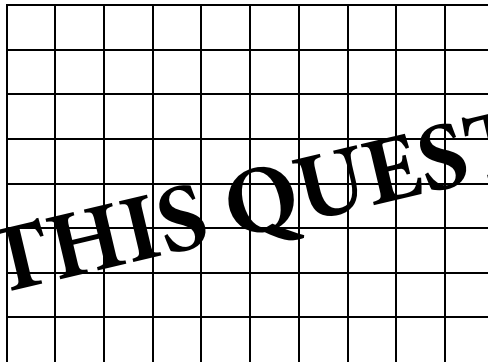

left regression split at a $Y1 = \text{vars } 5: > > 1: \text{RegEq } / (x \leq a)$  right regression $Y2 = \text{vars } 5: > > 1: \text{RegEq } / (x \geq a)$	Left Regression used:	
	Right Regression used:	
	Location of split (a)	
Find $Y1(a)$ $Y2(a)$	$\lim_{x \rightarrow a^-} r(x)$	
	$\lim_{x \rightarrow a^+} r(x)$	

3. Roughly split the graph into two regions and perform different regressions on each side.  
Plot data and regressions. Label Axis.



left regression split at a Y1=vars 5: >> 1: RegEq /(x≤a)	Left Regression used:	
right regression Y2=vars 5: >> 1: RegEq /(x≥a)	Right Regression used:	
Find Y1(-9999) Y2(9999)	$\lim_{x \rightarrow -\infty} r(x)$	
	$\lim_{x \rightarrow +\infty} r(x)$	

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



**OMIT THIS QUESTION**

Y1(x)=regression (y2=split regression) Y3=L- $\epsilon$ Y4=L+ $\epsilon$ Calc 5:intersect y1 and y3 = x1 Calc 5:intersect y1(2) and y4 = x2 $\delta = \text{maximum}( a-x1 ,  a-x2 )$	$\lim_{x \rightarrow a} r(x) = L$	
	Given $\epsilon =$	
	Find $\delta =$	

5. Roughly plot data and regression. Draw the secant and tangent lines at  $x = a$  Label Axis.


Pick x values in order

X1=	
X2=	
X3=	
a=	
X4=	
X5=	
X6=	

Find the average rate of change between the exterior x-values around  $x = a$  using regression

$\{Y1(x1) - Y1(x6)\} / \{x1 - x6\} = m_{sec}$	Average Rate of Change	
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Find the average rate of change between an interior x-values around  $x = a$  using regression

$\{Y1(x2) - Y1(x5)\} / \{x2 - x5\} = m_{sec}$	Average Rate of Change	
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Find the average rate of change between the more interior x-values around  $x = a$  using regression

$\{Y1(x3) - Y1(x4)\} / \{x3 - x4\} = m_{sec}$	Average Rate of Change	
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Find the instantaneous rate of change at  $x = a$

nderiv(y1,x,a) or calc 6:dydx and x =a	Instant Rate of Change	
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6. Find the derivatives of different regressions using rules at  $x = x1$

Linear Regression $y1=ax+b$	y' = a	y'(x1) =
Quadratic Regression $y2=ax^2+bx+c$	y' = 2ax+b	y'(x1) =
Cubic Regression $y3=ax^3+bx^2+cx+d$	y' = 3ax^2+2bx+c	y'(x1) =
Quartic Regression $y4=ax^4+bx^3+cx^2+dx+e$	y' = 4ax^3+3bx^2+2cx+d	y'(x1) =

Compare to  $y5 = nderv(y4,x,x)$  at  $x = x2, x3, x4$

X2=	y4'(x2) =
X3=	y4'(x3) =
X4=	y4'(x4) =

7. Find the derivatives of different regressions using rules at  $x = x_1$

Exponential $y_6 = a \cdot b^x$	$y' = a \cdot b^x \cdot \ln(b)$	$y'(x_1) =$
Ln Regression $y_7 = a \ln x + b$	$y' = a/x$	$y'(x_1) =$

Compare to  $y_8 = \text{nderv}(y_6, x, x)$  at  $x = x_2, x_3, x_4$

X2=	$y_8'(x_2) =$
X3=	$y_8'(x_3) =$
X4=	$y_8'(x_4) =$

8. Find the second derivatives of different regressions using rules at  $x = x_1$

Linear Regression $y_1 = ax + b$	$y'' = 0$	$y''(x_1) =$
Quadratic Regression $y_2 = ax^2 + bx + c$	$y'' = 2a$	$y''(x_1) =$
Cubic Regression $y_3 = ax^3 + bx^2 + cx + d$	$y'' = 6ax + 2b$	$y''(x_1) =$
Quartic Regression $y_4 = ax^4 + bx^3 + cx^2 + dx + e$	$y'' = 12ax^2 + 6bx + 2c$	$y''(x_1) =$

Compare to  $y_5 = \text{nderv}(\text{nderiv}(y_4, x, x), x, x)$  at  $x = x_2, x_3, x_4$

X2=	$y_5''(x_2) =$
X3=	$y_5''(x_3) =$
X4=	$y_5''(x_4) =$

9. Make a transformation of your x-values and your y-values

New x-values (units)	Old x-values(units)	Y1=
Old x-values(units)	Old y-values(units)	Y2(regression)=
Old y-values(units)	New y-values(units)	Y3=

Example: cm to inches  $y_1 = x/2.54$   
 Inches to lbs  $y_2 = \text{linreg}$   
 Lbs to kg  $y_3 = x/2.2$

$Y_4'(A) =$   
 $\text{nderiv}(y_3, x, (y_2, x, (y_1, x, A))) * \text{nderiv}(y_2, x, (y_1, x, A)) * \text{nderiv}(y_1, x, A)$

OMIT THIS QUESTION

Regression used:	
New x-value(A)	
$Y_4'(A)$	
units	

10. Find the derivatives of sine regression using rules at  $x = x_1$

Sine Regression $y_2 = a \sin(bx+c)+d$	$y' = a \cos(bx+c) * b$	$y'(x_1) =$
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Find the second derivatives of sine regression using rules at  $x = x_1$

Sine Regression $y_2 = a \sin(bx+c)+d$	$y'' = -a \sin(bx+c) * b^2$	$y''(x_1) =$
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OPTIONAL

11. Find the derivatives of the inverse sine regression using rules at  $y = y_1$

Sine Regression $y_2 = a \sin(bx+c)+d$	$X = \sin^{-1}((y-d)/a)/b-c$	$x'(y_1) =$
	$X' = 1/(1-((y-d)/a)^2)^{.5}/b$	

**OMIT THIS QUESTION**

12. Use the mean value theorem on the two end points OF a regression and identify a point on the graph with a similar slope?

$Y_1 = \text{regEq}$ $Y_2 = \text{nderv}(y_1, x, x)$ $Y_3 = \text{"average rate of change"}$ Calc 5:intersect	Regression used:	
	Ave Rate of change:	
	Point(s) of intersection:	

13. Was the zero found by using Newton's Method for by using  $x=0$  or  $x=1$  as an initial guess?

$Y_1 = \text{cubic regression}$   
 $0 \text{ to } x$   
 $x - y_1 / \text{nderv}(y_1, x, x) \text{ to } x$

iteration \_\_\_\_\_

iteration \_\_\_\_\_

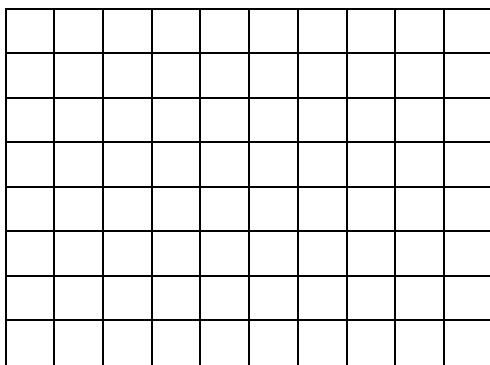
iteration \_\_\_\_\_

zero: \_\_\_\_\_

14. Related rates

OPTIONAL  
**OMIT THIS QUESTION**

15. Graph the cubic or quartic regression, identify all critical points, concavity, and inflection points.



X:									
Y'									
Increasing or Decreasing									
Y''									
Concavity? Up or Down									

16.

Find  $y'=0$  to identify critical values  $a_1, a_2$

Critical Points	
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Find  $y''(a_1)$  and  $y''(a_2)$  to determine max/min

Y'' at critical Points	
Max or Min	

17. Find  $y''=0$  to identify inflection points Did the student take the second derivative and identify concavity for the zero of the cubic regression?  $Y''=0$  at  $-b/(6a)$ : \_\_\_\_\_

Inflection Points	
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