NAME:

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Data points:

|  |  |  |  |  |  |  |  |  |  |
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| X: |  |  |  |  |  |  |  |  |  |
| Y: |  |  |  |  |  |  |  |  |  |

Description of X values:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Units:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Description of Y values:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Units:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Source of the data: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Why it is interesting:

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ALL regressions calculated:

LinReg: a=\_\_\_\_\_ b=\_\_\_\_\_\_ r2=\_\_\_\_\_\_\_

QuadReg: a=\_\_\_\_\_ b=\_\_\_\_\_\_ c=\_\_\_\_\_\_\_ r2=\_\_\_\_\_\_\_

CubicReg: a=\_\_\_\_\_ b=\_\_\_\_\_\_ c=\_\_\_\_\_ d=\_\_\_\_\_\_ r2=\_\_\_\_\_\_\_

QuartReg: a=\_\_\_\_\_ b=\_\_\_\_\_\_ c=\_\_\_\_\_ d=\_\_\_\_\_\_ e=\_\_\_\_\_ r2=\_\_\_\_\_\_\_

ExpReg: a=\_\_\_\_\_ b=\_\_\_\_\_\_ r2=\_\_\_\_\_\_\_

LnReg: a=\_\_\_\_\_ b=\_\_\_\_\_\_ r2=\_\_\_\_\_\_\_

SinReg\*: a=\_\_\_\_\_ b=\_\_\_\_\_\_ c=\_\_\_\_\_ d=\_\_\_\_\_\_\_

\*sin regression has a period of \_\_\_\_\_\_\_\_\_\_\_

Calculated with SinReg 1,L1,L2,# (where # is twice the distance from largest to smallest x value.)

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| Prof. Porter | Mercer County College | Spr 2017 | REGRESSION PROJECT WORK SHEET |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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| 1. Plot of data and regression.  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | | Regression used: |  | | First x (a) |  | | Last x (b) |  |   Average rate of change between the first and last x-values using regression   |  |  |  | | --- | --- | --- | | {Y(b)-Y(a)}/{b - a} | Average Rate of Change |  |   Meaning: |
| 1. The graph split into two regions with two different regressions on each side.  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | | left regression split at a  Y1=vars 5: > > 1: RegEq /(x≤a)  right regression  Y2=vars 5: > > 1: RegEq /(x≥a) | Left Regression used: |  | | Right Regression used: |  | | Location of split (a) |  | | Find Y1(a)  Y2(a) |  |  | |  |  |   Meaning:   1. The graph split into two regions with two different regressions on each side.  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | | left regression split at a  Y1=vars 5: > > 1: RegEq /(x≤a)  right regression  Y2=vars 5: > > 1: RegEq /(x≥a) | Left Regression used: |  | | Right Regression used: |  | | Find Y1(-9999)  Y2(9999) |  |  | |  |  |   Meaning: |
| 1. Using the derivative to find the equation of the tangent line at a point  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | Y1=regression  Y2=nderiv(y1,x,x)  Table values:   |  |  |  | | --- | --- | --- | | a= | y1 | y2 |   Y3=y1+y2(x-a) | Regression: |  | | Given a= |  | | Equation of Tangent Line: |  |   Meaning: |
| 1. The graph split into two regions with two different regressions on each side.  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | | left regression split at a  Y1=vars 5: > > 1: RegEq /(x≤a) + adjust  right regression  Y2=vars 5: > > 1: RegEq /(x≥a) + adjust | Left Regression used: |  | | Right Regression used: |  | | Location of split (a) |  | | Find Y1(a)  Y2(a) |  |  |   Meaning: |
| 1. For a continuous regression: Given ɛ = small number Find δ > 0 that satisfies   Roughly adjust the regressions so the graph is continuous.  Plot data and graph the regressions. Label Axis.   |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | | Y1(x)=regression (y2=split regression)  Y3=L- ɛ  Y4=L+ ɛ  Calc 5:intersect y1 and y3 = x1  Calc 5:intersect y1(2) and y4 = x2  δ = maximum(|a-x1|,|a- x2|) | =L |  | | Given ɛ = |  | | Find δ = |  |   Meaning: |
| 1. 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   |  |  |  | | --- | --- | --- | | {Y(x1) - Y(x6)}/{x1 – x6}= msec | Average Rate of Change |  |   Find the average rate of change between an interior x-values around x = a using regression   |  |  |  | | --- | --- | --- | | {Y(x2) - Y(x5)}/{x2 – x5}= msec | Average Rate of Change |  |   Find the average rate of change between the more interior x-values around x = a using regression   |  |  |  | | --- | --- | --- | | {Y(x3) - Y(x4)}/{x3 – x4}= msec | Average Rate of Change |  |   Find the instnataneous rate of change at x = a   |  |  |  | | --- | --- | --- | | nderiv(y1,x,a) | Instant Rate of Change |  |   Meaning: |
| 1. Find the derivatives of different regressions using rules at x = x1  |  |  |  | | --- | --- | --- | | Linear Regression y1=ax+b | y’= a | y’(x1) = | | Quadratic Regression y2=ax2+bx+c | y’= 2ax+b | y’(x1) = | | Cubic Regression y3=ax3+bx2+cx+d | y’= 3ax2+2bx+c | y’(x1) = | | Quartic Regression y4=ax4+bx3+cx2+dx+e | y’=4ax3+3bx2+2cx+d | y’(x1) = |     Compaire to y5 = nderv(y4,x,x) at x = x2, x3, x4   |  |  | | --- | --- | | X2= | y4’(x2) = | | X3= | y4’(x3) = | | X4= | y4’(x4) = | |
| 1. Find the derivatives of different regressions using rules at x = x1  |  |  |  | | --- | --- | --- | | Exponential y6=a\*b^x | y’= a\*b^x\*ln(b) | y’(x1) = | | Ln Regression y7=alnx+b | y’= a/x | y’(x1) = |   Compaire to y8 = nderv(y6,x,x) at x = x2, x3, x4   |  |  | | --- | --- | | X2= | y8’(x2) = | | X3= | y8’(x3) = | | X4= | y8’(x4) = | |
| 1. .Find the second derivatives of different regressions using rules at x = x1  |  |  |  | | --- | --- | --- | | Linear Regression y1=ax+b | y’’= 0 | y’’(x1) = | | Quadratic Regression y2=ax2+bx+c | y’’= 2a | y’’(x1) = | | Cubic Regression y3=ax3+bx2+cx+d | y’’= 6ax+2b | y’’(x1) = | | Quartic Regression y4=ax4+bx3+cx2+dx+e | y’’=12ax2+6bx+2c | y’’(x1) = |   Compaire to y5 = nderv(nderiv(y4,x,x),x,x) at x = x2, x3, x4   |  |  | | --- | --- | | X2= | y4’’(x2) = | | X3= | y4’’(x3) = | | X4= | y4’’(x4) = | |
| 1. 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= | |  |  |  | |
| 1. Find the derivatives of sine regression using rules at x = x1      |  |  |  | | --- | --- | --- | | Sine Regression y2=asin(bx+c)+d | y’= acos(bx+c)\*b | y’(x1) = |   Find the second derivatives of sine regression using rules at x = x1   |  |  |  | | --- | --- | --- | | Sine Regression y2=asin(bx+c)+d | y’’= -asin(bx+c)\*b^2 | y’’(x1) = |   Find the third derivatives of sine regression using rules at x = x1   |  |  |  | | --- | --- | --- | | Sine Regression y2=asin(bx+c)+d | y’’’= acos(bx+c)\*b | y’’’(x1) = |   Meaning: |
| 1. Use the mean value theorem on the two end points OF a regression and identify a point on the graph with a similar slope?  |  |  |  | | --- | --- | --- | | Y1=regEq  Y2=nderiv(y1,x,x)  Y3=”average rate of change”  Calc 5:intersect | Regression used: |  | | Ave Rate of change: |  | | Point(s) of intersection: |  |   Meaning: |
| 1. Was the zero found by using Newton’s Method for by using x=0 or x=1 as an initial guess?   Y1=cubicregression  0 sto x  x-y1/nderv(y1,x,x)stox  iteration\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  iteration\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  iteration\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  zero:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  Meaning: |
| 1. Graph of a complex regression with all critical points, concavity, and inflection points.  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | X: |  |  |  |  |  |  |  |  |  | | Y’ |  |  |  |  |  |  |  |  |  | | Increasing or Deceasing |  |  |  |  |  |  |  |  |  | | Y’’ |  |  |  |  |  |  |  |  |  | | Concavity?  Up or Down |  |  |  |  |  |  |  |  |  |   Meaning:   1. Using y’=0 to identify critical values a1,a2  |  |  | | --- | --- | | Critical Points |  |   Using y’’(a1) and y”(a2) to determine max/min   |  |  | | --- | --- | | Y’’ at critical Points |  | | Max or Min |  |  1. Using y’’=0 to identify inflection points Y’’=0 at –b/(6a):\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  |  |  | | --- | --- | | Inflection Points |  | |
| 1. Error for all the regressions:   Using differentials to identify the error in a prediction?  Y1= regression or derivative  dx=error in measuring x value (±.5\*last sig fig)  error ~f’(a)dx  Meaning: |
| 1. The area under the best regression and between the first and last values found using calculator and the Fundamental Theorem?  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  |  |   Calc 7: lower\_\_\_\_\_\_ Upper:\_\_\_\_\_\_\_\_  Regression f(x):\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  Antiderivative: F(x):\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  F(upper)-F(lower):\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  Meaning: |
| 1. The area under the best regression and between the first and last values approximated using left and right endpoint rectangles?  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | X: |  |  |  |  |  |  | | Y: |  |  |  |  |  |  |   Sum of 8 rectangles left endpoints:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Right endpoints:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  Meaning:   1. The area under the best regression and between the first and last values approximated using left and right endpoint rectangles?   Take the limit as the number of rectangles goes to infinity using right endpoints.  Sum(seq(Y1,X,a+(b-a)/n,b, (b-a)/n))\*(b-a)/n  Meaning: |
| 1. Were the units identified for the area under the curve?   Units (y) \* Units (x) =\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  Was the average value given?  Area (from 15) divided by (last x-first x):\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  Meaning: |