

# Derivatives of Functions

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

$$\frac{d}{dx} \text{ Constant} = 0$$

$$\frac{d}{dx} mx + b = m$$

$$\frac{d}{dx} x^n = nx^{n-1}$$

Power Rule.

$$\frac{d}{dx} (f+g) = \frac{d}{dx} f + \frac{d}{dx} g$$

$$\frac{d}{dx} c \cdot f = c \cdot \frac{d}{dx} f$$

Ex

$$y = \underbrace{3x^2}_{3 \cdot 2x} + \underbrace{6x} + \underbrace{-5}$$
$$y' = 3 \cdot 2x + 6 + 0$$
$$= 6x + 6$$

Ex  $y = \frac{1}{2}x^{10} - 2x^4 + 3x^{1/2} - x^{-5}$   
 $y' = 5x^9 - 8x^3 + \frac{3}{2}x^{-1/2} + 5x^{-6}$

Ex  $y = \frac{5x^3 - 7\sqrt{x} + \sqrt[4]{x^3} + 8}{x}$   
 $= 5x^2 - 7x^{-1/2} + x^{-1/4} + 8x^{-1}$   
 $y' = 10x + \frac{7}{2}x^{-3/2} + \frac{1}{4}x^{-5/4} - 8x^{-2}$

Less is more      Expect less

$$y = Ax^3 + Bx^2 + (x + 1)$$

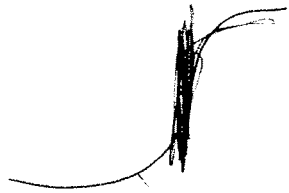
$$y' = 3Ax^2 + 2Bx + C$$

$$y = Ax^4 + Bx^3 + Cx^2 + Dx + E$$

$$4Ax^3 + 3Bx^2 + 2Cx + D$$

# Differentiability

Not at Cusp,



Ex  $y = \sqrt[3]{x}$   
 $y' = \frac{1}{3} x^{-2/3}$

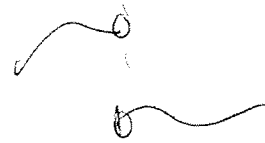
when  $x=0$   
 $y'$  is undefined

Corner,



Ex  $y = |x|$   
 $y' = \text{DNE}$   
 at  $x=0$

Discontinuity



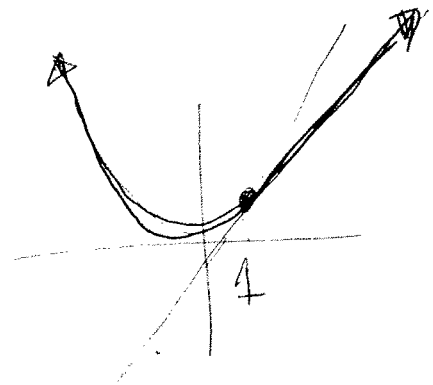
$x=0$

Rule

No Derivatives  
 at Discontinuities

$$f(x) = \begin{cases} x^2 & x < 1 \\ 2x-1 & x \geq 1 \end{cases}$$

$$f'(x) = \begin{cases} 2x & x < 1 \\ 2 & x \geq 1 \end{cases} \quad \left[ f(1) = 2 - 1 = 1 \right]$$



$$\lim_{x \rightarrow 1^-} 1^2 = 1$$

$$\lim_{x \rightarrow 1^+} 2 - 1 = 1$$

$y_1 = \text{regression}$

$$y_2 = \frac{\text{nderr}(y_1, X, X)}{\uparrow}$$

mat 8:  $\uparrow$

vars  $\textcircled{>}$  1: 1:

<p>GROUP NAME: <u>10 leaders</u></p> <p>Logo:</p>	<p>Student Names (First and Last)</p> <p>Speaker/Presenter: _____</p>
<p>Date: _____</p> <p>Topics:</p>	<p>Writer/Prep: <u>Kevin Ching</u></p> <p>QC/Leader: <u>Ethan Stewart</u></p>

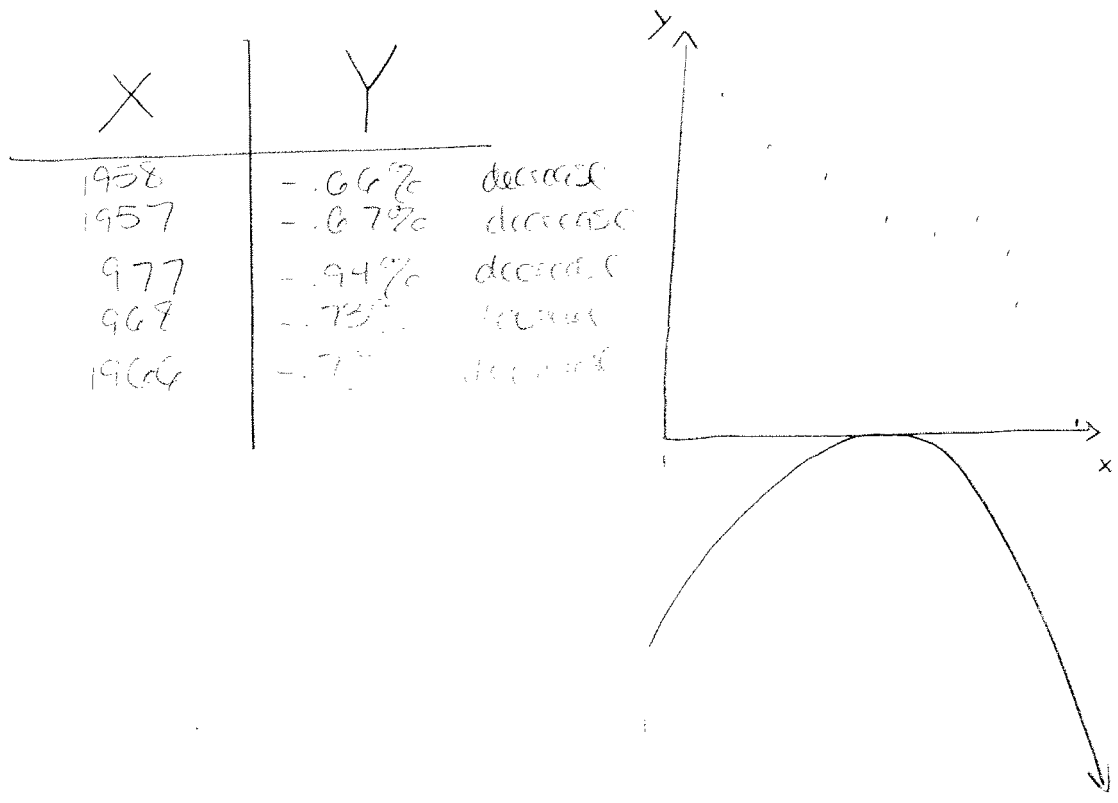
Instructions:

x	y	
1950	-0.2813	decreasing
1960	-0.0862	decreasing
1970	0.07772	increasing
1980	0.21058	increasing
2000	0.35000	increasing

GROUP NAME: Mathletes  
Logo:  
Date: 10/09/2013  
Topics:

Student Names (First and Last)  
Speaker/Presenter: Aidan Callahan  
Writer/Prep: Logan Applebury  
QC/Leader: \_\_\_\_\_

Instructions:



Bridge effectiveness is decreasing

GROUP NAME: Time Is Money



Logo:

Student Names (First and Last)

Speaker/Presenter: Angelika Mazurek

Writer/Prep: Shviam Singh (Shiv)

QC/Leader: Eugenio Pelaez

Date: 9/18/19

Topics:

Instructions:

Find Derivative of all points.

iPhone 4S Sales. [6]

Cubic Reg.

$L_1$	$L_2$	$\rightarrow$ Data
1	600	$x = 1 \quad y'_1 = -334.1$
2	350	$x = 2 \quad y'_1 = -190.8$
3	200	$x = 3 \quad y'_1 = -71.5$
4	250	$x = 4 \quad y'_1 = 23.786$
5	199	$x = 5 \quad y'_1 = 95.071$

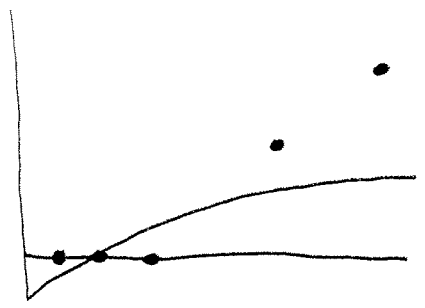
Year

- 1  $\rightarrow$  Decreasing
- 2  $\rightarrow$  Decreasing
- 3  $\rightarrow$  Decreasing
- 4  $\rightarrow$  Increasing
- 5  $\rightarrow$  Increasing

<p>GROUP NAME: <u>Wolf Pack + Guest</u></p> <p>Logo:</p>	<p>Student Names (First and Last)</p> <p>Speaker/Presenter: <u>Jared Schuster</u></p>
<p>Date: <u>9/18/13</u></p> <p>Topics:</p>	<p>Writer/Prep: <u>DOMINIC CONNOR</u></p> <p>QC/Leader: <u>Anne Spjenska Quay</u></p>

Instructions: A +

x	y	
1996	-1009	Decreasing
1998	15.424	Increasing
2001	1189.4	Increasing
2003	1730.7	Increasing
2004	1928.8	Increasing
2006	2180.3	Increasing



Other than 1996 the speed of internet was increasing.



GROUP NAME: The Scientists

Logo:

Date: 9/18/13

Topics:

Student Names (First and Last)

Speaker/Presenter: Dorin C.

Writer/Prep: Nicole

QC/Leader: \_\_\_\_\_

Instructions:

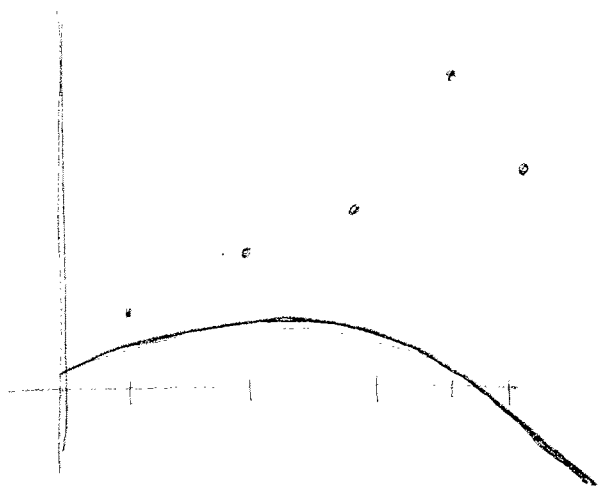
Year	Increase of extinct species
2008	103.07
2009	48.026
2010	15.542
2011	5.6138
2012	18.241
2013	53.423

# of extinct species are all ways  
INCREASING

<p>GROUP NAME: <u>CSC</u></p> <p>Logo:</p>	<p>Student Names (First and Last)</p> <p>Speaker/Presenter: <u>Stephanie</u></p>
<p>Date: <u>09/18/13</u></p> <p>Topics:</p>	<p>Writer/Prep: <u>Courney Frank</u></p> <p>QC/Leader: <u>Conrad Dough</u></p>

Instructions:

APPLE STOCK PRICE



$x = 2009$	$y' = 75.63306$
$x = 2010$	$y' = 116.8907$
$x = 2011$	$y' = 106.61534$
$x = 2012$	$y' = 44.80698$
$x = 2013$	$y' = -68.53437$

- 2009 - increase
- 2010 - increase
- 2011 - decrease
- 2012 decrease
- 2013 decrease

GROUP NAME: IRISH MATH BOMBS

Logo:



Student Names (First and Last)

Speaker/Presenter: Conner Krusman

Date: \_\_\_\_\_

Writer/Prep: Bobby O'connor

Topics:

QC/Leader: Bill Smith

Instructions:

x	y	
2003	1.783	Increasing
2005	2.2987	Increasing
2007	2.9948	Increasing
2009	3.6216	Increasing
2011	3.9289	Increasing
2013	3.6667	<del>Decreasing</del> Increasing

