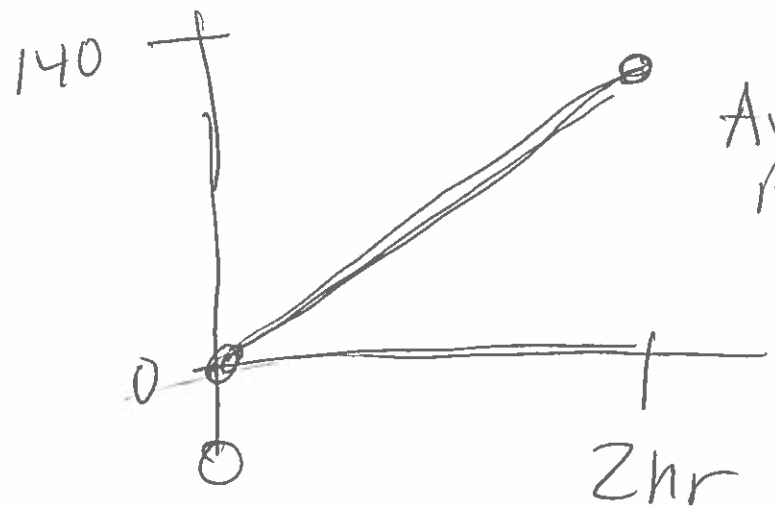
Mean Value Theorem



Ave. Rate of Change =

$$\frac{\Delta Y}{\Delta X} = 70 \text{ mph}$$

If $f(x)$ is continuous.
(And differentiable on $[a,b]$)

Then there is a point "c" on $[a,b]$

$$a \leq c \leq b$$

So that

Average Rate of Change = Instantaneous Rate: $f'(c)$

$$\frac{f(b)-f(a)}{b-a} = f'(c)$$

$\frac{\sin(x)}{\cos(x)}$

$\frac{P(x)}{Q(x)}$ < continuous.
everywhere except
$Q(x) = 0$

Intermediate Value Theorem

$f(a) \leq M \leq f(b)$

If $f(x)$ is continuous

Then there is a "c" on $[a,b]$

so that $f(c) = M$

Ex $f(x) = x^{20} - 5x + 2$

$f(0) = 2$ (+)

$f(1) = -2$ (−)

Is there a zero between 0 and 1

$[0,1]$?

1. Is $f(x)$ continuous on $[0,1]$? Yes because (All Poly's are continuous)
2. $f(1) \leq 0 \leq f(0)$
3. Then, by the IVT, there is a "c" on $[0,1]$ so that $f(c) = 0$

Yes there is a zero on $[0,1]$

Ex $y^3 - 5xy + \sin(y^2) = 2x^3$

↓ Implicit diff.

$$3y^2\frac{dy}{dx} - 5\left(x\frac{dy}{dx} + y\right) + \cos(y^2)2y\frac{dy}{dx} = 6x^2$$

$$3y^2\frac{dy}{dx} - 5x\frac{dy}{dx} - 5y + \cos(y^2)2y\frac{dy}{dx} = 6x^2$$

$$\frac{dy}{dx}\left(3y^2 - 5x + 2y\cos(y^2)\right) = 6x^2 + 5y$$

$$\frac{dy}{dx} = \frac{6x^2 + 5y}{3y^2 - 5x + 2y\cos(y^2)}$$

Hyperbolic Trig Functions

Hyperbolic cosine: $\cosh(x) \equiv \frac{e^x + e^{-x}}{2}$

Hyperbolic sine: $\sinh(x) \equiv \frac{e^x - e^{-x}}{2}$

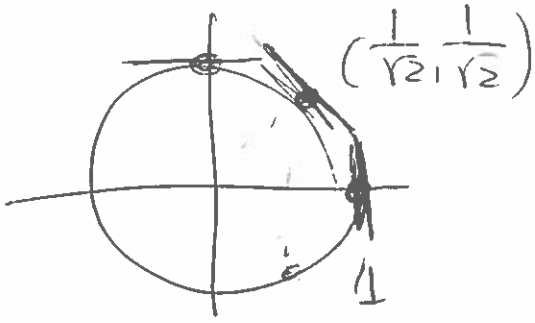
Hyperbolic tangent: $\tanh(x) = \frac{\sinh(x)}{\cosh(x)}$

(4) $\frac{d}{dx}\cosh(x) = \sinh(x)$

(4) $\frac{d}{dx}\sinh(x) = \cosh(x)$

$\cosh^2(x) - \sinh^2(x) = 1$

Ex $x^2 + y^2 = 1$



$\downarrow$

$y = \pm\sqrt{1-x^2}$

$\downarrow$ Implicit Different

x	y
0	1
$1/\sqrt{2}$	$1/\sqrt{2}$
1	0

$$\frac{d}{dx} x^2 + \frac{d}{dx} y^2 = 0$$

$$2x + 2y \cdot \frac{dy}{dx} = 0$$

$$\frac{dy}{dx} = -\frac{x}{y}$$

at $(0,1)$

$dy/dx = -0/1 = 0$

at $(1,0)$

$dy/dx = -1/0 = \text{UNI}$

at $(1/\sqrt{2}, 1/\sqrt{2})$

$$\frac{dy}{dx} = -\frac{1/\sqrt{2}}{1/\sqrt{2}} = -1$$

Implicit Differentiation

Skills

$$\frac{d}{dx} y = \frac{dy}{dx}$$

$$\frac{d}{dx} x = 1$$

$$\frac{d}{dy} x^5 = 5x^4$$

$$\frac{d}{dx} t^5 = 5t^4 \cdot \frac{dt}{dx}$$

$$\frac{d}{dw} \sin(y) = \cos(y) \cdot \frac{dy}{dw}$$

Explicit v. Implicit

Explicit

I will cut you heads off.

$$f(x) = x^2 + 5x$$

$$f'(x) = 2x + 5$$

Implicit

Heads are going to roll

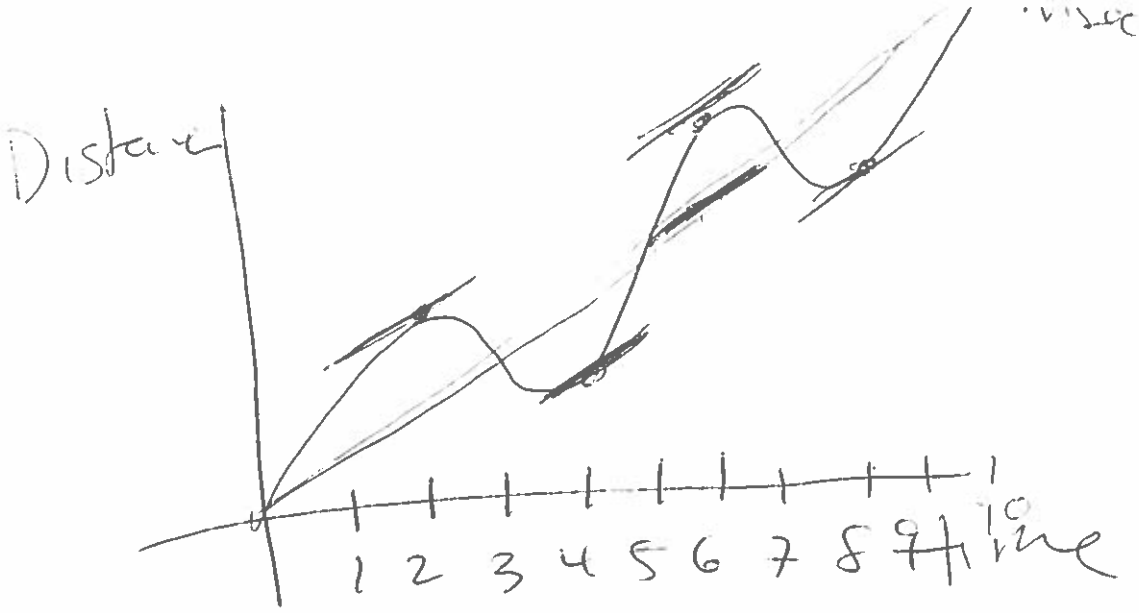
$$x^2 = y - 5x$$

Implicit Differentiation

$$\frac{d}{dx} x^2 = \frac{d}{dx} y - 5x$$

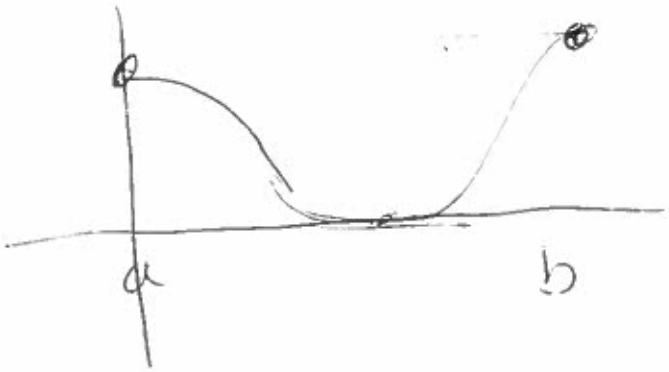
$$2x = \frac{dy}{dx} - 5$$

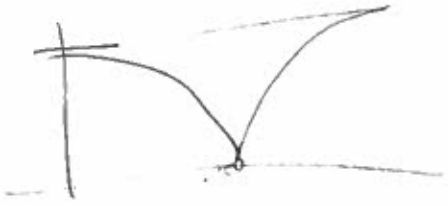
$$2x + 5 =$$



or $[0, 10]$

$C = 1.5, 4, 6, 8.5$





GROUP NAME: ♡ Science

Date: 25FEB14

Student Names (First and Last)

Speaker/Presenter: Corrina H.

Writer/Prep: Lindsey Lansberry

Leader/Collaborator: Dominique C.

Independant Variable (x-axis): Time (hr)

Dependant Variable (y-axis): Concentration (PPM)

Conclusion (in words):

At 2.17 hrs the instantaneous rate of change is the same as the average rate of change from 0 5 hrs which is -17.88 PPM/hr

Supporting Work:

Time (hr)	Conc. (PPM)
0	100
1	84
2	68
3	46
4	29
5	22

$Y_1 = ExpReg = 112.2043773 \times .7271447176^x$

$Y_2 = (Y_1(b) - Y_1(a))/(b - a)$

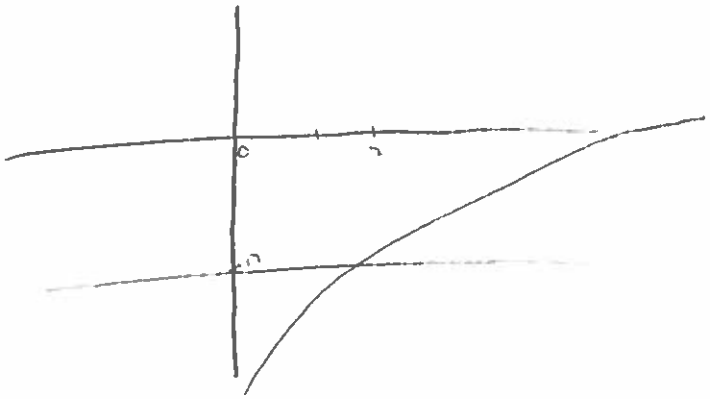
$= (Y_1(5) - Y_1(0))/(5 - 0)$

$= -17.879$

$Y_3 = nDeriv(Y_1, X, X)$

Intersection

$X = 2.17 \quad Y = -17.88$



GROUP NAME: El business

Date: 2\25

Student Names (First and Last)

Speaker/Presenter: Ryan

Writer/Prep: Andy

Leader/Collaborator: Brittany

Independant Variable (x-axis): games

Dependant Variable (y-axis): goal

Conclusion (in words): World cup three is our best representation of our trend with an increase of 2.13 goals per world cup game

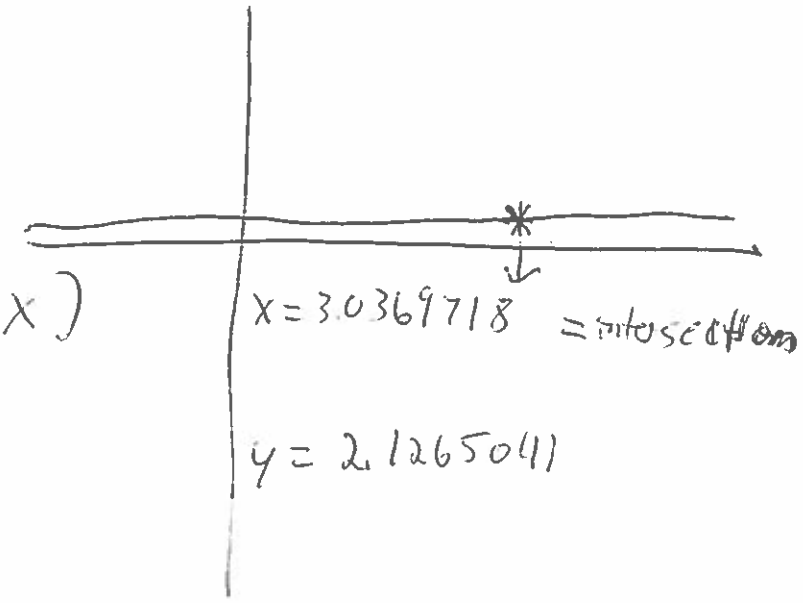
Supporting Work:

$Y1 = 32.385487892$

$26 * 1.057048399358^{X}$

$Y2 = 2.126504094$

$Y3 = nDeriv(Y_1, X, X)$



GROUP NAME: The Trannies

Date: 25 FEB14 ~~The Most Magnificent~~

Student Names (First and Last)

Speaker/Presenter: Brandon Reyes

Writer/Prep: Greg, Kacy

Leader/Collaborator: ~~Brandon~~

Independant Variable (x-axis): Torque lb/ft

Dependant Variable (y-axis): Horsepower Hp

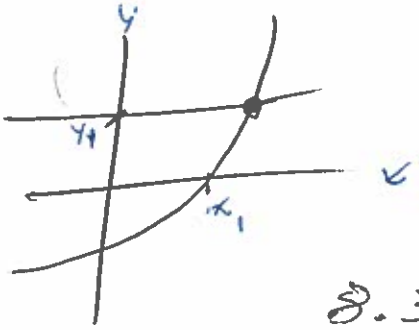
Conclusion (in words): ~~The average rate of~~ torque per horsepower is ~~33.774 HP/lb/ft~~ At 8.3 Torques the rate of change is representative of the Interval from 3 to 13.

Supporting Work:

$Y_1 = 10.718 \times 1.095^{x}$

$Y_1 = 33.819$

$Y_3 = nDeriv(Y_1, X, X)$



8.3

X: ~~38.774~~

Y = 33.819

L_1	L_2
3	13
5	19
7	21
10	25
12	29
13	39

GROUP NAME:

Date: 2/25

Student Names (First and Last)

Speaker/Presenter: Mink.

Independant Variable (x-axis): hours

Dependant Variable (y-axis): total consumed in liters

Writer/Prep: Kevin I

Leader/Collaborator: Kevin V

Transcriber: Mik

Conclusion (in words):

The average rate of consumption is 60.2 L/hr. At 3.2 hrs the rate of consumption is the same as average rate of consumption between hr 1 to hr 5

Supporting Work:

Exp Reg

$y = a(b^x)$

$a = 26.23$

$b = 1.35$

X	Y
1	35
2	65
3	80
4	100
5	110

when $x = 3.199$, $y = 226.2$