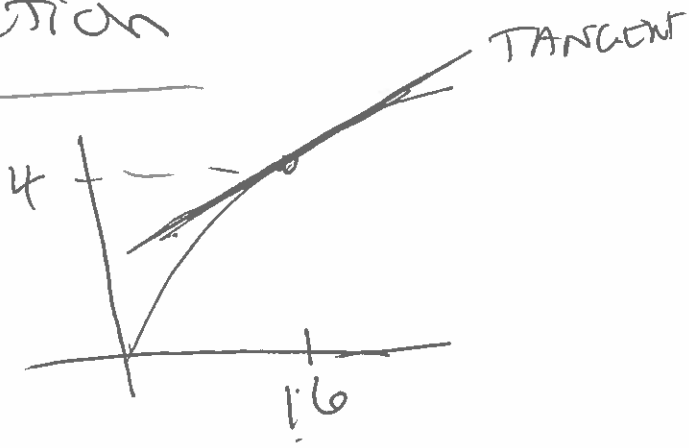
Applications of Derivatives

Linearize a Function



EX Find $\sqrt{17}$

$f(x) = \sqrt{x}$

$m_{tan} = f'(16)$

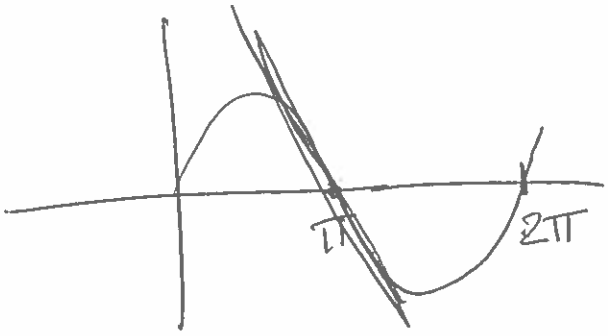
$= \frac{1}{2} 16^{-1/2} = \frac{1}{8}$

PONT $(16, 4)$

$y - 4 = \frac{1}{8}(x - 16)$

$y(17) = 4 + \frac{1}{8}$

EX $\sin\left(\frac{11}{4}\right)$



$f(x) = \sin(x)$

$m_{tan} = f'(\pi)$

$= \cos(\pi) = -1$

Point $(\pi, 0)$

$y - 0 = -1(x - \pi)$

$y = -x + \pi$

$y\left(\frac{11}{4}\right) = -\frac{11}{4} + \pi$

Newton's Method

$x^4 - 5x^3 - 7x + 12 = 0$ Guess $x = 2$

$Y_1 = X\wedge 4 - 5X\wedge 3 - 7X + 12$

$2 \xrightarrow{STO} X$

$X - Y_1/nderiv(Y_1, X, X) \xrightarrow{STO} X$

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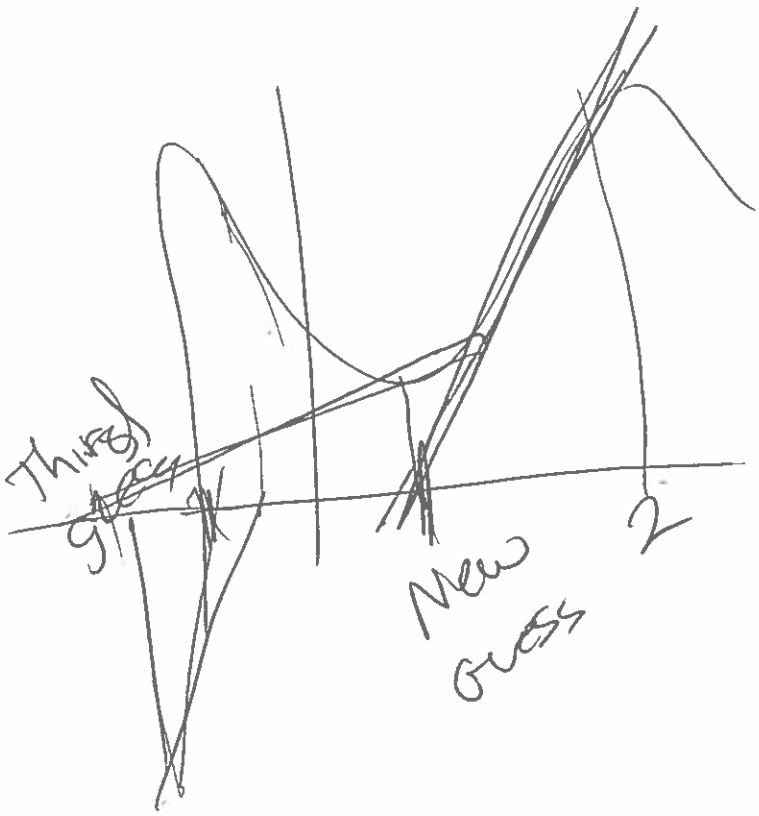
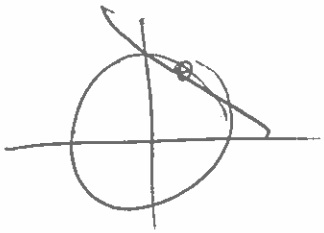


Implicit Differentiation

$$\frac{d}{dx} f(x,y) = \frac{d}{dx} g(x,y)$$



Related Rate (Balloon)

$$\frac{d}{dt} f(x,y) = \frac{d}{dt} g(x,y)$$

L'Hôpitals Rule (LHR)

Low Pee Tall's Rule

Mind Blowing

Used to find Limits

$$\lim_{x \to a} \frac{f(x)}{g(x)} = \frac{0}{0} \text{ or } \frac{\infty}{\infty} \quad \text{Then.}$$

$$= \lim_{x \to a} \frac{f'(x)}{g'(x)}$$

Ex $\lim_{x \to 0} \frac{\sin x}{x} = \frac{0}{0}$ use (LHR)

$= \lim_{x \to 0} \frac{\cos x}{1} = \cos(0) = 1$

Ex $\lim_{x \to \infty} \frac{3x^2 - 5x + 7}{4x^2 + 12} = \frac{\infty}{\infty}$ use (LHR)

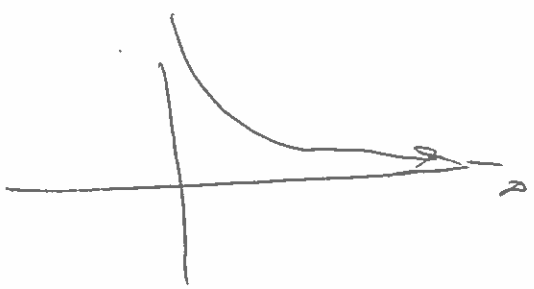
$= \lim_{x \to \infty} \frac{6x - 5}{8x} = \frac{\infty}{\infty}$ use (LHR)

$= \lim_{x \to \infty} \frac{6}{8} = \frac{3}{4}$

Ex $\lim_{x \to \infty} \frac{3}{x^{23}} \cdot \frac{x^{23}}{1} = 3$

$x \to \infty$ $\quad \frac{3}{\infty} \cdot \frac{\infty}{1}$

$\frac{3}{\infty} = 0$



Could Be Anything

CBA

0 1 ∞

Multiplication

$0 \cdot 1 = 0$

$0 \cdot \infty =$ CBA ← Goes to Denominator

$1 \cdot \infty = \infty$

$\frac{1}{0} = \infty$

$\frac{\infty}{0} \to \infty \cdot \frac{1}{0} = \infty \cdot \infty$

Division

$0/0 =$ CBA ← LHR

$0/1 = 0$

$0/\infty = 0$

$1/1 = 1$

$1/0 = \pm\infty$

$1/\infty = 0$

$\infty/\infty =$ CBA ← LHR

$\infty/1 = \infty$

$\infty/0 = \pm\infty$

Subtraction

$\infty - \infty =$ CBA

$0^0 =$ CBA $\leftarrow e^{\ln x}$

$1^\infty =$ CBA

Ex $\lim_{x \to \infty} x \ln\left(1 + \frac{R}{x}\right)$ $\quad \infty \cdot 0$

$= \lim_{x \to \infty} \frac{\ln\left(1 + \frac{R}{x}\right)}{x^{-1}}$ (LHR)

$= \lim_{x \to \infty} \frac{\frac{1}{\left(1 + \frac{R}{x}\right)} \cdot \frac{d}{dx}\left(1 + \frac{R}{x}\right)}{-x^{-2}}$ (CHAIN; Rx^{-1})

$= \lim_{x \to \infty} \frac{\frac{1}{\left(1 + \frac{R}{x}\right)} \cdot -Rx^{-2}}{-x^{-2}}$

$= R \lim_{x \to \infty} \frac{1}{\left(1 + \frac{R}{x}\right)}$ (1; 0)

$= R$

$\infty - \infty$ Ex $\lim_{x \to \infty} \sqrt{x} - \sqrt{1+x}$

$\infty - \infty$

$$= \lim_{x \to \infty} \left(\sqrt{x} - \sqrt{1-x}\right) \frac{\sqrt{x} + \sqrt{1+x}}{\sqrt{x} + \sqrt{1+x}}$$

$$= \lim_{x \to \infty} \frac{x - 1 - x}{\sqrt{x} + \sqrt{1+x}}$$

$$= \lim_{x \to \infty} \frac{-1}{\sqrt{x} + \sqrt{1+x}} = \frac{-1}{\infty} = 0$$

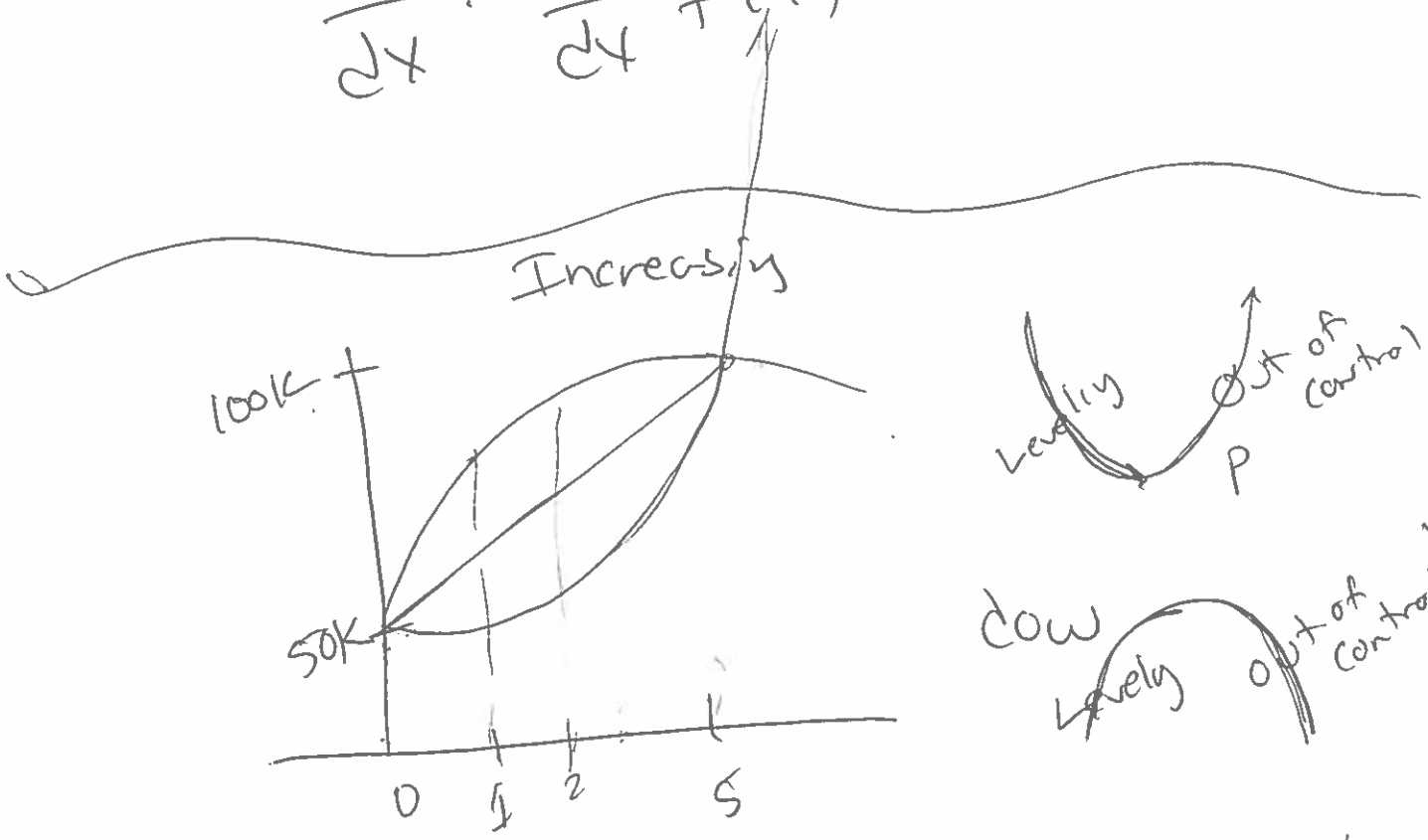
Ex $\lim_{x \to \infty} \sqrt{x^2} - \sqrt{x + x^2}$

Second Derivative-

Function $f''(x)$ D_{xx} y'' $\frac{d^2y}{dx^2}$

Value $f''(a)$ $D_{xx}(a)$ $y''(a)$ $\left.\frac{d^2y}{dx^2}\right|_{x=a}$

$\frac{d}{dx} \cdot \frac{d}{dx} f(x)$



In 2014 Lady is worth 570 $mill

Increases at 335 $mill/yr.

Increasing "Out of control" 145 $mill/yr

Y_1 | Y_2 | Y_3

$ | $/yr | $/yr/yr

GROUP NAME: Money Makers

Date: 3/12/14

Student Names (First and Last)

Speaker/Presenter: Brian S

Writer/Prep: Edna O

Leader/Collaborator: Monica V.

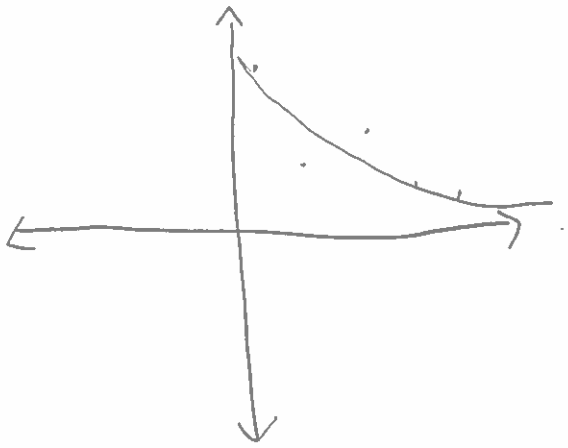
Independant Variable (x-axis): time (year)

Dependant Variable (y-axis): percent of crime

Conclusion (in words): In 2014, the crime rate decreasing by 2%. and increasing by 2%. Levels off.

Supporting Work:

X	Y
9	.75
10	.52
11	.59
12	.44
13	.39



X	Y_1	Y_2	Y_3
13	.398	-.04	.02
11	.598	-.08	.02 or .02
14	.368	-.02	

$Y_1 = .01x^2 + -.3x + 2.608$ (Quadratic regression)

$Y_2 = nDeriv(Y_1, X, X)$

$Y_3 = nDeriv(Y_2, X, X)$

GROUP NAME: We mean Business
Date: 3/12/14

Student Names (First and Last)
Speaker/Presenter: Simar Kalra
Writer/Prep: Yasmin Silverio
Leader/Collaborator:

Independant Variable (x-axis): Years
Dependant Variable (y-axis): interest Rates

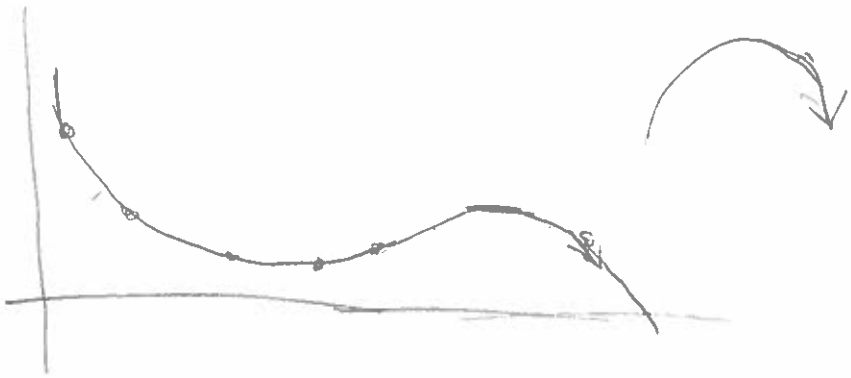
Conclusion (in words): In 2014 interest Rates are decreasing by -.35%
Interest rates are ~~constant~~ Out of control

Supporting Work:

X	Y
2008	3.71
2009	1.53
2010	.29
2011	.38
2012	.58

X	Y_1	Y_2	Y_3
2014	.938	-.35	-25.79
2013	.95	.3	

(Cubic Regression)



$y = ax^3 + bx^2 + cx + d$

$y' = 3ax^2 + 2bx + c$

$y'' = 6ax + 2b$

GROUP NAME: (BEST FRIENDS) – (ELLIOT)

Date: 10/12/2014

Student Names (First and Last)

Speaker/Presenter: VINNIE AVHAD

Writer/Prep: LAUREN DOBO

Leader/Collaborator:

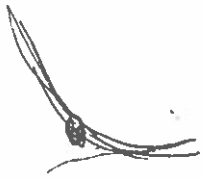
Independant Variable (x-axis): YEARS

Dependant Variable (y-axis): CARS SOLD

Conclusion (in words): IN 2015, ELECTRIC CARS ARE SELLING AT -20502 PER YEAR, BUT THEY ARE INCREASING AT 274386 CARS PER YEAR PER YEAR.

Supporting Work:

YEAR x	CARS SOLD y	SinREG y_1	y'	y''
2009	290292	363234	-2.1×10^5	34757
2010	274555	216914	-37134	271545
2011	284064	307439	193081	125048
2012	487480	507031	150760	-2×10^5
2013	592192	533965	-1×10^5	-2.4×10^5
2015	_____	215158	-20502	274386



SIN REG

$y = a \cdot \sin(bx + c) + d$

$a = 170314.8844$

$b = 1.272131339$

$c = -1.470607369$

$d = 384709.1247$

$y_1 = a(\sin(bx + c)) + d$

$y_2 = nDeriv(y_1, X, X)$

$y_3 = nDeriv(y_2, X, X)$

GROUP NAME: TI rates

Date: 03/12/2014 Everyday we Calculatin'

Student Names (First and Last)

Speaker/Presenter: Shanon Isoe

Writer/Prep: Onur Turkay

Leader/Collaborator:

Independant Variable (x-axis): Years

Dependant Variable (y-axis): ~~NOKIA Pink Phone Sales~~ NOKIA Phones

Conclusion (in words): In 2015, ~~Pink Phone Sales~~ NOKIA Phones are at -19.93 Million dollars decreasing at 58.4% and decreasing out of control at -25.71 million

MATH 3

Supporting Work:

Nokia Pink phones

Years	Sales
1	50
5	46
8	34
11	55
12	51
14	25

MATH 3

Quad

X	Y_1	Y_2	Y_3
15	-19.93	-58.4	-30.64
00	20.952	40.809	-25.71

Increase Leveling off

Exp.

X	Y_1	Y_2	Y_3
15	35.532	-.9133	.02347
00	52.247	-1.34	.0452

In 2000 ave sales at 20.95 million increasing at 40 milling and leveling off at 25.71 million

GROUP NAME: Polarz Bearz

Date:________

Student Names (First and Last)

Speaker/Presenter: Kausalya Mannum

Writer/Prep: Frehiwot Bekele

Leader/Collaborator:________

Independant Variable (x-axis): years

Dependant Variable (y-axis): deaths in millions

Conclusion (in words):
In 2014.9 there 4.1792 million deaths - HIV and it's increasing by 1.375 million/per year. increasing a little out of control , 5 mil/per yr/per yr

Supporting Work:

Cubic Reg

y_1 = ~~Quart Reg~~

y_2 = nderiv(y_1, x, x)

y_3 = nderiv(y_2, x, x)

Graph

Quart Reg - fail

Table

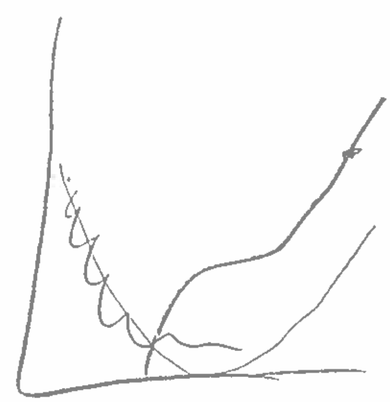
x	y_1	y_2	y_3
2015	16.4	-50	-50000

↑ plummeting out of control

Cubic Reg

Table

x	y_1	y_2	y_3
2014.9	4.1792	1.375	5



GROUP NAME: Cha-Ching

Date: 3/12/14

Student Names (First and Last)

Speaker/Presenter: Trey Morrill

Writer/Prep: Sheila Mae Gan

Leader/Collaborator:

Independant Variable (x-axis): Years

Dependant Variable (y-axis): Revenue

Conclusion (in words): In 2014 our club revenue is $96 million. It increases at $110.58 million per year. It increases "out of control" $127.42 million per year

Supporting Work:

L_1	L_2
13	35
12	27
11	26
10	17
9	16

X	Y_1	Y_2	Y_3
14	$96	$110.58	$127.42

$/yr $/yr $/yr

GROUP NAME: Functional Paradigm

Date: 03/12

Student Names (First and Last)

Speaker/Presenter: Nader Shenouda

Writer/Prep: Karol Zarski

Leader/Collaborator:

Independant Variable (x-axis): time (hours)

Dependant Variable (y-axis): memory usage (MB)

Conclusion (in words): During the 10th hour of use, 11,835 MB will be used, it ~~will~~ is increasing at 2,741.2 MB/hour and ~~the~~ future memory ~~P~~ use will be increasing out of control at 635.23 MB/ho

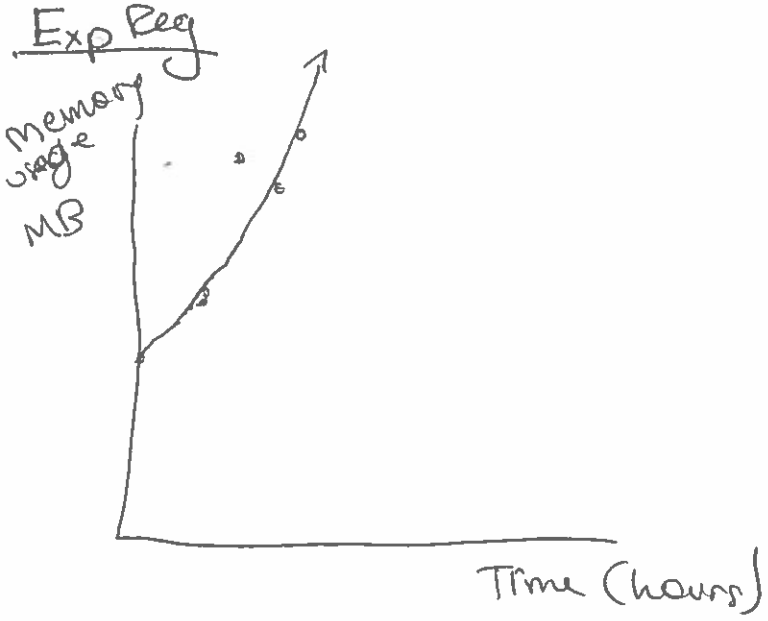
Supporting Work:

X	Y_1	Y_2	Y_3
10	11835	2741.2	635.23

Y_1 = Exp Reg

Y_2 = nDeriv(Y_1, X, X)

Y_3 = nDeriv(Y_2, X, X)



GROUP NAME: illustrators

Date: 3/12/14

Student Names (First and Last)

Speaker/Presenter: Ryan Piotrowski

Writer/Prep: Bishop Barr

Leader/Collaborator: Danyan Zhou

Independant Variable (x-axis): years

Dependant Variable (y-axis): gas prices

Conclusion (in words): In 2014 gas prices are increasing at a fast rate but they are increasing out of control rate of increase is .09225

Supporting Work:

x	y
95	1
100	1.54
105	2.5
112	3
114	3.3

y_1 = Quantity

y_2 = accrue(y_1, x, x)

y_3 = accrue(y_2, y, x)

gas prices are increasing out of control!!

x	y_1	y_2	y_3
114	3.3	.22376	0.09225

	y_1	y_2
~~2014~~	~~1.7~~	~~3.55~~