Note Title 6/16/2015

Linear Function

Non-linear Function

$f(x)$

$x_1 \quad x_2$

$f(x_1+x_2) = f(x_1) + f(x_2) + c$

$f(x) = 5x + 3$

$x_1 = 1 \quad x_2 = 2$

$f(x_1) = f(1) = 5\times1+3 = 8$

$f(x_2) = f(2) = 5\times2+3 = 13$

$f(x_1+x_2) = f(1+2) = f(3) = 5\times3+3 = 18$

$f(x_1+x_2) = 18$

$f(x_1) + f(x_2) = 8+13 = 21$

$f(x) = 8x$

$f(1) = 8 \quad f(2) = 16$

$f(1+3) = 24$

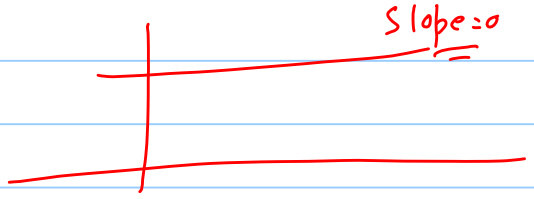
$24 = 8+16$

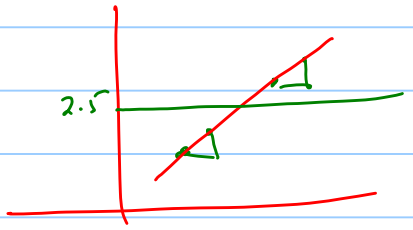
$f(x) = x^2$

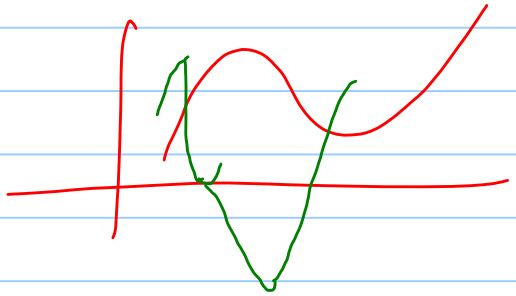
$f(1) = 1^2 = 1$

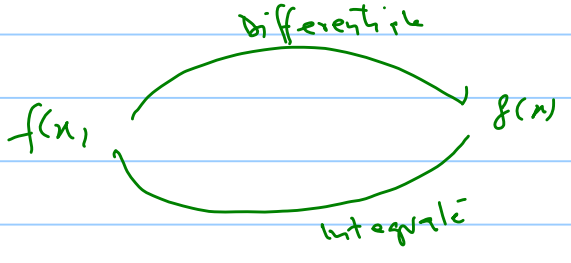
$f(2) = 2^2 = 5$

$f(1+2) = 3^2 = 9$



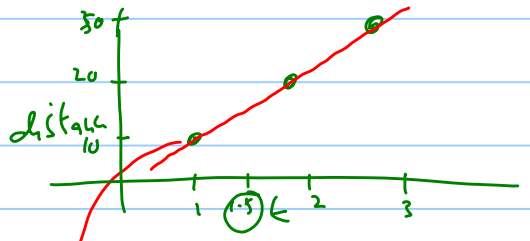






$$v_f = v_i + at$$

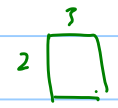
$$s = v_i t + \frac{1}{2} a t^2$$



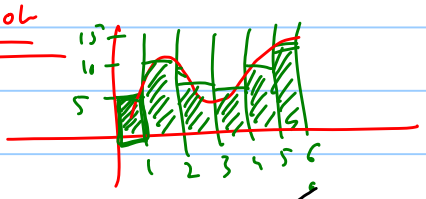
Regression

distance = $a \times t + b$

distance = $2t + 1$



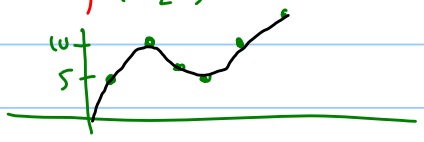
Integration



Differentiable

slope

change of function

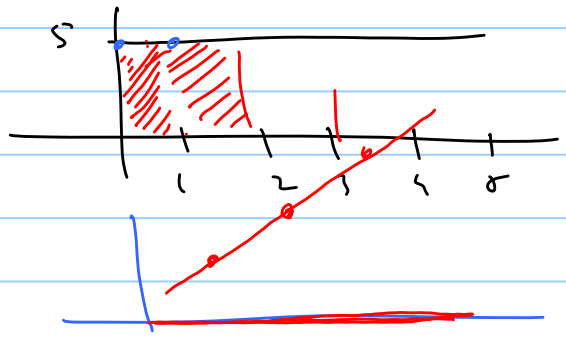


$$\int c\,dx = cx + d$$

$f(x) = 2$

$= \int 2\,dx$

$= 2x$



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

$$\frac{1}{3} = 0.33333333\ldots$$

$$3\overline{)10}\ 0.333\ldots \quad 9,\ 10,\ 9,\ 10$$

Round off → 0.33

Round off error : $0.33333\ldots - 0.33$

$\therefore 0.00333\ldots$

Grades — Ali 92.56

↓ 93 round off

Round off error : $92.56 - 93 = -0.44$

$93.5 < \begin{matrix} 93 \\ 94 \end{matrix}$ $\quad 94.5 < \begin{matrix} 94 \\ 95 \end{matrix}$

~~92.4~~ 92.9 ~ 93.

92 0.9 0.1

$-1 \times 10^{-5} \longrightarrow -1E-5$

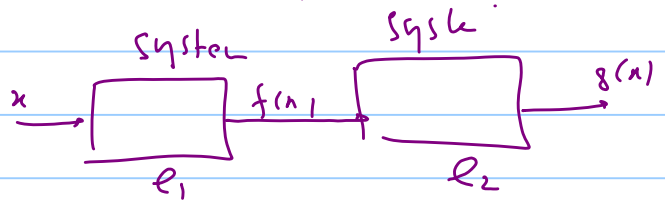
$f(x) \approx 10x + 50 - 3x^2 + 0.0003x^3 + 0.000009x^5$

$x = 1$

$f(1) = 10 + 50 - 3 + 0.0003 + 0.000009$

$= 57.000309$

$e^x = 1 + x + \frac{x^2}{2!} + \cdots$



$x_{i+1} = 2x_i^2$

$x_0 = 2;$

For $i = 1$ to 10

$x(i+1) = x(i)^2$

end

$x_0 = 2.2$

	x^t	x^e	error
0	2.2	2.0	0.2
1	4.84	4	0.84
	23.4256	16	7.42

$X = 2.0 \pm 0.1$ Max = 2.1, Min = 1.9

$Y = 3.0 \pm 0.2$ Max = 3.2, Min = 2.8

$Z = X * Y$

$Z = 2 \times 3 = 6$

Max $2.1 \times 3.2 = 6.72$

Min $1.9 \times 2.8 = 5.32$

$5.32 \leq Z \leq 6.72$

$Z = 6 \pm 0.7$

$$\epsilon = \frac{F}{h^2 E}$$

$$\Delta\epsilon = \frac{\partial \epsilon}{\partial F}\Delta F + \frac{\partial \epsilon}{\partial h}\Delta h + \frac{\partial \epsilon}{\partial E}\Delta E$$

$$\epsilon = \frac{F}{h^2 E}$$

$$\frac{\partial \epsilon}{\partial F} = \frac{1}{h^2 E}\frac{\partial F}{\partial F} = \frac{1}{h^2 E}$$

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

$$\frac{\partial \epsilon}{\partial h} = \frac{F}{E}\frac{\partial}{\partial h}\left(\frac{1}{h^2}\right) = \frac{F}{E}\frac{\partial}{\partial h}\left(h^{-2}\right)$$

$$= \frac{F}{E} - 2 \times h^{-2-1}$$

$$= \frac{F}{E} \times \frac{-2}{h^3}$$

$$y = x^2 + z^2$$

$$y = 2^2 + 3^2 = 4 + 9 = 13$$

$x = 2 \pm 1$

$z = 3 \pm 2$

$\Delta x = 1$

$\Delta z = 2$

$$\Delta y = \left|\frac{\partial y}{\partial x}\Delta x\right| + \left|\frac{\partial y}{\partial z}\Delta z\right|$$

$y = x^2 + z^2$

$$\frac{\partial y}{\partial x} = 2x^{2-1} = 2x = 2 \times 2 = 4$$

$$\frac{\partial y}{\partial z} = 2z^{2-1} = 2z = 2 \times 3 = 6$$

$y = x^c$

$\frac{\partial y}{\partial x} = c x^{c-1}$

$$\Delta y = 4 \times 1 + 6 \times 2 = 4 + 12 = 16$$

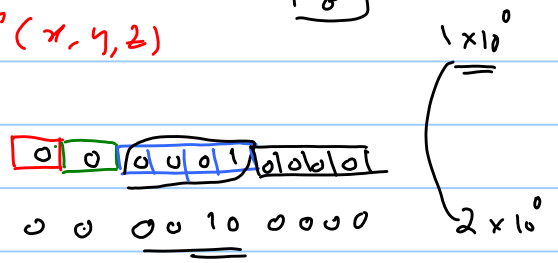
$\Delta y = 16$

$y = 13$

$y = 13 \pm 16$

$\frac{1}{8}$

$f(x, y, z)$



□

decimal ——— Binary

4 ——— 00100

8 ——— 01000

2.4

Polynomial function

$$f(x) = 2x$$

$$f(x) = a_0 + a_1 x + a_2 x^2 + a_3 x^3 + \cdots$$

$f(x) = x^2$ $\quad x=2 \to 4$, $x=3 \to 9$

$f(x+h) = f(x) + 2x \times h + \frac{2 \times h^2}{2!} + \frac{0 \times h^3}{3!} + \cdots$

$x=2$, $h=1$

$f(3) = 4 + \frac{2 \times 2 \times 1}{1!} + \frac{2 \times 1}{2!} = 4+4+1 = 9$

$f(x) = x + x^3$ $\quad x=2 \ f(x)=10$, $x=3 \ f(x)=30$

$f'(x) = 1 + 3x^2$ $\quad f'(2) = 13$

$f''(x) = 0 + 6x$ $\quad f''(2) = 12$

$f'''(x) = 6$ $\quad f'''(2) = 6$

$f^{iv}(x) = 0$

$f(x+h) = f(x) + f'(x)h + \frac{f''(x)h^2}{2!} + \frac{f'''(x)h^3}{3!} + \cdots$

$f(2+1) = f(2) + f'(2) \times 1 + \frac{f''(2) \times 1}{2} + \frac{f'''(2) \times 1}{6}$

$= 10 + 13 \times 1 + \frac{12 \times 1}{2} + \frac{6 \times 1}{6}$

$= 10 + 13 + 6 + 1 = 30$

n	Actual	Predicted	Error
1	30	10	20
2	30	23	7
3	30	29	1
4	30	30	0
5	30	30	

$$e^x = 1 + x + \frac{x^2}{2!} + \frac{x^3}{3!} + \frac{x^4}{4!} + \cdots$$

$x = 2$

$e^x = e^2 = 7.389$ ~~$7.3880 - 10.34$~~

$n=1 \rightarrow 1$

$n=2 \rightarrow 3$

$n=3 \quad 1+2+\frac{4}{2} = 1+2+2 = 5$

$n=4 \quad 1+2+\frac{4}{2}+\frac{8}{6} = 5+\frac{8}{6} = 6.33$

$n=5 \quad 6.33 + \frac{16}{18} = 7.2$