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$$\frac{\left(9^{\log_9 5}\right)^2 + \left(3^{\log_3 \sqrt{6}}\right)^3}{409}\left(\left(7^{\log_7 25}\right)^{\frac{1}{2}} - \left(5^{\log_5 6}\right)^{3/2}\right)$$

13. $4\cdot\left(2^{\log_{10} x}\right)^2 - 3^{\log_{10} x}\, 2^{\log_{10} x} - 18\left(3^{\log_{10} x}\right)^2 = 0$

$$\boxed{\left(\frac{2}{3}\right)^{\log_{10} x} = t}$$

$$4t^2 - t - 18 = 0$$

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$a = 2^5$

$b = 2^{25^2}$

$(c^4)^{\frac{1}{5^3+1}} = (c^2)^{\frac{2}{5^3+1}} = 8 = 2^3$

$c^4 = 2^{3(5^3+1)}$

$\log_2 5 = b$

$\log_2 3 = a$

$\frac{a^2 b^5}{c^4} = \frac{2^{25} \, 2^{10 5^2}}{2^{3(5^3+1)}}$

$\frac{\log_2 63}{\log_2 140} = \frac{\log_2 7 + 2\log_2 3}{\log_2 7 + \log_2 5 + 2}$

$= \frac{\frac{1}{c} + 2a}{\frac{1}{c} + 2 + ab}$

$$\frac{\log_{10}^3 N \; \log_{10}(abc)}{\log_{10} N \; \log_{10} a \; \log_{10} b \; \log_{10} c}$$

$$x = \left(\frac{1}{2}\right)^{\frac{1}{\log_a 5}} = \left(\frac{1}{2}\right)^{\log_5 a}$$

$$\frac{\log_a N \; \log_b N \; \log_c N}{\log_{abc} N}$$

$$x^{\log_a 5} = \frac{1}{2}$$

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19.

$$\frac{\sin x}{3+\cos x}$$

$$6t+4-4t^2=5+5t^2$$

$$\frac{3+\frac{1-t^2}{1+t^2}}{\frac{2t}{1+t^2}}=\frac{4+2t^2}{2t}=\frac{2}{t}+t\in(-\infty,-2\sqrt{2}]\cup[2\sqrt{2},\infty)$$

$t\in(0,1)$

$t\in R-\{0\}$

$\boxed{\sin(x+\alpha)=1}$

$x+\alpha=\frac{\pi}{2}$

$2\sqrt{2}\le y<\infty$

$t>0 \quad 0<\frac{1}{y}\le\frac{1}{2\sqrt{2}}$

$$\left(\sqrt{t}-\frac{\sqrt{2}}{\sqrt{t}}\right)^2+2\sqrt{2}\ge 2\sqrt{2}$$

$t=-u$

$$-\left(\frac{2}{u}+u\right)$$

$t<0$

$2<9<3$

$\frac{1}{3}<\frac{1}{9}<\frac{1}{2}$

$$\frac{3+\cos x}{\sin x}=y$$

$y=?$ $\sqrt{1+y^2}<3$

$= y\sin x-\cos x\le\sqrt{1+y^2}$

$\sin\alpha=\frac{4}{5}$

$\cos\alpha=\frac{3}{5}$

$2\cos\alpha+\sin\alpha+4\cot\alpha$

$9\le 1+y^2$

$y^2\ge 8$

$(y-2\sqrt{2})(y+2\sqrt{2})\ge 0$

$+ \quad - \quad +$

$-2\sqrt{2} \quad 2\sqrt{2}$

$y\in(-\infty,-2\sqrt{2}]\cup[2\sqrt{2},\infty)$

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$2 < a < 3$ $\qquad \frac{1}{3} < \frac{1}{a} < \frac{1}{2}$

$\frac{1}{a} \in \left(-\infty, -\frac{1}{3}\right) \cup \left(\frac{1}{2}, \infty\right)$

$-3 < a < -1 \qquad -1 < \frac{1}{a} < -\frac{1}{3}$

$\frac{1}{a}$

$\boxed{-3 < a < 2}$

$-3 < a < 0$ or $\boxed{0 < a < 2} \Rightarrow \frac{1}{2} < \frac{1}{a} < \infty$

$\Rightarrow -\infty < \frac{1}{a} < -\frac{1}{3}$

-0.001

-0.5

$a = -1, -2, -1000$

$\frac{1}{a} = -1,$

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$\frac{3+\cos x}{\sin x} \in (-\infty, -2\sqrt{2}] \cup [2\sqrt{2}, \infty)$

∴ Black book :

∴ Pink book

∴ $\boxed{\text{Yellow}}$

$\in \left[-\frac{1}{2\sqrt{2}}, 0\right) \cup \left(0, \frac{1}{2\sqrt{2}}\right]$

$\frac{1}{\left(\frac{3+\cos x}{\sin x}\right)}$

x ✓

$\frac{1}{\left(\frac{1}{x}\right)}$

$\boxed{\frac{\sin x}{3+\cos x} \in \left[-\frac{1}{2\sqrt{2}}, \frac{1}{2\sqrt{2}}\right]}$

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Functions

y is a function of x ← $y = \sqrt{x}$

$y = -\sqrt{x}$

$f(x) = \log_2 x$

$y^2 = x$

$x = 4$

$\boxed{y = -\sqrt{x}}$

$y = f(x)$

y is a function of x.

$f(x) = x^3 - x^2 + 2x + \sin x$

$1^3 - 1^2 + 2 + \sin 1 = 2 + \sin 1$

$x = 1$

$y = 2$

$y = -2$

$y^2 = 4$

take unique value for every x.

Calculus for Beginners

Introduction to Calculus

Nishant Jindal

- <u>Function</u>

$$\underset{\text{range}}{y} = f(\underset{\text{domain}}{x})$$

y is a function of x if y takes a unique value for any x.

- <u>Domain of Function</u>, $y = f(x)$
  set of all real values of x for which f(x) is real.
- <u>Range of function</u>
  set of all real values that f(x) attain.

Limit of function at point $x=a$.

$\boxed{x=a}$

$\lim_{x \to a} f(x)$

Limit of function $f(x)$ as x approaches 'a'.

$(a-\delta, a) \cup (a, a+\delta)$

is the value $f(x)$ appear to attain for <u>all values</u> of x which are very close to 'a'.

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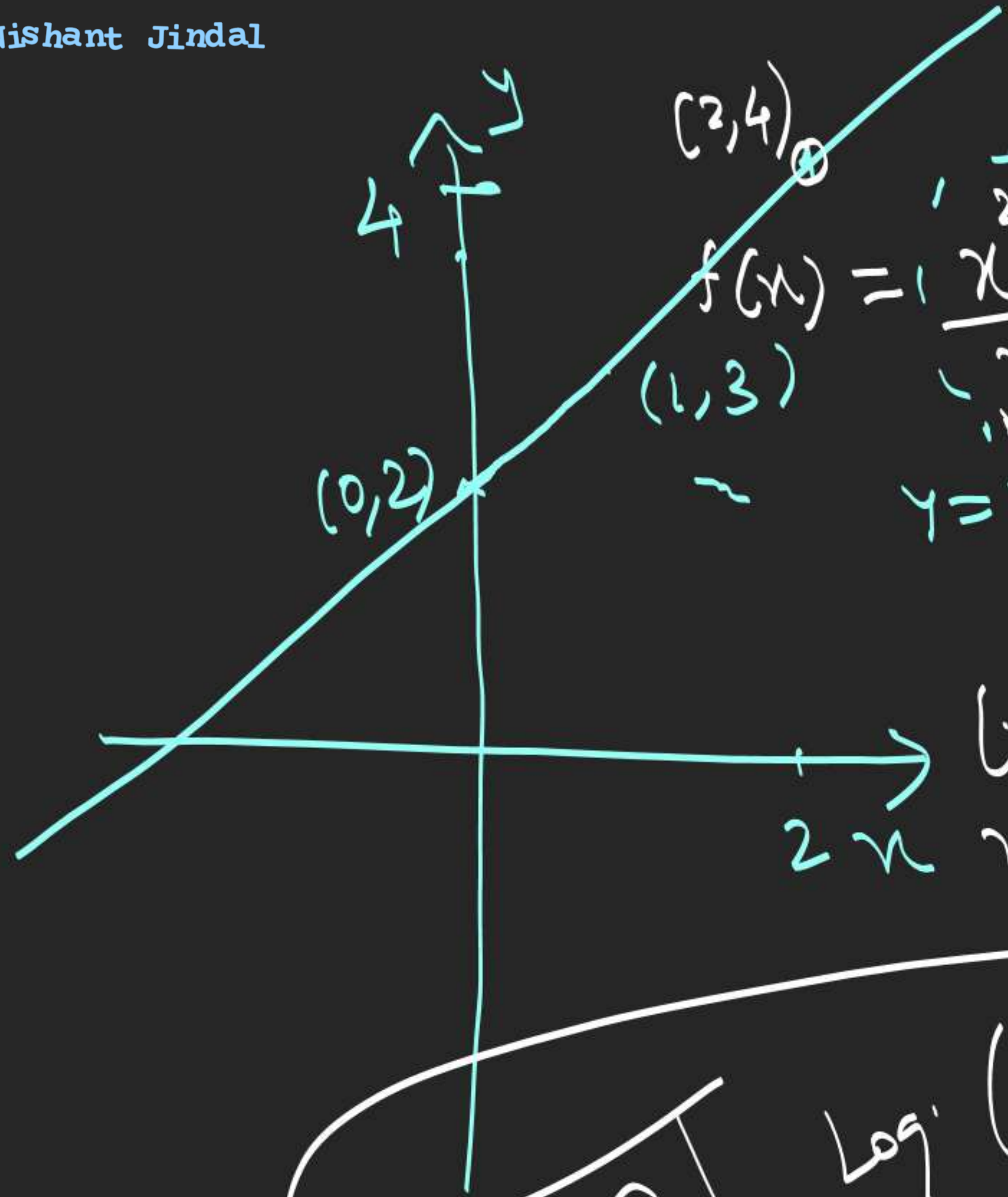
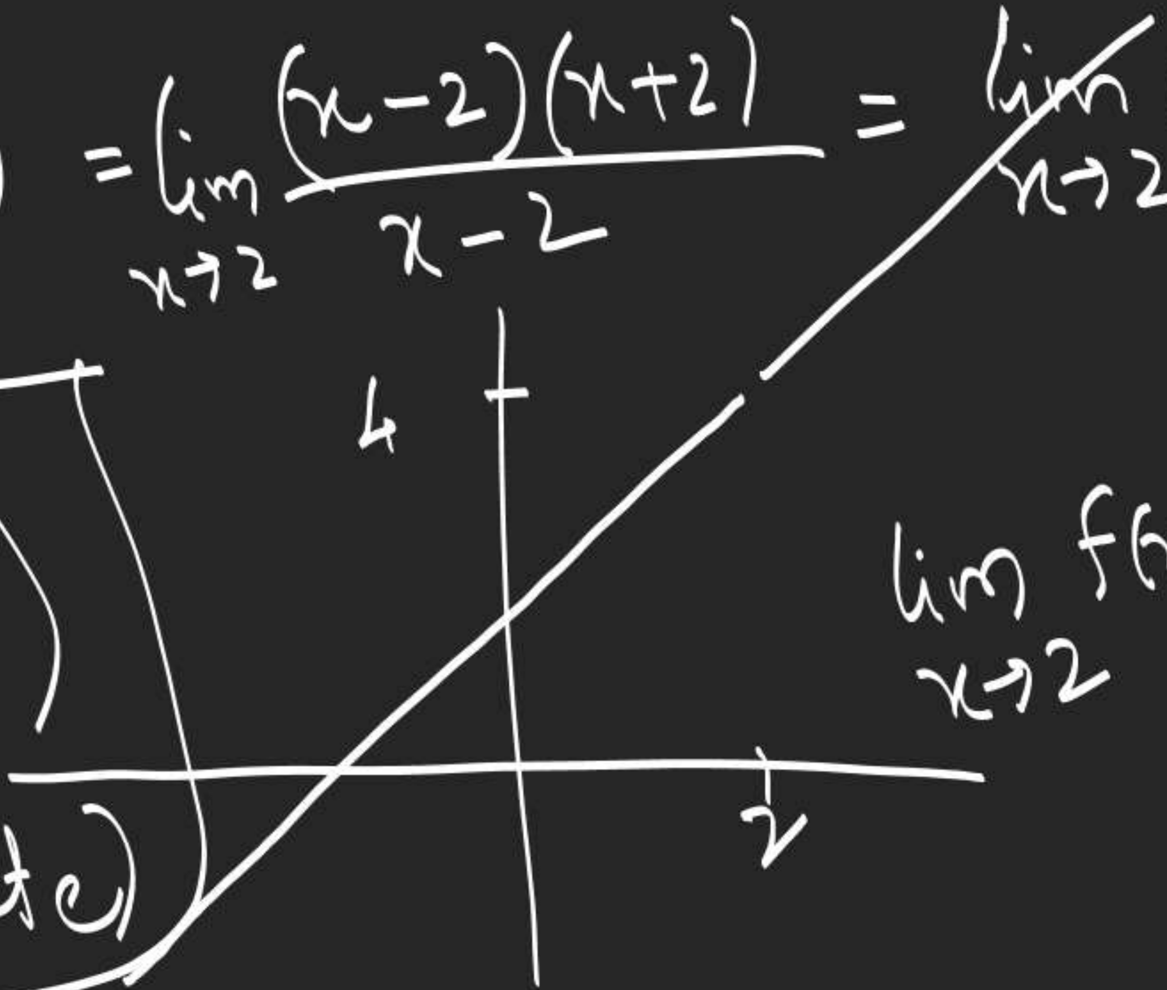


$$f(x) = \frac{x^2-4}{x-2} \qquad x \neq 2$$

$y = x+2$

$$D_f = R - \{2\}$$

$$\lim_{x\to 2} f(x) = \lim_{x\to 2}\frac{(x-2)(x+2)}{x-2} = \lim_{x\to 2}(x+2) = 4$$



$$\lim_{x\to 2} f(x) = 4$$

Q. 20

Log (Ex-I 21-25)

Ex-III (complete)