

PRAAYAS

JEE 2026

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Mathematics

Basic Maths

Lecture - 12

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Topics *To be covered*



A Logarithmic Inequalities

B Introduction to Modulus

C Problem Practice

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Homework Discussion

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QUESTION



Tah03

Solve the following logarithmic equations:

$$1. \log_3(x^2 - 3x - 5) = \log_3(7 - 2x)$$

$$2. x^{0.5 \log_{\sqrt{x}}(x^2 - x)} = 3^{\log_9 4}$$

$$3. 25^{\log_{10} x} = 5 + 4 \times \log_{10} 5$$

$$4. 1 + 2 \log_{x+2} 5 = \log_5(x + 2)$$

$$5. 2 \log_2(\log_2 x) + \log_{\frac{1}{2}}(\log_2(2\sqrt{2}x)) = 1$$

$$\text{Solve } 25^{\log_{10} x} = 5 + 4x^{\log_{10} 5}$$

TAH -03 ka 3rd Question ye hai
usmein typing error hai

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$$\log_2(\log_2 x)^2 - \log_2(\log_2 2\sqrt{2} + \log_2 x) = 1$$

$$\text{let } \log_2 x = t$$

$$\log_2 t^2 - \log_2(3/2 + t) = 1$$



$$\log_2 \left(\frac{t^2}{\frac{3}{2} + t} \right) = 1$$

$$\frac{t^2}{\frac{3}{2} + t} = 2$$

$$t^2 = 3 + 2t$$

$$t^2 - 2t - 3 = 0$$

$$(t-3)(t+1) = 0$$

$$t = 3, -1$$

$$\log_2 x = 3 \text{ or } \log_2 x = -1$$

$$x = 8, \frac{1}{2}$$

QUESTION



Solve the following equations :

$$(vi) \log_{5-x}(x^2 - 2x + 65) = 2$$

$$(vii) \log_{10} 5 + \log_{10}(x + 10) - 1 = \log_{10}(21x - 20) - \log_{10}(2x - 1)$$

$$(viii) x^{1+\log_{10} x} = 10x$$

$$(ix) 2(\log_x \sqrt{5})^2 - 3\log_x \sqrt{5} + 1 = 0$$

$$(x) 3 + 2\log_{x+1} 3 = 2\log_3(x + 1)$$

$$\log_{10} 5 + \log_{10}(x+10) - \log_{10} 10 = \log_{10} \left(\frac{21x-20}{2x-1} \right)$$

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$$\log_{10} \left(\frac{x+10}{2} \right) = \log_{10} \left(\frac{21x-20}{2x-1} \right)$$

$$\frac{x+10}{2} = \frac{21x-20}{2x-1}$$

Answers:

i. $\{1 + \sqrt{3}\}$

ii. $\{3\}$

iii. $\{4\}$

iv. $\{2\}$

v. $\{0\}$

vi. $\{-5\}$

vii. $\{3/2, 10\}$

viii. $\{10^{-1}, 10\}$

ix. $\{\sqrt{5}, 5\}$

x. $\{-(3 - \sqrt{3})/3, 8\}$



Aao Machaay Dhamaal Deh Swaal pe Deh Swaal

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Logarithmic Inequalities



If f is an increasing fn
 $x > y \iff f(x) > f(y)$

Kisi inequality mai inc fn laagane
 jaa hataone pe sign of inequality
 mai koi change nahi hotaa

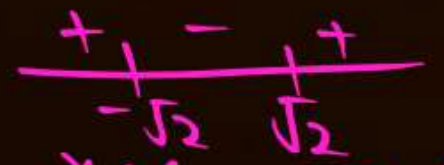
Ex: $f(x) = e^x$ is an inc fn

find range of $x: e^{x^2+2} \geq e^4$

$$x^2 + 2 \geq 4$$

$$x^2 - 2 \geq 0$$

$$(x - \sqrt{2})(x + \sqrt{2}) \geq 0$$



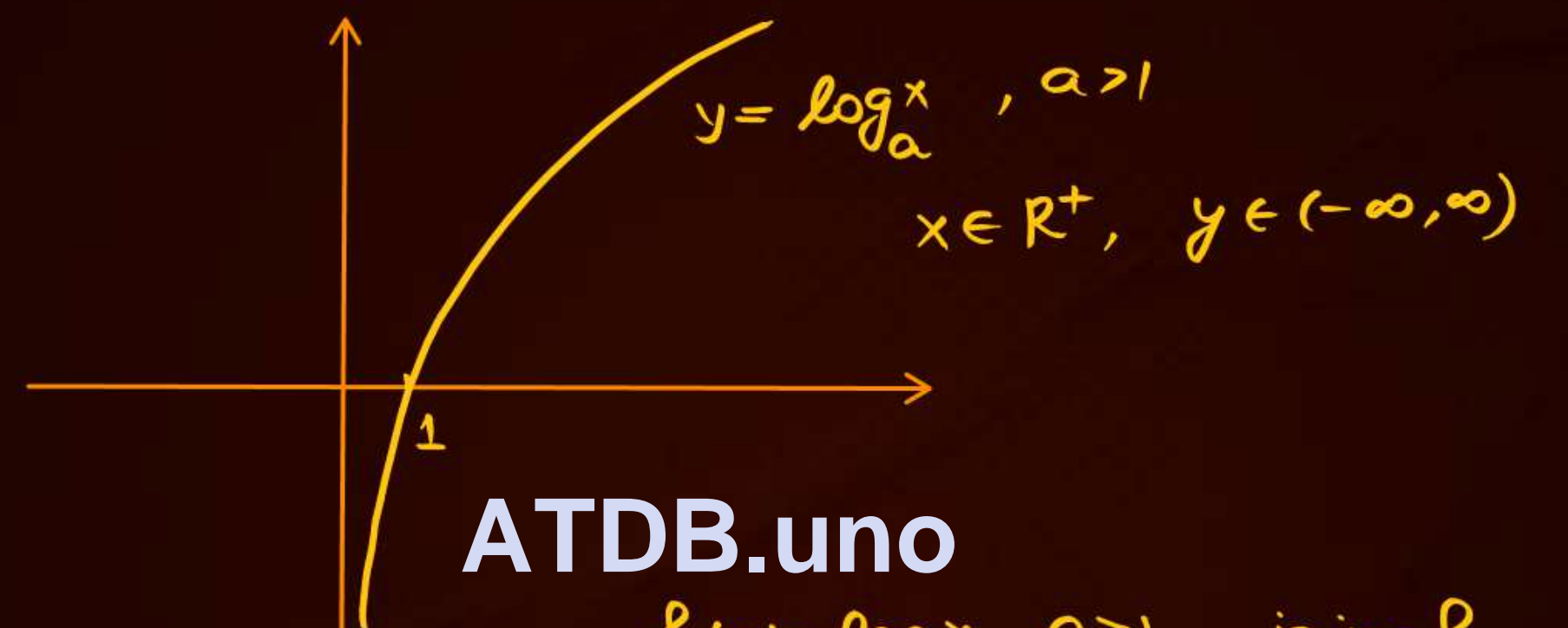
$$x \in (-\infty, -\sqrt{2}] \cup [\sqrt{2}, \infty)$$

$$y = \log_2 x$$

x	y
1	0
1/2	-1
1/4	-2
2	1
4	2



for base $a > 1$ $y = \log_a x$
 is an increasing function



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$f(x) = \log_a x, a > 1$, is inc fn.

Domain = \mathbb{R}^+

Range = \mathbb{R}

Ex: $\log_{10} x \geq 2$
 inc fn.

lalu: $\log_{10} x \geq \log_{10} 100$
 $x \geq 100$

Kalu

$\log_{10} x \geq 2$
 $x \geq 10^2 = 100$

Ex: $\log_{10}(x-1) < 1$

$x-1 < 10^1$ & $x-1 > 0$

$x < 11$ & $x > 1$

$x \in (1, 11)$

QUESTION



$$\log_7 \left(\frac{2x-6}{2x-1} \right) > 0$$

$$\frac{2x-6}{2x-1} > 7^0$$

$$\neq \frac{2x-6}{2x-1} > 0$$

No Need

$$\frac{2x-6}{2x-1} > 1$$

$$\frac{2x-6}{2x-1} - 1 > 0$$

$$\frac{\cancel{2x} - 6 - \cancel{2x} + 1}{2x-1} > 0$$

$$\frac{-5}{2x-1} > 0$$

$$\frac{1}{2x-1} < 0$$

$$2x-1 < 0$$

$$x < \frac{1}{2} \Rightarrow \text{Ans: } x \in (-\infty, \frac{1}{2})$$

\log_a^x is defined only if $x \in \mathbb{R}^+$
 $a > 0, a \neq 1$

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QUESTION



$$\log_5(x^2 - 5x + 6) > -1$$

inc

$$x^2 - 5x + 6 > 5^{-1}$$

$$x^2 - 5x + 6 > \frac{1}{5}$$

$$5x^2 - 25x + 30 > 1$$

$$5x^2 - 25x + 29 > 0$$

$$\& \quad x^2 - 5x + 6 > 0$$

↓
(No Need)

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$$5 \cdot \left(x - \frac{25 - 3\sqrt{5}}{10}\right) \left(x - \frac{25 + 3\sqrt{5}}{10}\right) > 0$$

$$\begin{array}{c} + \quad \quad \quad - \quad \quad \quad + \\ \hline \frac{25 - 3\sqrt{5}}{10} \quad \quad \quad \frac{25 + 3\sqrt{5}}{10} \end{array}$$

$$x \in \left(-\infty, \frac{25 - 3\sqrt{5}}{10}\right) \cup \left(\frac{25 + 3\sqrt{5}}{10}, \infty\right)$$

$$x = \frac{25 \pm \sqrt{625 - 580}}{10}$$

$$x = \frac{25 \pm \sqrt{45}}{10}$$

$$x = \frac{25 \pm 3\sqrt{5}}{10}$$

QUESTION



$$\log_2(\log_3(\log_5 x)) > 0$$

$$\log_3(\log_5 x) > 2^0$$

$$\log_3(\log_5 x) > 1$$

$$\log_5 x > 3^1 = 3$$

$$x > 5^3$$

$$x > 125 \text{ Ans.}$$



$$\neq \log_3(\log_5 x) > 0$$

↓
(No Need)

$$\neq \log_5 x > 0$$

↓
(No Need)

$$\neq x > 0$$

↓
(No Need)

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QUESTION [WB JEE 2022]



If x satisfies the inequality $\log_{25} x^2 + (\log_5 x)^2 < 2$, then x belongs to

A $\left(\frac{1}{5}, 5\right)$

~~**B**~~ $\left(\frac{1}{25}, 5\right)$

C $\left(\frac{1}{5}, 25\right)$

D $\left(\frac{1}{25}, 25\right)$

$$\log_{5^2} x^2 + (\log_5 x)^2 < 2$$

$$\frac{2}{2} \log_5 |x| + (\log_5 x)^2 < 2$$

(clearly $x > 0$)

$$\log_5 x + (\log_5 x)^2 < 2$$

let $\log_5 x = t$

$$t^2 + t - 2 < 0$$

$$(t+2)(t-1) < 0$$

$$t \in (-2, 1)$$

$$-2 < t < 1 \Rightarrow -2 < \log_5 x < 1$$

$$5^{-2} < x < 5^1 \Rightarrow x \in \left(\frac{1}{25}, 5\right)$$

Ans. B



If f is a dec. fn then
 $x > y \iff f(x) < f(y)$

kisi Inequality mai dono side
 koi dec. fn lagao yaa hatao
 sign of inequality reverse ho jaata hai

$y = \log_a x$, $x \in \mathbb{R}^+$, $0 < a < 1$ is decreasing fn

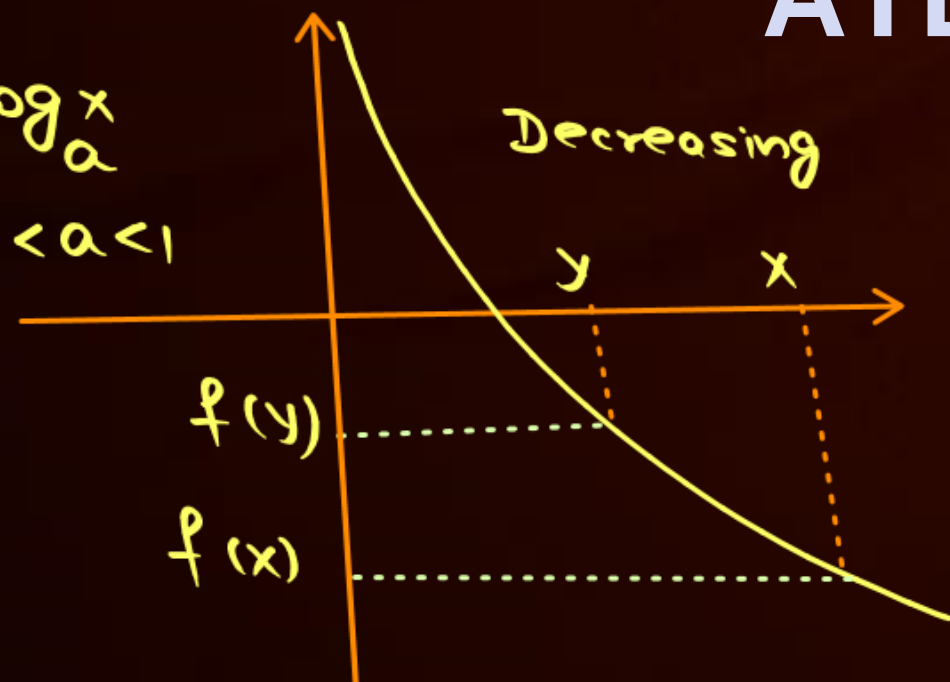
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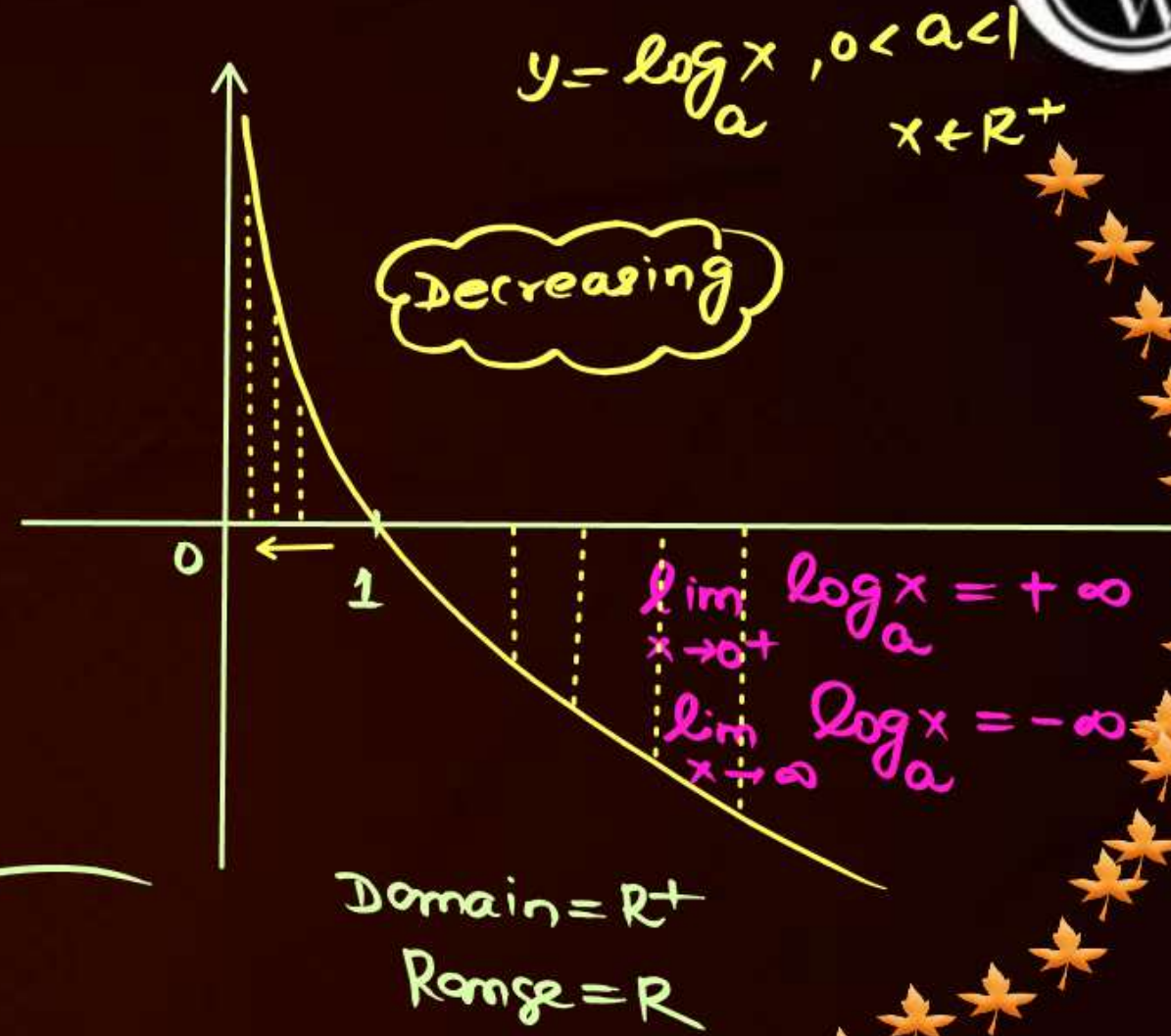
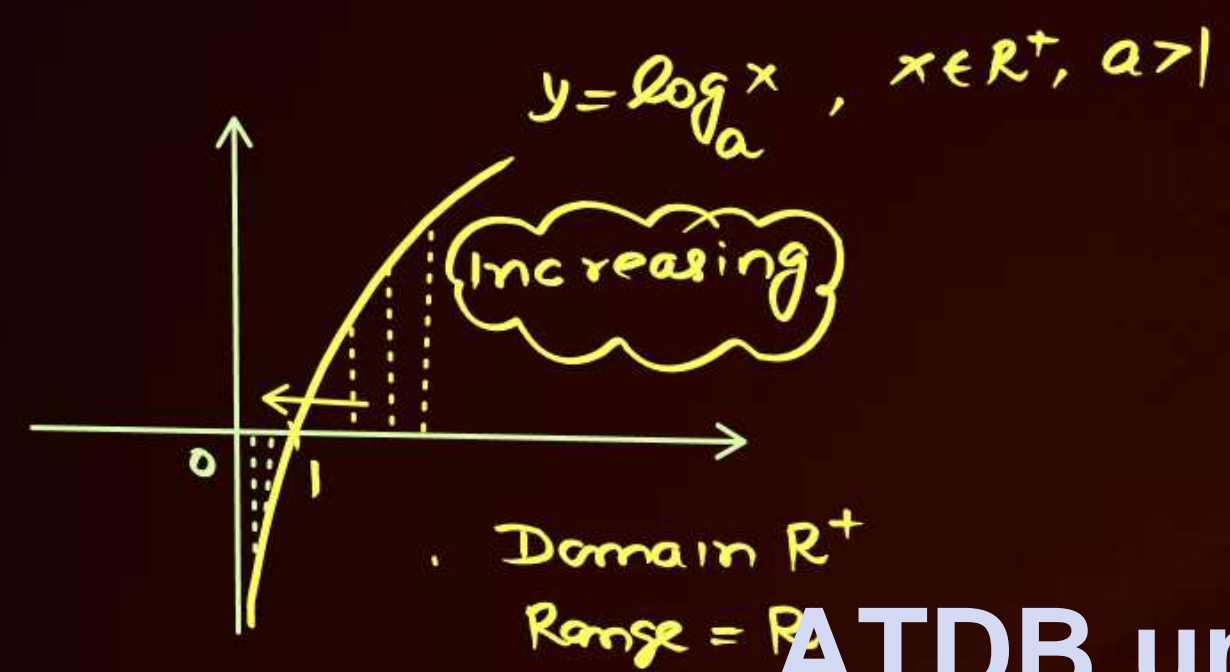
$$y = \log_a x$$

$$0 < a < 1$$

Domain \mathbb{R}^+

Range \mathbb{R}

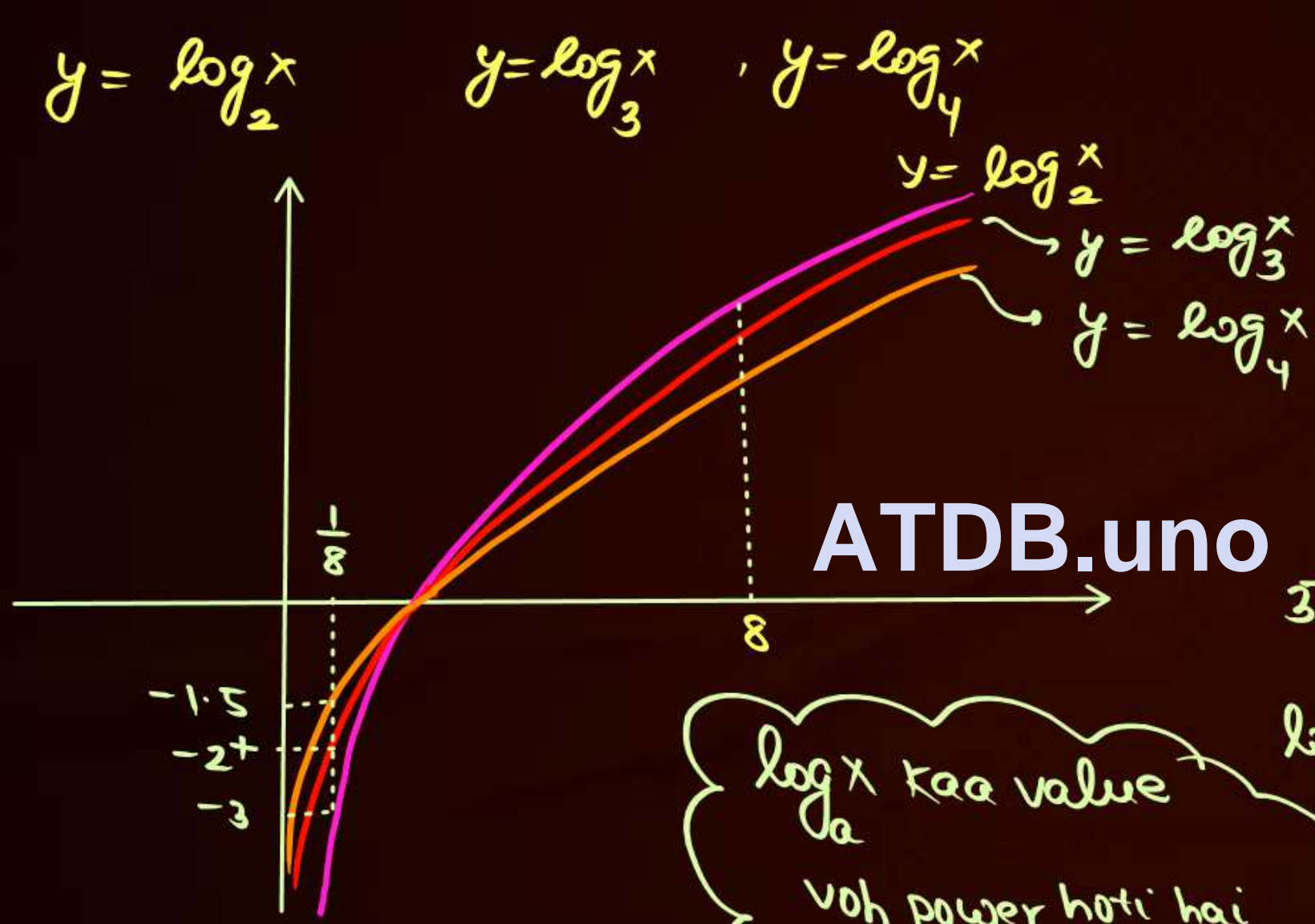




$\lim_{x \rightarrow 0^+} \log_a x = -\infty$
 $\lim_{x \rightarrow \infty} \log_a x = \infty$

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$f(x) = \log_a x$ Domain \mathbb{R}^+
Range \mathbb{R}



$$\log_4 \frac{1}{8} = \log_{2^2} 2^{-3}$$

$$= -\frac{3}{2}$$

$$\log_3 \frac{1}{8} = -3 \log_3 2$$

$$3^{-2} = \frac{1}{9} < \frac{1}{8}$$

$$\log_3 \frac{1}{8} > -2$$

log x kaa value
 'a'
 voh power hoti hai
 jo 'a' pe lagayi
 jaaye taaki x aa jayay

QUESTION [WB JEE 2016]



If $\log_{0.3}(x-1) < \log_{0.09}(x-1)$, then x lies in the interval

~~A~~ $(2, \infty)$

$$\log_{0.3}(x-1) < \log_{(0.3)^2}(x-1)$$

$$\& \quad x-1 > 0$$

B $(1, 2)$

$$\log_{0.3}(x-1) < \frac{1}{2} \log_{0.3}(x-1)$$

$$\& \quad x > 1$$

C $(-2, -1)$

$$2 \log_{0.3}(x-1) < \log_{0.3}(x-1)$$

D None of these

$$\log_{0.3}(x-1)^2 < \log_{0.3}(x-1) \Rightarrow (x-1)^2 > x-1$$

$$(x-1)^2 - (x-1) > 0$$

$$(x-1)(x-2) > 0$$

$$x \in (-\infty, 1) \cup (2, \infty)$$

decreasing fn



$$\cap \quad x \in (2, \infty)$$

Ans. A

QUESTION



$$\log_{0.2}(x^2 - x - 2) > \log_{0.2}(-x^2 + 2x + 3)$$

$$x^2 - x - 2 < -x^2 + 2x + 3$$

$$2x^2 - 3x - 5 < 0$$

$$2x^2 - 5x + 2x - 5 < 0$$

$$(2x - 5)(x + 1) < 0$$

$$x \in (-1, 5/2)$$

$$\beta \quad x^2 - x - 2 > 0$$

$$(x - 2)(x + 1) > 0$$

$$x \in (-\infty, -1) \cup (2, \infty)$$

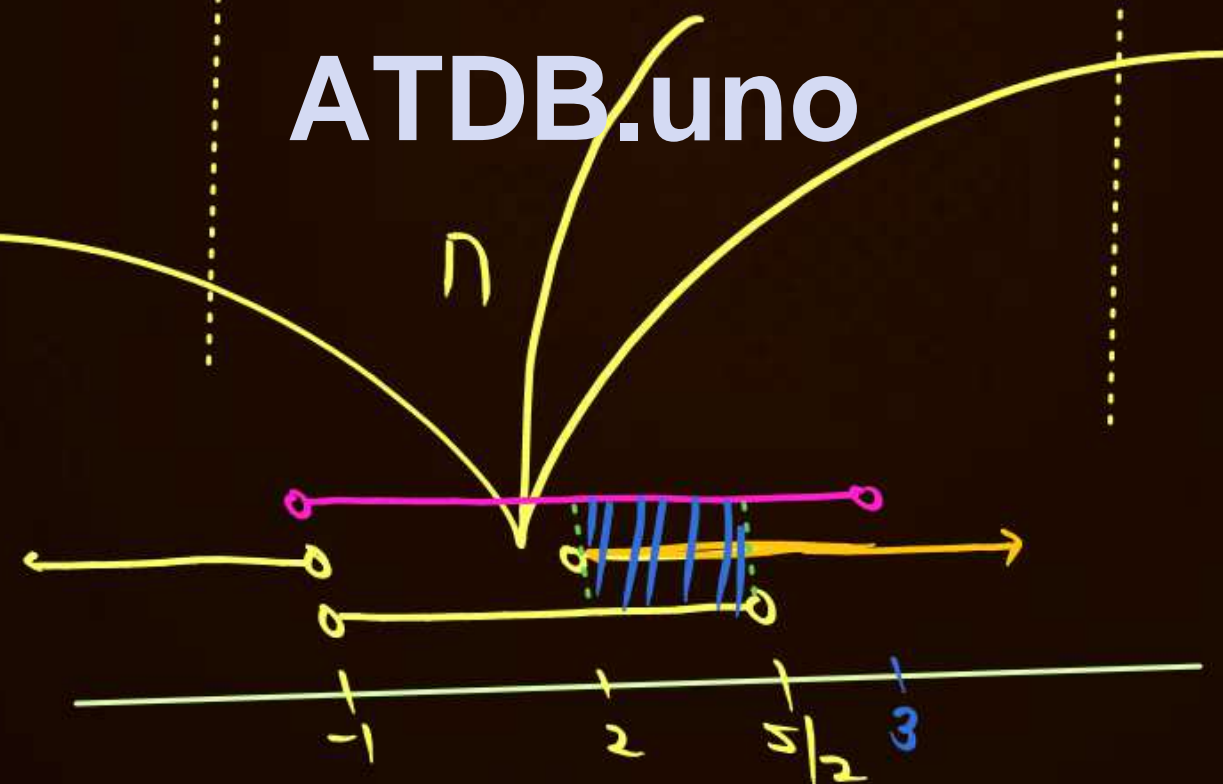
$$\gamma \quad -x^2 + 2x + 3 > 0$$

$$x^2 - 2x - 3 < 0$$

$$(x - 3)(x + 1) < 0$$

$$x \in (-1, 3)$$

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$$x \in (2, 5/2) \text{ Ans}$$

QUESTION



If $\log_{0.5}(\log_5(x^2 - 4)) > \log_{0.5} 1$ then find possible values of x

$$\log_5(x^2 - 4) < 1$$

$$x^2 - 4 < 5$$

$$x^2 - 9 < 0$$

$$(x-3)(x+3) < 0$$

$$x \in (-3, 3)$$

$$\& \log_5(x^2 - 4) > 0$$

$$x^2 - 4 > 5^0$$

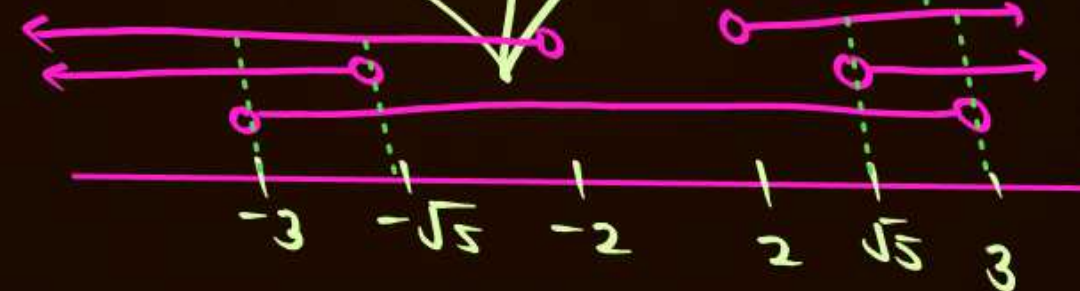
$$x^2 - 5 > 0$$

$$x \in (-\sqrt{5}, \sqrt{5}) \cup (\sqrt{5}, \infty)$$

$$\& x^2 - 4 > 0$$

$$(x-2)(x+2) > 0$$

$$x \in (-\infty, -2) \cup (2, \infty)$$



$$x \in (-3, -\sqrt{5}) \cup (\sqrt{5}, 3)$$



Variable Base



$$\log_{f(x)} g(x) > \log_{f(x)} h(x)$$

case ① if $f(x) > 1 \Rightarrow$

$$g(x) > h(x)$$

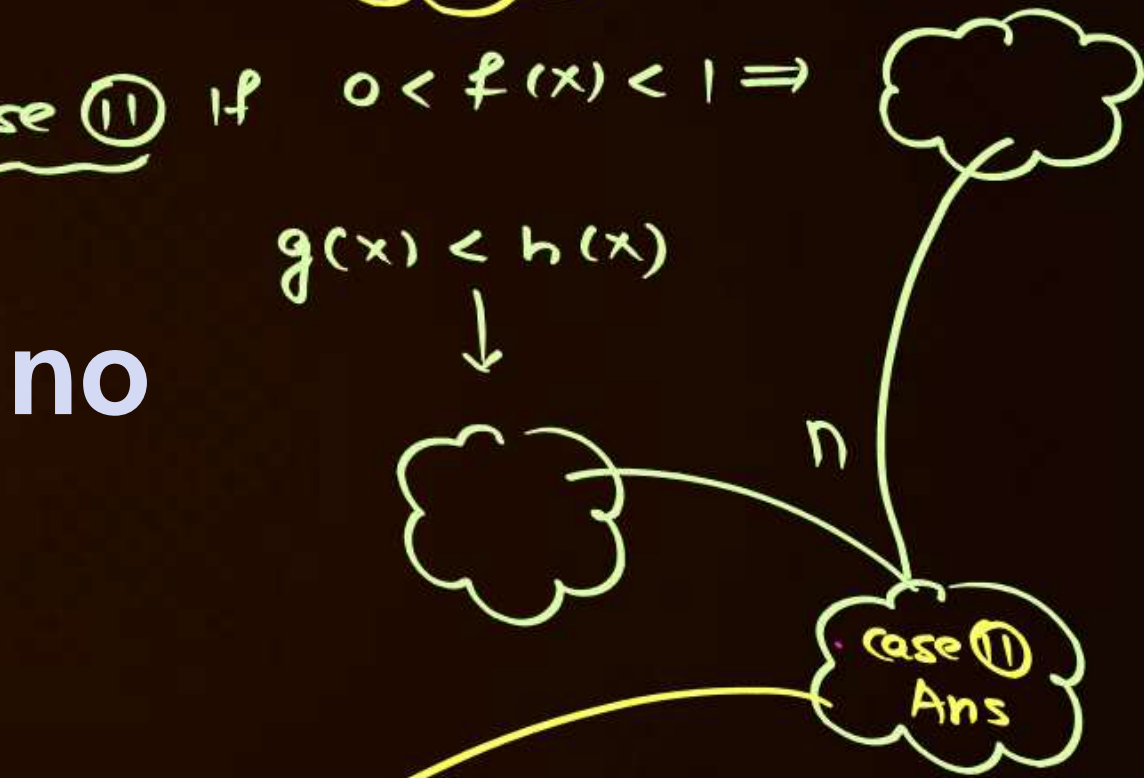
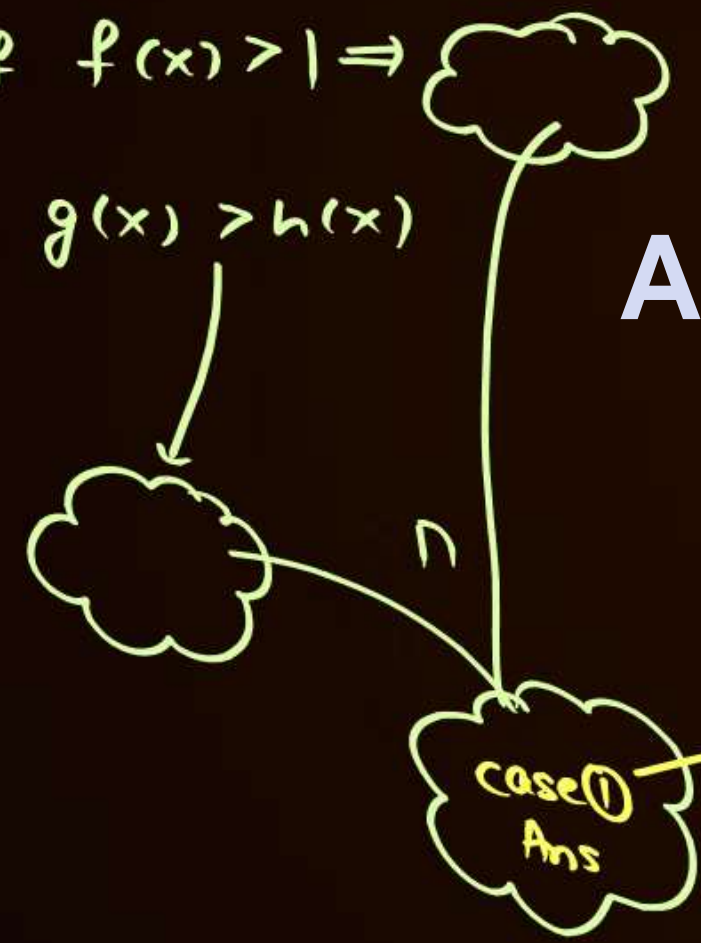
case ② if $0 < f(x) < 1 \Rightarrow$

$$g(x) < h(x)$$

$$g(x) > 0 \ \& \ h(x) > 0$$



Cases ke Answers koa hamesha union hotaa hai



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Final Ans: A ∩ B

QUESTION



Also $2x - \frac{3}{4} > 0 \Rightarrow x > \frac{3}{8}$ — (A)

$$\log_x \left(2x - \frac{3}{4} \right) > 2$$

Case (i) if $x > 1$

$$2x - \frac{3}{4} > x^2$$

$$8x - 3 > 4x^2$$

$$4x^2 - 8x + 3 < 0$$

$$4x^2 - 6x - 2x + 3 < 0$$

$$(2x - 1)(2x - 3) < 0$$

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

$$x \in \left(\frac{1}{2}, \frac{3}{2} \right)$$

Case (ii) if $0 < x < 1$

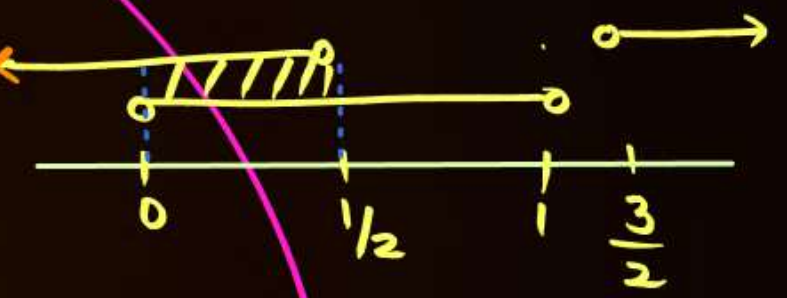
$$2x - \frac{3}{4} < x^2$$

$$8x - 3 < 4x^2$$

$$4x^2 - 8x + 3 > 0$$

$$(2x - 1)(2x - 3) > 0$$

$$x \in (-\infty, \frac{1}{2}) \cup (\frac{3}{2}, \infty)$$



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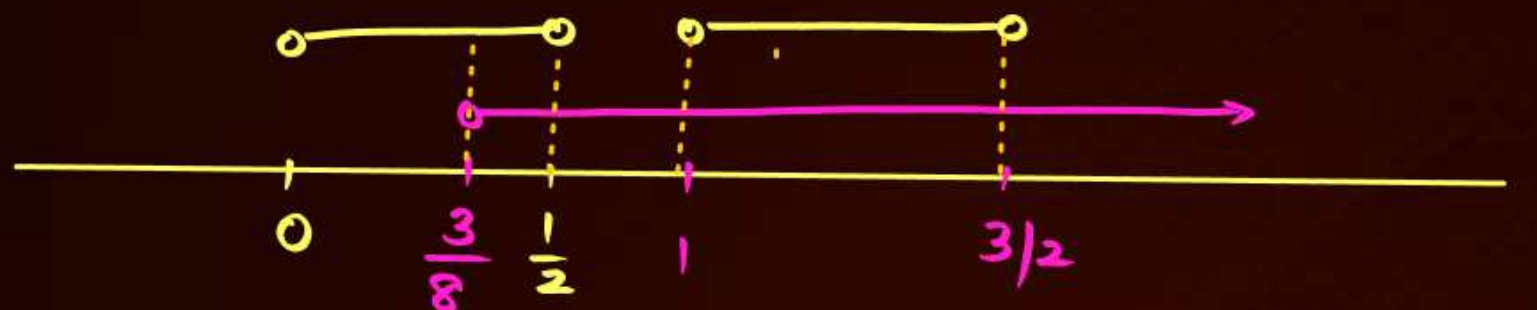
$x \in \left(1, \frac{3}{2} \right)$

UNION (U)

$x \in \left(0, \frac{1}{2} \right) \cup \left(1, \frac{3}{2} \right)$ — (B)



$A \cap B$



Ans: $x \in (\frac{3}{4}, \frac{1}{2}) \cup (1, \frac{3}{2})$ Ans



QUESTION

$$\log_{2x+3}(x^2) < \log_{2x+3}(2x+3)$$

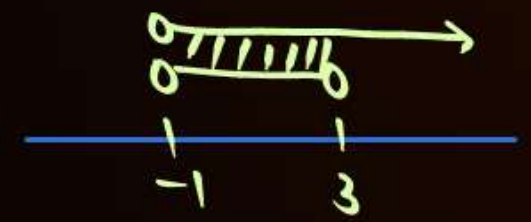
$$x^2 > 0$$
$$\downarrow$$
$$x \in R_0 = (-\infty, \infty) - \{0\} \text{ --- (A)}$$

$$\log_{2x+3} x^2 < 1$$

Case ① If $2x+3 > 1 \Rightarrow x > -1$

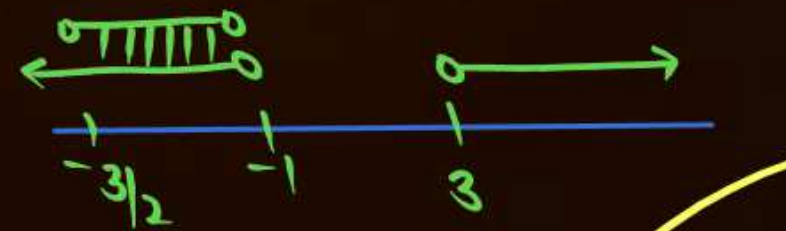
$$x^2 < 2x+3$$
$$x^2 - 2x - 3 < 0$$
$$(x-3)(x+1) < 0$$

$$x \in (-1, 3)$$



Case ② If $0 < 2x+3 < 1 \Rightarrow -3 < 2x < -2$
 $-\frac{3}{2} < x < -1$

$$x^2 > 2x+3$$
$$x^2 - 2x - 3 > 0 \Rightarrow (x+1)(x-3) > 0$$
$$x \in (-\infty, -1) \cup (3, \infty)$$



$$x \in (-3/2, -1)$$

UNION

$$x \in (-3/2, -1) \cup (-1, 3) \text{ --- (B)}$$

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Ans: $A \cap B$

$$x \in \left(-\frac{3}{2}, -1\right) \cup (-1, 0) \cup (0, 3)$$

OR

$$x \in \left(-\frac{3}{2}, 3\right) - \{0, -1\}$$

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QUESTION [JEE Mains 2023]



The number of integral solutions x of $\log_{\left(x+\frac{7}{2}\right)} \left(\frac{x-7}{2x-3}\right)^2 \geq 0$ is :

Tahoi

A 8

B 7

C 5

D 6

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QUESTION



$$\log_{x+3}(x^2 - x) < 1$$

Tah 02

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Saari Class Illustrations ATDB.uno Retry karni Hai



Home Challenge-04



Let a, b, c be three distinct positive real numbers such that

$(2a)^{\log_e a} = (bc)^{\log_e b}$ and $b^{\log_e 2} = a^{\log_e c}$. Then, $6a + 5bc$ is equal to

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Today's KTK



No Selection **TRISHUL** Selection with Good Rank
Apnao IIT Jao



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QUESTION [MHT CET 2023 (9 May)]

(KTK 01)



If $\log_2 x + \log_4 x + \log_8 x + \log_{16} x = \frac{25}{36}$ and $x = 2^k$ then k is

A 1

B $\frac{1}{2}$

C $\frac{1}{3}$

D $\frac{1}{8}$

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Ans. C

QUESTION [BITSAT 2021]

(KTK 02)



If $\log_7 5 = a$, $\log_5 3 = b$ and $\log_3 2 = c$, then the logarithm of the number 70 to the base 225 is

A $\frac{1 - a + abc}{2a(1 + b)}$

B $\frac{1 - a - abc}{2a(1 + b)}$

C $\frac{1 + a - abc}{2a(1 + b)}$

D $\frac{1 + a + abc}{2a(1 + b)}$

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Ans. D

QUESTION [BITSAT 2020]

(KTK 03)



If $\log_5 \frac{(a + b)}{3} = \frac{\log_5 a + \log_5 b}{2}$, then $\frac{a^4 + b^4}{a^2 b^2}$ is equal to

- A** 50
- B** 47
- C** 44
- D** 53

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Ans. B

QUESTION [WB JEE 2024]

(KTK 04)



If $(x^2 \log_x 27) \cdot \log_9 x = x + 4$ then the value of x is

A 2

B $-\frac{4}{3}$

C -2

D $\frac{4}{3}$

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Ans. A

QUESTION [WB JEE 2020]

(KTK 05)



If $2 \log(x + 1) - \log(x^2 - 1) = \log 2$, then $x =$

A only 3

B -1 and 3

C only -1

D 1 and 3

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Ans. A

QUESTION [WB JEE 2018]

(KTK 06)



If $x + \log_{10}(1 + 2^x) = x \log_{10} 5 + \log_{10} 6$, then the value of x is

A $\frac{1}{2}$

B $\frac{1}{3}$

C 1

D 2

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Ans. C

QUESTION [WB JEE 2019]

(KTK 07)



If $\log_2 6 + \frac{1}{2x} = \log_2 (2^{\frac{1}{x}} + 8)$, then the value of x are

A $\frac{1}{4}, \frac{1}{3}$

B $\frac{1}{4}, \frac{1}{2}$

C $-\frac{1}{4}, \frac{1}{2}$

D $\frac{1}{3}, -\frac{1}{2}$

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Ans. B

QUESTION [WB JEE 2017]

(KTK 08)



If $(\log_5 x)(\log_x 3x)(\log_{3x} y) = \log_x x^3$, then y equals

A 125

B 25

C 513

D 243

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Ans. A

QUESTION [COMEDK 2023]

(KTK 09)



The value of $a^{\log_b c} - c^{\log_b a}$, where $a, b, c > 0$ but $a, b, c \neq 1$, is

A a

B b

C c

D 0

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Ans. D

QUESTION [COMEDK 2022]**(KTK 10)**

The value of $3^{\log_4 5} - 5^{\log_4 3}$ is

- A** 0
- B** 1
- C** 2
- D** 4

ATDB.uno**Ans. A**

QUESTION [COMEDK 2021]

(KTK 11)



$8^3 \log_8 5$ is equal to

A $\log_8 25$

B 120

C 125

D $\log_8 15$

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Ans. C

QUESTION [COMEDK 2020]

(KTK 12)



$7^{2 \log_7 5}$ is equal to

- A** 5
- B** $\log_7 35$
- C** $\log_7 25$
- D** 25

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Ans. D

QUESTION

(KTK 13)



Find the exhaustive solutions set of $\frac{(x^2-9)^{101}(x^2+6)(x^2-4)^{100}}{(x^2-5x+6)^{13}(x^2-16)^{16}} > 0$.

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Ans. $(-\infty, -3) \cup (2, \infty) - \{\pm 4, 3\}$

QUESTION

(KTK 14)



Find the exhaustive solutions set of $\frac{(x-4)^{30}(x^2-9)^9(x^2-3x+2)^{17}(3x^2+10)^{10}}{(x^2-5x+6)^{52}(x^2-25)^{60}(x^2+10)^{11}} \leq 0$.

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Ans. $[-3, 1] \cup (2, 3)$

QUESTION

(KTK 15)



Solve in real numbers the equation $\sqrt{x} + \sqrt{y} + 2\sqrt{z-2} + \sqrt{u} + \sqrt{v} = x + y + z + u + v$.

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Ans. $x = y = u = v = 1/4, z = 3$

QUESTION**(KTK 16)**

Find all pair of positive integer (m, n) that satisfy $mn + 3m - 8n = 59$.

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Ans. 3

QUESTION

(KTK 17)



The least value of the expression $(x + y)(y + z)$ where given that $x, y, z > 0$ and $xyz(x + y + z) = 1$

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Ans. 2



Today's BPP

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QUESTION



Solve the following inequalities:

$$(a) \log(x^2 - 2x - 2) \leq 0$$

$$(b) \log_5(x^2 - 11x + 43) < 2$$

$$(c) 2 - \log_2(x^2 + 3x) \geq 0$$

$$(d) \log_{1.5} \frac{2x-8}{x-2} < 0$$

$$(e) \log_3 \frac{1+2x}{1+x} < 1$$

$$(f) \log_4 \frac{3x+2}{x} \leq 0.5$$

$$(g) \log_2 \frac{x^2-4x+2}{x+1} \leq 1$$

$$(h) \log_2 \left(\frac{4x-3}{4-3x} \right) > -\frac{1}{2}$$

Answers:

$$(a) [-1, 1 - \sqrt{3}) \cup (1 + \sqrt{3}, 3];$$

$$(b) (2, 9);$$

$$(c) [-4, -3) \cup (0, 1];$$

$$(d) (4, 6);$$

$$(e) (-\infty, -2) \cup (-1/2, \infty);$$

$$(f) [-2, -2/3);$$

$$(g) [0, 2 - \sqrt{2}) \cup (2 + \sqrt{2}, 6];$$

$$(h) \left(\frac{3}{4}, \frac{4}{3} \right)$$



Homework From Module



Prarambh (Topicwise) : Q1 to Q17

Prabal (JEE Main Level) : Q1 to Q7

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Solution to Previous TAH

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QUESTION



If $\log_{10} 5 = a$ and $\log_{10} 3 = b$, then :

A $\log_{30} 8 = \frac{3(1+a)}{b+1}$

B $\log_{30} 8 = \frac{3(1-a)}{b+1}$

C $\log_{243} (32) = \frac{(1-a)}{b}$

D $\log_{40} (15) = \frac{a+b}{3-2a}$

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IAH-01

Q. If $\log_{10} 5 = a$ & $\log_{10} 3 = b$, then:

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From bihar**

$$\frac{\log_5 5}{\log_5 5 + \log_5 2} = a$$

$$\frac{\log_5 3}{\log_5 5 + \log_5 2} = b$$

$$\frac{1}{1 + \log_5 2} = a$$

$$\log_5 3 = b \left(1 + \frac{1-a}{a}\right) = \frac{b}{a}$$

$$\log_5 2 = \frac{1-a}{a}$$

Now, i) $\log_{30} 32 = \frac{3 \log_5 2}{(1 + \log_5 3 + \log_5 2)} = \frac{3(1-a)}{1 + \frac{b}{a} + \frac{1-a}{a}} = \frac{3(1-a)}{b+1}$

ii) $\log_{10} 15 = \frac{\log_5 5 + \log_5 3}{\log_5 5 + 3 \log_5 2} = \frac{1 + \frac{b}{a}}{1 + \frac{3(1-a)}{a}} = \frac{a+b}{3-2a}$

ii) $\log_{2+3} 32 = \frac{5 \log_5 2}{5 \log_5 3} = \frac{5 \frac{(1-a)}{a}}{5 \frac{b}{a}} = \frac{1-a}{b}$



TAM-2

$$\textcircled{1} \cdot 2 \log_3 (x-2) + \log_3 (x-4)^2 = 0$$

$$\Rightarrow 2 \log_3 (x-2) + 2 \log_3 |x-4| = 0$$

$$\Rightarrow \log_3 ((x-2)|x-4|) = 0$$

$$\Rightarrow (x-2)|x-4| = 1$$

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From Bihar

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Case - I \rightarrow if $x-4 > 0$
 $x > 4$

$$(x-2)(x-4) = 1$$

$$x^2 - 6x + 7 = 0$$

$$(x - 3 - \sqrt{2})(x - 3 + \sqrt{2}) = 0$$

$$x = 3 - \sqrt{2}, \boxed{3 + \sqrt{2}}$$

Case II \rightarrow if $x-4 < 0$
 $x < 4$

$$(x-2)(4-x) = 1$$

$$x^2 - 6x + 9 = 0$$

$$(x-3)^2 = 0$$

$$\boxed{x = 3}$$

QUESTION



Solve the following logarithmic equations:

$$1. \log_3(x^2 - 3x - 5) = \log_3(7 - 2x)$$

$$2. x^{0.5 \log_{\sqrt{x}}(x^2 - x)} = 3^{\log_9 4}$$

$$3. 25^{\log_{10} x} = 5 + 4 \times \log_{10} 5$$

$$4. 1 + 2 \log_{x+2} 5 = \log_5(x + 2)$$

$$5. 2 \log_2(\log_2 x) + \log_{\frac{1}{2}}(\log_2(2\sqrt{2}x)) = 1$$

$$\text{Solve } 25^{\log_{10} x} = 5 + 4x^{\log_{10} 5}$$

TAH -03 ka 3rd Question ye hai
usmein typing error hai

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$$Q.1 \rightarrow \log_3(x^2 - 3x - 5) = \log_3(7 - 2x)$$

$$x^2 - 3x - 5 = 7 - 2x$$

$$x^2 - x - 12 = 0$$

$$(x - 4)(x + 3) = 0$$

$$x = 4, \boxed{-3}$$

$$Q.3 \rightarrow 25^{\log_{10} x} = 5 + 4x^{\log_{10} 5}$$

$$x^{2 \log_{10} 5} = 5 + 4x^{\log_{10} 5}$$

$$\text{Put } 2 \log_{10} 5 = t$$

$$x^{2t} = 5 + 4x^t$$

$$\text{again Put } x^t = a$$

$$\& a^2 = x^{2t}$$

$$a^2 = 5 + 4a$$

$$a^2 - 4a - 5 = 0$$

$$(a - 5)(a + 1) = 0$$

$$a = 5, -1$$

$$x^t = 5 \quad -1 \times$$

$$t \log_5 x = 1$$

$$\log_{10} 5 \cdot \log_5 x = 1$$

$$\frac{1}{1 + \log_5 2} + \log_5 x = 1$$

$$\log_5 x = 1 + \log_5 2$$

$$x = 5 * 5^{\log_5 2} = 5 \cdot 2 = 10$$



TAH-03 i) $\log_3 (x^2 - 3x - 5) = \log_3 (7 - 2x)$

$$x^2 - 3x - 5 = 7 - 2x$$

$$x^2 - 3x + 2x - 7 - 5 = 0$$

$$\therefore x^2 - x - 12 = 0$$

$$x^2 - 4x + 3x - 12 = 0$$

$$(x - 4)(x + 3) = 0$$

$$x = 4, -3$$

∴

$$16 - 12 - 5 = -ve$$

$$9 + 9 - 5 = +ve, 7 - 6 = +ve$$

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$$4^{\frac{1}{2} \log_3 3}$$

ii) $x^{0.5 \log_{\sqrt{x}} (x^2 - x)} = 3^{\log_9 4}$

$$(x^2 - x)^{0.5 \times 2} = 4^{1/2}$$

$$x^2 - x = 2$$

$$x^2 - x - 2 = 0$$

$$\therefore (x - 2)(x + 1) = 0$$

$$x = 2, -1$$

Spiral

Tah3 (3)

$$25^{\log_{10} x} = 5 + 4 \times \log_{10} 5$$

$$5^2 \log_{10} x = 5 + 4 \times \log_{10} 5$$

$$x^2 \log_{10} 5 = 5 + 4 \times \log_{10} 5$$

Let
 $x \log_{10} 5 = t$

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

Sakshi

$$t^2 - 4t - 5 = 0$$

$$(t-5)(t+1) = 0$$

$$t = 5, -1$$

reject bcz $N > 1$

$$x \log_{10} 5 = 5$$

$$\log x^5 = \log_{10} 5^5$$

$$\boxed{x = 10} \quad \underline{\underline{Am}}$$





$\text{iv) } 1 + 2 \log_{\sqrt{x+2}} 5 = \log_5 (x+2)$	$t^2 - 2t + t - 2 = 0$
$1 + \frac{2}{\log_5(x+2)} = \log_5(x+2)$	$(t-2)(t+1) = 0, t = -1, 2$
$\text{let, } \log_5(x+2) = t$	$\Rightarrow \log_5(x+2) = -1$
$1 + \frac{2}{t} = t$	$x+2 = 5^{-1}$
$t + 2 - t^2 = 0$	$x = \frac{1}{5} - 2 = \frac{1-10}{5} = \frac{-9}{5}$
$t^2 - t - 2 = 0$	$\Rightarrow \log_5(x+2) = 2$
	$x+2 = 25$
	$x = 23$



$$\textcircled{Q.4} \rightarrow 1 + 2 \log_{x+2} 5 = \log_5 (x+2)$$

$$\text{Put } \log_5 (x+2) = t$$

$$1 + \frac{2}{t} = t$$

$$t^2 - t - 2 = 0$$

$$(t-2)(t+1) = 0$$

$$t = 2, -1$$

$$\log_5 (x+2) = 2, -1$$

$$x+2 = 25, 5^{-1}$$

$$x = 23, -\frac{9}{5}$$

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$$\log_2 (\log_2 x)^2 - \log_2 (\log_2 (2\sqrt{2}x)) = 1$$

$$\log_2 \frac{(\log_2 x)^2}{\log_2 (2\sqrt{2}x)} = 1$$

$$\frac{(\log_2 x)^2}{\log_2 (2\sqrt{2}x)} = 2$$

Tah 3

$$(\log_2 x)^2 = 2 \cdot (\log_2 2\sqrt{2} + \log_2 x)$$

$$\log_2 x (\log_2 x - 2) = 2 \cdot \frac{3}{2} = 3$$

$$\text{Put } \log_2 x = t$$

$$t^2 - 2t - 3 = 0$$

$$t = 3, -1$$

$$\log_2 x = 3, -1$$

$$x = \underline{\underline{8}}, \underline{\underline{\frac{1}{2}}}$$

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From Bihar**



$$v) \quad 2 \log_2 (\log_2 x) + \log_{\frac{1}{2}} (\log_2 (2\sqrt{2}x)) = 1$$

let $\log_2 x = t$	$\log_2 (2\sqrt{2}x)$ $\log_2 2\sqrt{2} + \log_2 x$ $\frac{3}{2} \log_2 2 = \frac{3}{2} + \log_2 x$
--------------------	---

$$2 \log_2 t - \log_2 \left(\frac{3}{2} + t \right) = \log_2 2$$

$$\log_2 \left(\frac{t^2}{\frac{3}{2} + t} \right) = \log_2 2$$

Now,
 $t = 3,$

$$\frac{t^2}{3+2t} = 2$$

$$\log_2 x = 3$$

$$x = 2^3 = 8$$

$$\frac{t^2 - 1}{3+2t} = 0$$

$t = -1,$

$$t^2 - 3 - 2t = 0$$

$$\log_2 x = -1$$

$$x = 2^{-1} = \frac{1}{2}$$

$$t^2 - 2t - 3 = 0$$

$$t^2 - 3t + t - 3 = 0$$

$$(t - 3)(t + 1) = 0$$

$$t = 3, -1$$

Sum



Solution to Previous BPPs

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QUESTION



Solve the following equations :

(i) $\log_{x-1} 3 = 2$

(ii) $\log_4 \left(2 \log_3 \left(1 + \log_2 \left(1 + 3 \log_3 x \right) \right) \right) = \frac{1}{2}$

(iii) $\log_3 \left(1 + \log_3 \left(2^x - 7 \right) \right) = 1$ **ATDB.uno**

(iv) $\log_3 (3^x - 8) = 2 - x$ $\xrightarrow{3^x - 8 = 3^{2-x}}$

$$3^x - 8 = 3^2 \cdot 3^{-x} = \frac{9}{3^x}$$

$$\text{Let } 3^x = t$$

$$t - 8 = \frac{9}{t}$$

(v) $\frac{\log_2 (9 - 2^x)}{3 - x} = 1$

QUESTION



Solve the following equations :

(vi) $\log_{5-x}(x^2 - 2x + 65) = 2$

(vii) $\log_{10} 5 + \log_{10}(x + 10) - 1 = \log_{10}(21x - 20) - \log_{10}(2x - 1)$

(viii) $x^{1+\log_{10} x} = 10x$

(ix) $2(\log_x \sqrt{5})^2 - 3\log_x \sqrt{5} + 1 = 0$

(x) $3 + 2\log_{x+1} 3 = 2\log_3(x + 1)$

$x^{1+\log_{10} x} = 10x$

$\log_{10}(x^{1+\log_{10} x}) = \log_{10}(10x) \Rightarrow (1+\log_{10} x) \cdot \log_{10} x = 1 + \log_{10} x$

let $\log_x \sqrt{5} = t$

$2t^2 - 3t + 1 = 0$

$2t^2 - 2t - t + 1 = 0$

$(2t-1)(t-1) = 0$

$t = 1/2, t = 1$

$\log_x \sqrt{5} = 1/2, 1$

$1/2 \log_x 5 = 1/2, 1$

$\log_x 5 = 1, 2$

$x^1 = 5$ or $x^2 = 5$

$x = \pm \sqrt{5}$
 $x = 5, \sqrt{5}$

$3 + \frac{2}{\log_3(x+1)} = 2 \log_3(x+1)$

Answers:

- i. $\{1 + \sqrt{3}\}$ ii. $\{3\}$ iii. $\{4\}$ iv. $\{2\}$
- v. $\{0\}$ vi. $\{-5\}$ vii. $\{3/2, 10\}$ viii. $\{10^{-1}, 10\}$
- ix. $\{\sqrt{5}, 5\}$ x. $\{-(3 - \sqrt{3})/3, 8\}$



$$\log_{x-1} 3 = 2$$

$$3 = (x-1)^2$$

$$x^2 + 1 - 2x = 3$$

$$x^2 - 2x - 2 = 0$$

$$\frac{2 \pm \sqrt{4 - 4 \times (-2)}}{2}$$

$$\frac{2 \pm \sqrt{12}}{2}$$

$$1 \pm \sqrt{3}$$

$$1 + \sqrt{3}, 1 - \sqrt{3}$$

$$\textcircled{2} \log_4 (2 \log_3 (1 + \log_2 (1 + 3 \log_3 x))) = \frac{1}{2}$$

$$2 \log_3 (1 + \log_2 (1 + 3 \log_3 x)) = (4)^{1/2}$$

$$2 \log_3 (1 + \log_2 (1 + 3 \log_3 x)) = 2$$

$$1 + \log_2 (1 + 3 \log_3 x) = 3$$

$$\log_2 (1 + 3 \log_3 x) = 2$$

$$1 + 3 \log_3 x = 4$$

$$3 \log_3 x = 3 \Rightarrow 1$$

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$$\textcircled{3} \log_3 (1 + \log_3 (2^x - 7)) = 1$$

$$1 + \log_3 (2^x - 7) = 3$$

$$\log_3 (2^x - 7) = 2$$

$$2^x - 7 = 3^2$$

$$2^x - 7 = 9$$

$$2^x = 16$$

$$2^x = 2^4$$

$$\boxed{x = 4}$$

$$\textcircled{4} \log_3 (3^x - 8) = 2 - x$$

$$3^x - 8 = 3^{(2-x)}$$

$$3^x - 8 = \frac{3^2}{3^x}$$

$$\text{Let } 3^x = t$$

$$t - 8 = \frac{9}{t}$$

$$t^2 - 8t = 9$$

$$t^2 - 8t - 9 = 0$$

$$(t-9)(t+1) = 0$$

$$t = 9, -1$$

$$3^x = 3^2 \Rightarrow x = 2 \quad 3^x = -1 \quad \times$$



(i) $\log_{x-1} 3 = 2$

$(x-1)^2 = 3$

$x^2 - 2x - 2 = 0$

$x^2 - 2x - 2 = 0$

$x - 1 = \sqrt{3}$

$x = 1 \pm \sqrt{3}$

$x = 1 + \sqrt{3}$; $x = 1 - \sqrt{3}$
 ↓ satisfy ↓ doesn't

(ii) $\log_4 (2 \log_3 (1 + \log_2 (1 + 3 \log_3 x))) = \frac{1}{2}$

$2 \log_3 (1 + \log_2 (1 + 3 \log_3 x)) = 2$

$1 + \log_2 (1 + 3 \log_3 x) = 3$

$\log_2 (1 + 3 \log_3 x) = 2$

$1 + 3 \log_3 x = 4$

$3 \log_3 x = 3$

$x = 3$

(iii) $\log_3 (1 + \log_3 (2^x - 7)) = 1$

$1 + \log_3 (2^x - 7) = 3$

$\log_3 (2^x - 7) = 2$

$2^x - 7 = 9$

$2^x = 16$

$x = 4$

(iv) $\log_3 (3^x - 8) = 2 - x$

$3^x - 8 = (3^x)^{2-x}$

$3^x - 8 = 3^2 \cdot 3^{-x}$

$3^x \cdot 3 \cdot 3^x = 8$

$3^{2x} - \frac{8}{3^x} = 8$

Let $3^x = t$

$t^2 - \frac{8}{t} = 8 \Rightarrow t^2 - 8 = 8t$

$t^2 - 8t - 8 = 0$

$(t-9)(t+1) = 0$

$t = 9 ; t = -1$

$3^x = 9 ; 3^x = -1$

$x = 2$

Not possible

Richathakur

v) $\frac{\log_2 (9 - 2^x)}{3 - x} = 1$

$\log_2 (9 - 2^x) = 3 - x$

$9 - 2^x = (2)^{3-x}$

$9 - 2^x = 8 \cdot 2^{-x}$

$9 - 2^x = \frac{8}{2^x}$ Let $t = 2^x$

$9 - t = \frac{8}{t}$

$9t - t^2 - 8 = 0$

$t^2 - 9t + 8 = 0$

$(t-8)(t-1) = 0$

$t = 8 ; t = 1$

$2^x = 8$

$2^x = 1$

$x = 3$

$x = 0$

Not possible



⑤ $\frac{\log_2(9-2^x)}{3-x} = 1$

$\log_2(9-2^x) = 3-x$

$9-2^x = 2^{(3-x)}$

$9-2^x = \frac{2^3}{2^x}$

$9-2^x = \frac{8}{2^x}$

Let $2^x = t$

$9-t = \frac{8}{t}$

$9t - t^2 = 8$

$t^2 - 9t + 8 = 0$

$(t-1)(t-8) = 0$

$t = 8, 1$

$2^x = 8$ $2^x = 1$

$x = 3$ $x = 0$

$\frac{\log_2(9-2^x)}{3-x} \rightarrow 0$

$x=3$

⑥ $\log_{5-x}(x^2-2x+65) = 2$

$x^2-2x+65 = (5-x)^2$

$x^2-2x+65 = 25+x^2-10x$

$10x-2x+65-25 = 0$

$8x+40 = 0$

$8x = -40$

$x = -5$ ✓

⑦ $x^{1+\log_{10}x} = 10x$

take log both side

$\log x^{1+\log_{10}x} = \log 10x$

$(1+\log_{10}x) \log_{10} x = \log_{10} 10 + \log_{10} x$

$(1+\log_{10}x) \log_{10} x = 1 + \log_{10} x$

put $\log_{10} x = t$

$(1+t)t = 1+t$

$t+t^2-1-t = 0$

$t^2-1 = 0$

$(t-1)(t+1) = 0$

$t = -1, 1$

$\log_{10} x = -1$ $\log_{10} x = 1$

$x = 10^{-1}$ $x = 10$

$x = \frac{1}{10}$ $x = 10$

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$$\begin{aligned}
 & x^2 - 9x + 65 = (5-x)^2 \\
 & x^2 - 9x + 65 = 25 + x^2 - 10x \\
 & 8x + 40 = 0 \\
 & \boxed{x = -5}
 \end{aligned}$$

(ix) $2(\log_2 \sqrt{5})^2 = 3\log_2 \sqrt{5} + 1 = 0$

Let $\log_2 \sqrt{5} = t$

$$2t^2 - 3t + 1 = 0$$

$$(t-2)(t-1) = 0$$

$t = 2$; $t = 1$

$\log_2 \sqrt{5} = 2$
 $(x)^2 = \sqrt{5}$
 $x = 5$

$\log_2 \sqrt{5} = 1$
 $x = \sqrt{5}$
 $x = \sqrt{5}$

Satisfy

Letting $\log_{10} x = t$

$$(1 + \log_{10} x) \log_{10} x = \log_{10} 10x$$

$$(1 + \log_{10} x) \log_{10} x = 1 + \log_{10} x$$

Let t

$$(1+t)t - t = 1$$

$$t + t^2 - t = 1$$

$$t = \pm 1$$

$\log_{10} x = 1$
 $x = 10$

$\log_{10} x = -1$
 $x = \frac{1}{10}$

Satisfy

Richa
Thakur

(vii) $\log_{10} 5 + \log_{10} (x+10) - 1 = \log_{10} (21x-20) - \log_{10} (2x-1)$

$$\Rightarrow \log_{10} 5(x+10) - 1 = \log_{10} \frac{21x-20}{2x-1}$$

$$\Rightarrow \log_{10} \frac{5(x+10)}{\frac{21x-20}{2x-1}} = 1$$

$$\Rightarrow \frac{5(x+10)(2x-1)}{21x-20} = 10 \Rightarrow \frac{(x+10)(2x-1)}{21x-20} = 2$$

$$\Rightarrow (x+10)(2x-1) = 42x-40$$

$$\Rightarrow 2x^2 - x + 20x - 10 = 42x - 40$$

$$\Rightarrow 2x^2 - 23x + 30 = 0$$

$$(2x-3)(x-10) = 0$$

$$x = \frac{3}{2} ; x = 10$$

Both possible.

BPP 7

$$\log_{10} 5 + \log_{10} (x+10) - 1 = \log_{10} \left(\frac{21x-20}{2x-1} \right)$$

$$\log_{10} 5 + \log_{10} (x+10) - \log_{10} 10 = \log_{10} \left(\frac{21x-20}{2x-1} \right)$$

$$\log_{10} \frac{5(x+10)}{10 \cdot 2} = \log_{10} \left(\frac{21x-20}{2x-1} \right)$$

$$(x+10)(2x-1) = (21x-20) \cdot 2$$

$$2x^2 + 19x - 10 = 42x - 40$$

$$2x^2 - 23x + 30 = 0$$

$$2x^2 - 20x - 3x + 30 = 0$$

$$2x(x-10) - 3(x-10) = 0$$

$$x = \frac{3}{2} \quad x = 10$$

Sakshi



BPP8

$$x^{1+\log_{10}x} = 10x$$

take log both side

$$(1+\log_{10}x) \log_{10}x = \log_{10}10x$$

$$1+\log_{10}x (\log_{10}x) = \log_{10}10 + \log_{10}x$$

let $\log_{10}x = t$

$$1+t(t) = 1+t$$

$$\cancel{1} + t^2 = 1 + \cancel{t}$$

$$t^2 - 1 = 0$$

$$(t+1)(t-1) = 0$$

$$t = 1, -1$$

$$\log_{10}x = 1, -1$$

$$\log_{10}x = 1$$

$$\boxed{x=10}$$

$$\log_{10}x = -1$$

$$\boxed{x=10^{-1}}$$

sakshi



$$\textcircled{2} \log_{10} 5 + \log_{10} (x+10) = 1 - \log_{10} (21x-20) - \log_{10} (2x-1)$$

$$\log_{10} (5(x+10)) - 1 = \log_{10} \left(\frac{21x-20}{2x-1} \right)$$

$$\log_{10} (5(x+10)) - \log_{10} \left(\frac{21x-20}{2x-1} \right) = 1$$

$$\log_{10} \left(\frac{5(x+10)(2x-1)}{21x-20} \right) = 1$$

$$\frac{5(x+10)(2x-1)}{21x-20} = 10^1$$

$$(x+10)(2x-1) = 42x-40$$

$$2x^2 - x + 20x - 10 = 42x + 40 = 0$$

$$2x^2 - 43x + 20x + 30 = 0$$

$$2x^2 - 23x + 30 = 0$$

$$2x^2 - 20x - 3x + 30 = 0$$

$$2x(x-10) - 3(x-10) = 0$$

$$(2x-3)(x-10) = 0$$

$$x = 10, \frac{3}{2}$$

$$\textcircled{2} 2(\log_x \sqrt{5})^2 - 3\log_x \sqrt{5} + 1 = 0$$

$$\log_x \sqrt{5} = t$$

$$2t^2 - 3t + 1 = 0$$

$$2t^2 - 2t - t + 1 = 0$$

$$2t(t-1) - 1(t-1) = 0$$

$$(2t-1)(t-1) = 0$$

$$\log_x \sqrt{5} = 1$$

$$\sqrt{5} = x^1$$

$$\sqrt{5} = x^1$$

$$\boxed{x = \sqrt{5}}$$

$$\log_x \sqrt{5} =$$

$$\sqrt{5} = x$$

$$\boxed{x = 5}$$

BPP9

$$2(\log_x \sqrt{5})^2 - 3\log_x \sqrt{5} + 1 = 0$$

$$\text{let } \log_x \sqrt{5} = t$$

$$2t^2 - 3t + 1 = 0$$

$$(2t-1)(t-1) = 0$$

sakshi

$$t = 1, 1/2$$

$$\log_x \sqrt{5} = 1/2$$

$$\sqrt{5} = x^{1/2}$$

$$\sqrt{5} = \sqrt{x}$$

$$\boxed{x=5}$$

$$\log_x \sqrt{5} = 1$$

$$\boxed{\sqrt{5} = x}$$



$$(10) \quad 3 + 2 \log_{x+1} 3 = 2 \log_3 (x+1)$$

$$3 + \frac{2}{\log_3 x+1} = 2 \log_3 (x+1)$$

$$\text{Let } \log_3 x+1 = t$$

$$3 + \frac{2}{t} = 2t$$

$$3t + 2 = 2t^2$$

$$2t^2 - 3t - 2 = 0$$

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

$$2t(t-2) + 1(t-2) = 0$$

$$(2t+1)(t-2) = 0$$

$$t = 2, -\frac{1}{2}$$

$$\log_3 x+1 = 2$$

$$x+1 = 3^2$$

$$x+1 = 9$$

$$\boxed{x = 8}$$

$$x+1 = 3^{-\frac{1}{2}}$$

$$x+1 = \frac{1}{\sqrt{3}}$$

$$\boxed{x = \frac{1-\sqrt{3}}{\sqrt{3}}}$$

$$\log_3 x+1 = -\frac{1}{2}$$

$$x+1 = 3^{-\frac{1}{2}}$$

$$x+1 = \frac{1}{\sqrt{3}}$$

$$x = \frac{1}{\sqrt{3}} - 1$$

$$\boxed{x = \frac{1-\sqrt{3}}{\sqrt{3}}}$$





$$3 + 2 \log_3(x+1) = 2 \log_3(x+1)$$

$$3 + \frac{2}{\log_3(x+1)} = 2 \log_3(x+1)$$

$$\text{Let } \log_3(x+1) \rightarrow t$$

$$3 + \frac{2}{t} = 2t$$

$$3t + 2 - 2t^2 = 0$$

$$2t^2 - 3t - 2 = 0$$

$$(2t+1)(t-2) = 0$$

$$t = -\frac{1}{2} ; t = 2$$

$$\log_3(x+1) = -\frac{1}{2}$$

$$(3)^{-1/2} = x+1$$

$$\frac{1}{\sqrt{3}} = x+1$$

$$x = \frac{1}{\sqrt{3}} - 1$$

$$x = \frac{1 - \sqrt{3}}{\sqrt{3}} \text{ possible}$$

$$x = -\left(\frac{3 - \sqrt{3}}{3}\right) \underline{A}$$

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$$\log_3(x+1) = 2$$

$$x+1 = 9$$

$$x = 8$$

possible



Mathematical Gyaan



★ Square of an integer leaves the remainder zero or one upon division by 4 that is every square is of the form $4K$ or $4K+1$

Any Integer is of type $2m$ or $2m+1$

$$(2m)^2 = 4m^2 = 4K \text{ - Form}$$

$$\begin{aligned} (2m+1)^2 &= 4m^2 + 4m + 1 \\ &= 4(m^2 + m) + 1 \\ &= 4K + 1 \text{ - Form.} \end{aligned}$$

1624999 - Form $4K+3$

$$\begin{array}{r} 24 \\ 4 \overline{)99} \\ \underline{8} \\ 19 \\ \underline{16} \\ 3 \end{array}$$

↓
Not a perfect square

Question



Prove that no integer in the following sequence is a perfect square:

11, 111, 1111, 11111,

↓
each no: in sequence

leaves remainder 3

on dividing by 4

None of the term in seq.

can be a perfect square

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THANK YOU

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