

Functions



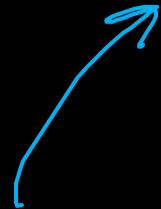
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LECTURE

11

1. ***Signum Function***
2. ***Exponential Function***
3. ***Square root Function***



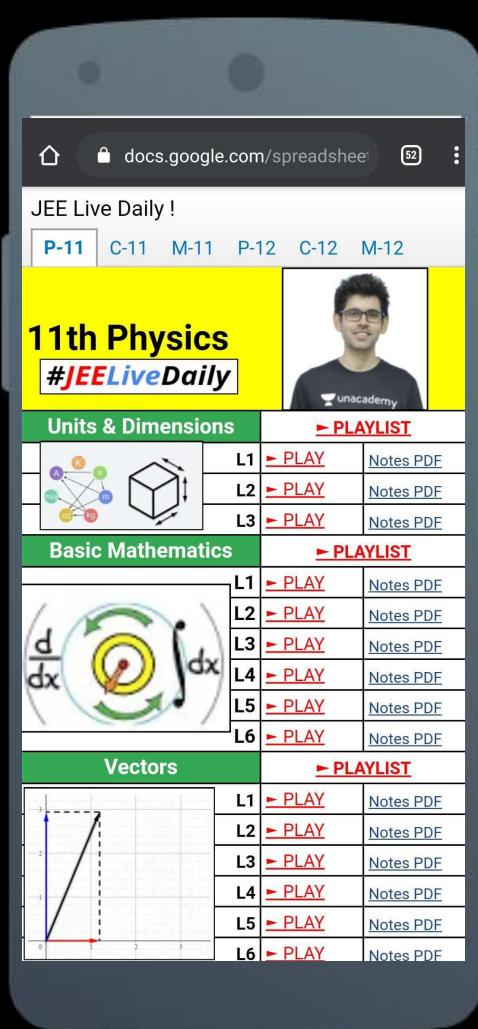
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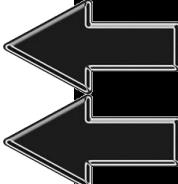
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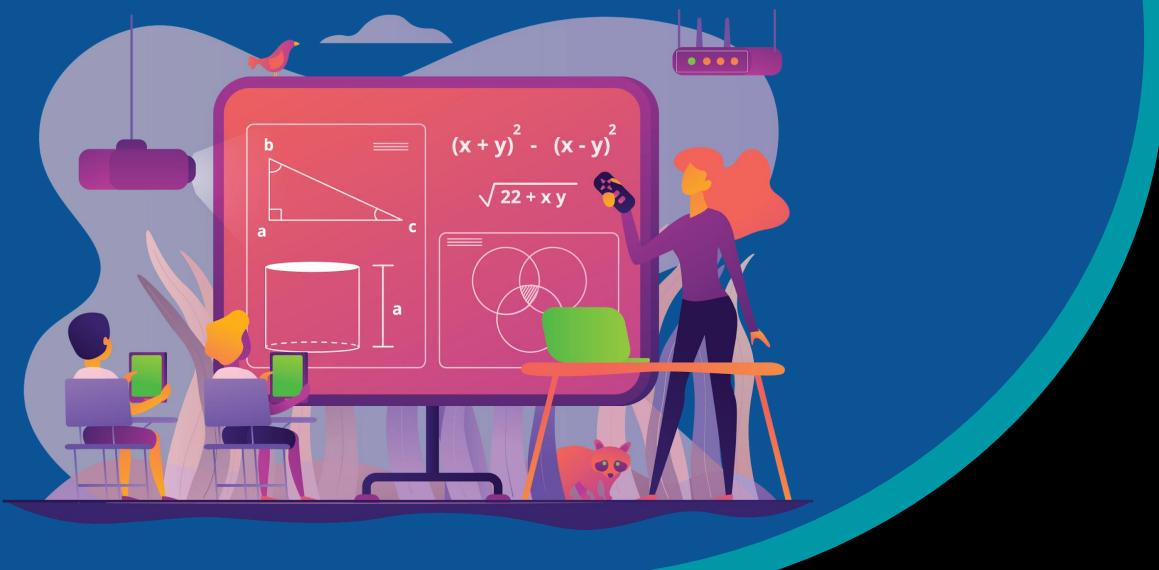
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LECTURE

11

1. ***Signum Function***
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Signum Function

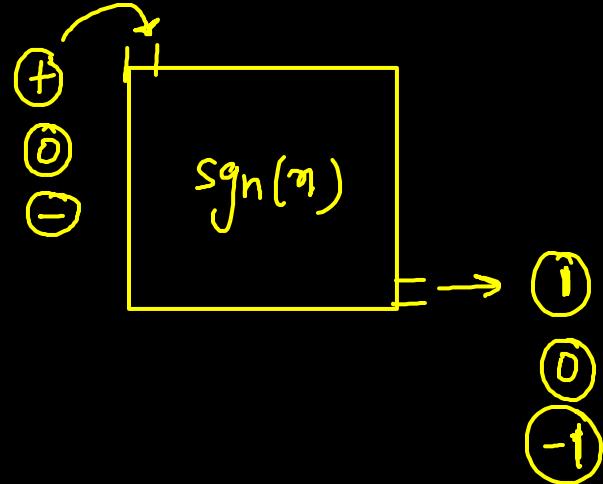


Signum Function

Definition

$$f(x) = \underline{\text{sgn}}(x)$$

$$f(x) = \begin{cases} 1 & x > 0 \\ 0 & x = 0 \\ -1 & x < 0 \end{cases}$$



Signum Function: Domain and Range



Definition

$$f(x) = \operatorname{sgn}(x)$$

$$f(x) = \begin{cases} 1; & x > 0 \\ 0; & x = 0 \\ -1; & x < 0 \end{cases}$$

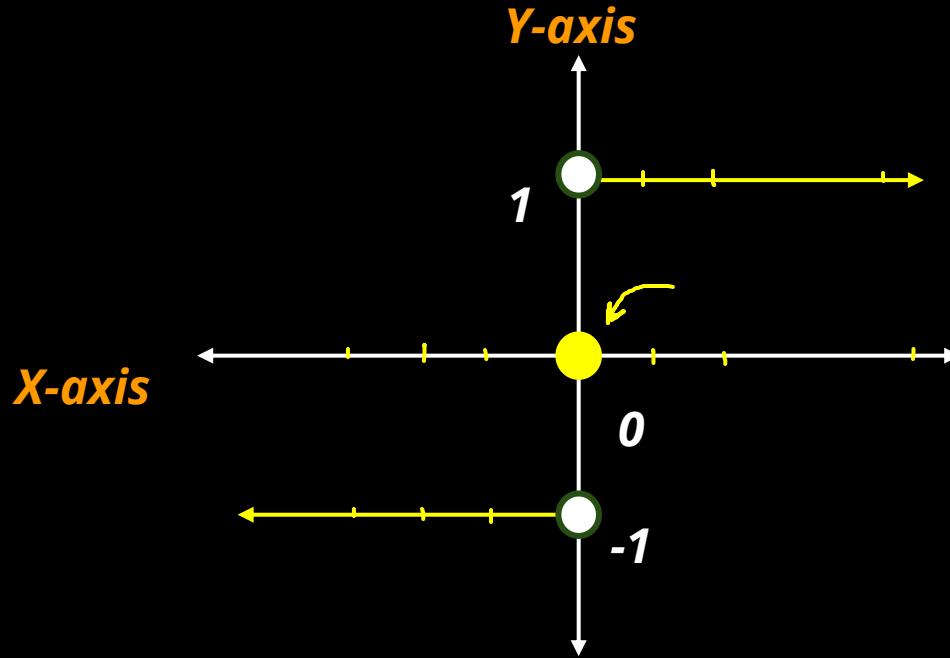
Domain:

$$x \in \mathbb{R}$$

Range:

$$y \in \{-1, 0, 1\}$$

Signum Function: Graph





Example

The complete solution set of the equation $\operatorname{sgn}\left(\frac{x^2 - 5x + 4}{\{x\}}\right) = -1$,
 (Where $\{.\}$ is fractional part function), is

A. $(1, 4)$

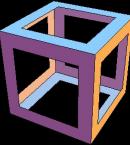
B. $[1, 4]$

C. $(-\infty, 1) \cup (4, \infty)$

~~D. $(1, 2) \cup (2, 3) \cup (3, 4)$~~

$$\frac{x^2 - 5x + 4}{\{\{x\}\}} < 0 \quad \left| \begin{array}{l} \rightarrow \{\{x\}\} \neq 0 \Rightarrow \boxed{x \notin \text{Integers}} \\ x^2 - 5x + 4 < 0 \\ (x-1)(x-4) < 0 \end{array} \right.$$

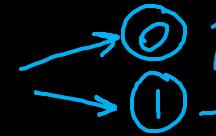
$\{\{x\}\} \in [0, 1)$





Example

Find the range of: $f(x) = \operatorname{sgn}(\ln(x^2 - 2x + 2))$



- A. $\{1\}$ B. $\{0, 1\}$ C. $\{-1, 0, 1\}$ D. $\{0\}$

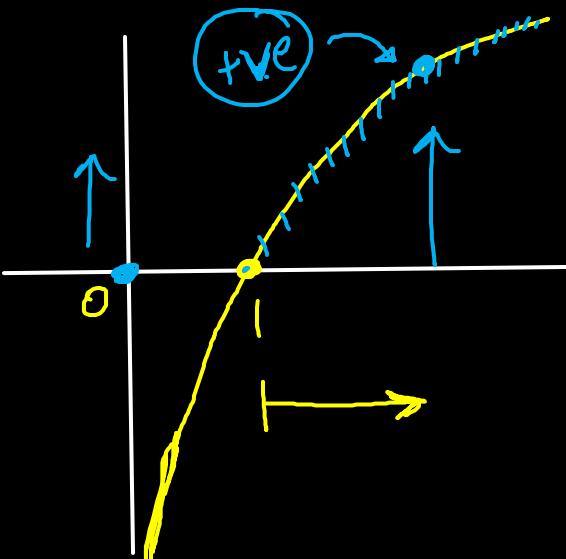
$$(x^2 - 2x + 2)$$

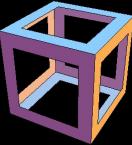


$$\boxed{(x-1)^2 + 1}$$



$$\boxed{> 1}$$







Example

Find the number of solutions of the equation: $\text{sgn}(x^2 - 3x + 2) = (2x - 1)$

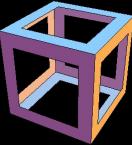
A. 1

B. 2

C. 3

D. 0

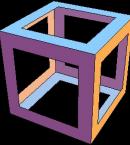
H.W.



Exponential Function



Exponential Function:



$$f(x) = a^x, a > 0, a \neq 1$$

Domain:

$$x \in \mathbb{R} \quad \checkmark$$

Range:

$$f(x) \in (0, \infty) \quad \checkmark$$

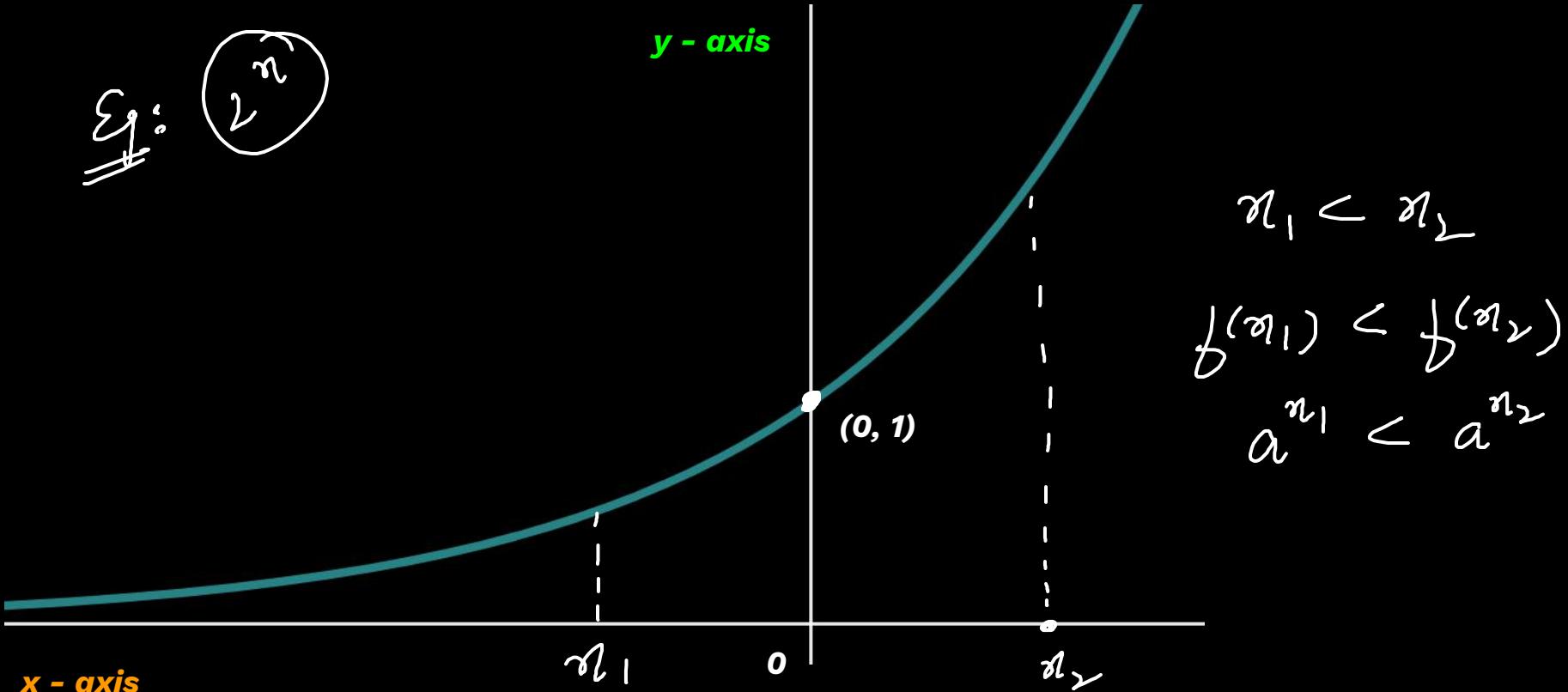
$$\left\{ \begin{array}{l} \log_a N = x \\ N = a^x \end{array} \right.$$

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

$2 \rightarrow 4$
 $-2 \rightarrow \frac{1}{4}$

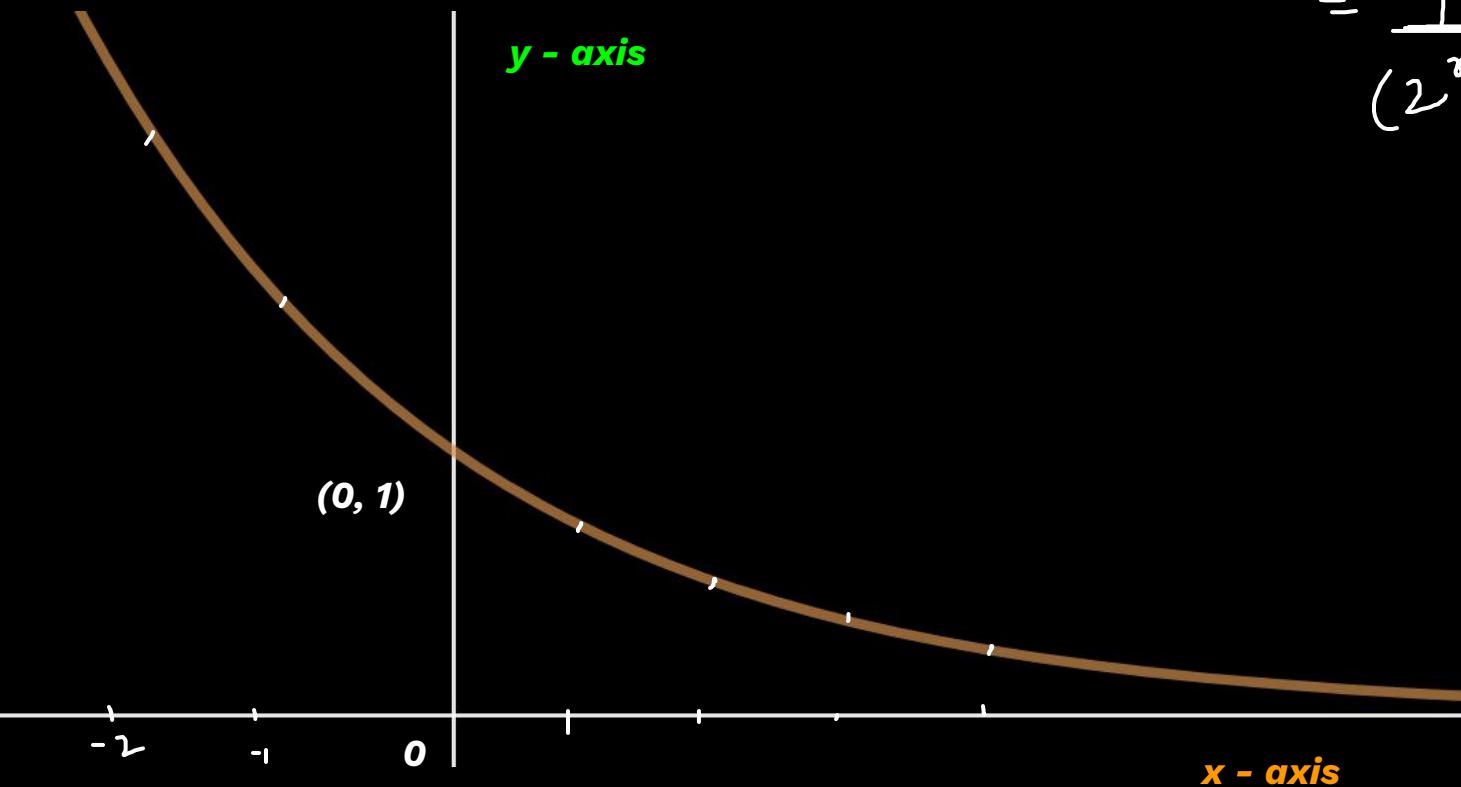
$F(x) = a^x$, when $a > 1$

\therefore $n_1 < n_2$



$F(x) = a^x$, when $0 < a < 1$

Eg : $f(x) = \left(\frac{1}{2}\right)^x$
= $\frac{1}{(2^x)}$



Solving Exponential Inequalities





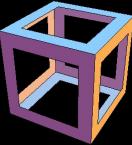
Example

Solve for x: $\frac{2x - 1}{(25)} > \frac{3x/2}{(5)}$

- A. $(2, \infty)$ **B.** $\left(\frac{4}{5}, \infty\right)$ C. $(-\infty, 2)$ D. $(-2, 2)$

$$(5)^{4x-2} > (5)^{\frac{3x}{2}} \quad \left\{ \begin{array}{l} 5^n > 1 \\ n > \frac{1}{5} \end{array} \right.$$
$$4x-2 > \frac{3x}{2}$$

$$8x - 4 > 3x$$





Example

Complete solution set of the inequality, $|3^x - 1| > |3^x - 9|$, is

D. $x > \log_3 5$

A. $x > 1$

B. $x > 2$

C. $x > 3$



$$-(3^x - 1) > -(3^x - 9)$$

$$-3^x + 1 > -3^x + 9$$

$$1 > 9$$



always false.

$$(3^x - 1) > -(3^x - 9)$$

$$3^x - 1 > -3^x + 9$$

$$2 \cdot 3^x > 10$$

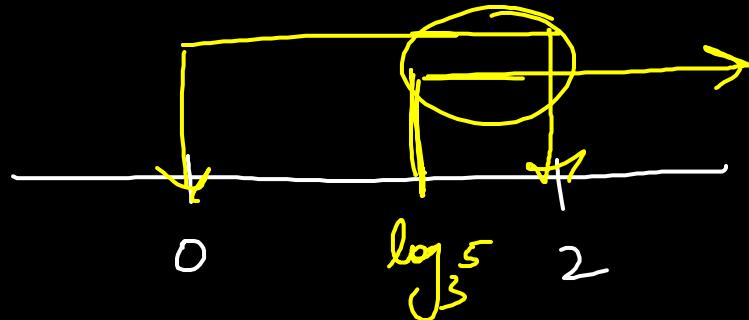
$$3^x > 5$$

$$-1 > -9$$



always true

$x > \log_3 5$



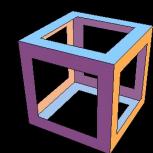
$$\log_3 3 < \log_3 5 < \log_3 9$$

$$\textcircled{1} < \log_3 5 < \textcircled{2}$$

$$(\log_3 5, 2] \cup [2, \infty)$$

Square Root Function





Square Root Function:

$$\sqrt{4} = \underline{\underline{2}}$$

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

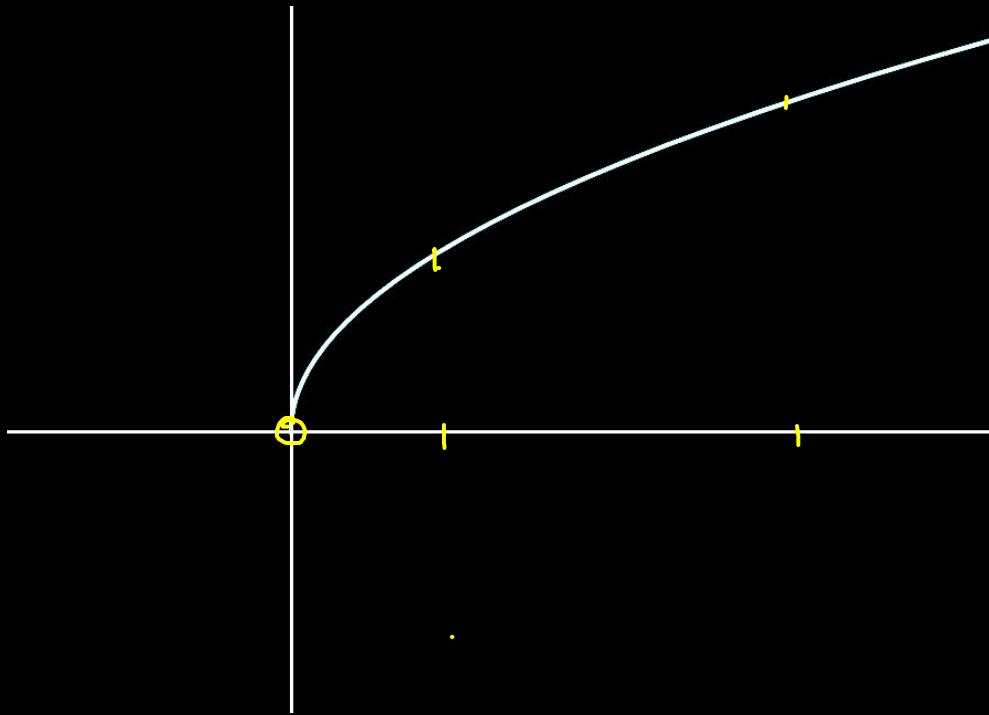
Domain:

$$x \in [0, \infty) \quad \checkmark$$

Range:

$$f(x) \in [0, \infty) \quad \checkmark$$

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



Inequalities of Square Root





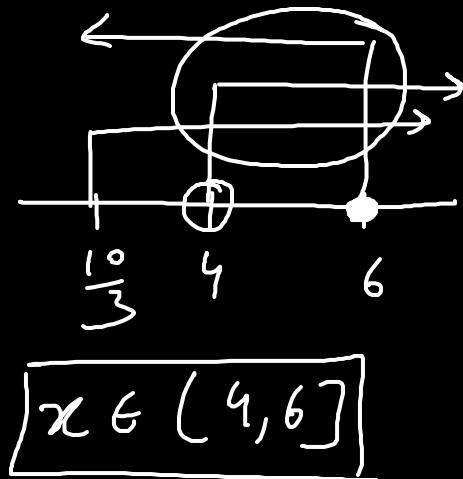
Example

Solve the inequalities

$$\sqrt{3x-10} > \sqrt{6-x}$$

* Domain: $3x-10 \geq 0 \rightarrow x \geq \frac{10}{3} \quad -\textcircled{1}$

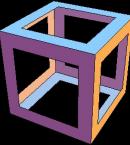
$$6-x \geq 0 \rightarrow x \leq 6 \quad -\textcircled{2}$$

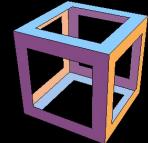


Square: $3x-10 > 6-x$

$$4x > 16$$

$$x > 4 \quad -\textcircled{3}$$





Type-1

$$\sqrt{f(x)} > g(x)$$

=

~~Eq:~~ $\sqrt{4} > -3 \checkmark$

$4 > 9 \times$

Type-2:

$$\sqrt{f(x)} < g(x)$$

≡



Example

Solve the following inequalities $x+4 > 2\sqrt{4-x^2}$

Domain: $4-x^2 \geq 0$

$$x^2-4 \leq 0$$

$$(x-2)(x+2) \leq 0$$

$$\begin{array}{c} + \\[-1ex] \boxed{-} \\[-1ex] + \end{array}$$

-2 2

$$\boxed{x \in [-2, 2]} - ①$$

↑

Case-1 $(x+4) < 0 \rightarrow \boxed{\text{No soln}}$

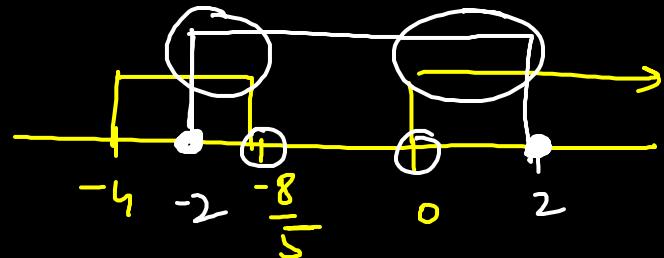
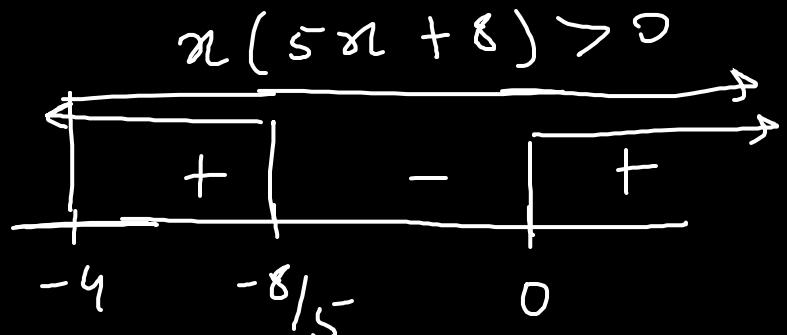
Case-2: $(x+4) \geq 0 \rightarrow \boxed{x \geq -4}$

$$(x+4)^2 > 4(4-x^2)$$

$$\begin{aligned} (x^2 + 8x + 16) &> (16 - 4x^2) \\ 5x^2 + 8x &> 0 \end{aligned}$$

$$5x^2 + 8x > 0$$

$$5x^2 + 8x > 0$$



$$\boxed{x \in \left[-2, -\frac{8}{5}\right) \cup (0, 2]}$$

Ans of Case-2 : $\left[-4, -\frac{8}{5}\right) \cup (0, \infty)$

Domain



Example

Solve the following inequalities $\sqrt{7-x} > (x-1)$

Domain : $7-x \geq 0 \rightarrow x \leq 7$

Case-1 : $(x-1) < 0 \rightsquigarrow \underline{\text{always true}}$

$$x < 1 ; x \in (-\infty, 1)$$

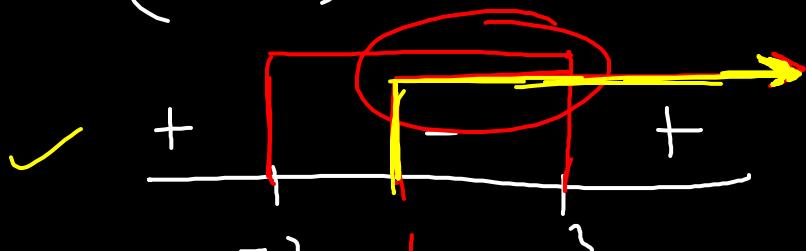
Case-2 : $\underline{(x-1)} \geq 0 \rightarrow x \geq 1$

$$\checkmark (7-x) > (x-1)^2$$

$$7-x > x^2 - 2x + 1$$

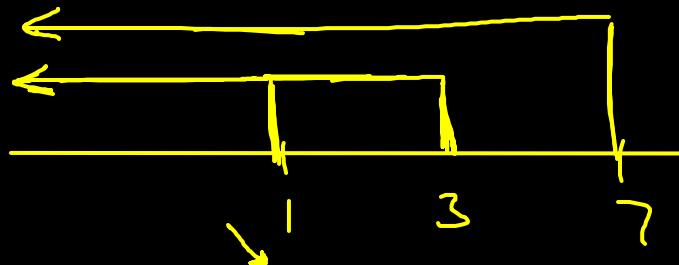
$$x^2 - x - 6 < 0$$

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



$$x \in [1, 3]$$

Final Ans:



$$(-\infty, 1) \cup [1, 3)$$

$$\underline{(-\infty, 3)}$$

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8 PM

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9 PM

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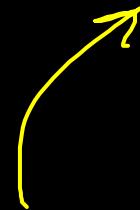
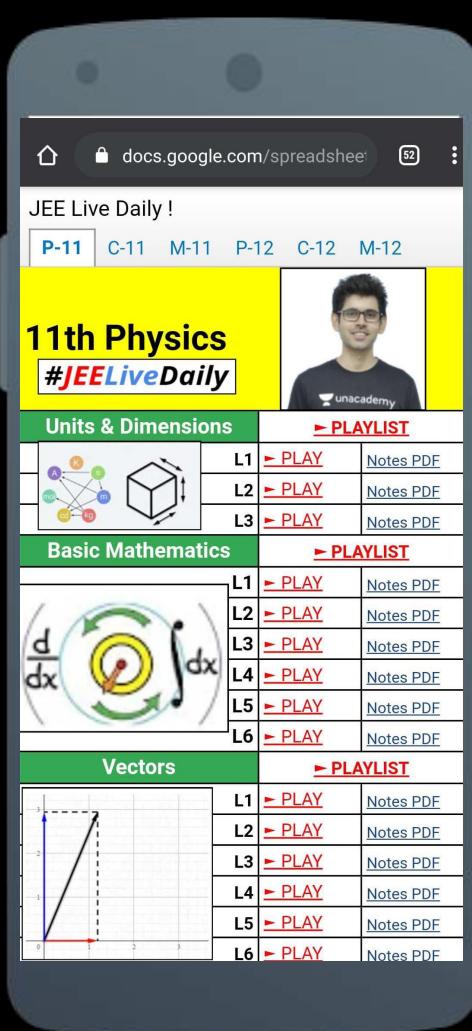
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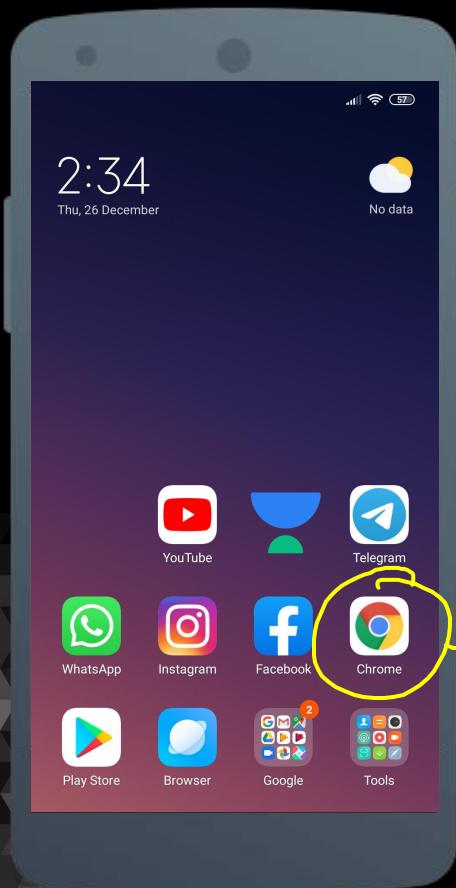


6 PM Namo Sir Physics



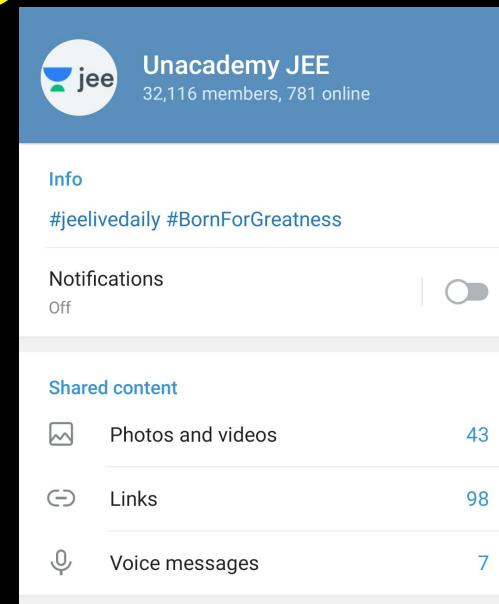
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The screenshot shows a Unacademy 'Question' page. At the top right is a profile picture of Rohit Sachan. Below it is a sidebar with user activity: 'Unacademy' joined, 'Chaudhuri nitration', 'Rohit Sachan Sir Baa rha mera', 'Sinchan Dutta Chaudhuri right', 'Shoib Alam Left', 'Vsvsgsg Right', 'Prashant Singh joined', and 'Rohit Sachan Left'. The main area displays a question about a chemical reaction:

Q. In the following reaction, NO_2^+ reacts with X , the structure of the major product X' is -

Reaction scheme:

Starting materials: NO_2^+ and a substituted benzene ring.

Products: X' (major product) and $\text{HNO}_3 / \text{H}_2\text{SO}_4$.

Handwritten notes on the right side of the reaction scheme:

NO_2^+ attacks on ϵ rich system

e^- deficient

$\downarrow \text{HNO}_3 / \text{H}_2\text{SO}_4$

The screenshot shows a 'View results' page for a Physics test. At the top right, it says '66 correct' and '2 wrong'. The main area shows a bar chart for Physics with the following data:

Score	Accuracy
88/120	73%

Below the chart, it says 'NEGATIVE MARKING' and 'YOU MISSED 0'.

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Question

ROHIT SACHAN:
Sir please solve the one more doubt...

16. In the following reaction, NO_2 reacts with H_2SO_4 . X is the structure of the major product 'X' is -

NO_2^+ → attacks on e^- rich system

Sirchana Dutta Chaudhuri right

Rohit Sachan Sir Baa rha mera

Sirchana Dutta Chaudhuri right

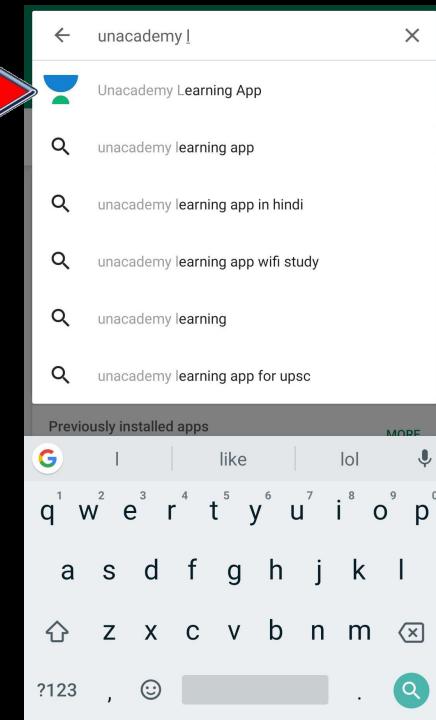
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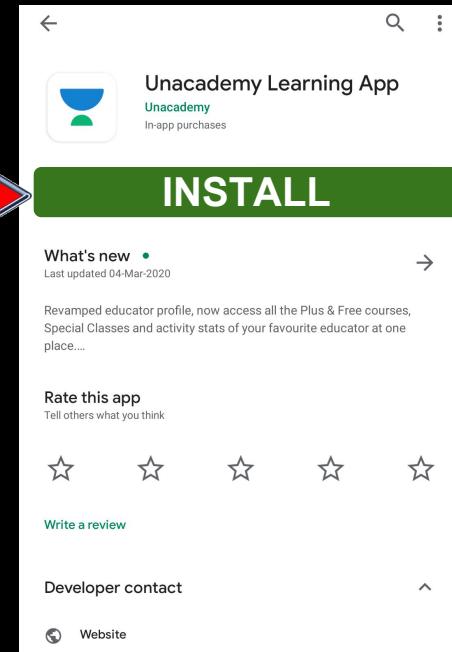
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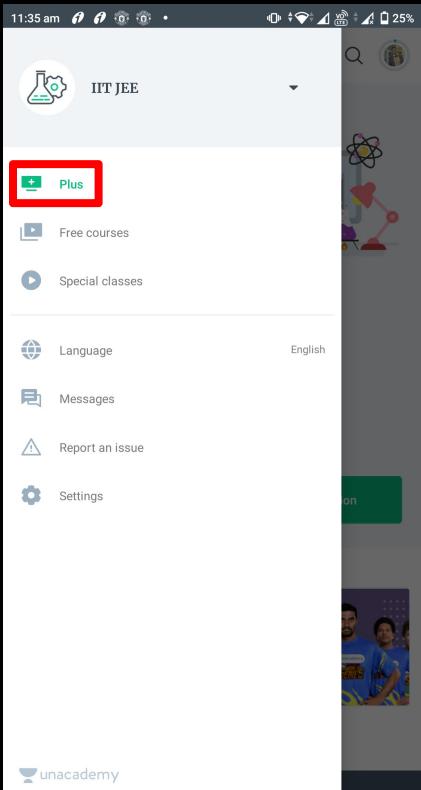
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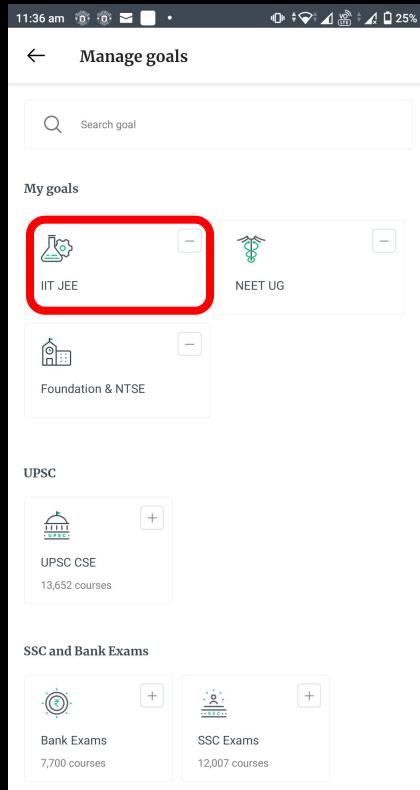
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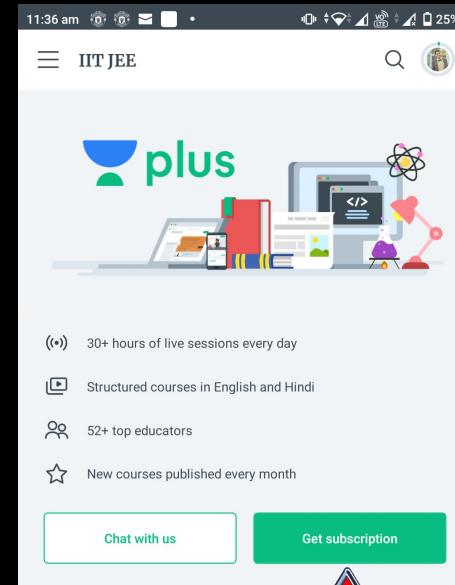
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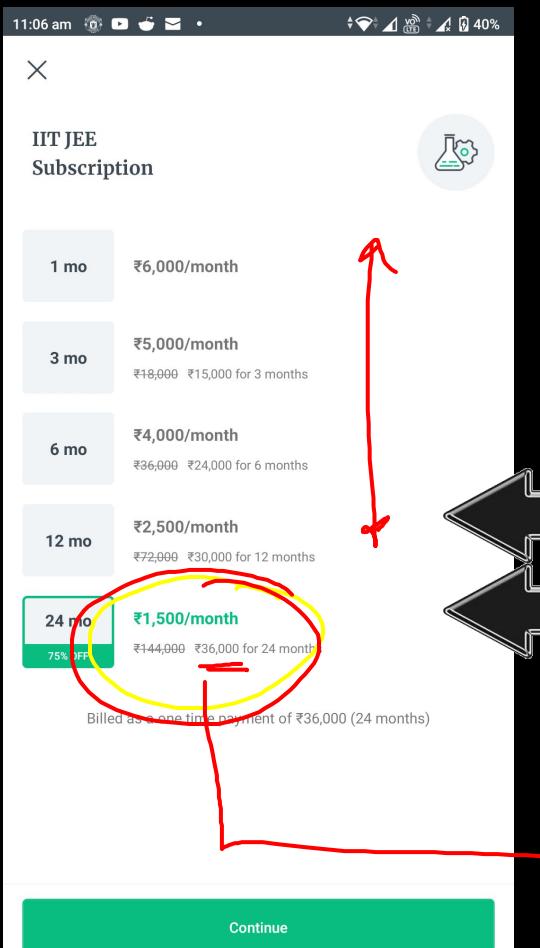
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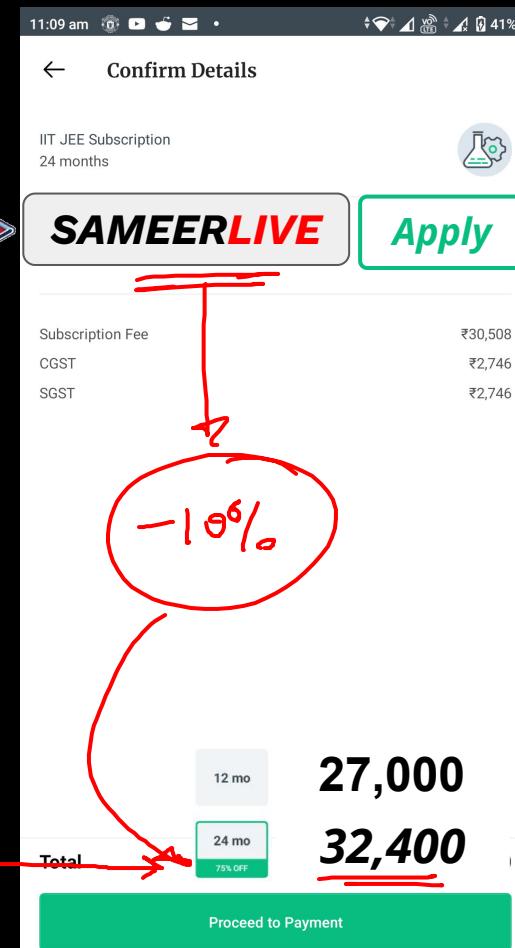
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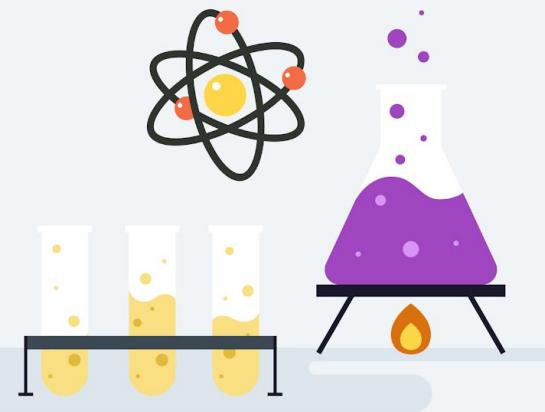
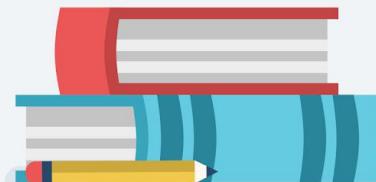




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