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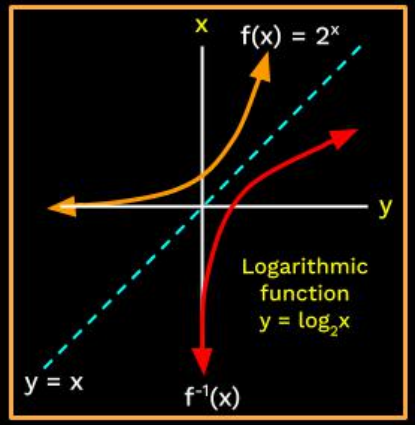
Functions

LECTURE 8

Logarithmic Function - 2



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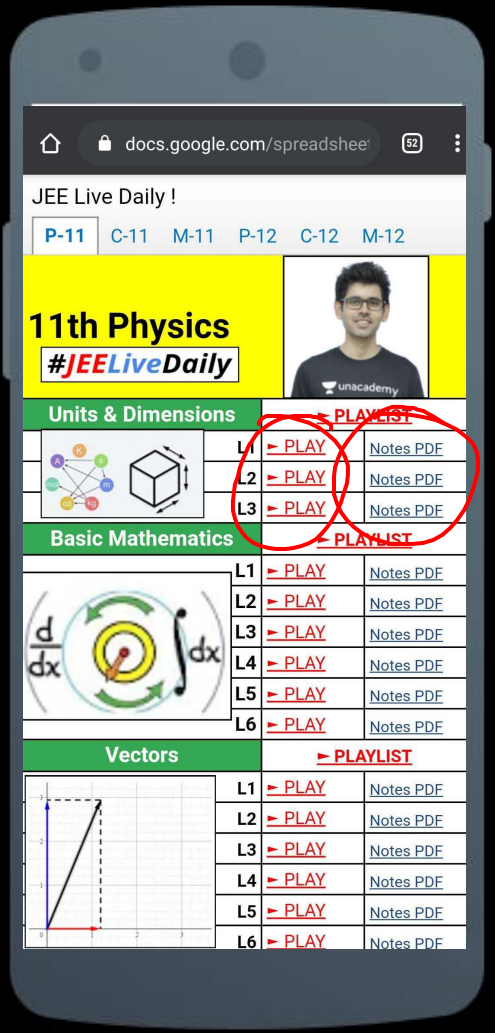

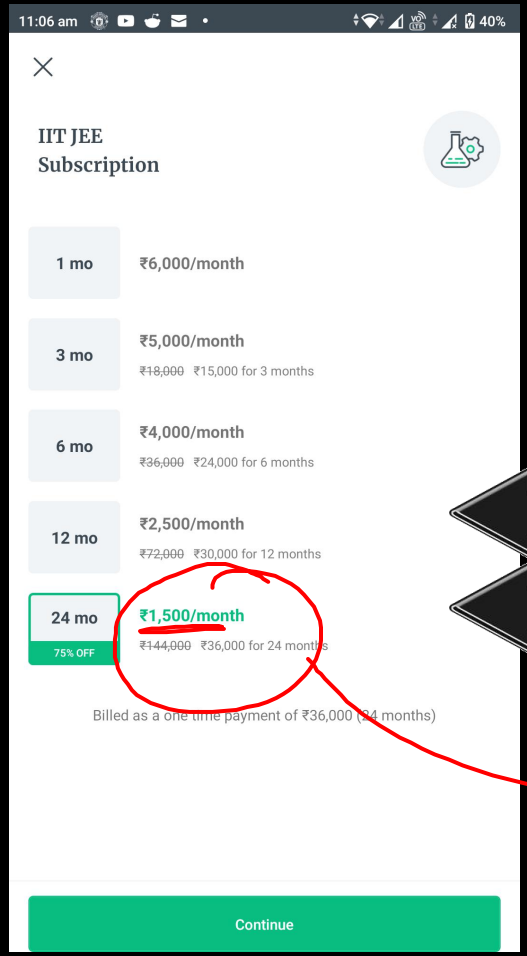

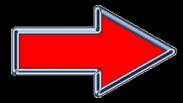

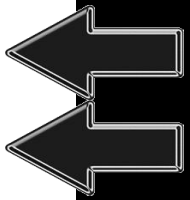

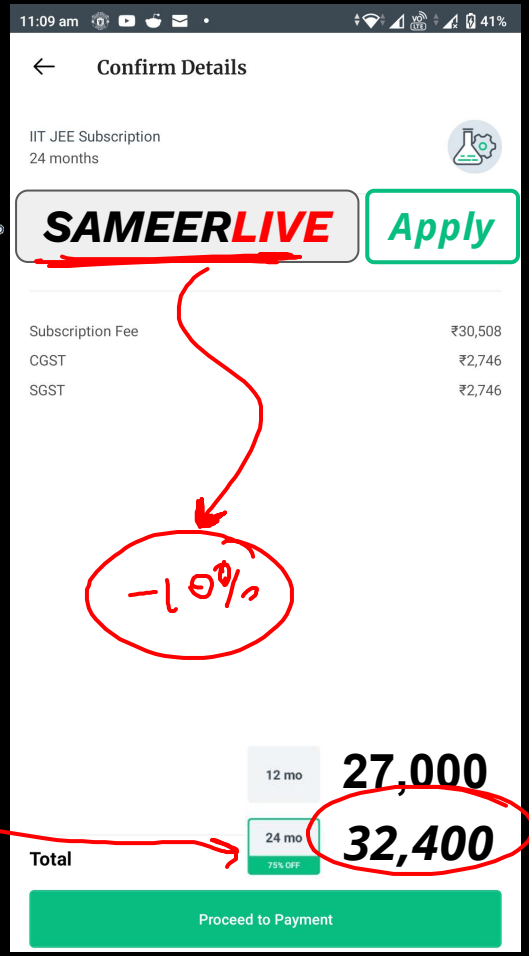

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Functions

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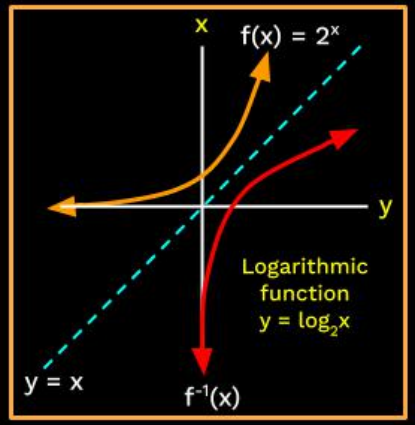
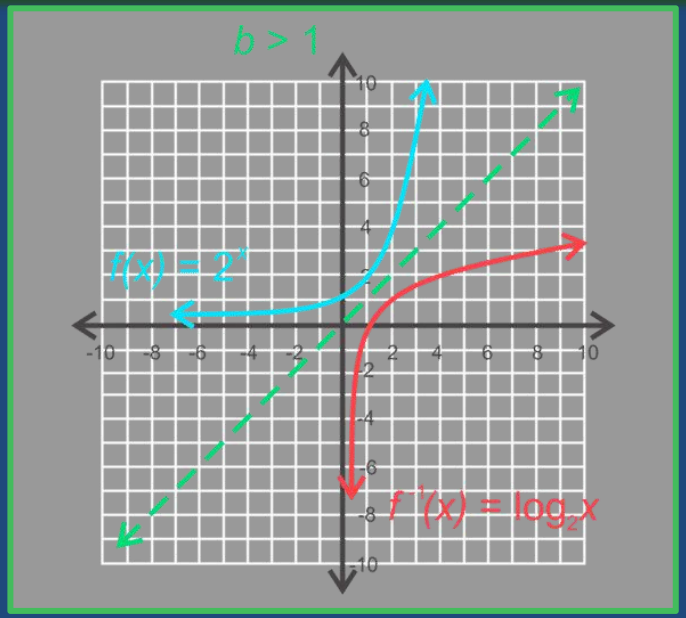
Logarithmic Function - 2



Properties of Log Function (Quick Recap)



Properties of Log Function

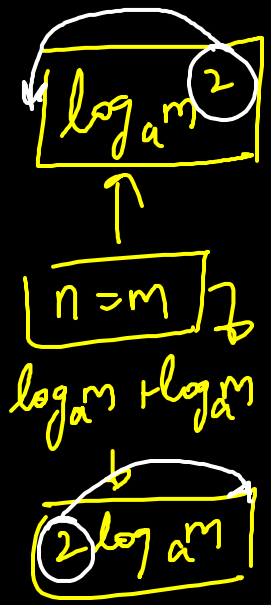
Property 1 $\log_a 1 = 0 \ (a \neq 1, a > 0)$

Property 2 $\log_a a = 1 \ (a \neq 1, a > 0)$

Property 3 $\log_a m + \log_a n = \log_a (m.n)$

Property 4 $\log_a m - \log_a n = \log_a \left(\frac{m}{n}\right)$

Property 5 $\log_a (m)^{\alpha} = \alpha \cdot \log_a m$



Properties of Log Function

Property 6

$$\log_{(a^{\beta})} m = \frac{1}{\beta}\log_a m$$

* **Property 7**

$$\log_a m = \frac{\log_b m}{\log_b a}$$

b = m

Property 8

$$\log_a m = \frac{1}{\log_m a}$$

Property 9

$$a^{\log_a x} = x$$

Property 10

$$a^{\log_b c} = c^{\log_b a}$$

Example

$$\log_{11}\left(1-\frac{1}{3}\right)+\log_{11}\left(1-\frac{1}{4}\right)+\log_{11}\left(1-\frac{1}{5}\right)+\cdots+\log_{11}\left(1-\frac{1}{242}\right)$$

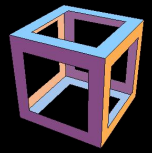
When ***simplified has the value*** equal to:

A. 2 ***B.*** - 2 ***C.*** 6 ***D.*** None of these

$$\log_{11}\left[\left(\frac{2}{3}\right)\left(\frac{3}{4}\right)\left(\frac{4}{5}\right)\cdots\left(\frac{241}{242}\right)\right]$$

$$\log_{11}\left(\frac{2}{242}\right)=\log_{11}\left(\frac{1}{121}\right)$$

$$=\log_{11}\left(11^{-2}\right)=-2$$



Example

If $\log_7 2 = m$, then $\log_{49} 28$ is equal to

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A. $2(1 + 2m)$ **B.** $\frac{1+2m}{2}$ **C.** $\frac{2}{1+2m}$ **D.** $1 + m$

$$\log_{49} 28$$

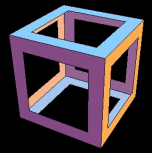
$$= \log_{(7^2)} (7 \times 4)$$

$$= \frac{1}{(2)} \log_7 (7 \times 4)$$

$$= \frac{1}{2} (\log_7 7 + \log_7 4)$$

$$= \frac{1}{2} (1 + 2 \log_7 2)$$

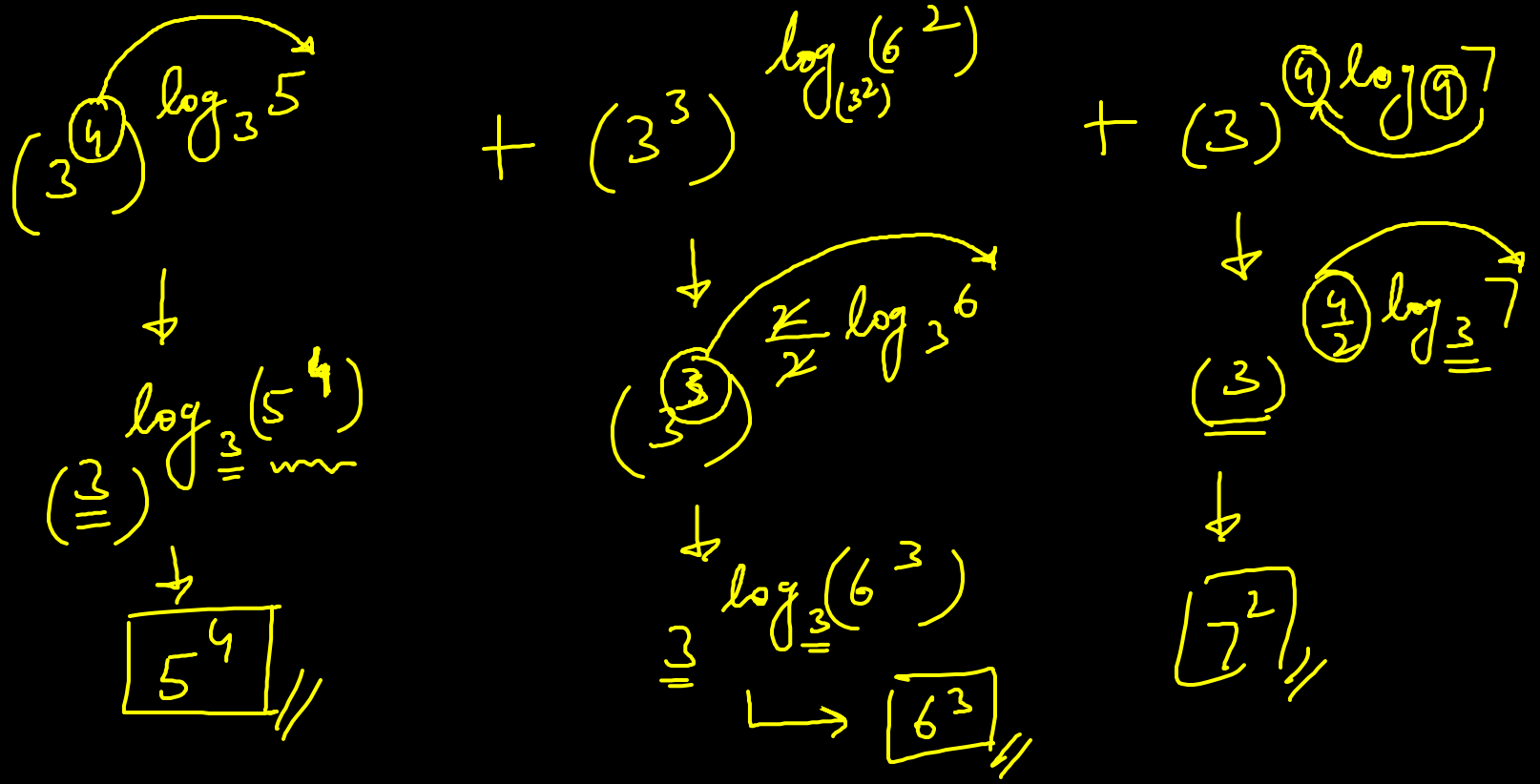
$$= \boxed{\frac{1}{2}(1+2m)}$$

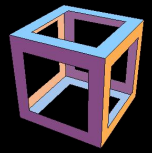


Example

The value of $81^{(1/\log_5 3)} + 27^{\log_9 36} + 3^{4/\log_7 9}$ is equal to

A. 49 **B.** 625 **C.** 216 **D.** 890





Example

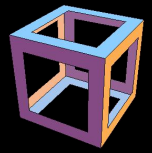
If $\log_5 a \cdot \log_a x = 2$, then x is equal to

A. 125 **B.** a^2 **C.** 25 **D.** None of these

$$\frac{\log_5 a}{\log_5 a} \times \frac{\log_5 x}{\log_5 a} = 2$$

$$\log_5 x = 2$$

$$x = 5^2 = 25$$



Example

If $\log_{12}16 = a$, *then the value of* $\log_6 27$ *in terms of* 'a' *is:*

A. $3\left(\frac{4-2a}{4+2a}\right)$ **B.** $3\left(\frac{4-2a}{4-a}\right)$ **C.** $3\left(\frac{4-2a}{4+a}\right)$ **D.** None

$\log_6 27$

$= 3\log_6 3$

$= \frac{3}{\log_3 6}$

$= \frac{3}{\log_3 3 + \log_3 2}$

$= \frac{3}{1 + \log_3 2}$

1

$a = \log_{12} 16$

$a = 4\log_{12} 2$

$a = \frac{4}{\log_2 12}$

$a = \frac{4}{2 + \log_2 3}$

$$a = \frac{4}{(2 + \log_2 3)}$$

$$2 + \log_2 3 = \frac{4}{a}$$

$$\log_2 3 = \left(\frac{4}{a} - 2\right)$$

$$\log_3 2 = \left(\frac{a}{4-2a}\right) \quad -(2)$$

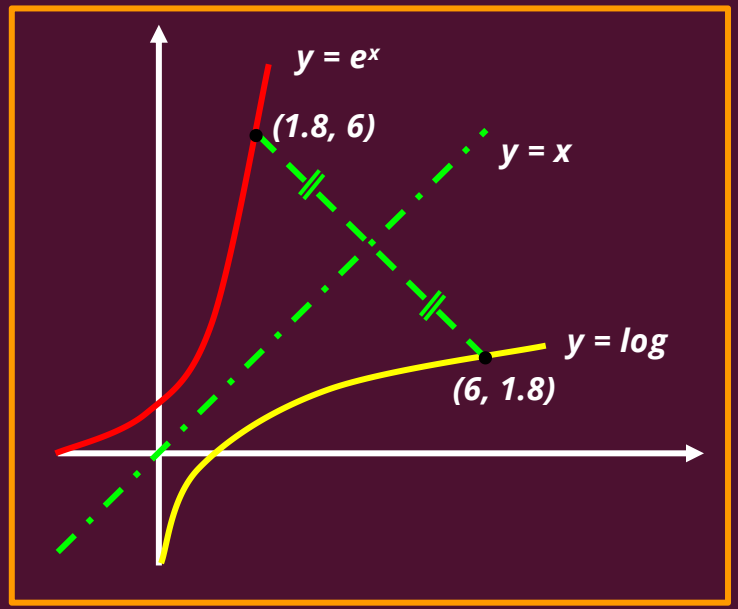
using eq^n (2) in eq^n (1)

$$= \frac{3}{1 + \left(\frac{a}{4-2a}\right)}$$

$$= \frac{3(4-2a)}{(4-2a+a)}$$

$$= 3\left(\frac{4-2a}{4-a}\right)$$

Solving Log Equations



2.0

$\log_2(x-4) = 4$

$(x-4) = 2^4$

$x = 20$

Example

The sum of values of x satisfying the following equation is:

$\log_4 (x + 1) + \log_4 (x + 4) = 1$

A. - 5 **B.** 5 **C.** 0 **D.** None

$\log_4 (x+1)(x+4) = 1$

$(x+1)(x+4) = (4)^1$

$x^2 + 5x + 4 = 4$

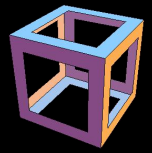
$x(x+5) = 0$

$x = 0 \; ; \; -5$

$x = 0$

$x = -5$ X

Domain Restriction



Example

The number of solutions of $\log_4 (x - 1) = \log_2 (x - 3)$ is / are

A. 3 **B.** 1 **C.** 2 **D.** 0

$$\log_2 (x-1) = \log_2 (x-3)$$

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

$$\log_2 (x-1) = \log_2 (x-3)^2$$

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

$$x - 1 = x^2 - 6x + 9$$

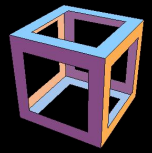
$$x^2 - 7x + 10 = 0$$

$$(x-5)(x-2) = 0$$

$x = 2, 5$

$x = 2$ ✗

$x = 5$ ✓



Example

The **sum of values of x satisfying** the following equation is:

$$16^{\log_4 |1-2x|} = 5x^2 - 4$$

A. - 5 **B.** 1 **C.** - 4 **D.** None

$$(4^2)^{\log_4 |1-2x|} = 5x^2 - 4$$

$$|1-2x|^2 = 5x^2 - 4$$

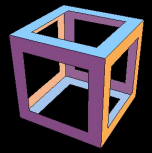
$$1 + 4x^2 - 4x = 5x^2 - 4$$

$$x^2 + 4x - 5 = 0$$

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

$$x = -5, 1$$

$$\text{Sum} = -4$$



Example

The ***number of values of x*** satisfying the following equation is:

$$x^{\left(\frac{\log x+5}{2}\right)} = 10^{5+\log x}$$

$(\log_{=} x \rightarrow \log_{10} x)$

A. 2 **B.** 3 **C.** 5 **D.** None of these

$$\log x^{\left(\frac{\log x+5}{2}\right)} = \log (10)^{(5+\log x)}$$

$$\left(\frac{\log x+5}{2}\right)(\log x) = (5+\log x)(1)$$

t

Let: $\left(\frac{t+5}{2}\right)(t) = (5+t)$

$$(t^2 + 5t) = 10 + 2t$$

$$t^2 + 3t - 10 = 0$$

$$(t+5)(t-2) = 0$$

$$t = -5 \quad ; \quad t = 2$$

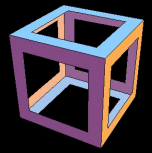
$$\log x = -5 \qquad \log x = 2$$

$$\boxed{x = 10^{-5}} \quad ; \quad \boxed{x = 10^2}$$

Example

Solve ***for x:*** $1 + 6\log_{(x+2)} 4 = \log_{(4)} (x+2)$

A. 62 ***B.*** 14 ***C.*** $\frac{-31}{16}$ ***D.*** $\frac{-127}{64}$



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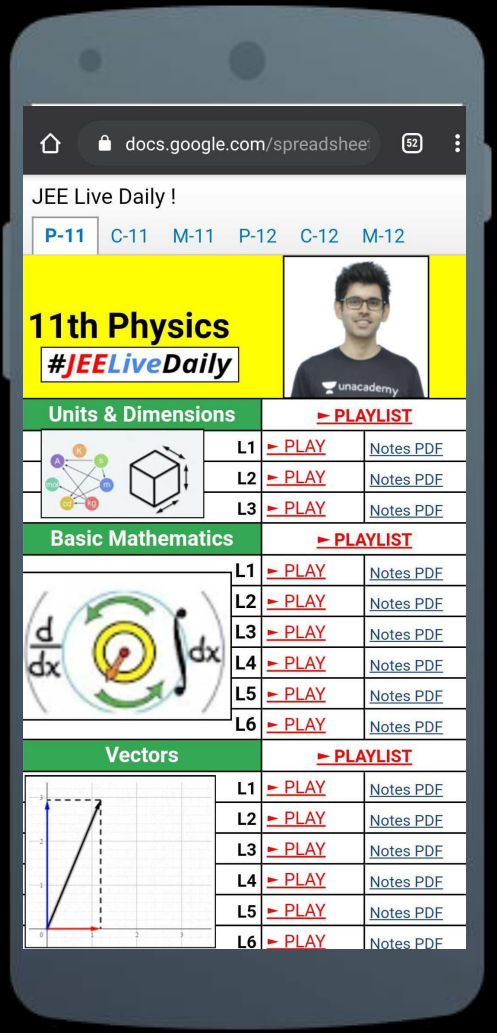

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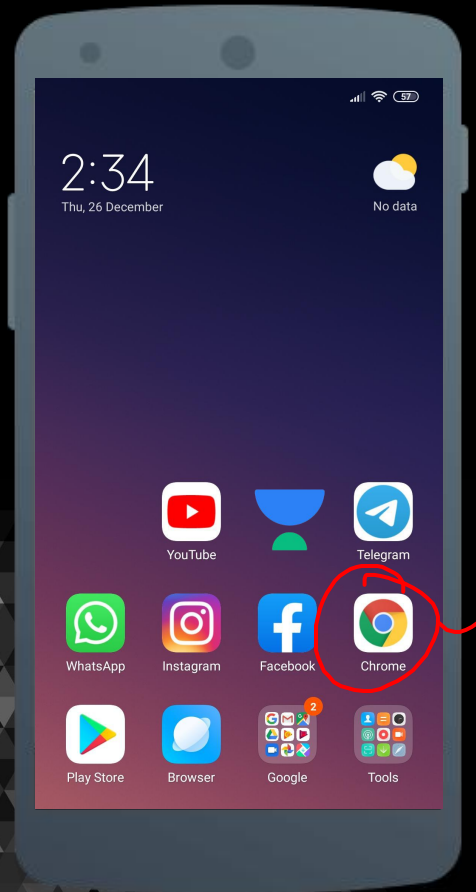

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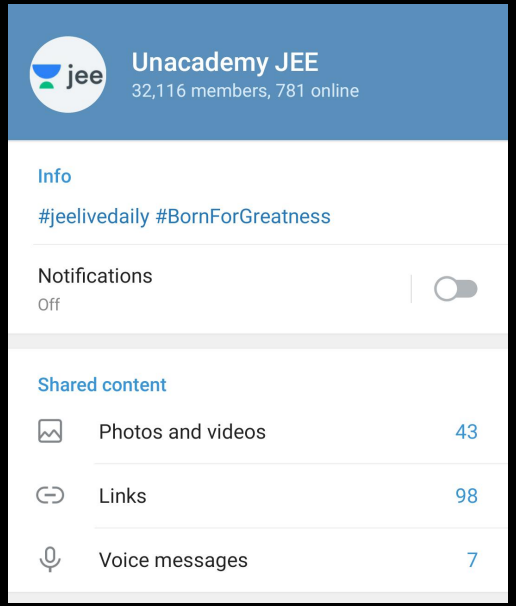

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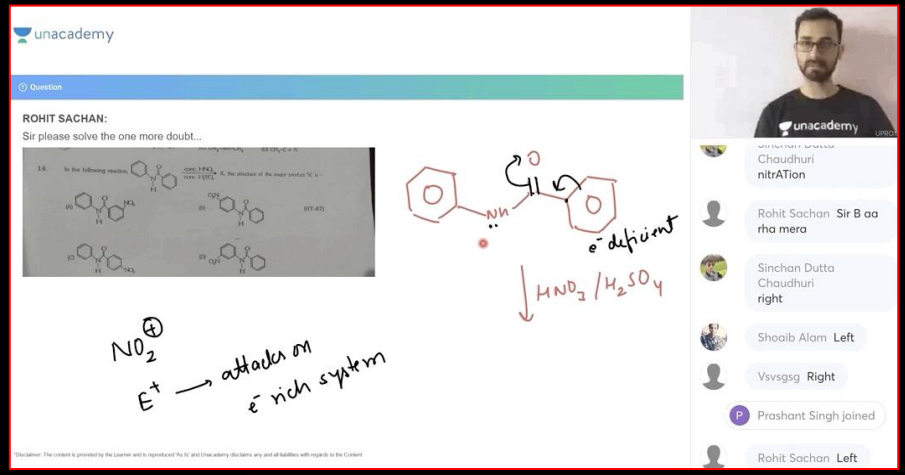

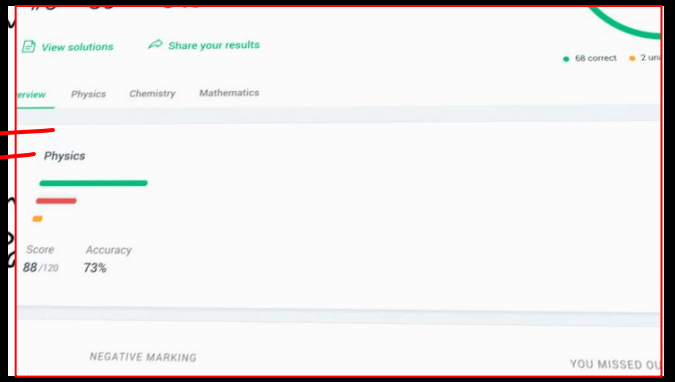

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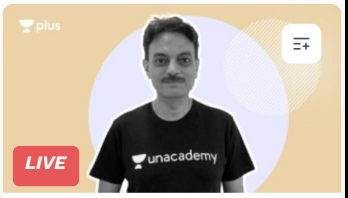

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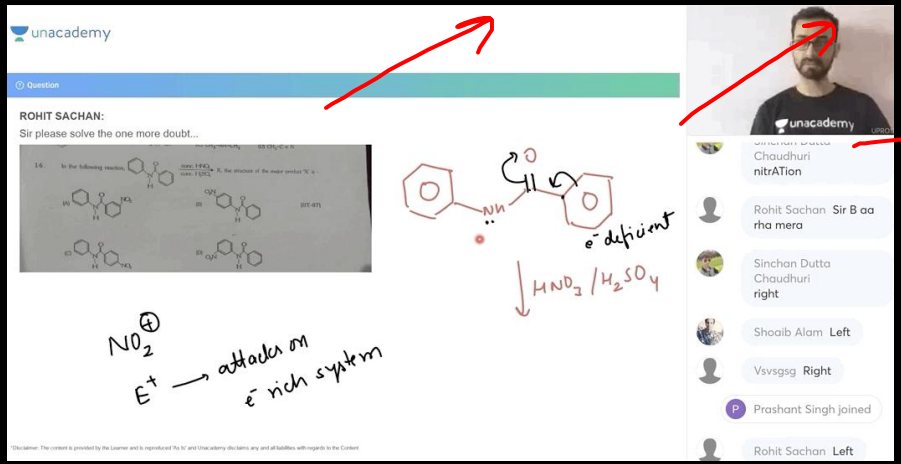
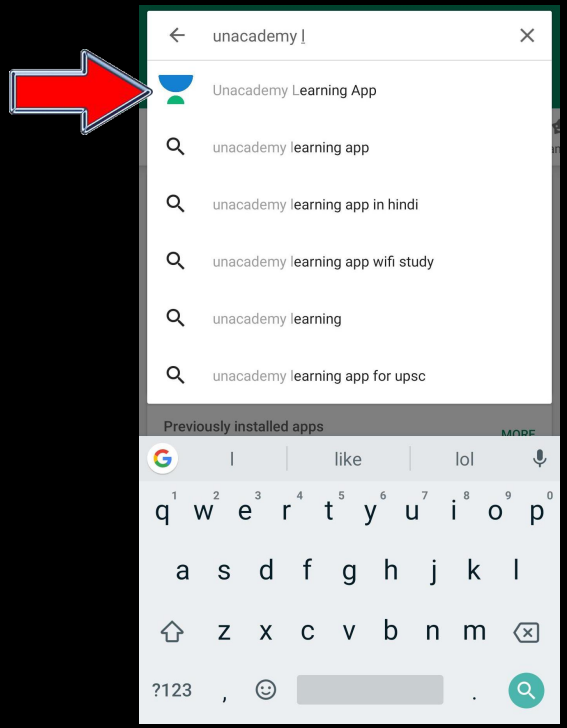


Step *1*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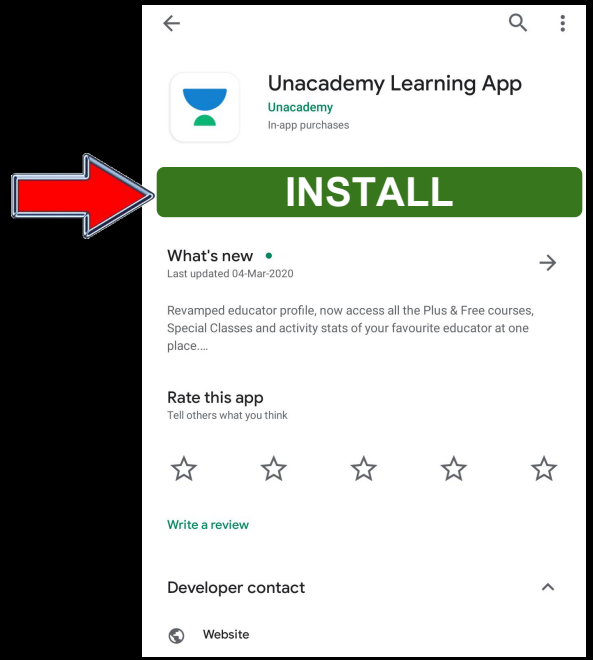
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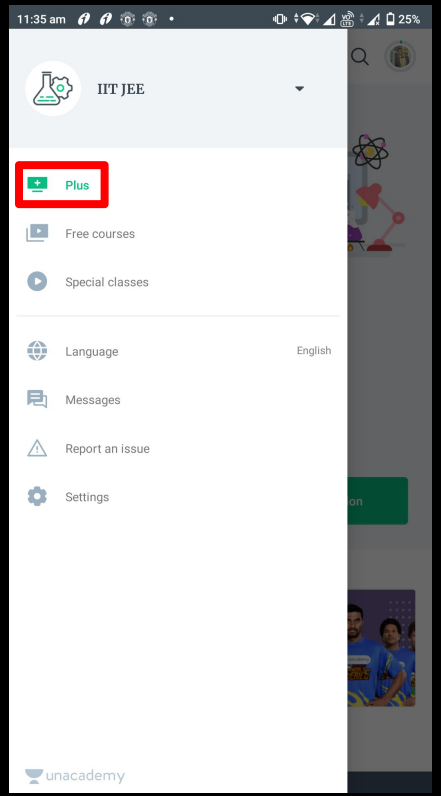

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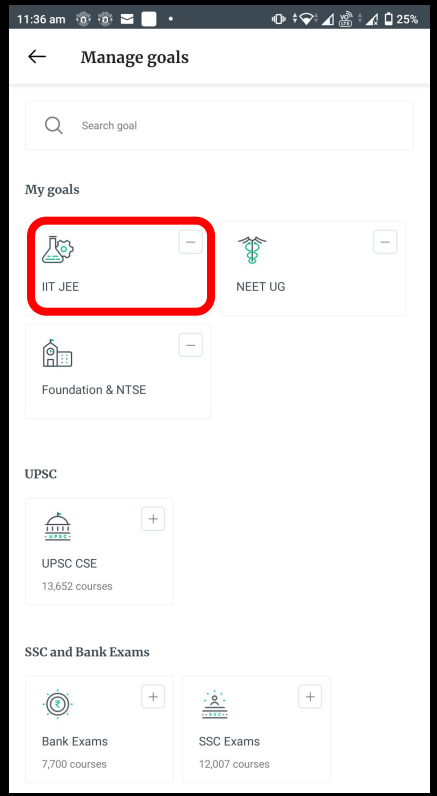

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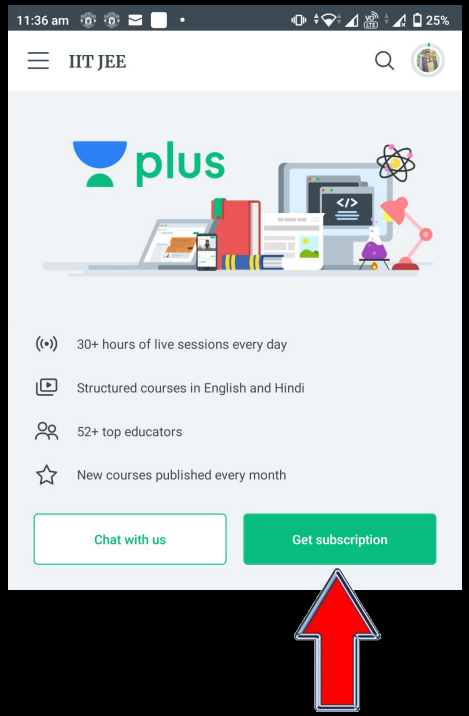

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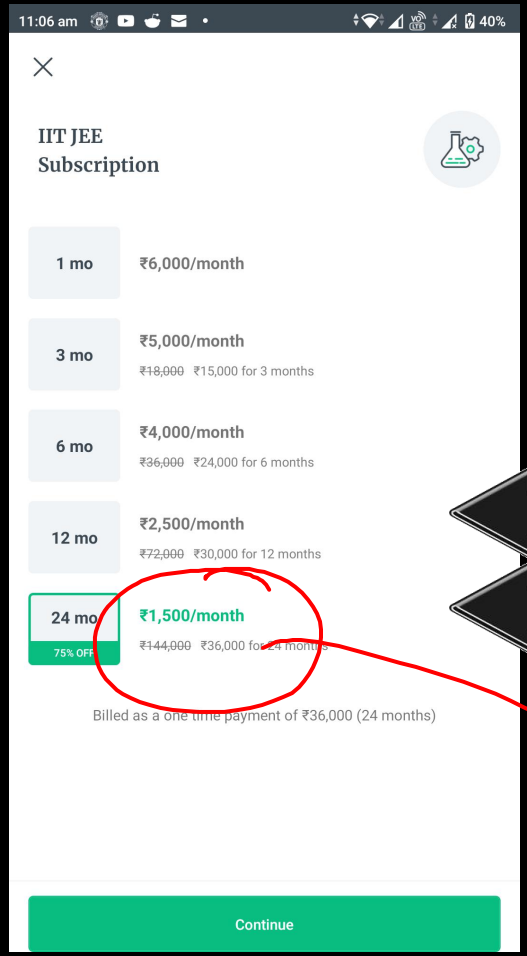
Step 6



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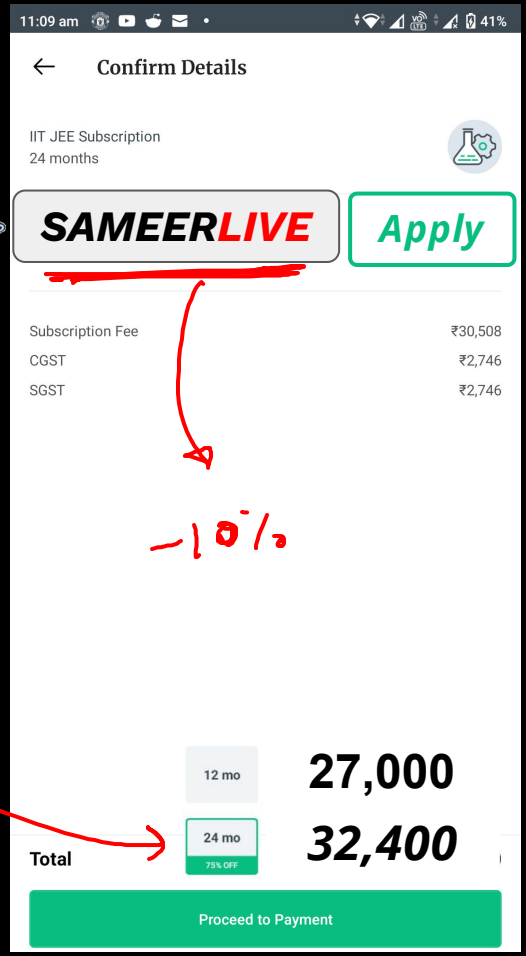

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