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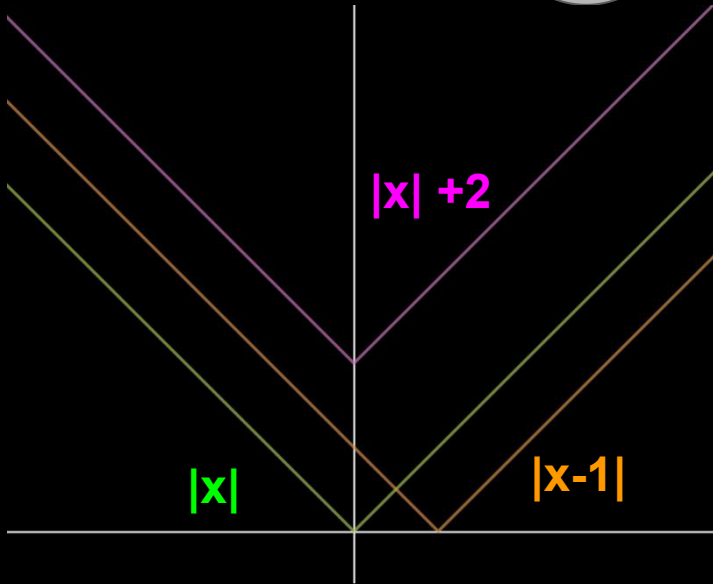
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Functions

LECTURE

5

Modulus Function - 2





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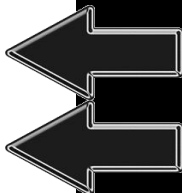
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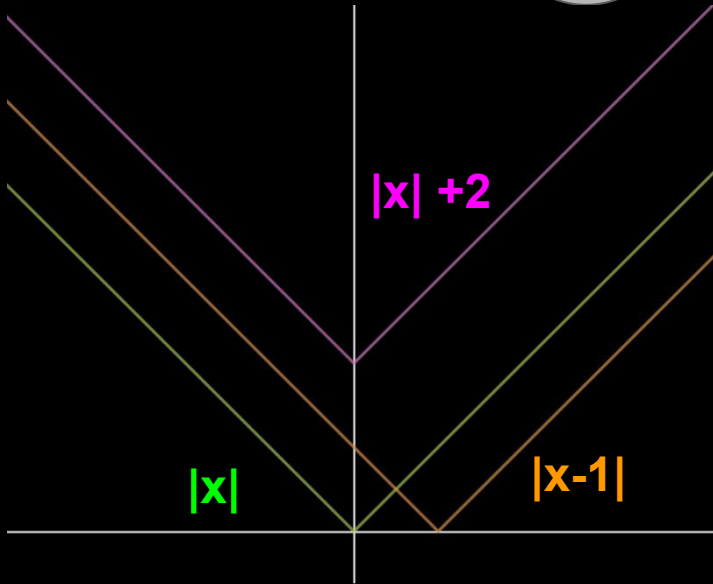
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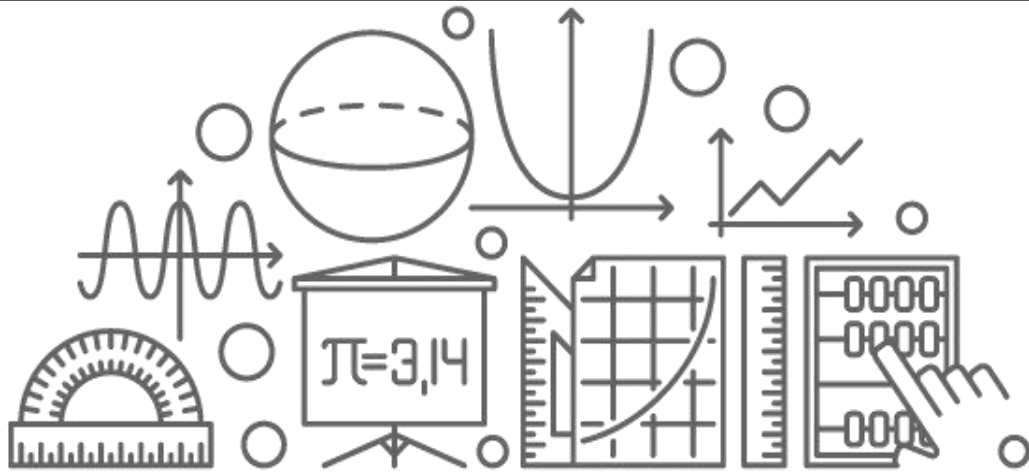
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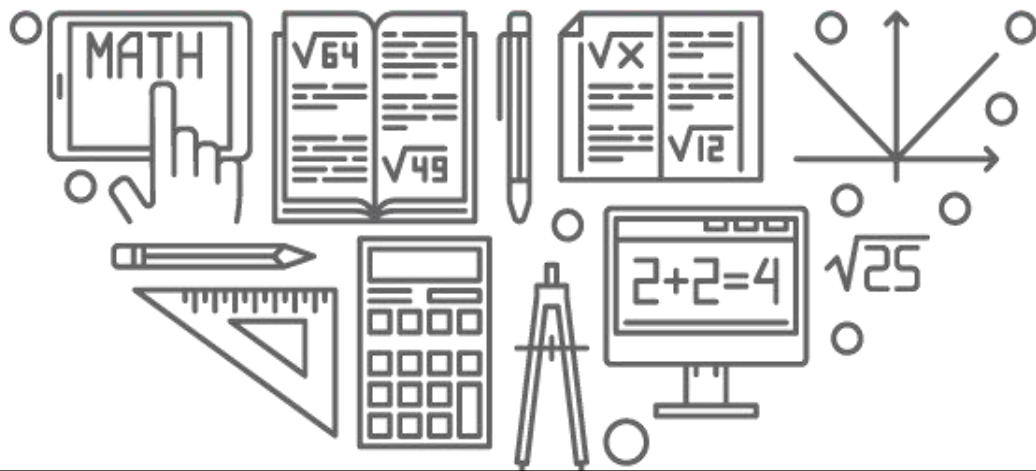
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Modulus Function - 2



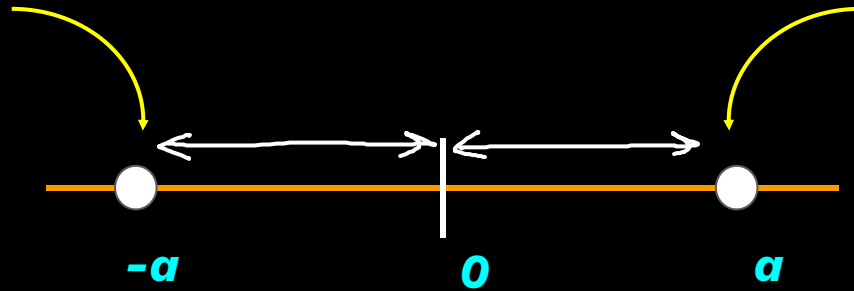


Modulus Equation



Solving Modulus Equality:

$$|f(x)| = a$$



$$f(x) = -a$$

or

$$f(x) = a$$

$$|f(x)| = a$$

$x = ?$



Example

Solve for x : $|x + 7| = 3$

$$(x+7) = 3$$

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



$$(x+7) = -3$$

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

Example

Solve for x : $||x+1|-4|=5$

\downarrow
 $f(x)$

$$|x+1|-4=5$$

$$|x+1|=9$$

$$x+1=9$$

$$x=8$$

$$x+1=-9$$

$$x=-10$$

$$|x+1|-4=-5$$

$$|x+1|=-1$$

always +ve

No solⁿ

Example

Solve for x : $|x-1| - |x| = 1$ ✓

$$|b^m| = a \quad \times$$



$$-10$$

$$|-11| - |-10|$$

$$11 - 10$$

$$= 1$$

$$-(x-1) - (-x) = 1$$

$$-x + 1 + x = 1$$

$$1 = 1 \quad \checkmark$$

(always true)

$$-(x-1) - (x) = 1$$

$$-x + 1 - x = 1$$

$$-2x = 0$$

$$x = 0 \quad \checkmark$$

$$(x-1) - (x) = 1$$

$$-1 = 1 \quad \times$$

Not true

$$x \in (-\infty, 0]$$

Example

Solve for x : $x^2 + 7/|x| + 10 = 0$

$$\boxed{C-2} : \boxed{x < 0}$$

← 0

→

$$\boxed{C-1} : \boxed{x > 0}$$

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

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

$$\boxed{x = 2, 5}$$

X ignore

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

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

$$\boxed{x = -2, -5}$$

X ignore

No solⁿ

M-2

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

$$\therefore \boxed{x^2 = |x|^2}$$

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

$$(|x| + 2)(|x| + 5) = 0$$

$$|x| = -2 \quad \text{or} \quad |x| = -5$$

\swarrow \times
 \swarrow \times

No solⁿ

$$(-2)^2 = |-2|^2$$

$$\downarrow$$

$$\textcircled{4}$$

$$\downarrow$$

$$\textcircled{4}$$

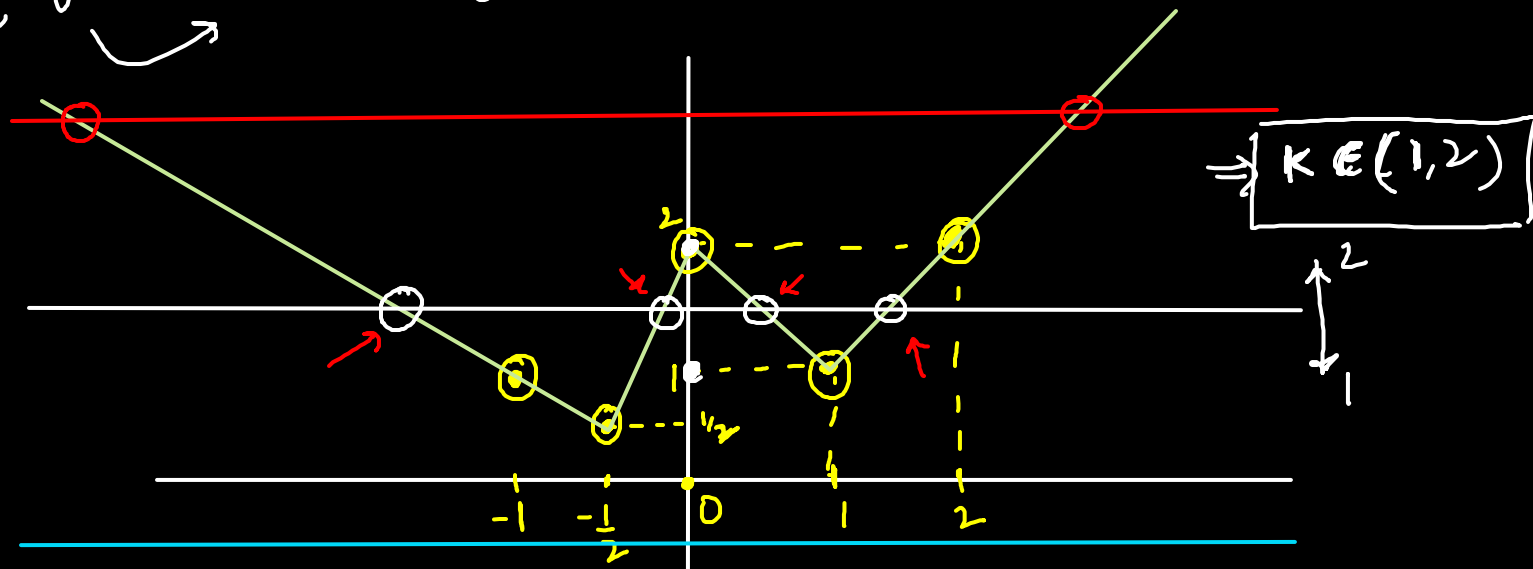
Example

Find 'k' for which following equation has 4 solutions

$$|x - 1| - 2|x| + |2x + 1| = k$$

$$\begin{aligned} \text{LHS} &\Rightarrow y = |x-1| - 2|x| + |2x+1| \quad \text{--- (1)} \\ \text{RHS} &\Rightarrow y = k \quad \text{--- (2)} \end{aligned}$$

$$\begin{aligned} & \left| -\frac{1}{2} - 1 \right| - 2 \left| -\frac{1}{2} \right| \\ & \frac{3}{2} - 1 = \frac{1}{2} \end{aligned}$$

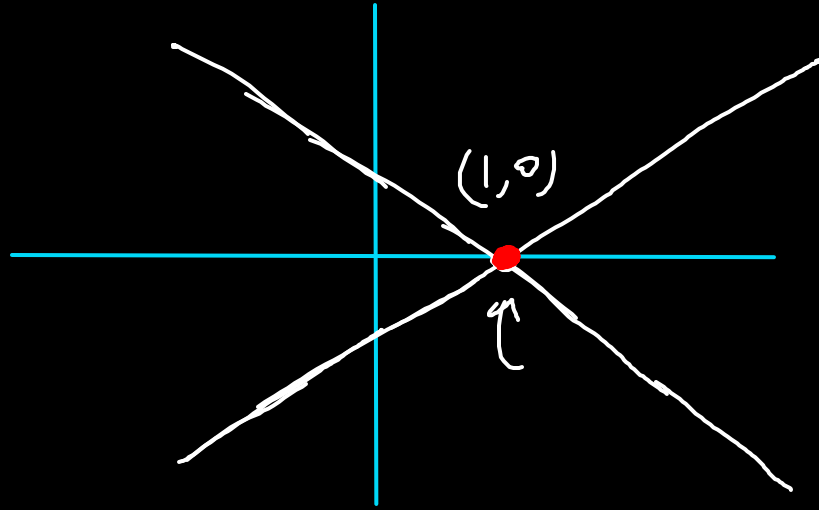


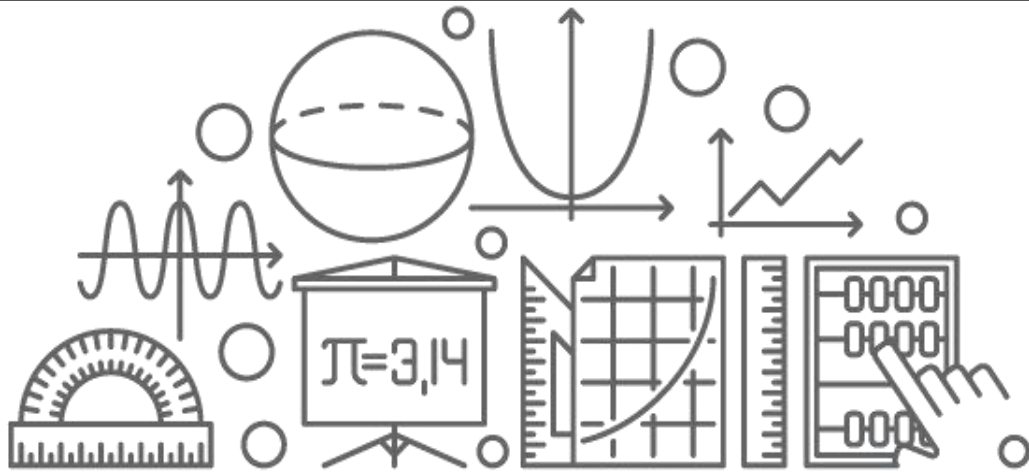
$$\begin{cases} y = x - 1 & \text{--- (1) ✓} \\ y = 1 - x & \text{--- (2) ✓} \end{cases}$$

$$2y = 0$$

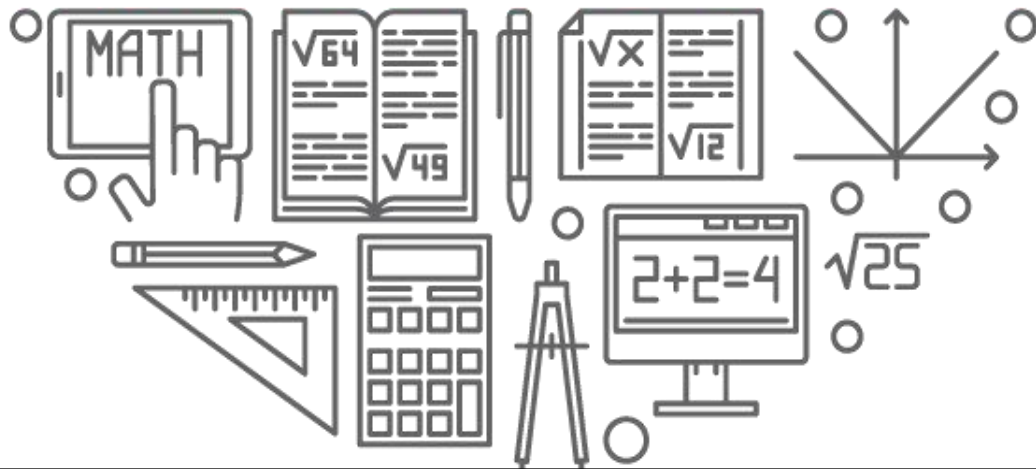
$$\Rightarrow y = 0 \Rightarrow x = 1$$

$\therefore (1, 0) \rightarrow$ intersection point



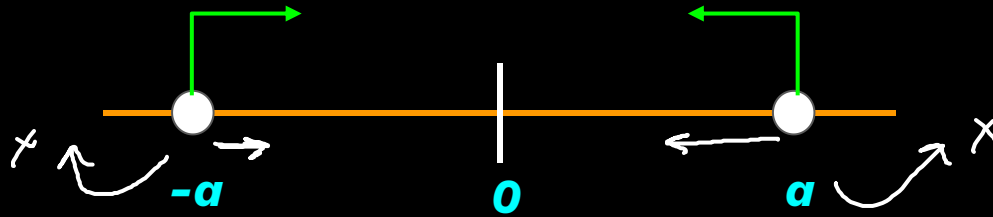


Modulus Inequality



Solving Modulus Inequality:

$$|f(x)| < a$$



$$f(x) > -a$$

and

$$f(x) < a$$

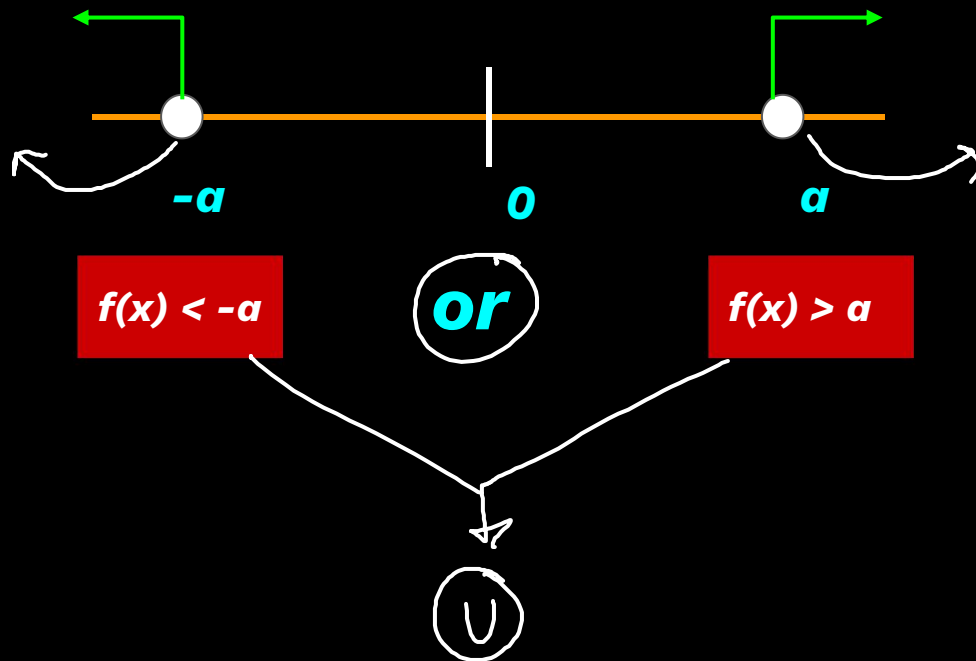


$$|f(x)| < a$$

$x = ?$

Solving Modulus Inequality:

$$|f(x)| > a$$



Example

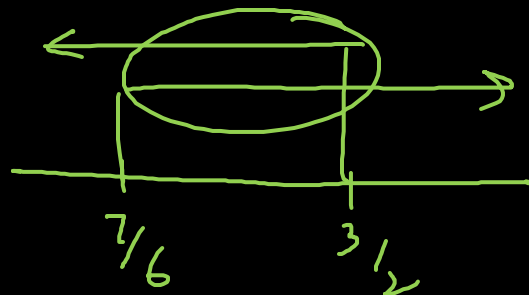
Find $|4 - 3x| \leq 1/2$ then x is equal to:

A. $\left[\frac{7}{6}, \frac{3}{2}\right]$

B. $\left(\frac{7}{6}, \frac{3}{2}\right)$

C. $\left[\frac{7}{6}, \frac{3}{2}\right]$

D. None of these



$$x \in \left[\frac{7}{6}, \frac{3}{2}\right]$$

$$4 - 3x \leq \frac{1}{2}$$

$$4 - \frac{1}{2} \leq 3x$$

$$3x \geq \frac{7}{2} \Rightarrow x \geq \frac{7}{6}$$

①
②

$$4 - 3x \geq -\frac{1}{2}$$

$$4 + \frac{1}{2} \geq 3x$$

$$3x \leq \frac{9}{2}$$

$$\Rightarrow x \leq \frac{3}{2}$$

Example

$$\left| \frac{2x-1}{x-1} \right| > 2$$

A. $(-\infty, -1] \cup [1, \infty)$

B. $(3/4, 1) \cup (1, 2)$

C. $(3/4, \infty)$

D. $(3/4, 1) \cup (1, \infty)$

$|C-1| :$

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

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

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

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

$$x > 1 \quad \text{--- (1)}$$

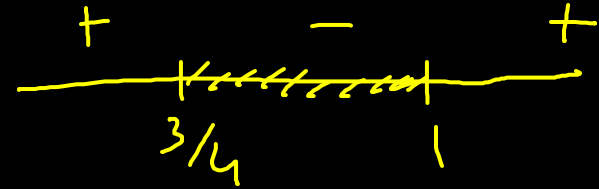
$$\boxed{C-2}:$$

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

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

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

$$\frac{4x-3}{x-1} < 0$$



$$\boxed{x \in \left(\frac{3}{4}, 1\right)} - (2)$$

Example

The complete set of real 'x' satisfying $||x - 1| - 1| \leq 1$ is:

A. $[0, 2]$

✓ B. $[-1, 3]$

C. $[-1, 1]$

D. $[1, 3]$

$$|x-1| - 1 \geq -1$$

$$|x-1| \geq 0$$

always true

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

$$\textcircled{&} |x-1| - 1 \leq 1$$

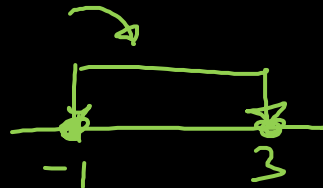
$$|x-1| \leq 2$$

$$(x-1) \geq -2$$

$$x \geq -1$$

$$\textcircled{&} (x-1) \leq 2$$

$$x \leq 3$$





Example

$$|x^3 - 1| \geq 1(1 - x)$$

A. $(-\infty, -1] \cup [0, \infty)$

B. $(-\infty, 0] \cup [1, \infty)$

C. $(-\infty, 0) \cup (1, \infty)$

D. $(-\infty, 0) \cup (0, \infty)$

H.W.

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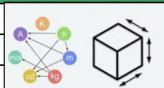
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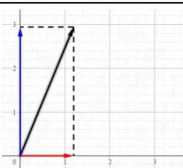
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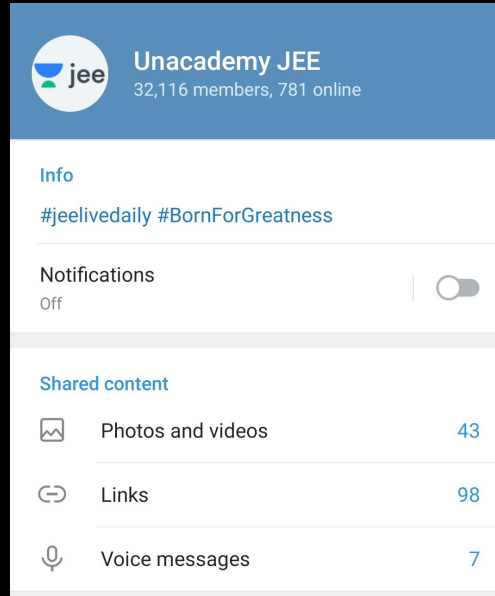
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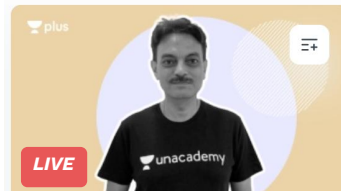


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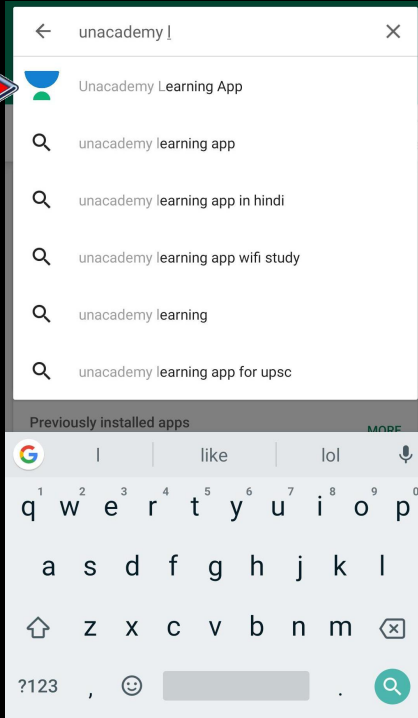
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Identify 'X'.

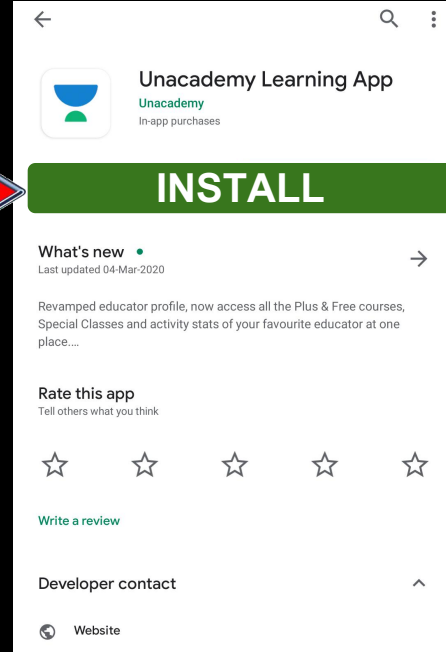
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e-deficient
HNO3/H2SO4
NO2+ attacks on e rich system

Participants:
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Sinchan Dutta Chaudhuri right
Shoaib Alam Left
Vsvsgsg Right
Prashant Singh joined
Rohit Sachan Left

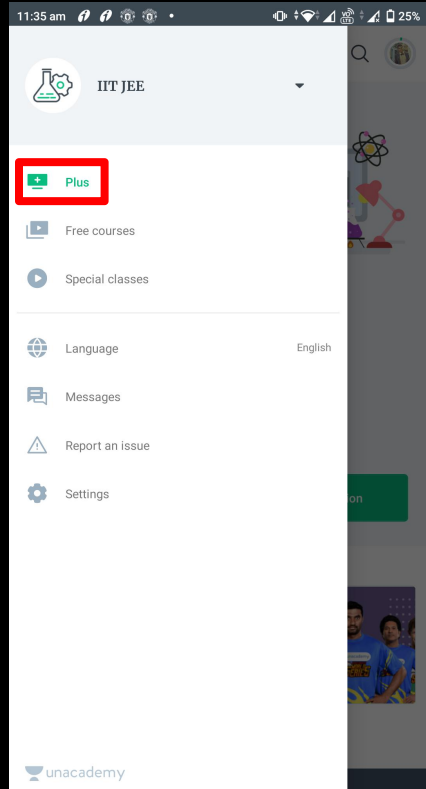
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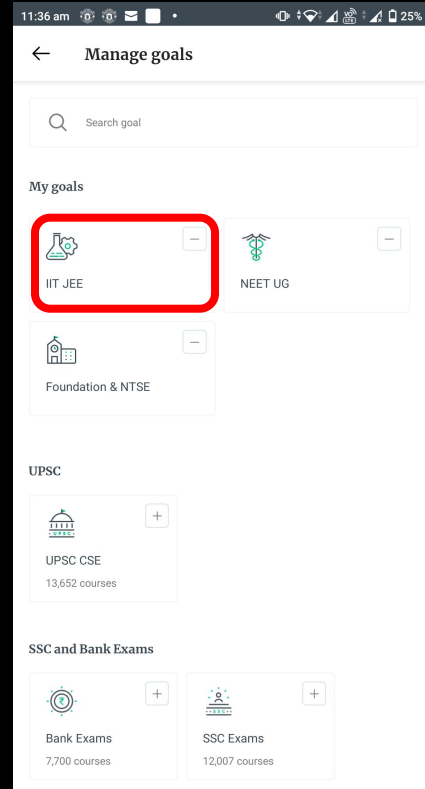
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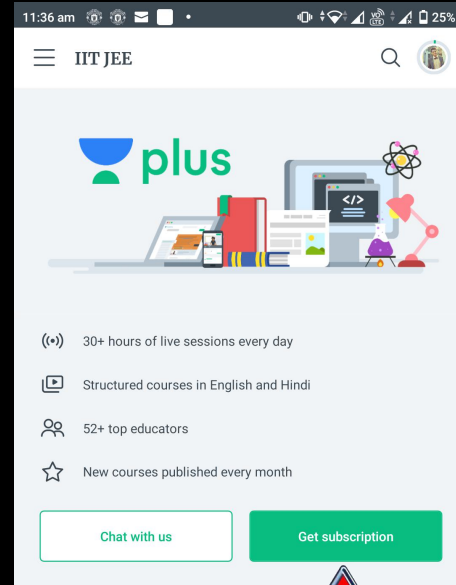
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Step 4



Step 5



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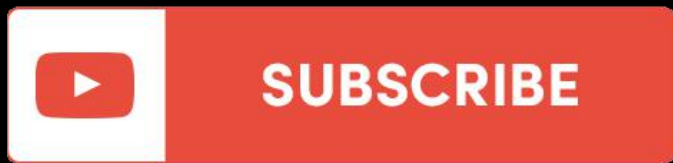
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