

## Location of Roots -2

### Quadratic Equations

8



$$\alpha + \beta = \frac{-b}{a}$$



$$\alpha\beta = \frac{c}{a}$$



$$|\alpha - \beta| = \frac{\sqrt{D}}{|a|}$$



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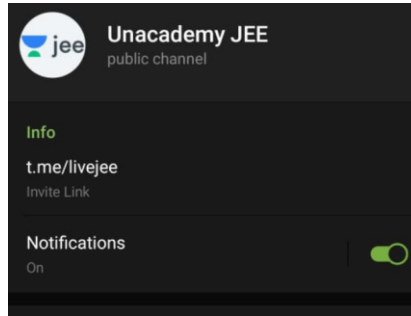
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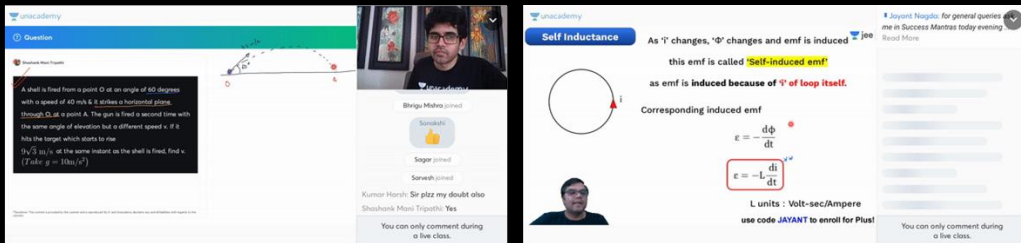
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Questions

A shell is fired from a point O at an angle of 60 degrees with a speed of 40 m/s. It strikes a horizontal plane through O at a point A. The gun is fired a second time with the same angle of elevation but a different speed  $v$ . If it hits the target which starts to rise  $(\sqrt{3}/2) \text{ m/s}^2$  at the same instant as the shell is fired, find  $v$ . (Take  $g = 10 \text{ m/s}^2$ )

Shreyas Mishra joined

Sagar joined

Saravali joined

Kumar Harsh: Sir plz my doubt also

Shashank Masi Tripathi: Yes

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Self Inductance

As  $\vec{I}$  changes,  $\vec{\Phi}$  changes and emf is induced

this emf is called **Self-induced emf**

as emf is induced because of  $\vec{I}$  of loop itself.

Corresponding induced emf

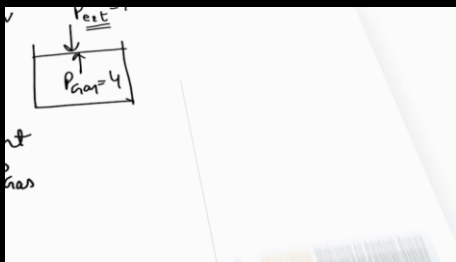
$$\mathcal{E} = -\frac{d\Phi}{dt}$$

$$\mathcal{E} = -L \frac{dI}{dt}$$

L units: Volt-sec/Ampere

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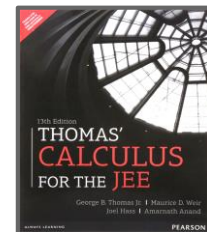
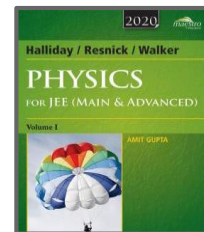
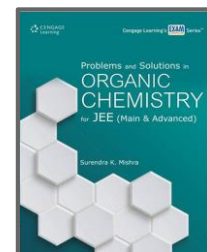
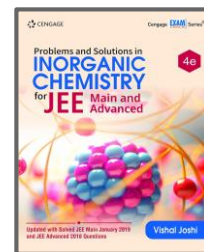
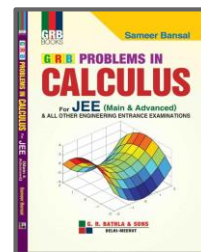
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# LET'S BEGIN!!



Find the set of values of ' $p$ ' for which the quadratic equation,  
 $(p - 5)x^2 - 2px - 4p = 0$  has at least one positive root.

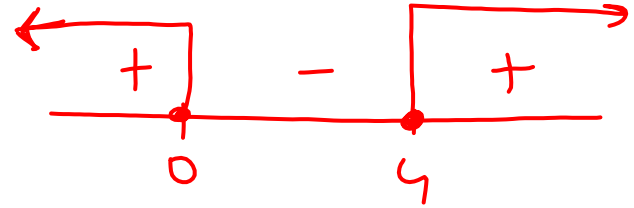
$$\textcircled{1} D \geq 0$$

$$\cancel{4}p^2 - 4(p-5)(-\cancel{4}p) \geq 0$$

$$p^2 + 4p(p-5) \geq 0$$

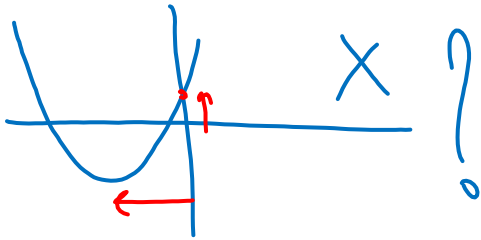
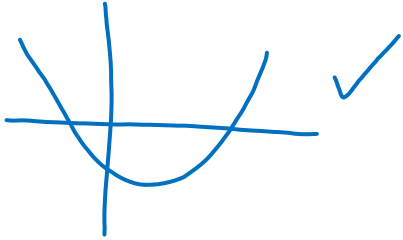
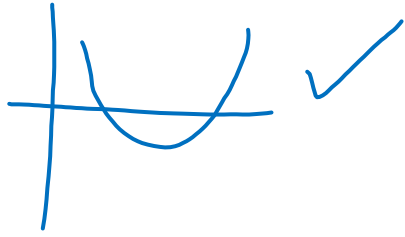
$$5p^2 - 20p \geq 0$$

$$5p(p-4) \geq 0$$



$$p \in (-\infty, 0] \cup [4, \infty)$$

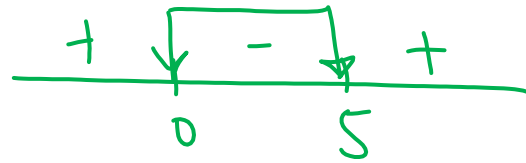
$$- \{5\}$$



① Both roots -ve:

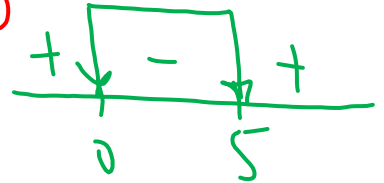
(i)  $D \geq 0 \Rightarrow p \in (-\infty, 0] \cup [4, \infty)$

(ii)  $V_x < 0 \Rightarrow \frac{2p}{p-5} < 0$

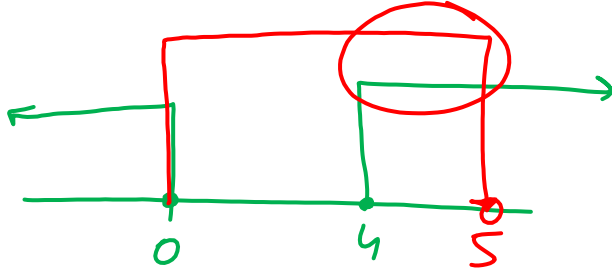


(iii)  $(p-5)(-4p) > 0$

$p(p-5) < 0$



(i)  $\cap$  (ii)  $\cap$  (iii)



$$P \in [4, 5)$$

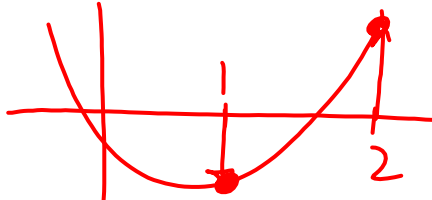
$$(-\infty, 0] \cup [4, 5) \cup (5, \infty)$$

$$- [4, 5)$$

$$\Rightarrow (-\infty, 0] \cup (5, \infty)$$



For what values of ' $a$ ' exactly one root of the equation  $2^a x^2 - 4^a x - 2^a - 1 = 0$ , lies between **1 and 2**.



$$f(1)f(2) < 0$$

$$f(1) = 2^a - 4^a - 2^a - 1$$

$$f(1) = -(4^a + 1)$$

$$\begin{aligned} f(2) &= 4 \cdot 2^a - 2 \cdot 4^a - 2^a - 1 \\ &= (3 \cdot 2^a - 2 \cdot (2^a)^2 - 1) \end{aligned}$$

$$-(4^a + 1)(3 \cdot 2^a - 2 \cdot (2^a)^2 - 1) < 0$$

$$(4^a + 1) \cdot (2 \cdot (2^a)^2 - 3 \cdot (2^a) + 1) < 0$$

(4^a + 1) is positive



$$\Rightarrow 2(2^a)^2 - 3 \cdot (2^a) + 1 < 0$$

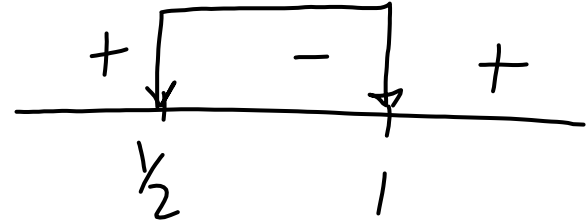
Let.  $2^a = t$

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

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

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

$$2^{-1} < 2^a < 2^0$$



$$\frac{1}{2} < t < 1$$

$$\frac{1}{2} < 2^a < 1$$

$$\log_2\left(\frac{1}{2}\right) < \log_2 2^a < \log_2 1$$

$$a \in (-1, 0)$$



Find the values of the parameter  $k$  for which the equation  $x^4 - (k-3)x^2 + k = 0$  has

- (i) Four real roots
- (ii) Exactly two real roots
- (iii) No real root

$$x^2 = t$$

$$t^2 - (k-3)t + k = 0$$

$$\begin{array}{ccc} & \swarrow & \searrow \\ \textcircled{x^2 = t_1} & \xleftarrow{t_1} & t_2 \xrightarrow{} \textcircled{x^2 = t_2} \end{array}$$

01 { for 4 real 'x'  
we should both roots  
of 't' positive }

$$t^2 - (k-3)t + k = 0$$

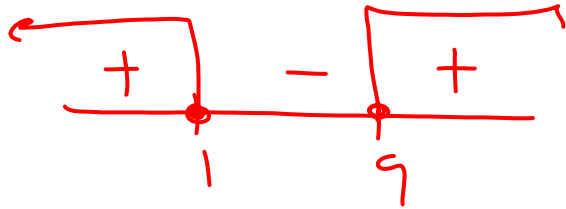
$$\textcircled{1} D \geq 0,$$

$$(k-3)^2 - 4k \geq 0$$

$$K^2 - 6K + 9 - 4K \geq 0$$

$$K^2 - 10K + 9 \geq 0$$

$$(K-1)(K-9) \geq 0$$



$$K \in (-\infty, 1] \cup [9, \infty)$$

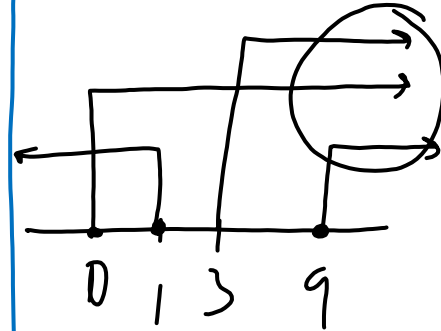
$$\textcircled{2} \quad \forall x \geq 0$$

$$\frac{K-3}{2} \geq 0$$

$$K \geq 3$$

$$\textcircled{3} \quad (1)(K) \geq 0$$

$$K \geq 0$$

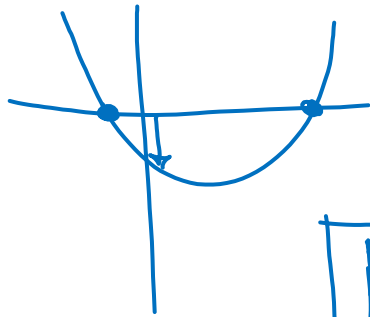


$$\therefore [9, \infty)$$

(ii) In  $eq^1$ :

$$t^2 - (K-3)t + K = 0$$

{ both roots should be }  
opposite sign.



$$f(0) = K < 0$$

$$K \in (-\infty, 0)$$

(ii) In  $eq^1$ :

$$t^2 - (K-3)t + K = 0$$

{ both roots should be }  
negative: Or both roots  
should be imaginary

Case-1 :  $D \geq 0$

$$\Rightarrow (-\infty, 1] \cup [9, \infty)$$

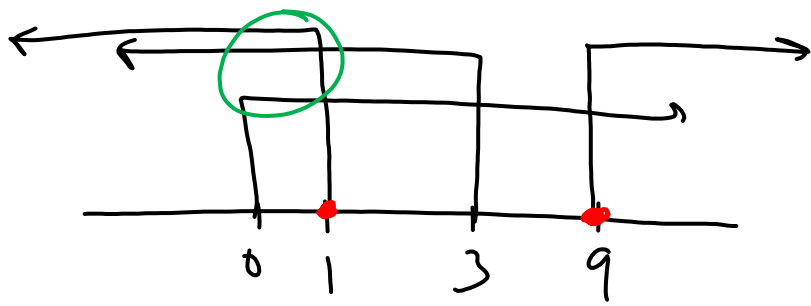
$$(2) V_n = \frac{K-3}{2} < 0$$

$$K < 3$$

$$(3) a f(\underline{x}_0) > 0$$

$$I(K) > 0$$

$$K > 0$$



$$K \in (0, 1]$$

$$\underline{\text{Case-2}}: D < 0$$

$$\Rightarrow K \in (1, 9)$$

U

$$(0, 9)$$



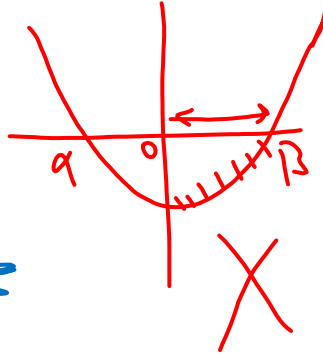
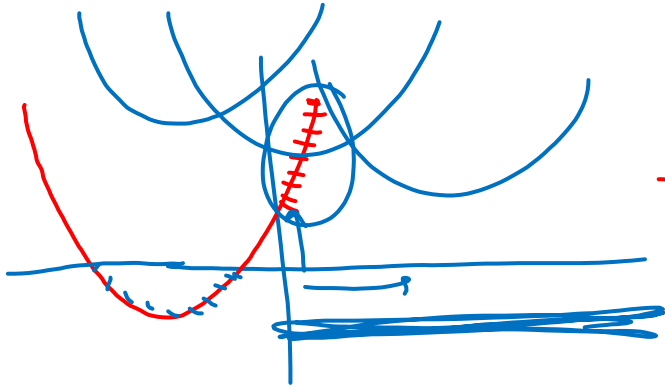




Find all values of ' $k$ ' for which the inequality  $k \cdot 4^x + (k-1) 2^{x+2} + k > 1$  is satisfied for all  $x \in \mathbb{R}$ .

Let  $2^x = t \Rightarrow t \in (0, \infty)$

$$k t^2 + (k-1)(4t) + (k-1) > 0$$



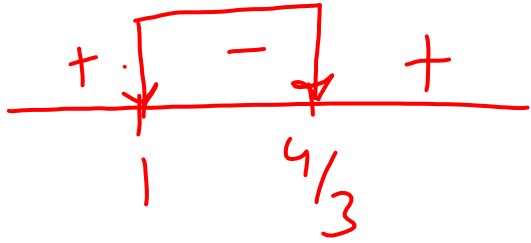
$$2^x \cdot 2^2$$

$$\textcircled{1} D < 0$$

$$4(k-1)^2 - 4k(k-1) < 0$$

$$(k-1)(4k-4-k) < 0$$

$$(k-1)(3k-4) < 0$$



$$K \in \left(1, \frac{4}{3}\right)$$

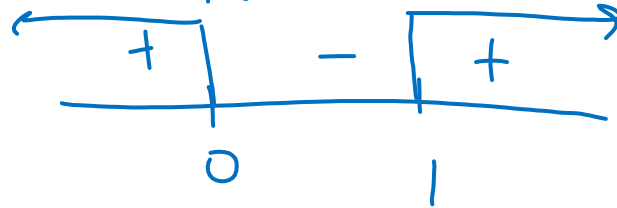
② (i)  $D \geq 0$

$\Rightarrow (-\infty, 1] \cup \left[\frac{4}{3}, \infty\right)$

(ii)  $\forall a < 0$

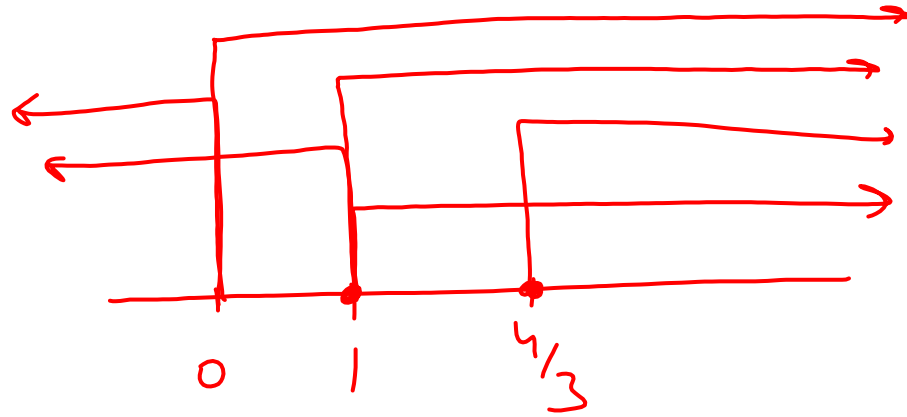
$$\frac{-9(K-1)}{2K} < 0$$

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



(iii)  $K > 0$

(iv)  $K-1 > 0$



$$K \in \left[ \frac{4}{3}, \infty \right)$$

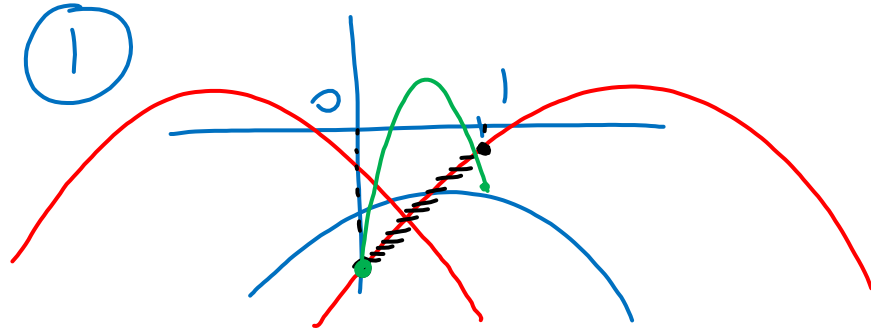
$$\textcircled{1} \cup \textcircled{2}$$

$$- \boxed{(1, \infty)}$$



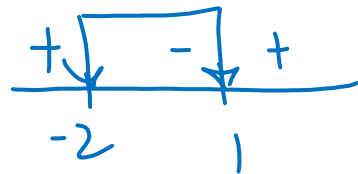


Find all possible parameters 'a' for which,  $f(x) = (a^2 + a - 2)x^2 - (a + 5)x - 2$  is negative for every  $x \in [0, 1]$ .



(A)  $a^2 + a - 2 < 0$  (downward facing)

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



Case-1 :  $D < 0$

$$(a+5)^2 - 4(a^2+a-2)(-2) < 0$$

$$(a^2 + 10a + 25)$$

$$+ (8a^2 + 8a - 16) < 0$$

$$9a^2 + 18a + 9 < 0$$



$$a^2 + 2a + 1 < 0$$

$$(a+1)^2 < 0$$

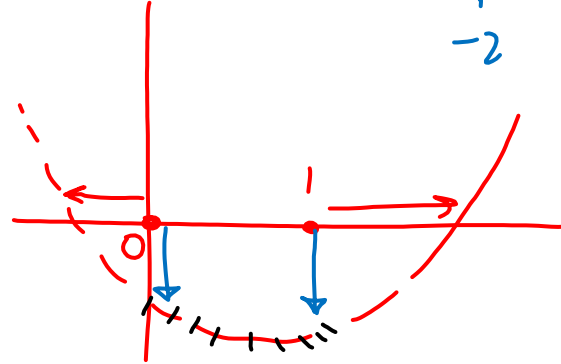
Not possible

Case-2 :  $D \geq 0$

hold

on next page

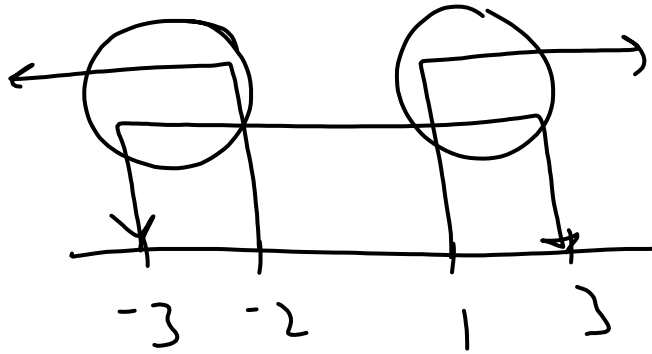
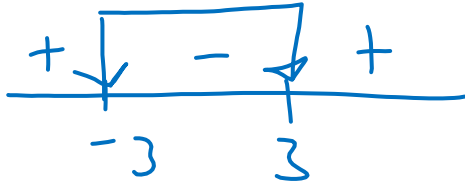
B upward.



$$f(0) = -2 < 0$$

$$\begin{aligned} f(1) &= a^2 + \cancel{a} - 2 - \cancel{a} - 5 - 2 \\ &= a^2 - 9 < 0 \end{aligned}$$

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



$$(-3, -2) \cup (1, 3)$$

Now getting back to

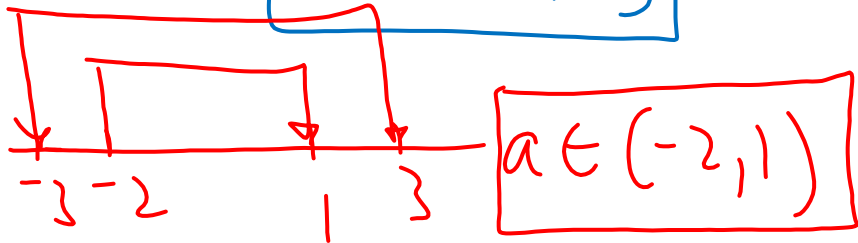
$[A] \rightarrow$  Case-2. Down  $\nearrow (-2, 1)$   
&  $D \geq 0$

$$f(0) = -2 < 0$$

*always*

$$f(1) = a^2 - 9 < 0$$

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



$$[A] \cup [B]$$

$$(-3, -2) \cup (-2, 1) \cup (1, 3)$$



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9:00 - 10:30 PM

12<sup>th</sup>



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1:30 - 3:00 PM



Anupam Sir | Chemistry

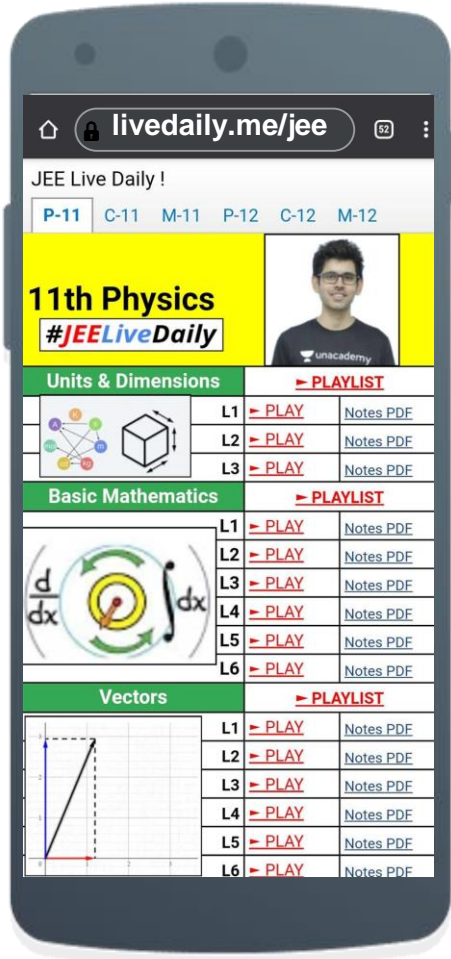
3:00 - 4:30 PM



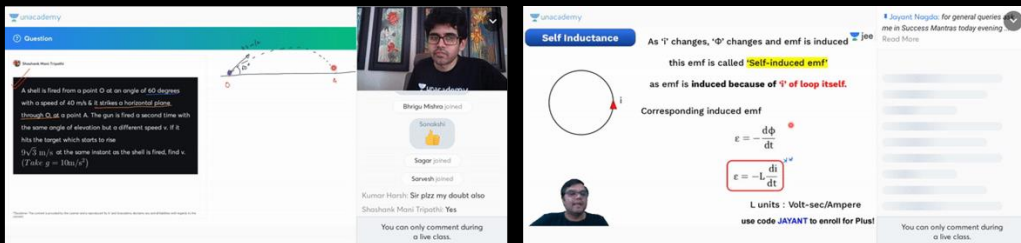
Nishant Sir | Maths

4:30 - 6:00 PM

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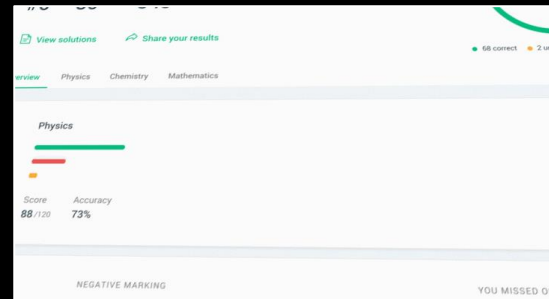
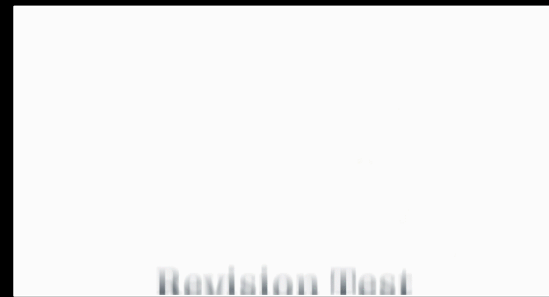


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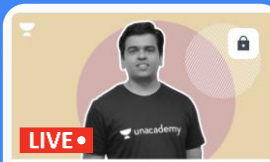
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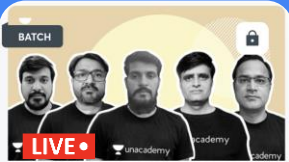
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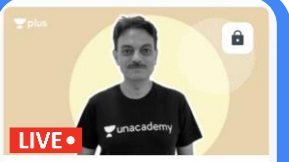
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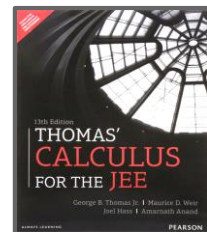
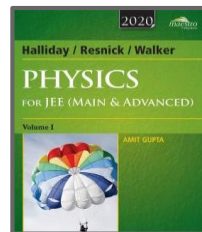
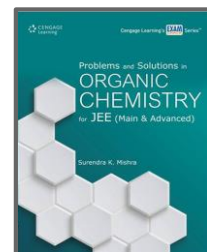
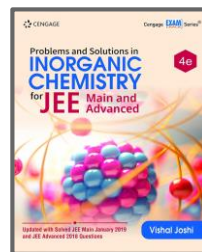
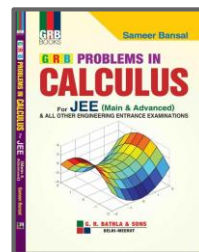
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Sundaram  
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Manas Pandey  
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Mihir Agarwal  
99.63



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Kalankar  
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Megh Gupta  
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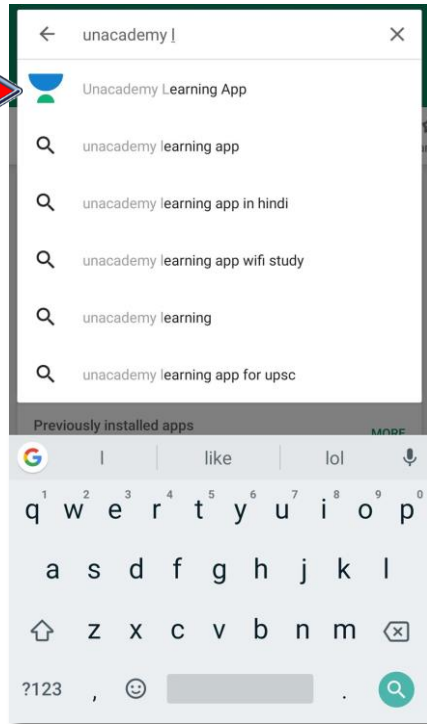


Naman Goyal  
98.48

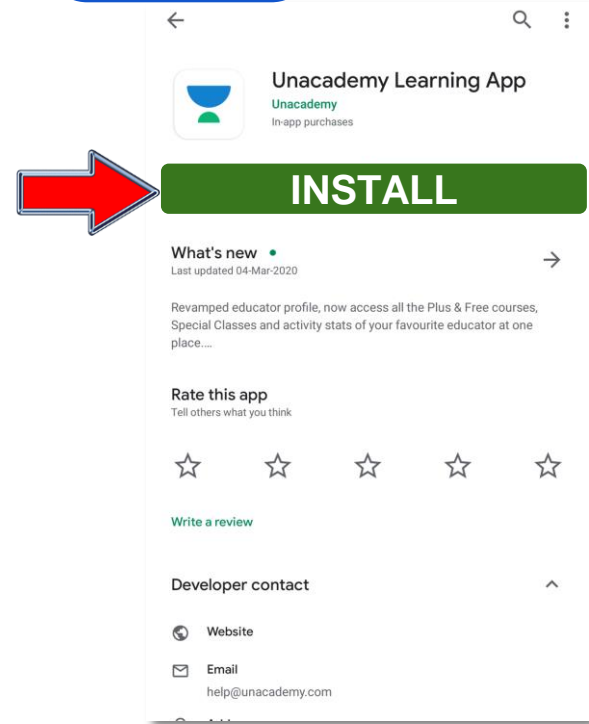


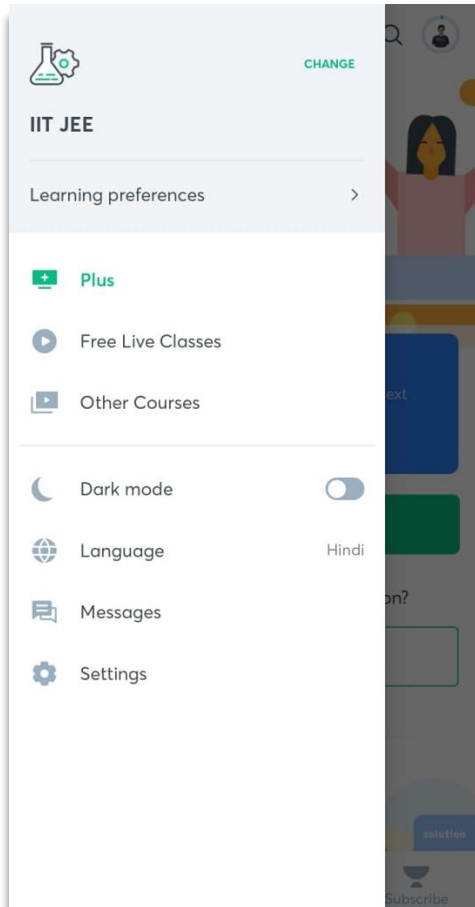
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