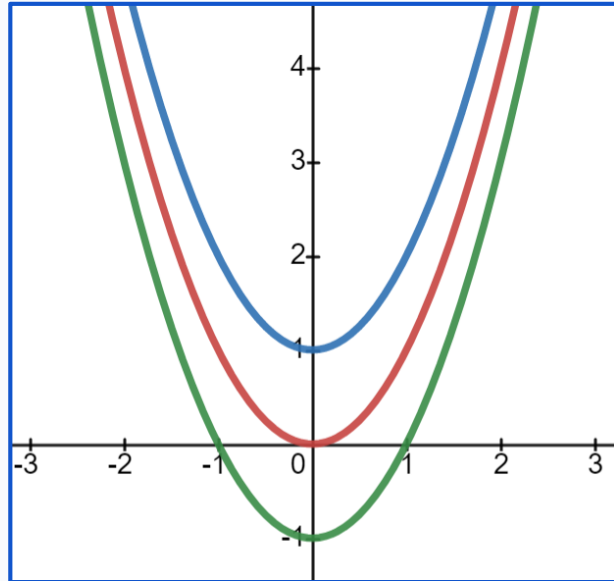


Range of Quadratic Quadratic Equations

6



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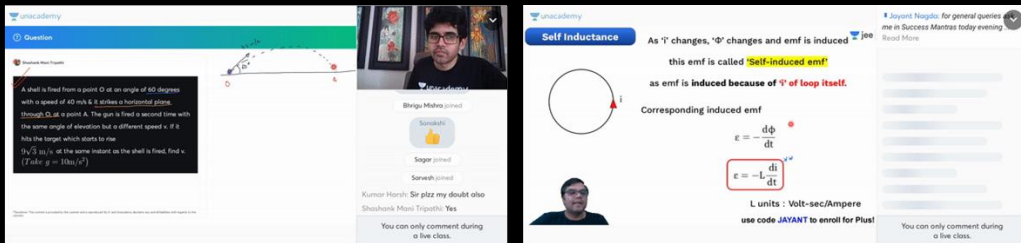
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A shell is fired from a point O at an angle of 60 degrees with a speed of 40 m/s. It strikes a horizontal plane through O at a point A. The gun is fired a second time with the same angle of elevation but a different speed v . If it hits the target 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

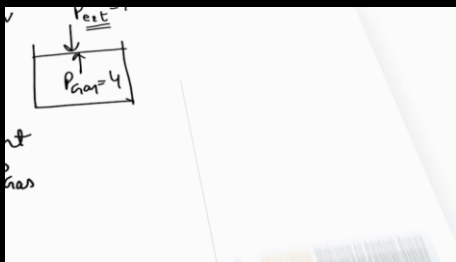
$$\mathcal{E} = -\frac{d\Phi}{dt}$$

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

L units: Volt-sec/Ampere

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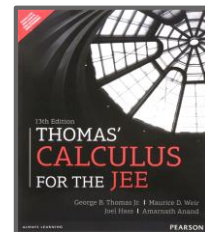
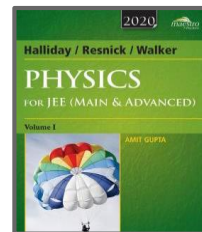
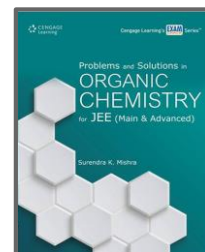
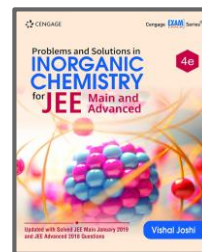
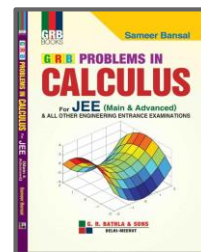
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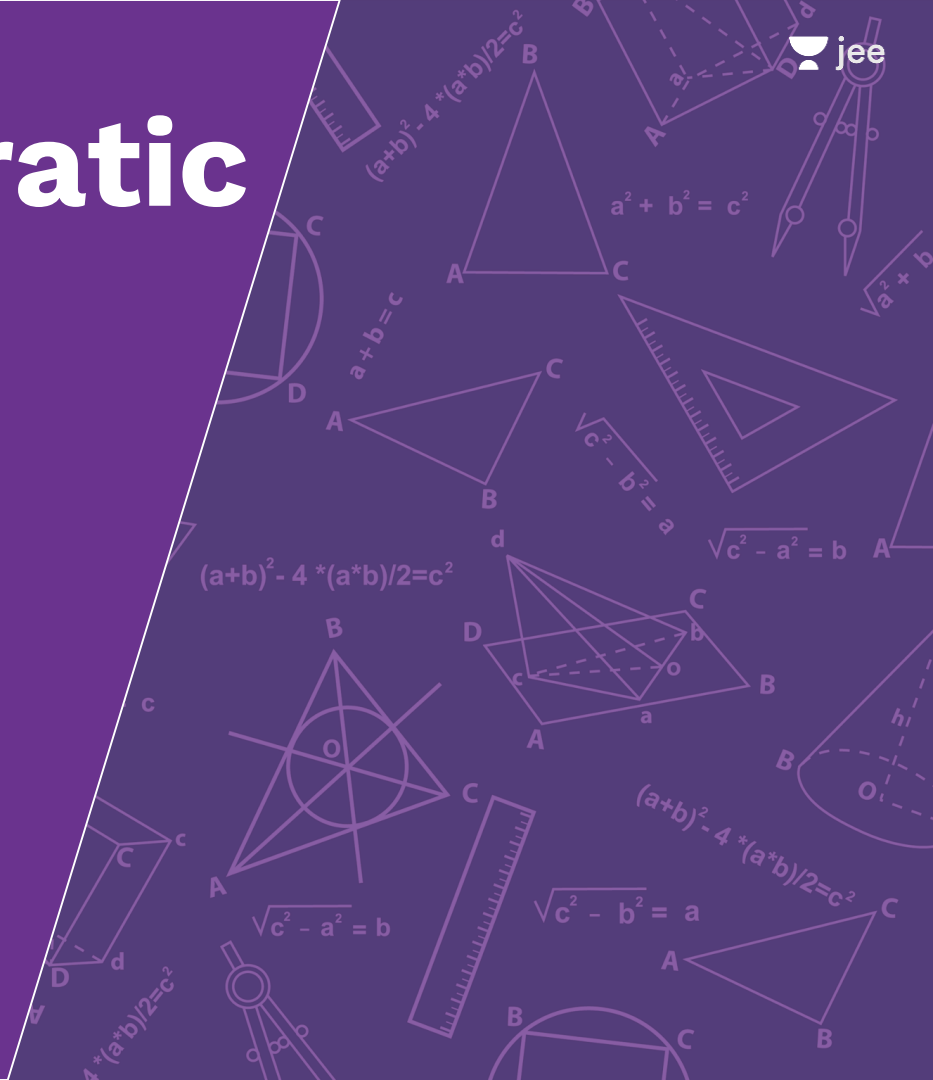


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LET'S BEGIN!!

Range of Quadratic Expression

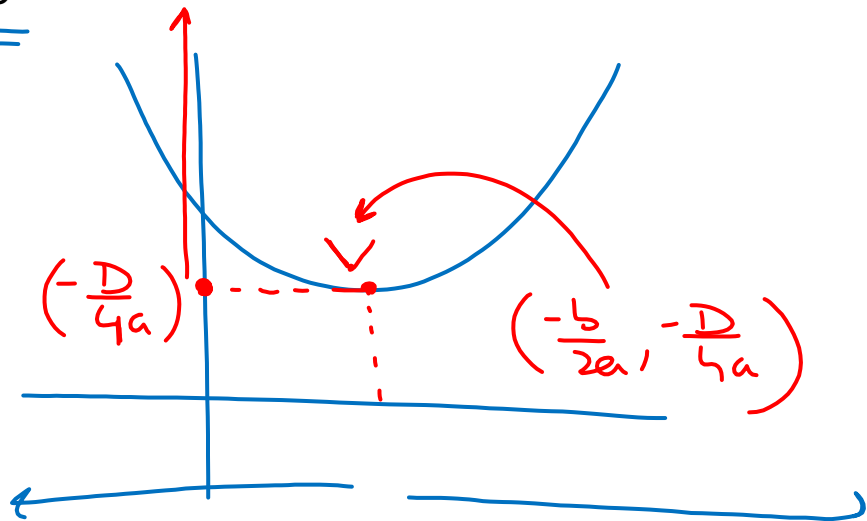




Range of Quadratic Expression (Absolute Range)

For : $y = ax^2 + bx + c$; if $a > 0$

$$f(x) \in \left[-\frac{D}{4a}, \infty \right)$$

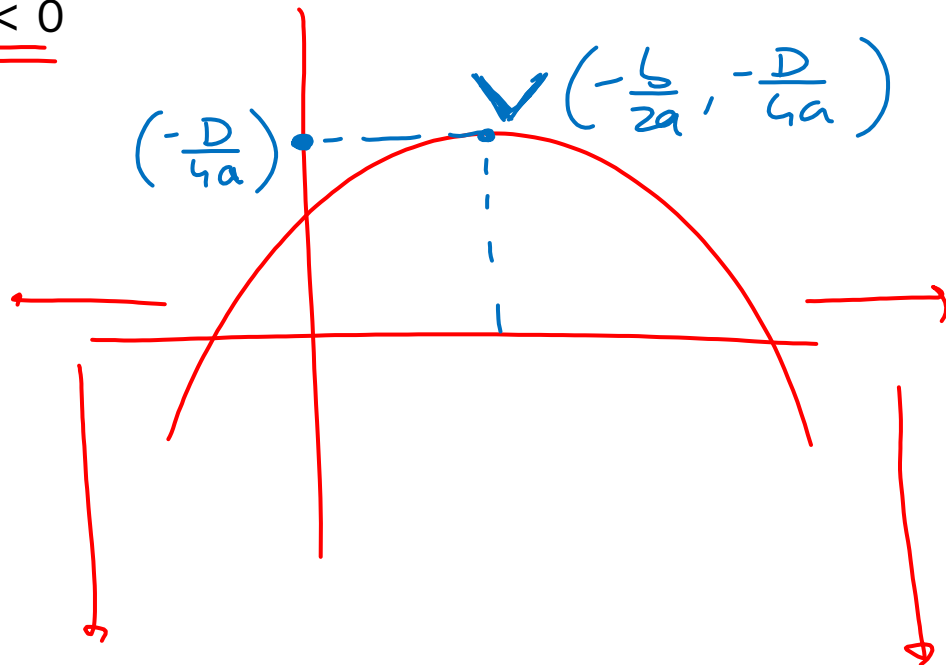




Range of Quadratic Expression (Absolute Range)

For : $y = ax^2 + bx + c$; if $a < 0$

$$f(x) \in \left(-\infty, -\frac{D}{4a}\right]$$





Let $P(x) = ax^2 + bx + 8$ is a quadratic polynomial. If the minimum value of $P(x)$ is 6 when $x = 2$, find the values of a and b .

$$P(x) = ax^2 + bx + 8$$

$$a > 0$$

$$V \equiv \left(-\frac{b}{2a}, -\frac{D}{4a} \right)$$

$$P(2) = 4a + 2b + 8 = 6$$

$$\Rightarrow -\frac{b}{2a} = 2$$

$$\Rightarrow b = -4a$$

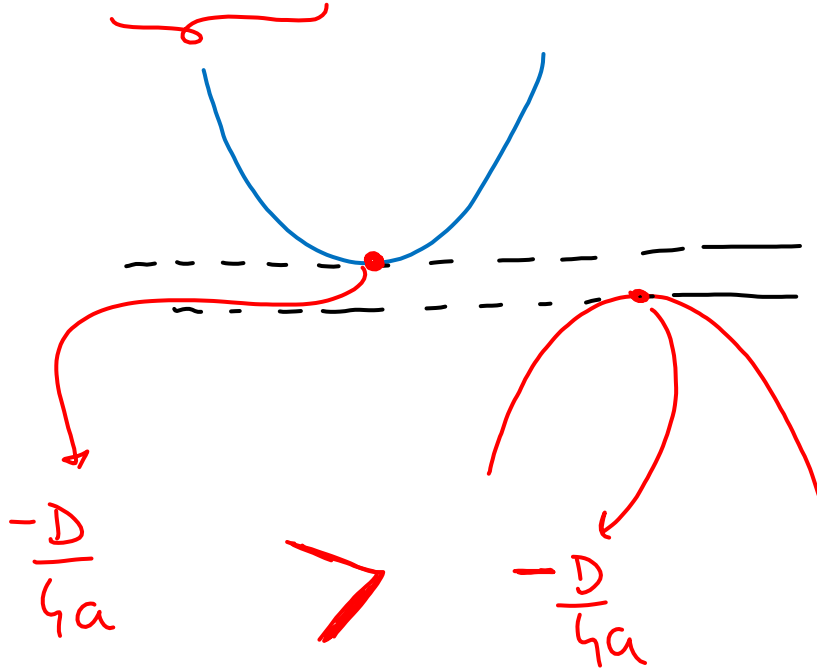
$$\Rightarrow 4a + 2(-4a) + 2 = 0$$

$$\Rightarrow 4a = 2 \Rightarrow a = \frac{1}{2}$$

$$\begin{cases} a = \frac{1}{2} \\ \& \\ b = -2 \end{cases}$$



If min $(x^2 + (a - b)x + (1 - a - b)) > \underline{\underline{\max}} (-x^2 + (a + b)x - (1 + a + b))$,
prove that $a^2 + b^2 < 4$.



$$\frac{-((a-b)^2 - 4(1)(1-a-b))}{\cancel{4(1)}} > \frac{-((a+b)^2 - 4(-1)(-(1+a+b)))}{\cancel{4(-1)}}$$

$$(a-b)^2 - 4(1-a-b) < -(a+b)^2 + 4(1+a+b)$$

$$(a^2 + b^2 - 2ab - 4 + 4a + 4b)$$

$$< -a^2 - b^2 - 2ab + 4 + 4a + 4b$$

$$2(a^2 + b^2) < 2(4)$$

$$\boxed{a^2 + b^2 < 4}$$



Consider the quadratic polynomial $f(x) = x^2 - 4ax + 5a^2 - 6a$.

Find the largest distance between the roots of the equation $f(x) = 0$.

$$f(x) = x^2 - 4ax + 5a^2 - 6a$$

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

$$= \frac{\sqrt{16a^2 - 4(1)(5a^2 - 6a)}}{1}$$

$$= 2\sqrt{4a^2 - (5a^2 - 6a)}$$

$$= 2\sqrt{-a^2 + 6a}$$

Now.

$$g(a) = -a^2 + 6a + 0$$

$$g(a)_{\max} = -\frac{D}{4a}$$

$$= -\frac{(36-0)}{4(-1)}$$
$$= 9$$

$$|\alpha - \beta|_{\max} = 2\sqrt{9}$$
$$= 6$$

Range in Restricted Domain

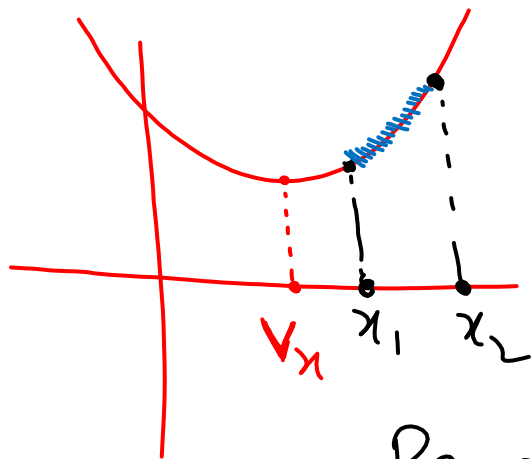




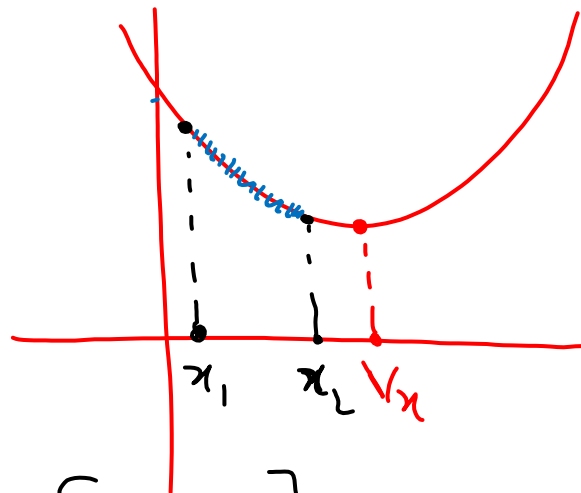
Range in Restricted Domain

For : $y = ax^2 + bx + c$; if $x \in [x_1, x_2]$

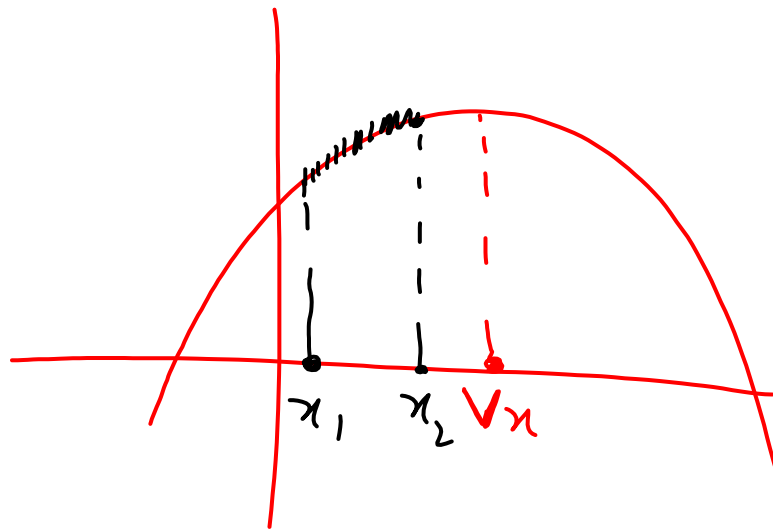
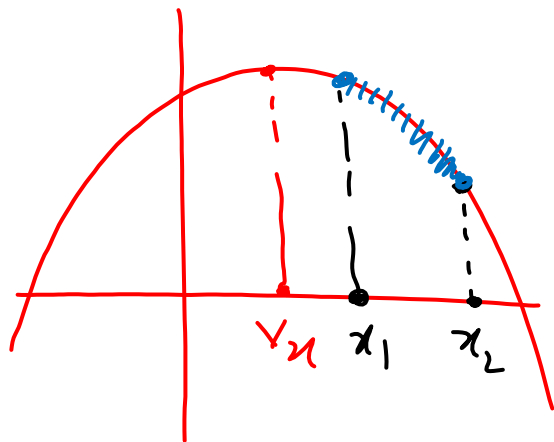
a) If $-\frac{b}{2a} \notin [x_1, x_2]$ then,



$$\max\{f(x_1), f(x_2)\} = M$$
$$\min\{f(x_1), f(x_2)\} = m$$



$$\text{Range} \in [m, M]$$

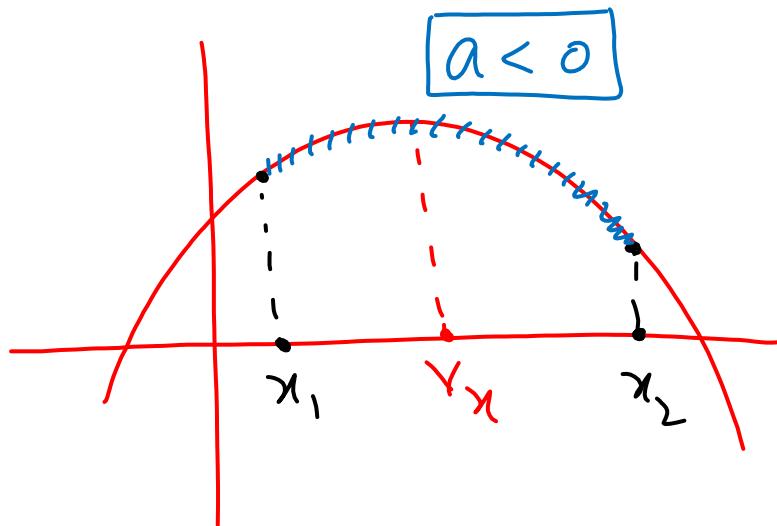
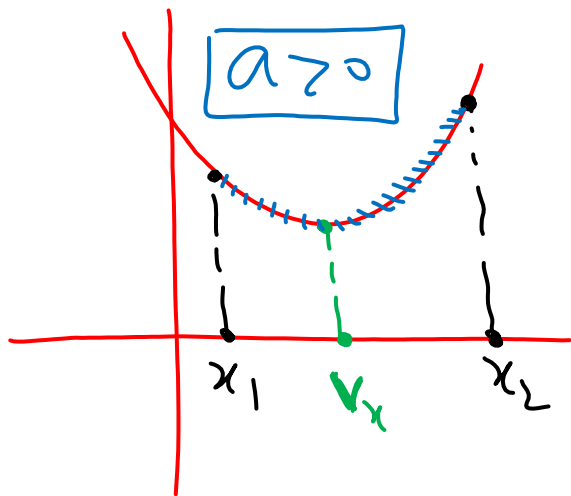




Range in Restricted Domain

For : $y = ax^2 + bx + c$; if $x \in [x_1, x_2]$

b) If $-\frac{b}{2a} \in [x_1, x_2]$ then,





Find the range of $f(x) = x^2 - 5x + 4$

- I. When $x \in [0, 2]$
- II. When $x \in [0, 3]$

$$f(x) = x^2 - 5x + 4$$

$$V_x = \frac{-b}{2a} = -\frac{(-5)}{2(1)} = \left(\frac{5}{2}\right)$$

$$(i) \quad \forall x \notin [0, 2]$$

$$f(0) = 4$$

$$f(2) = 4 - 10 + 4 = -2$$

$$\boxed{\text{Range} \in [-2, 4]}$$

$$\underline{\underline{(ii)}} \quad \forall x \in [0, 3]$$

$$f(0) = 4$$

$$f(3) = 9 - 15 + 4 = -2$$

$$f\left(\frac{5}{2}\right) = \frac{25}{4} - 5\left(\frac{5}{2}\right) + 4$$

$$= \frac{25 - 50 + 16}{4} = -\frac{9}{4}$$

$$\text{Range} \in \left[-\frac{9}{4}, 4\right]$$



Find the difference between the least and greatest values of

$$y = -2x^2 + 3x - 2 \text{ for } x \in [0, 2].$$

$$V_x = -\frac{b}{2a} = -\frac{3}{2(-2)} = \boxed{\frac{3}{4}}$$

$$V_x \in [0, 2]$$

$$f(0) = -2$$

$$f(2) = -8 + 6 - 2 = -4$$

$$f\left(\frac{3}{4}\right) = -2\left(\frac{9}{16}\right) + 3\left(\frac{3}{4}\right) - 2$$

$$b\left(\frac{3}{4}\right) = \frac{-9 + 18 - 16}{8}$$

$$= -\frac{7}{8}$$

$$\text{Range} \in \left[-4, -\frac{7}{8}\right]$$

Difference:

$$-\frac{7}{8} - (-4)$$

$$= -\frac{7}{8} + 4$$

$$= \frac{-7 + 32}{8}$$

$$= \boxed{\frac{25}{8}}$$



Find the range of $y = 3^{x+1} + 2 \cdot 3^{2x} - 2$

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

$$y = 3 \cdot (3^x) + 2 \cdot (3^x)^2 - 2$$

Let $3^x = t \Rightarrow t > 0$

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

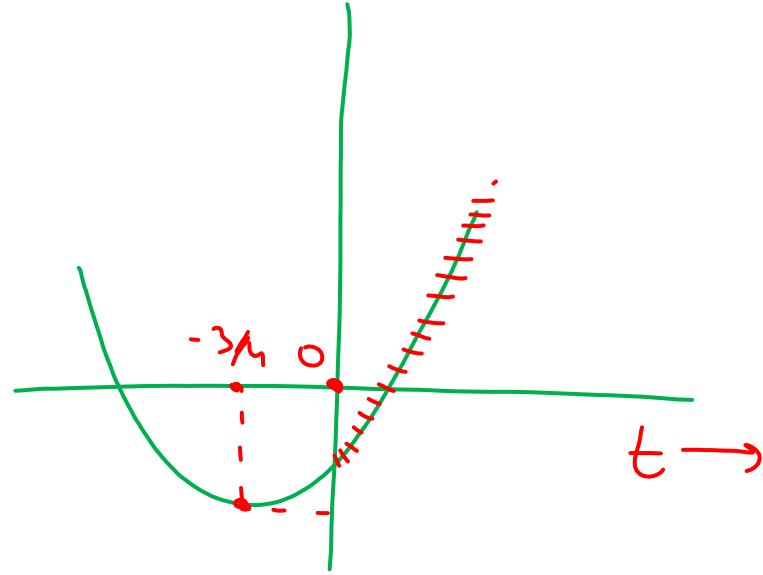
$$y = 2t^2 + 3t - 2$$

$$V_x = \frac{-b}{2a}$$

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

$$= \boxed{-\frac{3}{4}}$$

$$\begin{aligned} t &\in (0, \infty) \\ \forall x &\notin (0, \infty) \\ \therefore \text{Range} &\in (-2, \infty) \\ &\downarrow \\ &-\frac{25}{8} \end{aligned}$$



Range of Rational Functions





Range of Rational Function

$$\frac{ax^2 + bx + c}{px^2 + qx + r} = f$$

$$\frac{Q}{Q} ; \frac{L}{Q} ; \frac{Q}{L}$$



Find the range of $\frac{2x^2 - 3x + 2}{2x^2 + 3x + 2}$ if x is real.

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

$$2yx^2 + 3yx + 2y = 2x^2 - 3x + 2$$

$$\underline{\underline{(2y-2)x^2 + (3y+3)x + (2y-2) = 0}}$$

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

$$D \geq 0$$

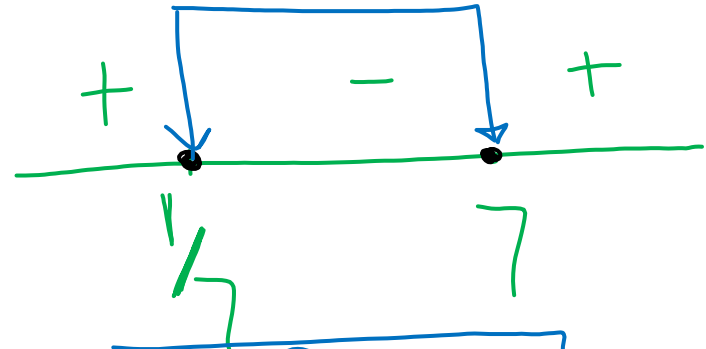
$$(3y+3)^2 - 4(2y-2)^2 \geq 0$$

$$(3y+3)^2 - (4y-4)^2 \geq 0$$

$$\Rightarrow ((3y+3) + (4y-4))((3y+3) - (4y-4)) \geq 0$$

$$\Rightarrow (7y-1)(7-y) \geq 0$$

$$\Rightarrow (7y-1)(y-7) \leq 0$$



$$\Rightarrow y \in \left[\frac{1}{7}, 7 \right]$$



If x is real, the maximum value of $\frac{3x^2 + 9x + 17}{3x^2 + 9x + 7}$ is

A. $\frac{1}{4}$

B. 41

C. 1

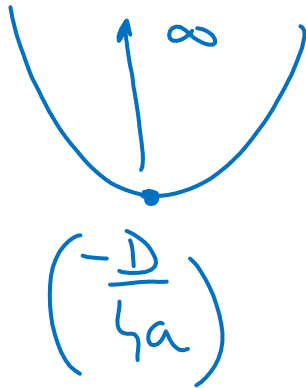
D. $\frac{17}{7}$

$$y = \frac{3x^2 + 9x + 17}{3x^2 + 9x + 7}$$

$$y = \frac{(3x^2 + 9x + 7)}{(3x^2 + 9x + 7)} + \frac{10}{3x^2 + 9x + 7}$$

$$y = 1 + \frac{10}{(3x^2 + 9x + 7)}$$

$$f(x) = 3x^2 + 9x + 7$$



$$f(x)_{\min} = \frac{-D}{4a}$$

$$= \frac{-(81 - 4(3)(7))}{4(3)}$$

$$= \frac{-(81 - 84)}{12}$$

$$= \frac{3}{12} = \frac{1}{4}$$

$$J_{\max} = 1 + \frac{10}{f(x)_{\min}}$$

$$= 1 + \frac{10}{(1/4)}$$

$$= 1 + 40$$

$$= 41$$



Show that the expression $\frac{mx^2 + 3x - 4}{m + 3x - 4x^2}$ will be capable of all values;
when x is real, provided that m has any value between 1 and 7 .

H.W



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6:00 - 7:30 PM



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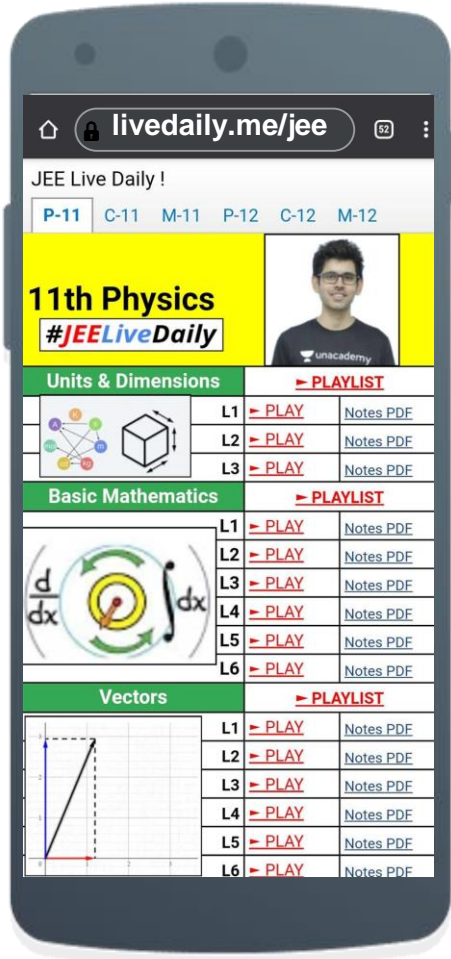
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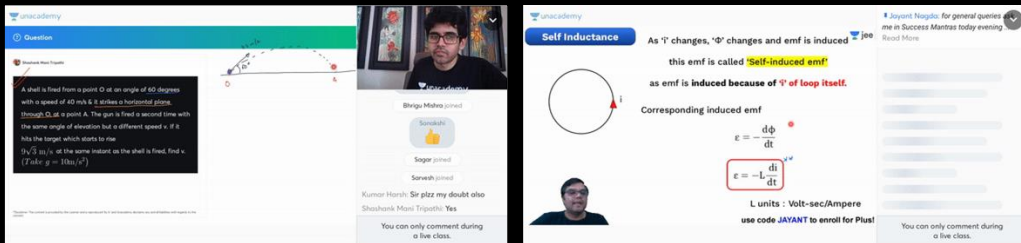
Nishant Sir | Maths

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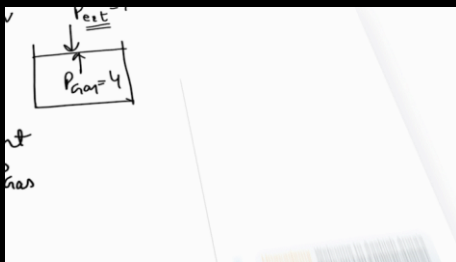
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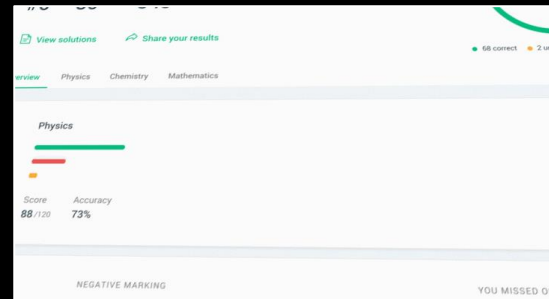
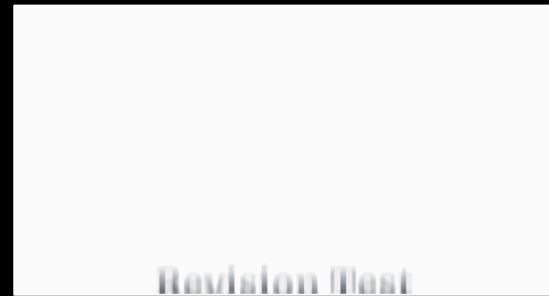


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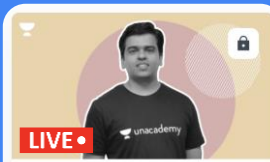


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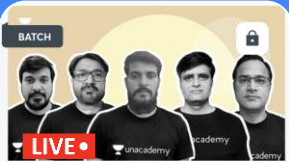
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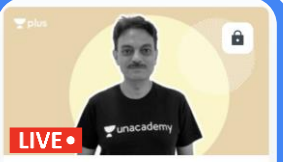
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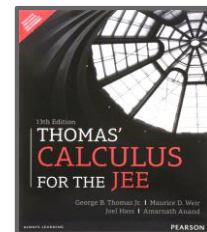
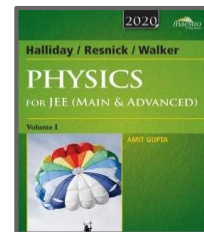
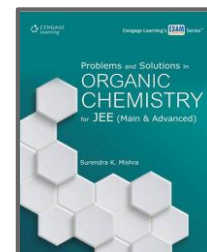
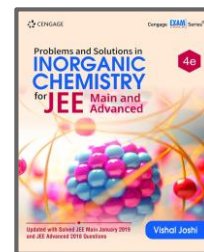
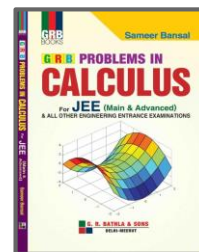
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99.46



Shrish
99.28



Yash Bhaskar
99.10



Subhash Patel
99.02



Ayush Kale
98.85



Ayush Gupta
98.67



Megh Gupta
98.59

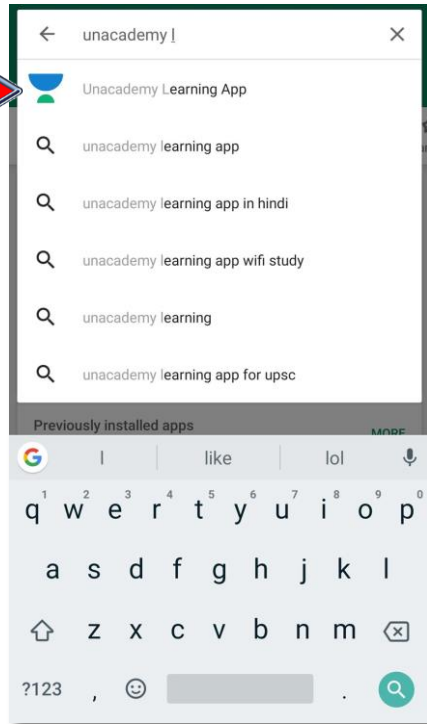


Naman Goyal
98.48

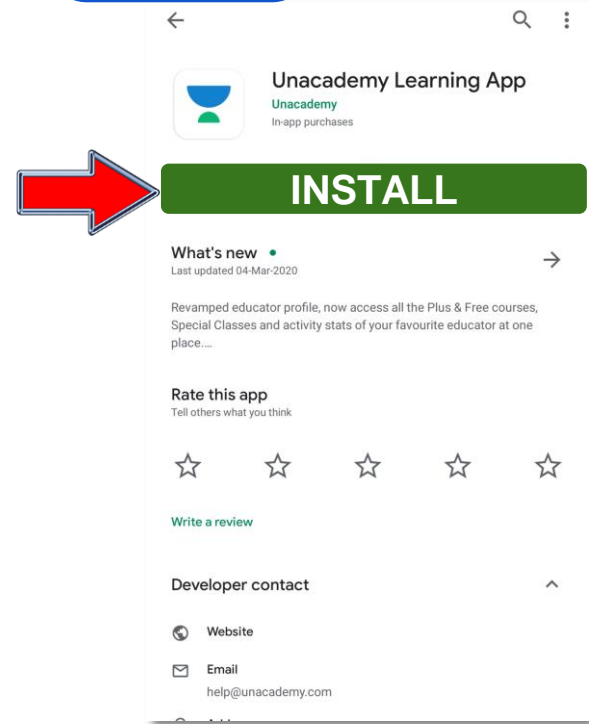


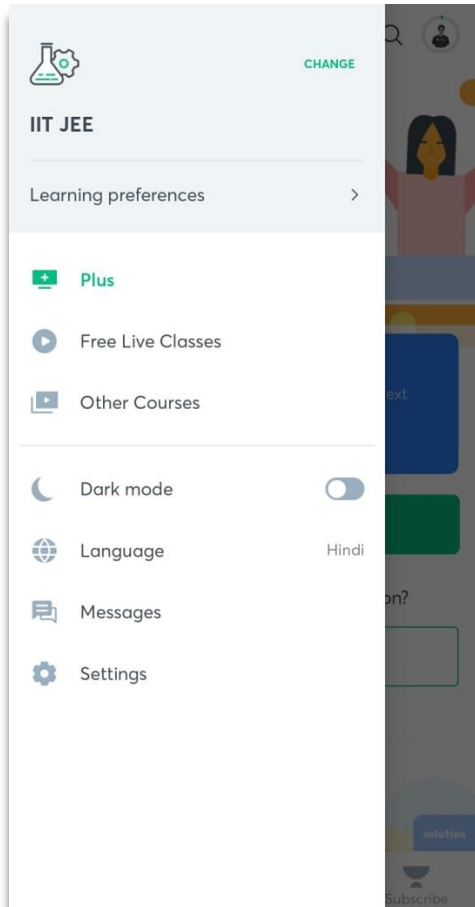
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