JEE MAIN 2025

PAPER DISCUSSION

Sub : Mathematics

Attempt : 01

Date : 29th Jan 2025

Shift : 01

LIVE

STREAMING

Mathematics

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JEE ULTIMATE CRASH COURSE 2025

Number of 7 letter words formed by the numbers "1, 2, 3" such that the sum of digits is 11.

$\underline{1}\ \underline{1}\ \underline{1}\ \underline{1}\ \underline{1}\ \underline{3}\ \underline{3} \rightarrow \frac{7!}{5!\,2!} = 21$

$\underline{1}\ \underline{1}\ \underline{1}\ \underline{1}\ \underline{2}\ \underline{2}\ \underline{3} \rightarrow \frac{7!}{4!\,2!} = \frac{7 \times \cancel{6}^{3} \times 5}{\cancel{2}} = 7 \times 15 = 105$

$\underline{1}\ \underline{1}\ \underline{1}\ \underline{2}\ \underline{2}\ \underline{2}\ \underline{2} \rightarrow \frac{7!}{3!\,4!} = \frac{7 \times 6 \times 5}{3!} = 35$

$\underline{\text{Ans} = 161}$

(D)

6 letter word formed with the letters from "Maths" such that the letters selected appear atleast twice.

MATHS

6A	${}^5C_1 \times 1$
4A & 2A	${}^5C_2 \times \frac{6!}{4!2!} \times 2$
3A & 3A	${}^5C_2 \ \frac{6!}{3!3!}$
2A & 2A & 2A	${}^5C_3 \times \frac{6!}{2!2!2!}$
	Ans = Sum

MMMMAA

AAAAMM

MMMAAA

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(D)

$\lim_{n\to\infty} \sum_{k=1}^{n} \frac{k^3+6k^2+11k+5}{(k+3)!}$ is equal to

$$\frac{(K^3+6K^2+11K+6)-1}{(K+3)!}$$

$$\frac{(K+1)(K+2)(K+3)-1}{(K+3)!}$$

$$T_K = \frac{1}{K!} - \frac{1}{(K+3)!}$$

$$\left(\underbrace{\frac{1}{1!}+\frac{1}{2!}+\frac{1}{3!}}+\underbrace{\cancel{\frac{1}{4!}+\ldots\infty}}\right)-\left(\cancel{\frac{1}{4!}+\frac{1}{5!}\ldots}\right)$$

$$\downarrow$$

$$\frac{1}{1}+\frac{1}{2}+\frac{1}{6}$$

$$\frac{6+3+1}{6} = 10/6 = 5/3$$

$$(K+3)! = (K+3)(K+2)(K+1)K!$$

M

Sum of the first three terms of an AP with integral common difference is 54 and sum of the first twenty terms lies between 1600 to 1800, find a_{11}.

(A) 108

(B) 90 ✓

(C) 111

(D) 115

$a-d,\ a,\ a+d$

$3a = 54$

$\Rightarrow a = 18$

First term : $18-d$

$1600 < S_{20} < 1800$

$16\cancel{0} < \frac{\cancel{20}}{\cancel{2}}\left[2(18-d) + 19 \times d\right] < 18\cancel{0}$

$160 < 36 - 2d + 19d < 180$

$160 < 17d + 36 < 180$

$124 < 17d < 144$

$\boxed{d = 8}$ ✓

First term : 10

$a_{11} = 10 + 10d$

$10 + 10 \times 8$

$= 90$

(E)

$\bar{a} = 2i - j + 3k, \bar{b} = 3i - 5j + k$, if $\boxed{\bar{a} \times \bar{c} = \bar{c} \times \bar{b}}$ and $(\bar{a} + \bar{c}) \cdot (\bar{b} + \bar{c}) = 168$ then maximum value of $|c|^2 =$ .... $77(-2)^2$

$\vec{a}+\vec{b} = 5\hat{i} - 6\hat{j} + 4\hat{k}$

$\vec{a}\cdot\vec{b} = 6+5+3 = 14$

$\vec{a}\times\vec{c} - \vec{c}\times\vec{b} = 0$

$\vec{a}\times\vec{c} + \vec{b}\times\vec{c} = 0$

$(\vec{a}+\vec{b})\times\vec{c} = 0$

$\vec{c} = \lambda(\vec{a}+\vec{b})$

$\vec{c} = \lambda(5\hat{i} - 6\hat{j} + 4\hat{k})$

$|\vec{c}|^2 = \lambda^2(25+36+16)$

$\lambda^2[77]$

$\vec{a}\cdot\vec{b} + \vec{c}\cdot\vec{c} + (\vec{a}+\vec{b})\cdot\vec{c} = 168$

$\underbrace{\vec{a}\cdot\vec{b}} + |\vec{c}|^2 + \lambda|\vec{a}+\vec{b}|^2 = 168$

$14 + 77\lambda^2 + \lambda\times 77 = 168$

$77\lambda^2 + 77\lambda = 154$

$\lambda^2 + \lambda = 2$

$\lambda = 1, -2$

$L_1 = \frac{x-1}{1} = \frac{y-2}{-1} = \frac{z-1}{2} = \lambda$, $L_2: \frac{x+1}{-1} = \frac{y-2}{2} = \frac{z}{1} = \mu$

Let the line L_3 passes through the point (α, β, γ) perpendicular to L_1 and L_2 and L_3 intersect line L_1 then $|5\alpha - 11\beta - 8\gamma|$.

(A) 25 ✓

(B) 18

(C) 16

(D) 20

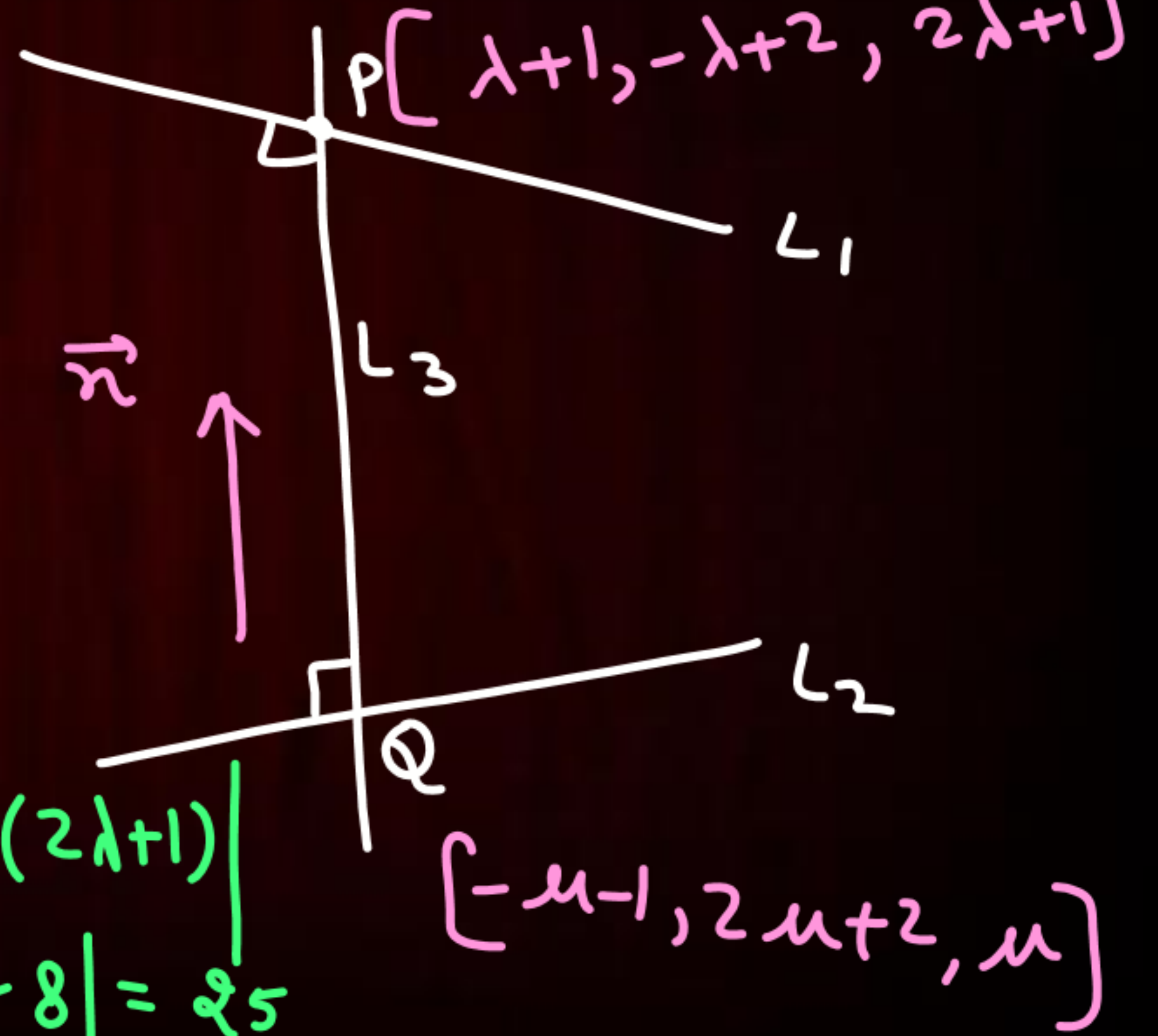
$P(\alpha, \beta, \gamma)$

$\vec{n} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 1 & -1 & 2 \\ -1 & 2 & 1 \end{vmatrix}$

$\alpha = \lambda + 1, \quad \beta = -\lambda + 2, \quad \gamma = 2\lambda + 1$

$|5\alpha - 11\beta - 8\gamma| = |5(\lambda+1) - 11(-\lambda+2) - 8(2\lambda+1)|$

$|\cancel{5\lambda} + 5 + \cancel{11\lambda} - 22 - \cancel{16\lambda} - 8| = 25$



The minimum value of n for which the number of integer terms in the binomial expansion of $(7^{1/3} + 11^{1/12})^n$ is 183, is

$$T_{r+1} = {}^nC_r \left(7^{1/3}\right)^{n-r} \cdot \left((11)^{1/12}\right)^r$$

$$= {}^nC_r\, 7^{\frac{n-r}{3}} \cdot 11^{r/12}$$

$r \rightarrow$ multiple of 12

$r = 0, 12, 12\times 2, \ldots 12\times 182$

$$\boxed{n = 12\times 182}$$

(E)

$$80\int_0^{\frac{\pi}{2}} \frac{\sin x+\cos x}{9+16\sin 2x}dx$$

Consider $(\sin x-\cos x)^2 = 1-\sin 2x$

$\sin 2x = 1-(\sin x-\cos x)^2$

$$80\int_0^{\pi/2} \frac{(\sin x+\cos x)\,dx}{9+16\left[1-(\sin x-\cos x)^2\right]}$$

$$80\int \frac{(\sin x+\cos x)\,dx}{25-16(\sin x-\cos x)^2}$$

$\boxed{\sin x-\cos x = t}$

$$80\int_{-1}^{1} \frac{dt}{25-16t^2}$$

$$\frac{80\times 2}{16}\int_0^1 \frac{dt}{\frac{25}{16}-t^2}$$

$$10\int_0^1 \frac{dt}{\frac{25}{16}-t^2}$$

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If R be a relation defined on $\underbrace{(0, \pi/2)}$ such that $xRy \Rightarrow \sec^2 x - \tan^2 y = 1$, then the relation.

$\sec^2 x = 1 + \underbrace{\tan^2}y$

$\sec^2 x = \sec^2 y$

$\sec x = \sec y$

$\Rightarrow \boxed{x = y}$

(A) Equivalence relation

(B) Reflexive and transitive only

(C) Symmetric and transitive only

(D) Neither reflexive nor transitive

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Area enclosed by $y \geq |x-1|, y+|x| \leq 3, x^2 \leq 2y-3$ is A, then $6A$ is (in sq. units)

$y \leq 3-|x|$

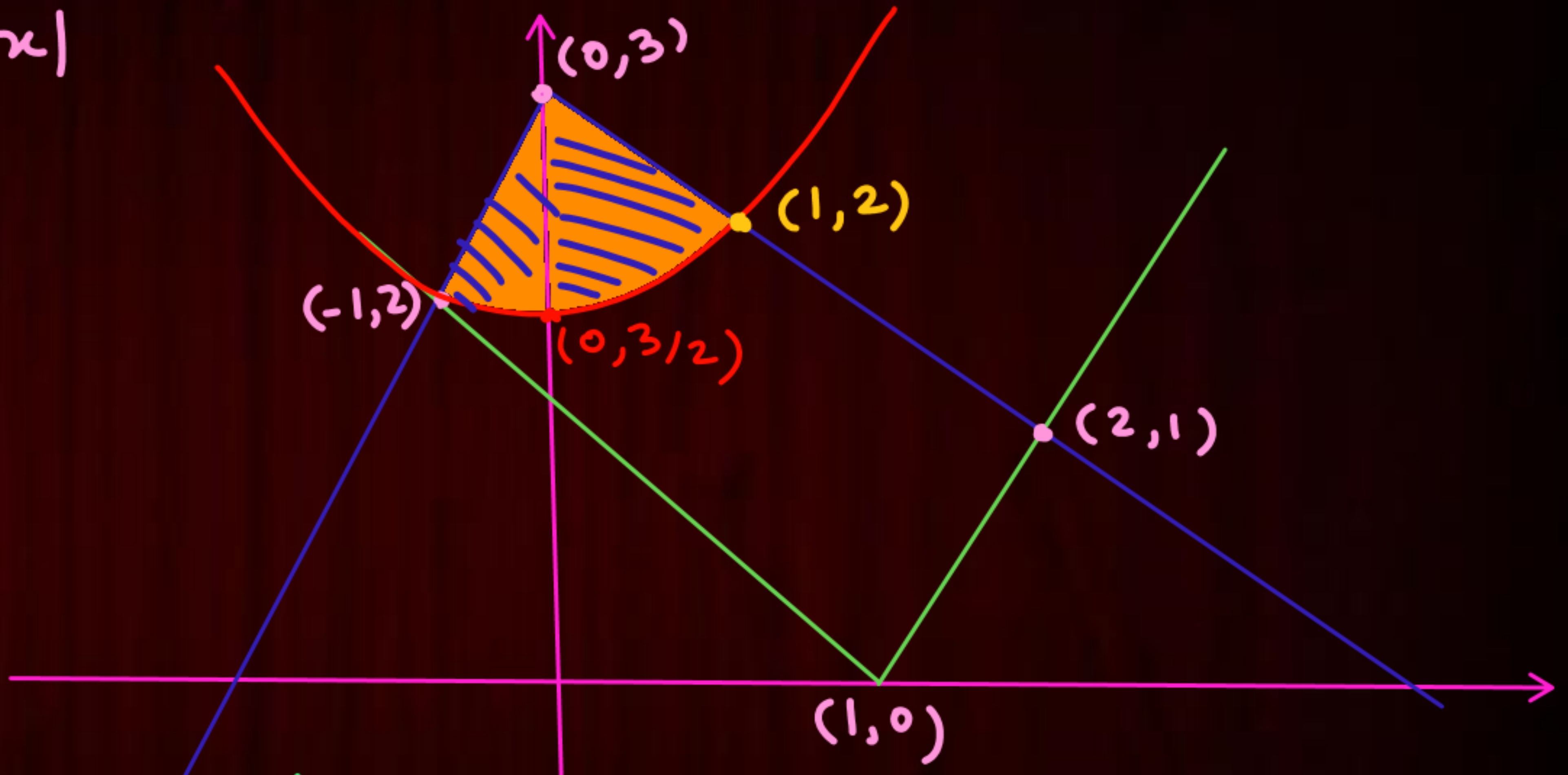
$\boxed{x^2 \geq 2y-3}$

$x^2 = 2y-3$

$x^2+3 = 2y$

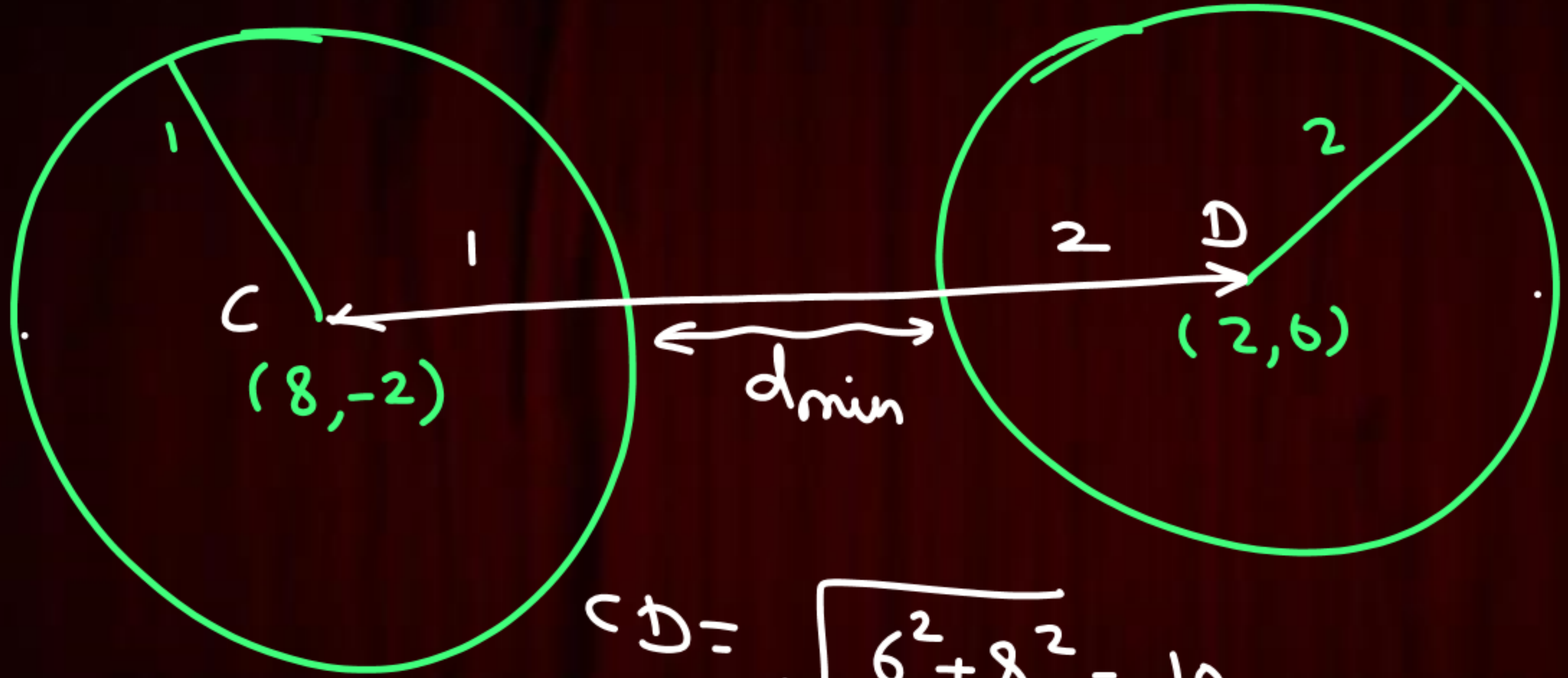
$\boxed{y = \frac{x^2+3}{2}}$

$(-1,2)$



Ans $= 2\int_0^1 \left[(3-x) - \left(\frac{x^2+3}{2}\right)\right] dx$

$|z_1 - 8 + 2i| \leq 1$ and $|z_2 - 2 - 6i| \leq 2$ then minimum value of $|z_1 - z_2|$ is equal to



$CD = \sqrt{6^2 + 8^2} = 10$

$d_{min} = 10 - (1+2)$

$= 7$

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If $\cos^{-1}x = \pi + \underbrace{\sin^{-1}x} + \underbrace{\sin^{-1}(2x-1)}$, then find the sum of all values of 'x'.

$x \in [-1,1]$ & $-1 \le 2x-1 \le 1$

$0 \le 2x \le 2$

$0 \le x \le 1 \rightarrow \cos^{-1}x \in [0, \pi/2]$

domain: $x \in [0,1]$

RHS at $x=0$: $\pi + \sin^{-1}0 + \sin^{-1}(-1) = \pi/2$

at $x=1$ $\pi + \sin^{-1}1 + \sin^{-1}1 = 2\pi$

LHS: $[0, \pi/2]$

$\Rightarrow \boxed{x=0}$ LHS = RHS = $\pi/2$

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Adv.

The minimum value of p such that

$$\lim_{x\to 0^+} \underbrace{x\left(\left[\frac{1}{x}\right]+\left[\frac{2}{x}\right]+\ldots+\left[\frac{p}{x}\right]\right)}_{L_1} - \underbrace{x^2\left(\left[\frac{1^2}{x^2}\right]+\left[\frac{2^2}{x^2}\right]+\ldots+\left[\frac{9^2}{x^2}\right]\right)}_{L_2} \geq 1, \text{ is equal to}$$

$$\lim_{x\to 0} x\left[\frac{r}{x}\right]$$

$$x\left(\frac{r}{x}-\left\{\frac{r}{x}\right\}\right)$$

$$\lim_{x\to 0}\left(\cancel{x}\frac{r}{\cancel{x}} - \underbrace{\underbrace{x}_{0}\underbrace{\left\{\frac{r}{x}\right\}}_{(0,1)}}_{0}\right)$$

$$= r$$

$$L_1 = \frac{p(p+1)}{2}$$

L_2 : $x^2\left[\frac{r^2}{x^2}\right]$

$$x^2\left(\frac{r^2}{x^2}-\left\{\frac{r^2}{x^2}\right\}\right)$$

$$r^2 - \underbrace{x^2}_{0}\underbrace{\left\{\frac{r^2}{x^2}\right\}}_{(0,1)}$$

$$r^2$$

$$L_2: 1^2+2^2+\ldots+9^2 = \frac{\cancel{9}^{3}\times\cancel{10}^{5}\times 19}{\cancel{6}} = 15\times 19$$

$$\frac{P(P+1)}{2} - 15\times 19 \geq 1$$

$$\frac{P(P+1)}{2} \geq 15\times 19 + 1$$

$$\boxed{P(P+1) \geq 572}$$

$$\boxed{P = 24}$$

Thank

YOU