PAPER SOLUTION

From Meerut

JEE MAIN 2025

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29	1st

Aryan Agarwal
Founder and CEO
CVPS INTEGRATED STAR COURSE

CITY VOCATIONAL PUBLIC SCHOOL

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LET'S SHINE TOGETHER

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Disclaimer: This academic course is exclusively for day boarders only

Rank Predictor

Question Paper

#Q. A triangle is formed by three lines $2x + 3y - 5 = 0, x + y - 1 = 0, 3x + 4y - 7 = 0$. Let (h, k) be the image of the centroid of ΔABC in the line $2x + 4y - 7 = 0$, then $h^2 + k^2 + hk$ is

A $\frac{903}{225}$

B $\frac{223}{225}$

C $\frac{100}{23}$

D $\frac{10006}{225}$

Ans. (A)

#Q. Two parabolas having common focus at $(4,3)$ intersect at points A and B. Find the value of $(AB)^2$ give that directrices of these parabolas are along X-axis and Y-axis respectively.

Ans. (192)

$1^2+2^2+\cdots+9^2 = \frac{9(10)(19)}{6}$

#Q. The minimum value of p ∈ N such that

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

$f(x)$

$$\frac{1}{x}-1 < \left[\frac{1}{x}\right] \leq \frac{1}{x}$$

$$\frac{2}{x}-1 < \left[\frac{2}{x}\right] \leq \frac{2}{x}$$

$$\frac{p}{x}-1 < \left[\frac{p}{x}\right] \leq \frac{p}{x}$$

$$\left(\frac{p(p+1)}{2x}-p\right)x < f(x) \leq \left(\frac{p(p+1)}{2x}\right)x$$

$x\to 0$

$$\frac{p(p+1)}{2}-0 \qquad \frac{p(p+1)}{2}$$

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

$$\frac{P(P+1)}{2} - \frac{3\cancel{6}(10)(19)}{\cancel{6}_2} \geq 1$$

$$P^2 + P - 570 \geq 2$$

$$\boxed{P^2 + P - 572 \geq 0}$$

$$P(P+1) \geq 572.$$

✓ $P = 24$ $\quad 24 \times 25 = 600$

✗ $P = 23$ $\quad 23 \times 24 < \boxed{572}$

Ans. (24)

JEE MAIN 2025 LIVE PAPER DISCUSSION

#Q. If $\begin{vmatrix} \sin^2 x & 1+\cos^2 x & \sin 4x \\ 1+\sin^2 x & \cos^2 x & \sin 4x \\ \sin^2 x & \cos^2 x & 1+\sin 4x \end{vmatrix} = L$ and $L_{min} = m$ and $L_{max} =$ M, then $|M^4 - m^4|$ is

(A) 76

(B) 80

(C) 78

(D) 79

$|1-81|$

$$L = \begin{vmatrix} \sin^2 x & 1+\cos^2 x & \sin 4x \\ 1 & -1 & 0 \\ -1 & 0 & 1 \end{vmatrix}$$

$$\sin^2 x(-1) - (1+\cos^2 x)(1) + \sin 4x(-1)$$

$$-\sin^2 x - 1 - \cos^2 x - \sin 4x = -2 - \sin 4x$$

max $= -1$

min $= -3$.

Ans. (B)

JEE MAIN 2025 LIVE PAPER DISCUSSION

#Q. If α, β are real numbers such that $sec^2(tan^{-1}\alpha) + cosec^2(cot^{-1}\beta) = 36$ and $\alpha + \beta = 8$ where $\alpha > \beta$, then $(\alpha^3 + \beta^3)$ is equal to

A. 150

B. 148

C. 152

D. 146

$1 + \tan^2(\tan^{-1}\alpha) + 1 + \cot^2(\cot^{-1}\beta) = 36$

$1 + \alpha^2 + 1 + \beta^2 = 36$

$\alpha^2 + \beta^2 = 34 = 25 + 9$

$\alpha + \beta = 8$

$\alpha = 5, \beta = 3$

$\alpha^3 = 125$

$\beta^3 = 27$

Ans. (C)

JEE MAIN 2025 LIVE PAPER DISCUSSION

MMAATH

#Q. How many 6 letter words can be formed using the word "MATHS" such that any letter can be used maximum two times?

(A) 9824

(B) 10000

(C) 8100

(D) 6400

MMAATT

2 same, 4 different

$${}^5C_1 \times \frac{6!}{2!} = 5 \times 360 = 1800$$

2 same, 2 same, 2 different

$${}^5C_2 \times {}^3C_2 \times \frac{6!}{2!2!}$$

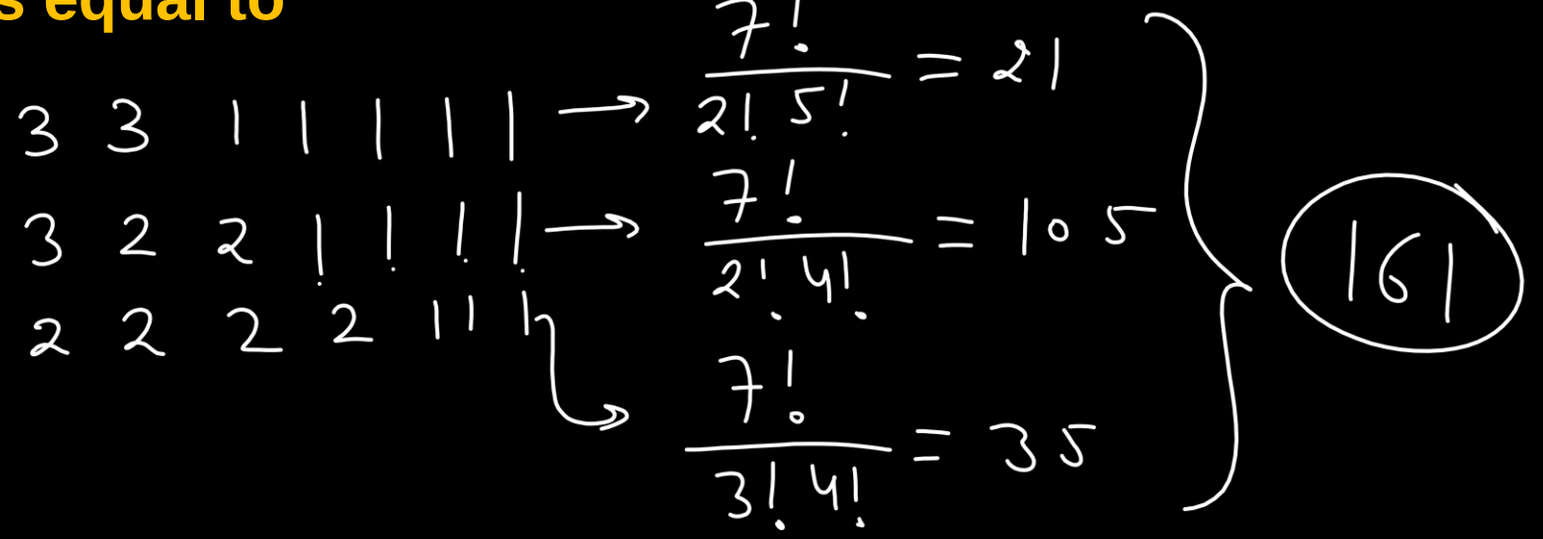
$$= 10 \times 3 \times 180 = 5400$$

2 same, 2 same, 2 same

$${}^5C_3 \times \frac{6!}{2!2!2!} = 10 \times 90 = 900$$

Ans. (C)

#Q. Number of 7-digit number made with the digits 1, 2, 3 such that sum of the digits is 11 is equal to



Ans. (161)

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

$$sec^2x = 1 + tan^2y$$
$$1 + tan^2x = 1 + tan^2y$$
$$tan^2x = tan^2y$$
$$tan x = tan y$$
$$x = y \quad \therefore$$

(A) Neither reflexive nor transitive

(B) Symmetric and transitive only

(C) Reflexive and transitive only

(D) ✓ Equivalence relation

Ans. (D)

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#Q. If z_1 lies on $|z-8+2i|=1$ and z_2 lies on $|z-2-6i|=2$, then $|z_1-z_2|_{min}$ is (where $i=\sqrt{-1}$)

A. 9

B. 7

C. 10

D. 8

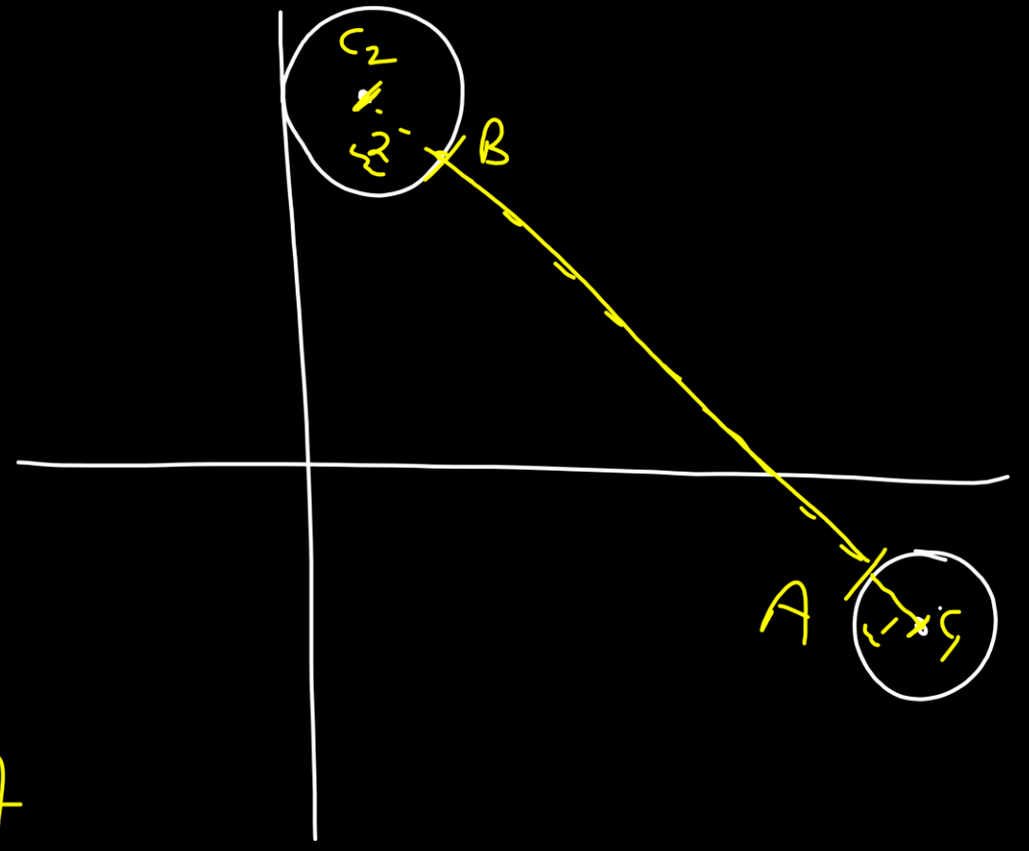
$C_1(8,-2)$, $r_1=1$

$C_2(2,6)$, $r_2=2$

$C_1C_2=\sqrt{36+64}$

$=10$

$AB=10-3=7$



Ans. (B)

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

$$\frac{\pi}{2} - \sin^{-1}x = \pi + \sin^{-1}x + \sin^{-1}(2x-1)$$

$$-\frac{\pi}{2} = 2\sin^{-1}x + \sin^{-1}(2x-1)$$

≥ 0 $\quad \geq -\frac{\pi}{2}$

$\geq -\frac{\pi}{2}$

$x = 0$

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

$0 \leq 2x \leq 2$

$0 \leq x \leq 1$

A. $\frac{3}{2}$

B. $\frac{1}{2}$

C. 0 ✓

D. 1

Ans. (C)

JEE MAIN 2025 LIVE PAPER DISCUSSION

#Q. Sum of first three terms of an AP with integral common difference is 54 and sum of first 20 terms lies between 1600 to 1800, find a_{11}

$a + a + d + a + 2d = 54$

$a + d = 18 \Rightarrow a = 18 - d$

(A) 115

(B) 111

(C) 90

(D) 108

$1600 < S_{20} < 1800$

$1600 < 10[2a + 19d] < 1800$

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

$124 < 17d < 144$

$d = 8$

$a = 10$

$a_{11} = a + 10d$

$= 10 + 10 \times 8$

$= 90$

Ans. (C)

JEE MAIN 2025 LIVE PAPER DISCUSSION

$x^3+6x^2+11x+6=(x+1)(x+2)(x+3)$

#Q. $\lim\limits_{n\to\infty}\sum_{k=1}^{n}\frac{k^3+6k^2+11k+5}{(k+3)!}$ **is equal to**

$$\lim_{n\to\infty}\sum\frac{(k+1)(k+2)(k+3)}{(k+3)(k+2)(k+1)k!}-\frac{1}{(k+3)!}$$

A $\frac{7}{3}$

B 3

C $\frac{8}{3}$

D $\frac{5}{3}$ ✓

$$\lim_{n\to\infty}\sum_{k=1}^{n}\left(\frac{1}{k!}-\frac{1}{(k+3)!}\right)$$

$$=\left(\frac{1}{1!}-\frac{1}{4!}\right)+\left(\frac{1}{2!}-\frac{1}{5!}\right)+\left(\frac{1}{3!}-\frac{1}{6!}\right)+\left(\frac{1}{4!}-\frac{1}{7!}\right)+\cdots$$

$$=1+\frac{1}{2}+\frac{1}{6}=\frac{6+3+1}{6}=\frac{10}{6}$$

Ans. (D)

$y = 3 - |x|$ $\quad 2y = x^2 + 3$

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

$3 + x = 1 - x$

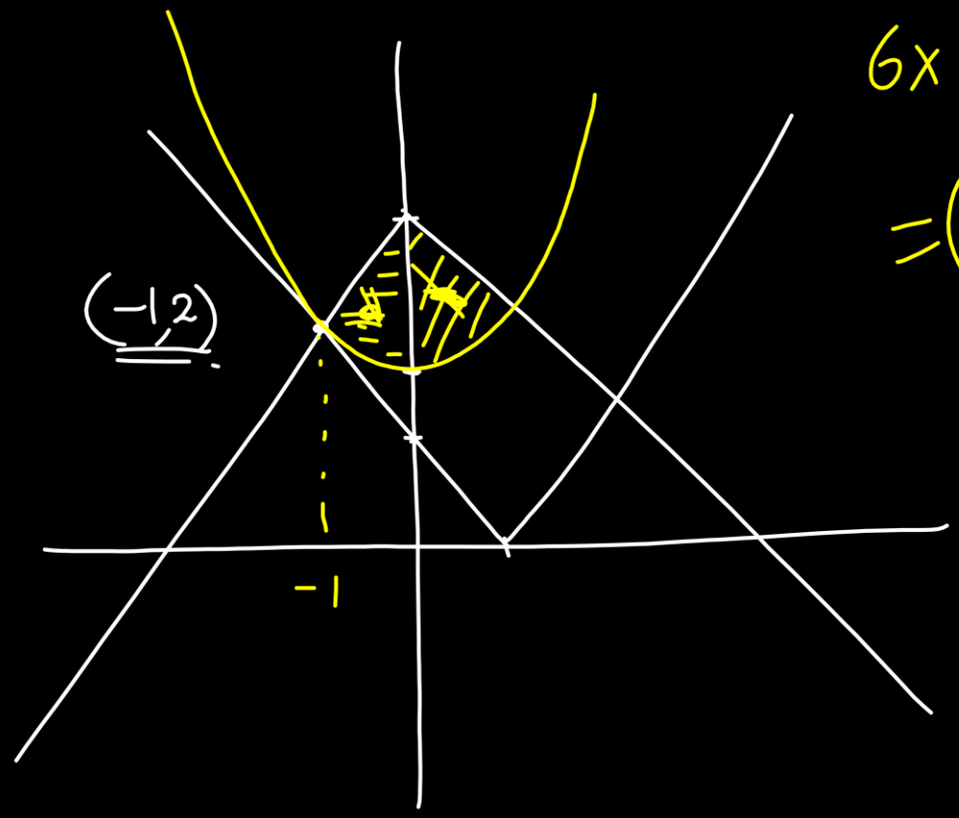
$2x = -2$

$x = -1$

$$2\int_{-1}^{0}\left(3+x\right) - \left(\frac{x^2+3}{2}\right)dx$$

$$\int_{-1}^{0}\left(6 + 2x - x^2 - 3\right)dx$$

$$\int_{-1}^{0}\left(3 + 2x - x^2\right)dx$$



$6 \times \frac{5}{3} = 10$

$$A = \int_{-1}^{0} (3 + 2x - x^2)\, dx$$

$$= \left[3x + x^2 - \frac{x^3}{3} \right]_{-1}^{0}$$

$$= 0 - \left[-3 + 1 + \frac{1}{3} \right]$$

$$= 2 - \frac{1}{3} = \frac{5}{3}$$

Ans. (10)

#Q. 80 $\int_0^{\pi/2} \frac{\sin x+\cos x}{9+16\sin 2x}\,dx$

~~4 80x $\frac{1}{20}$ ln 9~~

4 ln 9

A. $8\ln 9$

B. $8\ln 3$

C. $8\ln 4$

D. $8\ln 8$

$\sin x - \cos x = t$

$(\cos x + \sin x)\,dx = dt$

$1 - \sin 2x = t^2$

$\sin 2x = 1 - t^2$

$$\int_{-1}^{1} \frac{dt}{9+16(1-t^2)}$$

$$2\int_0^1 \frac{dt}{(5)^2-(4t)^2} = \cancel{2}\cdot\frac{1}{\cancel{2}\times 5\times 4}\ln\left|\frac{5+4t}{5-4t}\right|_0^1$$

$$= \frac{1}{4\times 5}\left[\ln 9 - \ln 1\right] = \frac{1}{20}\ln 9$$

Ans. (B)

JEE MAIN 2025 LIVE PAPER DISCUSSION

#Q. The minimum value of n for which the number of integral terms in the binomial expansion of $\left(7^{1/3}+11^{1/12}\right)^n$ is 183, is

- **A** 2184
- **B** 2183
- **C** 2185
- **D** 2182

$${}^{n}C_{r}\, 7^{\frac{n-r}{3}} \cdot (11)^{\frac{r}{12}}$$

$r \rightarrow$ multiple of 12

$n-r \rightarrow$ multiple of 3

$r = 0, 12, 24, - - -,$

$= 0\times12, 1\times12, 2\times24, - - -, 182\times12$

$\left[\frac{n}{12}\right] + 1 = 183$

2184

Ans. (A)

$\bar{a}+\bar{b}=5\hat{i}-6\hat{j}+4\hat{k}$ $\quad 25+36+16$

#Q. $\bar{a}=2i-j+3k, \bar{b}=3i-5j+k$, *if* $\bar{a}\times\bar{c}=\bar{c}\times\bar{b}$ *and* $(\bar{a}+\bar{c})\cdot(\bar{b}+\bar{c})=168$.

Then $|c|^2=$ _____.

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

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

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

$\lambda^2+\lambda=2$

$\lambda=1,-2$

$|\vec{c}|^2=\lambda^2(77)$

$\vec{a}.\vec{b}+\vec{a}.\vec{c}+\vec{b}.\vec{c}+\vec{c}.\vec{c}=168$

$14+(\vec{a}+\vec{b}).\lambda(\vec{a}+\vec{b})+\lambda(\vec{a}+\vec{b}).\lambda(\vec{a}+\vec{b})=168$

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

- (A) 77 ✓
- (B) 88
- (C) 99
- (D) 66

Ans. (A)