



PAPER SOLUTION

From Meerut

JEE MAIN

JAN

SHIFT

28

2nd

2025

Aryan Agarwal

Founder and CEO

CVPS INTEGRATED STAR COURSE



CITY VOCATIONAL PUBLIC SCHOOL

INTEGRATED STAR COURSE



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IX-XII BATCHES

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NEET 2024 STAR

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TOPPER



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JEE ADVANCED AIR 1741
IIT DELHI



HARSHWARDHAN

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ALOK CHAUDHARY

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ADITYA KUMAR BHARGWAL

NEET SCORE
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99.677%ile

AIR 7364

Aryan Agarwal
Founder & CEO

Disclaimer: This academic course is exclusively for day boarders only

9389338683, 7906236652



Rank Predictor



Question Paper



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#Q. If $Q = \begin{bmatrix} \cos \theta & -\sin \theta \\ \sin \theta & \cos \theta \end{bmatrix}$, $B = PQQ^T$ and matrix A is defined as $A = Q^T B^{10} Q$ (where $P = \begin{bmatrix} \sqrt{2} & -2 \\ 0 & 1 \end{bmatrix}$), then trace of matrix A is

A

$$A = Q^T B^{10} Q = \boxed{Q^T Q} P \boxed{Q^T Q} P \boxed{Q^T Q} \dots \boxed{Q^T Q} P \boxed{Q^T Q} = P^{10}$$

B

$$P^2 = \begin{bmatrix} \sqrt{2} & -2 \\ 0 & 1 \end{bmatrix} \begin{bmatrix} \sqrt{2} & -2 \\ 0 & 1 \end{bmatrix} = \begin{bmatrix} 2 & - \\ 0 & 1 \end{bmatrix} \quad \left| \quad P^{10} = \begin{bmatrix} 2^5 & - \\ - & 1 \end{bmatrix} \right.$$

C

$$P^3 = \begin{bmatrix} \sqrt{2} & -2 \\ 0 & 1 \end{bmatrix} \begin{bmatrix} 2 & - \\ 0 & 1 \end{bmatrix} = \begin{bmatrix} 2\sqrt{2} & - \\ 0 & 1 \end{bmatrix} \quad \left| \quad \text{tr}(A) = 32 + 1 = 33 \right.$$

D



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Ans. (33)

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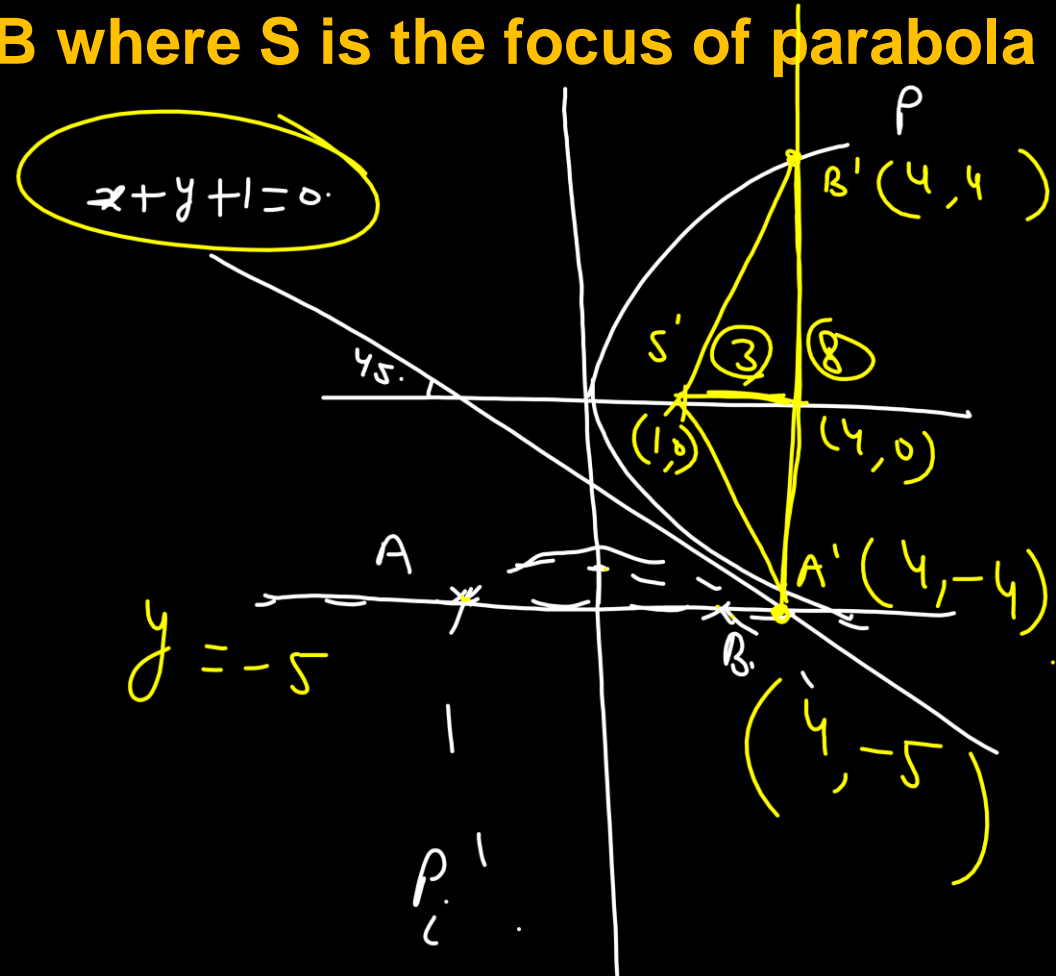
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#Q. Let P_i be image of parabola $P: y^2 = 4x$ with respect to line $x + y + 1 = 0$. Let the line $y + 5 = 0$ intersect P_i at A and B. If a is the distance between A and B and d be the area of triangle SAB where S is the focus of parabola P_i . Then $(a + d)$ is

- A** 8
- B** 12
- C** 20 ✓✓
- D** 10

$$a = 8.$$

$$d = \frac{1}{2} \times 8 \times 3 = 12$$





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Ans. (C)



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#Q. For positive integer n , $4a_n = n^2 + 5n + 6$ and $S_n = \sum_{K=1}^n \frac{1}{a_K}$. Then the value of $507(S_{2025})$ is

$$a_k = \frac{k^2 + 5k + 6}{4}$$

$$\frac{1}{a_k} = \frac{4}{(k+2)(k+3)} = 4 \left[\frac{1}{k+2} - \frac{1}{k+3} \right]$$

A 725

B 1350

C 540

D 675 ✓

$$S_n = 4 \left[\frac{1}{3} - \frac{1}{4} + \frac{1}{4} - \frac{1}{5} + \dots + \frac{1}{n+2} - \frac{1}{n+3} \right]$$

$$S_n = 4 \left[\frac{1}{3} - \frac{1}{n+3} \right] = \frac{4n}{3(n+3)}$$



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$$507 S_{2025} = \frac{\cancel{507} \times \cancel{4} \times 2025}{3 \times \cancel{2028}}$$
$$= \frac{4n}{3(n+3)}$$
$$= 675$$

Ans. (D)

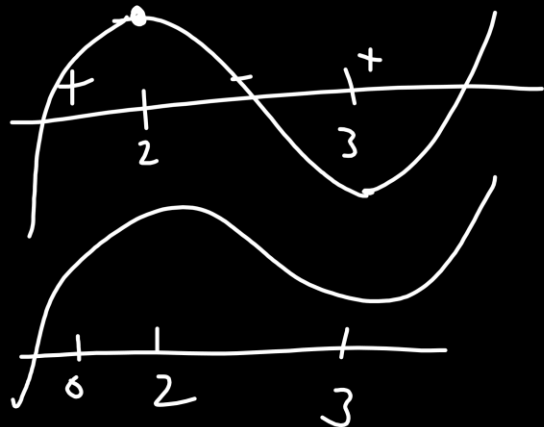


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#Q. $f: [0, 3] \rightarrow \overset{\text{Range}}{b}$ $f(x) = 2x^3 - 15x^2 + 36x + 7$ is an onto function $g: [0, \infty) \rightarrow$
 d $g(x) = \frac{x^{2025}}{x^{2025} + 1}$ is also an onto function. Find the number of elements in the
set $S = \{x: x \in \mathbb{Z}, x \in b \text{ or } x \in d\}$

Solⁿ

$$\begin{aligned} f'(x) &= 6x^2 - 30x + 36 \\ &= 6(x^2 - 5x + 6) \\ &= 6(x-2)(x-3) \end{aligned}$$



$$\begin{aligned} f(2) &= 2 \times 8 - 15 \times 4 + 36 \times 2 + 7 \\ &= 16 - 60 + 72 + 7 = 35 \\ f(0) &= 7 \\ b &= [7, 35] \end{aligned}$$



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$$g(x) = \frac{x^{2025}}{x^{2025} + 1}, \quad 0 \leq x < \infty$$

$$\min g(x) = 0.$$

$$\text{Range } a = [0, 1) \rightarrow \textcircled{0} \rightarrow 1$$

$$\underline{b} = [7, 35] \rightarrow \textcircled{29}$$

$$\textcircled{30}$$

Ans. (30)



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#Q. The greatest interior angle of a polygon is 171° with n sides such that its angles are in Arithmetic progression with common difference of 6° . Then n is equal to

$$a = 171, d = -6$$

Sum of all interior angles

$$(n-2) \times 180 = \frac{n}{2} [2 \times 171 - (n-1) \times 6]$$

$$180n - 360 = n[171 - 3n + 3]$$

$$180n - 360 = 174n - 3n^2$$

$$3n^2 + 6n - 360 = 0$$

$$n^2 + 2n - 120 = 0$$

$$(n+12)(n-10) = 0$$

$$n = -12, 10 \checkmark$$



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Ans. (10)

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#Q. If S is a set of words formed by all the letters of word "GARDEN", then find the probability that vowels are not in alphabetical order.

$$\frac{1}{2}$$



A

$\frac{1}{5}$

B

$\frac{1}{4}$

C

$\frac{1}{3}$

D

$\frac{1}{2}$





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Ans. (D)



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#Q. In isosceles triangle two equal sides are $x + 2y = 4$, $x + y = 4$, then the sum of all possible value of slope of third side of triangle is

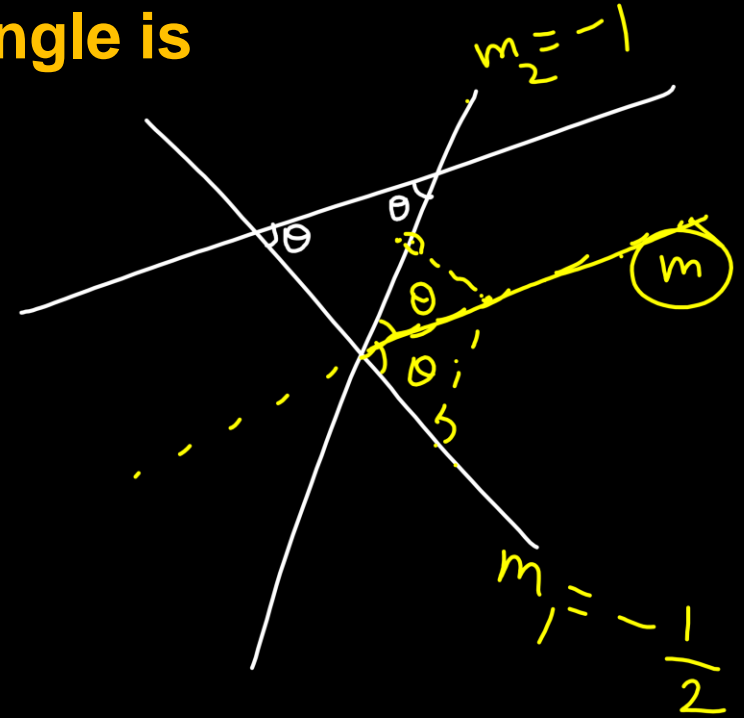
$$\tan \theta = \frac{m - (-\frac{1}{2})}{1 + (-\frac{1}{2})m} = \frac{-1 - m}{1 + (-1)m}$$

$$\frac{2m+1}{2-m} = \frac{m+1}{m-1}$$

$$2m^2 + m - 2m - 1 = 2m + 2 - m^2 - m$$

$$3m^2 - 2m - 3 = 0$$

$$\text{Sum of roots} = -\frac{(-2)}{3} = \frac{2}{3}$$



A

$\frac{-2}{3}$

B

$\frac{-3}{2}$

C

$\frac{2}{3}$

D

$\frac{3}{2}$



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Ans. (C)



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#Q. If $\alpha, \beta, \gamma, \delta$ are real numbers such that $\alpha + i\beta$ and $\gamma + i\delta$ are roots of the equation $x^2 - (3 - 2i)x - (2i - 2) = 0$ (where $i = \sqrt{-1}$), then $(\alpha\gamma + \beta\delta)$ is equal to

$$3 - 2i$$

$$(2 - 2i), 1$$

Roots $1, 2 - 2i$

$$\alpha + i\beta = 1 \Rightarrow \alpha = 1, \beta = 0$$

$$\gamma + i\delta = 2 - 2i \Rightarrow \gamma = 2, \delta = -2$$

$$\alpha\gamma = 2, \beta\delta = 0$$

A -6

B 6

C 2 ✓✓

D -2



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Ans. (C)



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#Q. The domain of the function $f(x) = \sec^{-1}(2[x] + 1)$ is (where $[\cdot]$ represents greatest integer function)

$$2[x] + 1 \geq 1 \quad \text{or} \quad 2[x] + 1 \leq -1$$

$$2[x] \geq 0$$

$$[x] \geq 0$$

$$0, 1, 2, 3, \dots$$

$$2[x] \leq -2$$

$$[x] \leq -1$$

$$-1, -2, -3, \dots$$

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

B $(-\infty, \infty) - \{0\}$

C $(-\infty, -1] \cup [1, \infty)$

D $(-\infty, \infty)$ ✓



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Ans. (D)



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$$p = 0$$

#Q. If p is the number of possible values of r such that T_r, T_{r+1}, T_{r+2} are three terms of $(a + b)^{12}$ are in geometric progression and if q is the sum of rational terms in the expansion of $(3^{1/4} + 4^{1/3})^{12}$, then $(p + q)$ is

A 250

B 240

C 238

D 283 ✓

$$(T_{r+1})^2 = T_r \cdot T_{r+2}$$
$$\binom{12}{r} a^{12-r} b^r = \binom{12}{r-1} a^{13-r} b^{r-1} \cdot \binom{12}{r+1} a^{11-r} b^{r+1}$$
$$\frac{(12)!}{r! (12-r)!} = \frac{(12)!}{(r-1)! (13-r)!} \cdot \frac{(12)!}{(r+1)! (11-r)!}$$
$$r(12-r) = (13-r)(r+1)$$



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$$\left(3^{\frac{1}{4}} + 4^{\frac{1}{3}}\right)^{12}$$

$${}^{12}C_r \cdot 3^{\frac{12-r}{4}} \cdot 4^{\frac{r}{3}}$$

$r \rightarrow$ multiple of 3 & 4

$r \rightarrow$ multiple of 12.

$$0 \leq r \leq 12, \quad r = 0, 12$$

$$\text{Sum} = {}^{12}C_0 \cdot 3^3 + {}^{12}C_{12} \cdot 4^4$$

$$= 27 + 256$$

$$\underline{\underline{283}}$$

Ans. (D)



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#Q. The no of natural number between 212 & 999 such that the sum of their digits is 15

$$\begin{matrix} x & x & x \\ 2 & \times & 2 < 1 \end{matrix}$$

$$\begin{matrix} 7 & 1 & 7 \\ 7 & 7 & 1 \end{matrix}$$

A

$$0, 6, 9 \rightarrow 4$$

$$0, 7, 8 \rightarrow 4$$

$$1, 5, 9 \rightarrow 4$$

$$1, 6, 8 \rightarrow 4$$

$$1, 7, 7 \rightarrow 2$$

$$2, 4, 9 \rightarrow 6$$

$$2, 5, 8 \rightarrow 6$$

$$2, 6, 7 \rightarrow 6$$

$$3, 3, 9 \rightarrow 3$$

B

$$3, 4, 8 \rightarrow 6$$

$$3, 5, 7 \rightarrow 6$$

$$3, 6, 6 \rightarrow 3$$

$$4, 4, 7 \rightarrow 3$$

$$4, 5, 6 \rightarrow 6$$

$$5, 5, 5 \rightarrow 1$$

C

D

64



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Ans. (64)



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#Q. There are three bag such that bag 1 has 4 white, 6 blue, bag 2 has 6 white and 4 blue and bag 3 has 5 white and 5 blue balls. A bag is randomly selected and a ball is randomly picked out of it, it comes out to be white then probability that selected bag was bag 2.

A

$$\frac{2}{5} \checkmark \checkmark$$

B

$$\frac{2}{15}$$

C

$$\frac{1}{15}$$

D

$$\frac{7}{15}$$



$$P(\text{II}) P\left(\frac{W}{\text{II}}\right)$$

$$\frac{P(\text{II}) P\left(\frac{W}{\text{II}}\right)}{P(\text{I}) P\left(\frac{W}{\text{I}}\right) + P(\text{II}) P\left(\frac{W}{\text{II}}\right) + P(\text{III}) P\left(\frac{W}{\text{III}}\right)} = \frac{\frac{6}{10}}{\frac{4}{10} + \frac{6}{10} + \frac{5}{10}} = \frac{6}{15} = \frac{2}{5}$$



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Ans. (A)

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#Q. Area bounded between the curves $C_1: x(1 + y^2) - 1 = 0$ and $C_2: y^2 - 2x = 0$ is (in sq. unit)

$$1 + y^2 = \frac{1}{x}$$

$$x \rightarrow 0, y \rightarrow \infty$$

~~scribble~~

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

$$1 + 2x = \frac{1}{x}$$

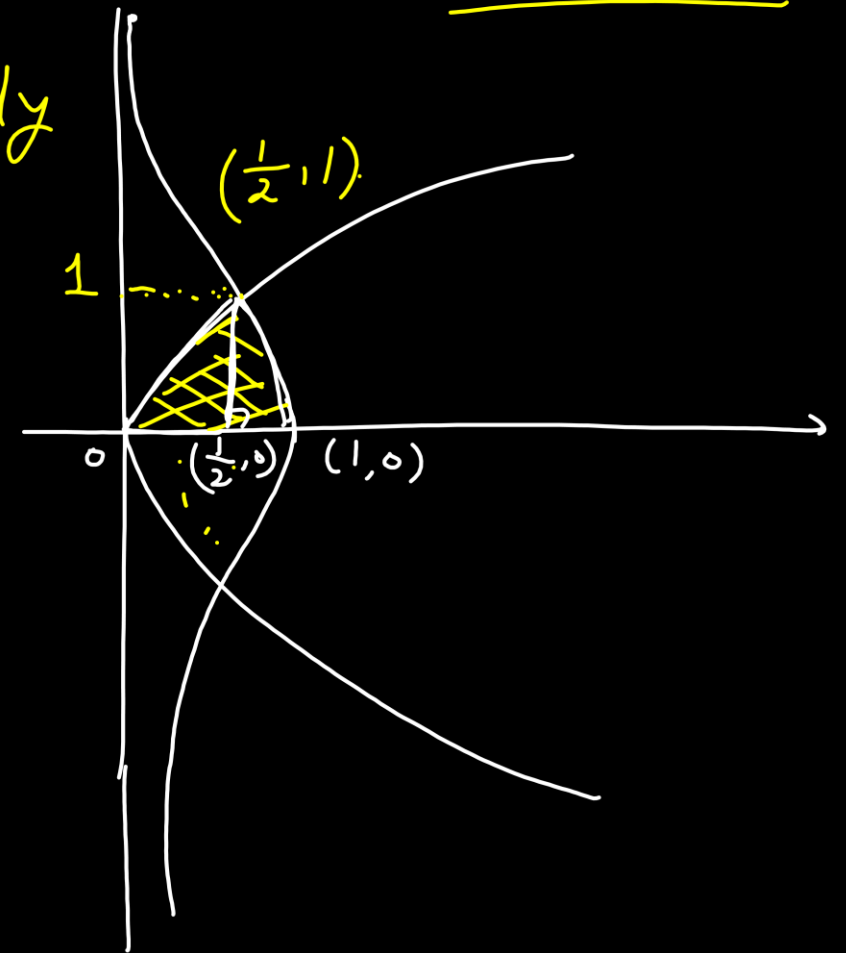
$$2x^2 + x - 1 = 0$$

$$2x^2 + 2x - x - 1 = 0$$

$$2x(x+1) - 1(x+1) = 0$$

$$x = \frac{1}{2}, (-1)$$

$$2 \int_0^1 \left(\frac{1}{1+y^2} - \frac{y^2}{2} \right) dy$$



- A** $\frac{\pi}{6} + \frac{1}{2}$
- B** $\frac{\pi}{2} - \frac{1}{3}$
- C** $\frac{\pi}{4} - \frac{1}{6}$
- D** $2 \left(\frac{\pi}{2} - \frac{1}{6} \right)$



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$$\begin{aligned} & 2 \int_0^1 \left(\frac{1}{1+y^2} - \frac{y^2}{2} \right) dy \\ &= 2 \left[\tan^{-1} y - \frac{y^3}{6} \right]_0^1 \\ &= 2 \left[\frac{\pi}{4} - \frac{1}{6} \right] \\ &= \frac{\pi}{2} - \frac{1}{3} \end{aligned}$$

Ans. (B)



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#Q. Evaluate

$$\sum_{r=1}^{13} \frac{1}{\sin\left[\frac{\pi}{4} + (r-1)\frac{\pi}{6}\right] \sin\left[\frac{\pi}{4} + \frac{r\pi}{6}\right]}$$

$$= 2 \sum \frac{\sin\left[\left(\frac{\pi}{4} + \frac{r\pi}{6}\right) - \left(\frac{\pi}{4} + (r-1)\frac{\pi}{6}\right)\right]}{\sin\left[\frac{\pi}{4} + (r-1)\frac{\pi}{6}\right] \sin\left(\frac{\pi}{4} + \frac{r\pi}{6}\right)}$$

A $3\sqrt{2} - 4 = 2 \sum \frac{\sin\left(\frac{\pi}{4} + \frac{r\pi}{6}\right) \cos\left(\frac{\pi}{4} + (r-1)\frac{\pi}{6}\right) - \sin\left(\frac{\pi}{4} + (r-1)\frac{\pi}{6}\right) \cos\left(\frac{\pi}{4} + \frac{r\pi}{6}\right)}{\sin\left(\frac{\pi}{4} + (r-1)\frac{\pi}{6}\right) \sin\left(\frac{\pi}{4} + \frac{r\pi}{6}\right)}$

B $3\sqrt{2} + 2$

C $2\sqrt{3} - 2 = 2 \sum_{r=1}^{13} \left[\cot\left(\frac{\pi}{4} + (r-1)\frac{\pi}{6}\right) - \cot\left(\frac{\pi}{4} + \frac{r\pi}{6}\right) \right]$

D $2\sqrt{3} + 2$



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$$2 \sum_{r=1}^{13} \left[\cot\left(\frac{\pi}{4} + (r-1)\frac{\pi}{6}\right) - \cot\left(\frac{\pi}{4} + r\frac{\pi}{6}\right) \right]$$

$$2 \left[\cot\frac{\pi}{4} - \cot\left(\frac{\pi}{4} + \frac{\pi}{6}\right) + \cot\left(\frac{\pi}{4} + \frac{\pi}{6}\right) - \dots - \cot\left(\frac{\pi}{4} + \frac{13\pi}{6}\right) \right]$$

$$= 2 \left[1 - \cot\left[\frac{\pi}{4} + \frac{\pi}{6} + 2\pi\right] \right]$$

$$= 2 [1 - \cot 75^\circ]$$

$$= 2 [1 - (2 - \sqrt{3})]$$

$$= \underline{2(\sqrt{3} - 1)}$$

$$\begin{aligned} \cot 75^\circ &= \tan 15^\circ \\ &= \tan(45^\circ - 30^\circ) \end{aligned}$$

Ans. (C)



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#Q. Let $f(x) = \int \frac{dx}{x^4(x^{1/4}+1)}$. If $f(0) = -6$ and $f(1) = a \ln 2 + b$ then $|a + b| =$

$\frac{4}{11} - \frac{8}{11}$

$$x = t^4$$
$$dx = 4t^3 dt$$

- A 4
- B 12
- C -4
- D 2

$$\int \frac{4t^3 dt}{t(t+1)} = 4 \int \frac{t^2 - 1 + 1}{t+1} dt$$
$$= 4 \int \left(\frac{(t-1)(t+1)}{t+1} + \frac{1}{t+1} \right) dt$$
$$= 4 \left[\frac{t^2}{2} - t + \ln|t+1| \right] + C$$

$$f(x) = 4 \left[\frac{x^{\frac{1}{2}}}{2} - x^{\frac{1}{4}} + \ln|x^{\frac{1}{4}}+1| \right] + C$$

$x = 0$

$$-6 = C$$

$$f(1) = 4 \left[\frac{1}{2} - 1 + \ln 2 \right] - 6$$
$$= 4 \left[-\frac{1}{2} + \ln 2 \right] - 6$$
$$= -8 + 4 \ln 2$$



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Ans. (A)

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#Q. $x^2 + y^2 - 8x = 0$, $\frac{x^2}{9} - \frac{y^2}{4} = 1$ intersect at A, B, A triangle is formed using vertices A, B, C where C lies on $2x - 3y + 4 = 0$ find locus of centroid of ΔABC .

- A** $6x+9y-20 = 0$
- B** $6x-9y+20 = 0$
- C** $6x-9y-20 = 0$
- D** $6x+9y+20 = 0$



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Ans. (C)