Vedantu

JEE-Main-22-01-2026 (Memory Based)
[EVENING SHIFT]
Maths

Question: If complex number Z_1, Z_2, ….Z_n satisfy the equation $4Z^2 + \overline{Z} = 0$, then $\sum_{i=1}^{n} |Z_i|^2$ **is equal to**

Options:

(a) $\frac{3}{16}$

(b) $\frac{3}{64}$

(c) $\frac{9}{64}$

(d) $\frac{1}{16}$

Answer: (a)

$4z^2 + \overline{z} = 0........(1)$

If $z = 0$

$\Rightarrow |z| = 0$

If $z \neq 0$

Multiply z on (1)

$4z^3 + z.\ \overline{z} = 0$

$4|z^3| = |z|^2$

$\Rightarrow |z| = \frac{1}{4}$

Put

$4z^3 = -\frac{1}{16}$

$z^3 = -\frac{1}{64}$

possible $z = \frac{-1}{4},\ \frac{-1}{4}\omega,\ \frac{-1}{4}\omega^2$

$$\sum |z_i|^2 = 0 + \frac{1}{16} + \frac{1}{16} + \frac{1}{16} = \frac{3}{16}$$

Question: Let α, β be the roots of quadratic equation $12x^2 - 20x + 3\lambda = 0$, $\lambda \in z$. If $1/2 \le |\beta - \alpha| \le 3/2$ then the sum of all possible values of λ is

Answer: (3)

$$12x^2 - 20x + 3\lambda = 0$$

$$a = 12,\ b = -20,\ c = 3\lambda$$

$$\alpha + \beta = \frac{-20}{12} = \frac{5}{3}$$

$$\alpha\beta = \frac{3\lambda}{12} = \frac{\lambda}{4}$$

$$\frac{1}{2} \le |\beta - \alpha| \le \frac{3}{2} \ ....(2)$$

$$(\beta - \alpha)^2 = (\beta + \alpha)^2 - 4\alpha\beta$$

$$= \left(\frac{5}{3}\right)^2 - 4\left(\frac{\lambda}{4}\right)$$

$$(\beta - \alpha)^2 = \frac{25}{9} - \lambda$$

$$|\beta - \alpha| = \sqrt{\frac{25}{9} - \lambda} \ ....(2)$$

$$(1)\ \&\ (2)\ \frac{1}{2} \le \sqrt{\frac{25}{9} - \lambda} \le \frac{3}{2}$$

$$S.B.S.\ \frac{1}{4} \le \frac{25}{9} - \lambda \le \frac{9}{4}$$

$$-\frac{91}{36} \le -\lambda \le -\frac{19}{36}$$

$$\frac{19}{36} \le \lambda \le \frac{91}{36}$$

$$\approx 0.527 \le \lambda \le 2.527$$

$$= 1,\ 2;\ \sum \lambda = 1 + 2 = 3$$

Question: The number of elements in the relation $R = \{(x,y) : 4x^2 + y^2 < 52, x, y, \in z\}$ is

Answer: (77)

$x = 0\,,\ y^2\ <\ 52,\ y = 0,\ \pm 1,\ \pm 2,\ \pm 3, \pm 4, \pm 5, \pm 6, \pm 7$

$x = \pm 1 \qquad y^2 < 48$

$x = \pm 2 \qquad y^2 < 36$

$x = \pm 3 \qquad y^2 < 16$

$2 \times 13 = 26$

$2 \times 11 = 22$

$2 \times 7 = 14$

$15 + 26 + 22 + 14 = 77$

Question: Area enclosed by $4x^2 + y^2 \leq 8$ and $y2 \leq 4x$ (in square unit) is
Options:

(a) $\left(\pi + \frac{4}{3}\right)$ sq.units

(b) $\left(\pi - \frac{4}{3}\right)$ sq.units

(c) $\left(\pi + \frac{2}{3}\right)$ sq. units

(d) $\left(\pi - \frac{2}{3}\right)$ sq. units

Answer: (c)

$4x^2 + y^2 \leq 8$

$\frac{x^2}{2} + \frac{y^2}{8} \leq 1$.......(1)

$y^2 \leq 4x$

Find intersecting

$4x^2\ + 4x = 8$

$x^2 + x - 2 = 0$

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

$x = 1,\ y = \pm 2$

$$A = 2\left[\int_0^1 2\sqrt{x}.\,dx + \int_1^{\sqrt{2}} 2\sqrt{2-x^2}.\,dx\right]$$

$$= 2\left[2\left[\frac{2}{3}\,x^{\frac{3}{2}}\right]_0^1 + 2\left(\frac{x}{2}\right)\sqrt{2-x^2} + \frac{2}{2}\sin^{-1}\left(\frac{x}{\sqrt{2}}\right)\right]_1^{\sqrt{2}}$$

$2[2 \times \frac{2}{3}(1) + 2[\frac{\pi}{2} - (\frac{1}{2}) + \frac{\pi}{4}]]$

$2[\frac{4}{3}\quad + 2[\frac{\pi}{4} - \frac{1}{2}]]$

$A = [\frac{8}{3}\ + 2(\frac{\pi}{2} - 1)]$

$A = \pi + \frac{2}{3}$

Question: If the mean deviation about the median of the numbers k, 2k, 3k …. 1000k is 500, then k^2 is equal to
Answer: (10^3)

For Mean Deviation about median for even no. of terms $(=n)$ in $A.P$

is $\left(\frac{k.n}{4}\right)$ $\quad k$ = common difference

$= \left(\frac{1000}{4}\right) k$ $\quad k = d$

no. of terms

$500 = \frac{1000}{4} k$ $\quad n = 10^3$

$K = 2$

$\boxed{K^2 = 4}$

Question: x -ny + z = 6
x -(n - 2)y + (n + 1)z = 8
(n -1)y + z =1
Let n = number on the dies when rolled randomly then p (that system equation has unique solution) = k/6, then sum of value of k and all possible value of n is
Options:
(a) 22
(b) 21
(c) 20
(d) 24
Answer: (d)

$\because$ Unique solution, $\Delta \neq 0$

$$\Delta = \begin{vmatrix} 1 & -n & 1 \\ 1 & -(n-2) & (n+1) \\ 0 & (n-1) & 1 \end{vmatrix} \neq 0$$

lets take $\Delta = 0$; $\{-(n-2) - (n-1)(n+1)\} - 1\{-n - (n-1)\}$

$-n + 2 - n^2 + 1 + n + n - 1$ $\quad n^2 - 1$ $\quad -n - n + 1$

$\Delta = -n^2 + n + 2 = 0 \Rightarrow n^2 - n - 2 = 0$

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

$n = -1$ & 2

$\therefore$ system has unique solution $(\Delta \neq 0)$ except for $n = -1$ &2

$\therefore n = \{1, 3, 4, 5, 6\}$, $k = 5\,value$

Sum $= k + 1 + 3 + 4 + 5 + 6 = 5 + 1 + 3 + 4 + 5 + 6$

$= 24$

Question: If $P\left(10, 2\sqrt{15}\right)$ **lie on hyperbola** $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ **& length of latus rectum is 8 then square of Area △ P S_1S_2**
Answer: (300)

$\frac{2b^2}{a} = 8$

$b^2 = 4a$

$\frac{100}{a^2} - \frac{60}{b^2} = 1 \Rightarrow \frac{100}{a^2} - \frac{60}{4a} = 1 \Rightarrow \frac{100}{a^2} - \frac{15}{a} = 1$

$\Rightarrow 100 - 15a = a^2 \Rightarrow a^2 + 15a = 100 \Rightarrow a = 5$

$b^2 = 20$

$\text{Area} = \frac{1}{2}.2ae.2\sqrt{15} - \sqrt{a^2 - b^2}.2\sqrt{15}$

$= \sqrt{5} \times 2\sqrt{15}$, square of area $= 300$

Question: $\cos(\alpha+\beta) = -\frac{1}{10}$ and $\sin(\alpha-\beta) = \frac{3}{8}$ where $0 < \alpha < \frac{\pi}{3}$ & $0 < \beta < \frac{\pi}{4}$ if $\tan 2\alpha = \frac{3\left(1-\gamma\sqrt{5}\right)}{\sqrt{11}\left(s+\sqrt{5}\right)}$, $\gamma, s \in N$,

then r + s is equal to ______

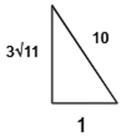
Answer: (20)

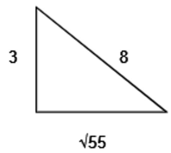
$\cos(\alpha+\beta) = -\frac{1}{10} \quad \in II$

$\sin(\alpha-\beta) = \frac{3}{8} \quad \in I$

$\sin(\alpha+\beta) = \frac{3\sqrt{11}}{10} \quad \in II$

$\cos(\alpha-\beta) = \frac{\sqrt{55}}{8} \quad \in II$





$\sin 2\alpha = \sin((\alpha+\beta) + (\alpha-\beta))$

$\sin(\alpha+\beta)\cos(\alpha-\beta) + \cos(\alpha+\beta)\sin(\alpha-\beta)$

$= \frac{33\sqrt{5}-3}{80}$

$\cos 2\alpha = \cos((\alpha+\beta) + (\alpha-\beta))$

$= -\sqrt{11}\frac{\left(\sqrt{5}+9\right)}{80}$

$\tan 2\alpha = \frac{\sin 2\alpha}{\cos 2\alpha}$

$= \frac{3\left(-1+11\sqrt{5}\right)}{-\sqrt{11}\left(9+\sqrt{5}\right)}$

$= \frac{3\left(1-11\sqrt{5}\right)}{\sqrt{11}\left(9+\sqrt{5}\right)}$

$r = 11$, $s = 9$

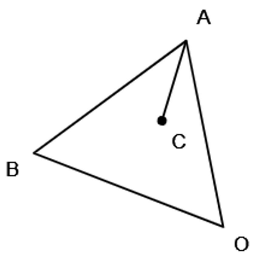
$r + s = 20$

Question: If $X = \begin{bmatrix} x \\ y \\ z \end{bmatrix}$ **is a Solution of Systems of equation AX = B where** $Adj\, A = \begin{pmatrix} 4 & 2 & 2 \\ -5 & 0 & 5 \\ 1 & -2 & 3 \end{pmatrix}$ & $B = \begin{bmatrix} 4 \\ 0 \\ 2 \end{bmatrix}$ **then |x + y + z| is equal to**

Options:
(a) 3
(b) 2
(c) $\frac{3}{2}$
(d) 1
Answer: (b)

$$|Adj\ A| = 4(0+10) - 2(-20) + 2 \times 10$$
$$= 40 + 40 + 20 = 100 \Rightarrow |A| = 10$$
$$X = \frac{1}{10}\begin{bmatrix} 4 & 2 & 2 \\ -5 & 0 & 5 \\ 1 & -2 & 3 \end{bmatrix}\begin{bmatrix} 4 \\ 0 \\ 2 \end{bmatrix}$$
$$= \frac{1}{10}\begin{bmatrix} 16 & +0 & +4 \\ -20+0+10 \\ 4 & +0 & +6 \end{bmatrix} = \frac{1}{10}\begin{bmatrix} 20 \\ -10 \\ 10 \end{bmatrix}$$
$$|x+y+z| = 2$$

Question: Among the statements
S_1: If A(5,-1) and B(-2,3) are two vertices of a triangle, whose orthocenter is (0,0), then its third vertex is (-4,-7)
S_2: If positive numbers 2a, b, c are three consecutive, in terms of an A.P, then the lines ax + by + c = 0 are concurrent at (2,-2)



2b = 2a+c

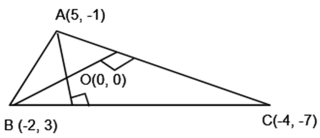
Options:
(a) both are correct
(b) only S_1 is correct
(c) both are incorrect
(d) only S_2 is correct
Answer: (d)

$m_{BC} = \frac{10}{2} = 5$

$m_{AO} = \frac{-1}{5}$

$m_{AC} = \frac{6}{9} = \frac{2}{3}$

$m_{BO} = \frac{-3}{2}$



S_1 is correct

$2a + c = 2b \Rightarrow 2a - 2b + c = 0$

$$ax + by + c = 0$$

$$(x, y) = (2, -2)$$

S_2 is correct