

# JEE MAIN COMPLEX NUMBERS AND QUADRATIC EQUATIONS — PYQS

Max. Marks: 460

Questions: 115

## Section A (MCQ) — 90 questions

**Q.1** The number of values of  $z \in \mathbb{C}$ , satisfying the equations  $|z - (4 + 8i)| = \sqrt{10}$  and

$$|z - (3 + 5i)| + |z - (5 + 11i)| = 4\sqrt{5}, \text{ is :}$$

[JEE Main 2026 (Online) 8th April Evening Shift]

- (1) 0      (2) 2      (3) 1      (4) 4

Scan or tap for the full solution 

**Q.2** Let  $e_1$  and  $e_2$  be two distinct roots of the equation  $x^2 - ax + 2 = 0$ . Let the sets  $\{a \in \mathbb{R} : e_1 \text{ and } e_2 \text{ are the eccentricities of hyperbolas}\} = (\alpha, \beta)$ , and  $\{a \in \mathbb{R} : e_1 \text{ and } e_2 \text{ are the eccentricities of an ellipse and a hyperbola, respectively}\} = (\gamma, \infty)$ . Then  $\alpha^2 + \beta^2 + \gamma^2$  is equal to :

[JEE Main 2026 (Online) 6th April Morning Shift]

- (1) 18      (2) 22      (3) 26      (4) 34

Scan or tap for the full solution 

**Q.3** Let the set of all values of  $k \in \mathbb{R}$  such that the equation  $z(\bar{z} + 2 + i) + k(2 + 3i) = 0$ ,  $z \in \mathbb{C}$ , has at least one solution, be the interval  $[\alpha, \beta]$ . Then  $9(\alpha + \beta)$  is equal to :

[JEE Main 2026 (Online) 6th April Morning Shift]

- (1) -10      (2) -8  
(3)  $10\sqrt{13}$       (4)  $8\sqrt{13}$

Scan or tap for the full solution 

**Q.4** Let  $S = \{z \in \mathbb{C} : z^2 + \sqrt{6}iz - 3 = 0\}$ . Then  $\sum_{z \in S} z^8$  is equal to :

[JEE Main 2026 (Online) 6th April Evening Shift]

- (1) 162      (2) 184      (3) 262      (4) 324

Scan or tap for the full solution 

**Q.5** Let  $a, b \in \mathbb{C}$ . Let  $\alpha, \beta$  be the roots of the equation  $x^2 + ax + b = 0$ . If  $\beta - \alpha = \sqrt{11}$  and  $\beta^2 - \alpha^2 = 3i\sqrt{11}$ , then  $(\beta^3 - \alpha^3)^2$  is equal to :

[JEE Main 2026 (Online) 5th April Morning Shift]

- (1) 160      (2) 176      (3) 194      (4) 187

Scan or tap for the full solution 

**Q.6** Let  $\alpha, \beta$  be the roots of the equation  $x^2 - x + p = 0$  and  $\gamma, \delta$  be the roots of the equation  $x^2 - 4x + q = 0$ ;  $p, q \in \mathbb{Z}$ . If  $\alpha, \beta, \gamma, \delta$  are in G.P., then  $|p + q|$  equals :

[JEE Main 2026 (Online) 5th April Evening Shift]

- (1) 16      (2) 32      (3) 34      (4) 38

Scan or tap for the full solution 

**Q.7** Let  $z_1, z_2 \in \mathbb{C}$  be the distinct solutions of the equation  $z^2 + 4z - (1 + 12i) = 0$ . Then  $|z_1|^2 + |z_2|^2$  is equal to :

[JEE Main 2026 (Online) 5th April Evening Shift]

- (1) 18      (2) 22      (3) 29      (4) 34

Scan or tap for the full solution 

**Q.8** If the set of all solutions of  $|x^2 + x - 9| = |x| + |x^2 - 9|$  is  $[\alpha, \beta] \cup [\gamma, \infty)$ , then  $(\alpha^2 + \beta^2 + \gamma^2)$  is equal to :

[JEE Main 2026 (Online) 4th April Morning Shift]

- (1) 9      (2) 18      (3) 36      (4) 72

Scan or tap for the full solution 

**Q.9** Let  $z$  be a complex number such that  $|z + 2| = |z - 2|$  and  $\arg\left(\frac{z+3}{z-i}\right) = \frac{\pi}{4}$ . Then  $|z|^2$  is equal to :

[JEE Main 2026 (Online) 4th April Morning Shift]

- (1) 9      (2) 4      (3) 5      (4) 1

Scan or tap for the full solution 

**Q.10** Let  $S = \{z \in \mathbb{C} : z^2 + 4z + 16 = 0\}$ . Then

$$\sum_{z \in S} |z + \sqrt{3}i|^2 \text{ is equal to :}$$

[JEE Main 2026 (Online) 4th April Evening Shift]

- (1) 42      (2) 23      (3) 27      (4) 38

Scan or tap for the full solution 

**Q.11** If the quadratic equation  $(\lambda + 2)x^2 - 3\lambda x + 4\lambda = 0$ ,  $\lambda \neq -2$ , has two positive roots, then the number of possible integral values of  $\lambda$  is :

[JEE Main 2026 (Online) 4th April Evening Shift]

- (1) 1      (2) 2      (3) 3      (4) 4

Scan or tap for the full solution 

**Q.12** Let  $\alpha, \alpha+2, \alpha \in \mathbb{Z}$ , be the roots of the quadratic equation  $x(x+2) + (x+1)(x+3) + (x+2)(x+4) + \dots + (x+n-1)(x+n+1) = 4n$  for some  $n \in \mathbb{N}$ . Then  $n + \alpha$  is equal to :

[JEE Main 2026 (Online) 2nd April Morning Shift]

- (1) 0 (2) 1 (3) 2 (4) 3

Scan or tap for the full solution



**Q.13** Let  $x$  and  $y$  be real numbers such that  $50\left(\frac{2x}{1+3i} - \frac{y}{1-2i}\right) = 31 + 17i$ ,  $i = \sqrt{-1}$ . Then the value of  $10(x-3y)$  is :

[JEE Main 2026 (Online) 2nd April Morning Shift]

- (1) 20 (2) 31 (3) 35 (4) 75

Scan or tap for the full solution



**Q.14** Let  $\alpha, \beta$  be the roots of the equation  $x^2 - 3x + r = 0$ , and  $\frac{\alpha}{2}, 2\beta$  be the roots of the equation  $x^2 + 3x + r = 0$ .

If the roots of the equation  $x^2 + 6x = m$  are  $2\alpha + \beta + 2r$  and  $\alpha - 2\beta - \frac{r}{2}$ , then  $m$  is equal to :

[JEE Main 2026 (Online) 2nd April Evening Shift]

- (1) -135 (2) -567 (3) 135 (4) 567

Scan or tap for the full solution



**Q.15** Let the circles  $C_1: |z| = r$  and  $C_2: |z - 3 - 4i| = 5$ ,  $z \in \mathbb{C}$ , be such that  $C_2$  lies within  $C_1$ .

If  $z_1$  moves on  $C_1$ ,  $z_2$  moves on  $C_2$  and  $\min|z_1 - z_2| = 2$ , then  $\max|z_1 - z_2|$  is equal to :

[JEE Main 2026 (Online) 2nd April Evening Shift]

- (1) 12 (2) 17 (3) 22 (4) 24

Scan or tap for the full solution



**Q.16** If  $\alpha, \beta$ , where  $\alpha < \beta$ , are the roots of the equation  $\lambda x^2 - (\lambda + 3)x + 3 = 0$  such that  $\frac{1}{\alpha} - \frac{1}{\beta} = \frac{1}{3}$ , then the sum of all possible values of  $\lambda$  is

[JEE Main 2026 (Online) 28th January Morning Shift]

- (1) 2 (2) 6 (3) 8 (4) 4

Scan or tap for the full solution



**Q.17** Let  $S = \{x^3 + ax^2 + bx + c : a, b, c \in \mathbb{N} \text{ and } a, b, c \leq 20\}$  be a set of polynomials. Then the number of polynomials in  $S$ , which are divisible by  $x^2 + 2$ , is

[JEE Main 2026 (Online) 28th January Morning Shift]

- (1) 6 (2) 120 (3) 20 (4) 10

Scan or tap for the full solution



**Q.18** Let  $z$  be a complex number such that  $|z - 6| = 5$  and  $|z + 2 - 6i| = 5$ . Then the value of  $z^3 + 3z^2 - 15z + 141$  is equal to :

[JEE Main 2026 (Online) 28th January Morning Shift]

- (1) 61 (2) 37 (3) 42 (4) 50

Scan or tap for the full solution



**Q.19** Let the arithmetic mean of  $\frac{1}{a}$  and  $\frac{1}{b}$  be  $\frac{5}{16}$ ,  $a > 2$ . If  $\alpha$  is such that  $a, 4, \alpha, b$  are in A.P., then the equation  $\alpha x^2 - ax + 2(\alpha - 2b) = 0$  has :

[JEE Main 2026 (Online) 28th January Evening Shift]

- (1) one root in  $(1, 4)$  and another in  $(-2, 0)$   
 (2) one root in  $(0, 2)$  and another in  $(-4, -2)$   
 (3) both roots in the interval  $(-2, 0)$   
 (4) complex roots of magnitude less than 2

Scan or tap for the full solution



**Q.20** Let  $A = \{z \in \mathbb{C} : |z - 2| \leq 4\}$  and  $B = \{z \in \mathbb{C} : |z - 2| + |z + 2| = 5\}$ .

Then the max  $\{|z_1 - z_2| : z_1 \in A \text{ and } z_2 \in B\}$  is :

[JEE Main 2026 (Online) 28th January Evening Shift]

- (1)  $\frac{17}{2}$  (2) 8 (3) 9 (4)  $\frac{15}{2}$

Scan or tap for the full solution



**Q.21** The number of the real solutions of the equation:  $x|x+3| + |x-1| - 2 = 0$  is

[JEE Main 2026 (Online) 24th January Morning Shift]

- (1) 3 (2) 2 (3) 5 (4) 4

Scan or tap for the full solution



**Q.22** Let  $S = \left\{ z \in \mathbb{C} : \left| \frac{z-6i}{z-2i} \right| = 1 \text{ and } \left| \frac{z-8+2i}{z+2i} \right| = \frac{3}{5} \right\}$ . Then  $\sum_{z \in S} |z|^2$  is equal to :

[JEE Main 2026 (Online) 24th January Morning Shift]

- (1) 413 (2) 398 (3) 385 (4) 423

Scan or tap for the full solution



**Q.23** The smallest positive integral value of  $a$ , for which all the roots of  $x^4 - ax^2 + 9 = 0$  are real and distinct, is equal to

[JEE Main 2026 (Online) 24th January Evening Shift]

- (1) 7 (2) 3 (3) 4 (4) 9

Scan or tap for the full solution



**Q.24** If  $\alpha$  and  $\beta$  ( $\alpha < \beta$ ) are the roots of the equation  $(-2 + \sqrt{3})(\sqrt{x} - 3) + (x - 6\sqrt{x}) + (9 - 2\sqrt{3}) = 0$ ,  $x \geq 0$ , then  $\sqrt{\frac{\beta}{\alpha}} + \sqrt{\alpha\beta}$  is equal to :

[JEE Main 2026 (Online) 23rd January Morning Shift]

- (1) 8 (2) 10 (3) 9 (4) 11

Scan or tap for the full solution



**Q.25** Let  $S = \{z : 3 \leq |2z - 3(1+i)| \leq 7\}$  be a set of complex numbers.

Then  $\min_{z \in S} \left| \left( z + \frac{1}{2}(5+3i) \right) \right|$  is equal to :

[JEE Main 2026 (Online) 23rd January Morning Shift]

- (1)  $\frac{1}{2}$  (2)  $\frac{5}{2}$  (3) 2 (4)  $\frac{3}{2}$

Scan or tap for the full solution



**Q.26** A building construction work can be completed by two masons A and B together in 22.5 days. Mason A alone can complete the construction work in 24 days less than mason B alone. Then mason A alone will complete the construction work in :

[JEE Main 2026 (Online) 23rd January Morning Shift]

- (1) 36 days (2) 24 days  
(3) 30 days (4) 42 days

Scan or tap for the full solution



**Q.27** If  $z = \frac{\sqrt{3}}{2} + \frac{i}{2}$ ,  $i = \sqrt{-1}$ , then  $(z^{201} - i)^8$  is equal to

[JEE Main 2026 (Online) 23rd January Evening Shift]

- (1) 1 (2) 0 (3) -1 (4) 256

Scan or tap for the full solution



**Q.28** The number of distinct real solutions of the equation  $x|x+4| + 3|x+2| + 10 = 0$  is

[JEE Main 2026 (Online) 22nd January Morning Shift]

- (1) 2 (2) 3 (3) 0 (4) 1

Scan or tap for the full solution



**Q.29** Let  $\alpha, \beta$  be the roots of the quadratic equation  $12x^2 - 20x + 3\lambda = 0$ ,  $\lambda \in \mathbb{Z}$ . If  $\frac{1}{2} \leq |\beta - \alpha| \leq \frac{3}{2}$ , then the sum of all possible values of  $\lambda$  is :

[JEE Main 2026 (Online) 22nd January Evening Shift]

- (1) 3 (2) 6 (3) 1 (4) 4

Scan or tap for the full solution



**Q.30** Let  $S = \{z \in \mathbb{C} : 4z^2 + \bar{z} = 0\}$ . Then  $\sum_{z \in S} |z|^2$  is equal to :

[JEE Main 2026 (Online) 22nd January Evening Shift]

- (1)  $\frac{5}{64}$  (2)  $\frac{1}{16}$  (3)  $\frac{7}{64}$  (4)  $\frac{3}{16}$

Scan or tap for the full solution



**Q.31** If  $x^2 + x + 1 = 0$ , then the value of

$$\left(x + \frac{1}{x}\right)^4 + \left(x^2 + \frac{1}{x^2}\right)^4 + \left(x^3 + \frac{1}{x^3}\right)^4 + \dots + \left(x^{25} + \frac{1}{x^{25}}\right)^4$$

is: [JEE Main 2026 (Online) 21st January Morning Shift]

- (1) 162 (2) 145 (3) 128 (4) 175

Scan or tap for the full solution



**Q.32** The sum of all the roots of the equation  $(x-1)^2 - 5|x-1| + 6 = 0$ , is :

[JEE Main 2026 (Online) 21st January Morning Shift]

- (1) 3 (2) 1 (3) 4 (4) 5

Scan or tap for the full solution



**Q.33** Let  $\alpha$  and  $\beta$  be the roots of the equation  $x^2 + 2ax + (3a+10) = 0$  such that  $\alpha < 1 < \beta$ . Then the set of all possible values of  $a$  is :

[JEE Main 2026 (Online) 21st January Evening Shift]

- (1)  $\left(-\infty, -\frac{11}{5}\right) \cup (5, \infty)$   
(2)  $\left(-\infty, -\frac{11}{5}\right)$   
(3)  $(-\infty, -3)$   
(4)  $(-\infty, -2) \cup (5, \infty)$

Scan or tap for the full solution



**Q.34** Let  $z$  be the complex number satisfying  $|z-5| \leq 3$  and having maximum positive principal argument.

Then  $34 \left| \frac{5z-12}{5iz+16} \right|^2$  is equal to:

[JEE Main 2026 (Online) 21st January Evening Shift]

- (1) 20 (2) 26 (3) 12 (4) 16

Scan or tap for the full solution



**Q.35** Let  $\alpha$  be a solution of  $x^2 + x + 1 = 0$ , and for some  $a$  and  $b$  in  $\mathbb{R}$ ,

$$\begin{bmatrix} 4 & a & b \\ 1 & 16 & 13 \\ -1 & -1 & 2 \\ -2 & -14 & -8 \end{bmatrix} = \begin{bmatrix} 0 & 0 & 0 \end{bmatrix}. \text{ If}$$

$$\frac{4}{\alpha^4} + \frac{m}{\alpha^a} + \frac{n}{\alpha^b} = 3, \text{ then } m+n \text{ is equal to } \underline{\hspace{2cm}}$$

[JEE Main 2025 (Online) 8th April Evening Shift]

- (1) 11 (2) 3 (3) 8 (4) 7

Scan or tap for the full solution



**Q.36** The sum of the squares of the roots of  $|x-2|^2 + |x-2| - 2 = 0$  and the squares of the roots of  $x^2 - 2|x-3| - 5 = 0$ , is

[JEE Main 2025 (Online) 8th April Evening Shift]

- (1) 24      (2) 26      (3) 36      (4) 30

Scan or tap for the  
full solution



**Q.37** Let

$$A = \left\{ \theta \in [0, 2\pi] : 1 + 10 \operatorname{Re} \left( \frac{2\cos\theta + i\sin\theta}{\cos\theta - 3i\sin\theta} \right) = 0 \right\}.$$

Then  $\sum_{\theta \in A} \theta^2$  is equal to

[JEE Main 2025 (Online) 8th April Evening Shift]

- (1)  $\frac{21}{4}\pi^2$       (2)  $6\pi^2$       (3)  $\frac{27}{4}\pi^2$       (4)  $8\pi^2$

Scan or tap for the  
full solution



**Q.38** Let the set of all values of  $p \in \mathbb{R}$ , for which both the roots of the equation  $x^2 - (p+2)x + (2p+9) = 0$  are negative real numbers, be the interval  $(\alpha, \beta]$ . Then  $\beta - 2\alpha$  is equal to

[JEE Main 2025 (Online) 7th April Morning Shift]

- (1) 5      (2) 0      (3) 20      (4) 9

Scan or tap for the  
full solution



**Q.39** Among the statements

(S1) : The set

$$\left\{ z \in \mathbb{C} - \{-i\} : |z| = 1 \text{ and } \frac{z-i}{z+i} \text{ is purely real} \right\}$$

contains exactly two elements, and

(S2) : The set

$$\left\{ z \in \mathbb{C} - \{-1\} : |z| = 1 \text{ and } \frac{z-1}{z+1} \text{ is purely imaginary} \right\}$$

contains infinitely many elements.

[JEE Main 2025 (Online) 7th April Morning Shift]

- (1) both are incorrect      (2) both are correct  
(3) only (S2) is correct      (4) only (S1) is correct

Scan or tap for the  
full solution



**Q.40** If the locus of  $z \in \mathbb{C}$ , such that

$$\operatorname{Re} \left( \frac{z-1}{2z+i} \right) + \operatorname{Re} \left( \frac{\bar{z}-1}{2\bar{z}-i} \right) = 2, \text{ is a circle of radius } r$$

and center  $(a, b)$ , then  $\frac{15ab}{r^2}$  is equal to :

[JEE Main 2025 (Online) 7th April Evening Shift]

- (1) 16      (2) 24      (3) 12      (4) 18

Scan or tap for the  
full solution



**Q.41** The number of real roots of the equation  $x|x-2| + 3|x-3| + 1 = 0$  is :

[JEE Main 2025 (Online) 7th April Evening Shift]

- (1) 4      (2) 3      (3) 2      (4) 1

Scan or tap for the  
full solution



**Q.42** Consider the equation  $x^2 + 4x - n = 0$ , where  $n \in [20, 100]$  is a natural number. Then the number of all distinct values of  $n$ , for which the given equation has integral roots, is equal to

[JEE Main 2025 (Online) 4th April Morning Shift]

- (1) 6      (2) 5      (3) 8      (4) 7

Scan or tap for the  
full solution



**Q.43** Let the product of  $\omega_1 = (8+i)\sin\theta + (7+4i)\cos\theta$  and  $\omega_2 = (1+8i)\sin\theta + (4+7i)\cos\theta$  be  $\alpha + i\beta$ ,  $i = \sqrt{-1}$ . Let  $p$  and  $q$  be the maximum and the minimum values of  $\alpha + \beta$  respectively. Then  $p + q$  is equal to :

[JEE Main 2025 (Online) 4th April Evening Shift]

- (1) 130      (2) 150      (3) 160      (4) 140

Scan or tap for the  
full solution



**Q.44** Let  $\alpha$  and  $\beta$  be the roots of  $x^2 + \sqrt{3}x - 16 = 0$ , and  $\gamma$  and  $\delta$  be the roots of  $x^2 + 3x - 1 = 0$ . If  $P_n = \alpha^n + \beta^n$

and  $Q_n = \gamma^n + \delta^n$ , then  $\frac{P_{25} + \sqrt{3}P_{24}}{2P_{23}} + \frac{Q_{25} - Q_{23}}{Q_{24}}$  is

equal to [JEE Main 2025 (Online) 3rd April Morning Shift]

- (1) 4      (2) 3      (3) 5      (4) 7

Scan or tap for the  
full solution



**Q.45** Let  $z \in \mathbb{C}$  be such that  $\frac{z^2 + 3i}{z - 2 + i} = 2 + 3i$ . Then the sum of all possible values of  $z^2$  is :

[JEE Main 2025 (Online) 3rd April Morning Shift]

- (1)  $-19 + 2i$       (2)  $-19 - 2i$   
(3)  $19 - 2i$       (4)  $19 + 2i$

Scan or tap for the  
full solution



**Q.46** If  $z_1, z_2, z_3 \in \mathbb{C}$  are the vertices of an equilateral triangle whose centroid is  $z_0$ , then  $\sum_{k=1}^3 (z_k - z_0)^2$  is

equal to [JEE Main 2025 (Online) 3rd April Evening Shift]

- (1) 0      (2) 1      (3)  $i$       (4)  $-i$

Scan or tap for the  
full solution



**Q.47** Let the equation  $x(x+2)(12-k) = 2$  have equal roots. Then the distance of the point  $\left(k, \frac{k}{2}\right)$  from the line  $3x + 4y + 5 = 0$  is

[JEE Main 2025 (Online) 3rd April Evening Shift]

- (1) 15      (2) 12      (3)  $5\sqrt{3}$       (4)  $15\sqrt{5}$

Scan or tap for the  
full solution



**Q.48** Let  $z$  be a complex number such that  $|z| = 1$ . If  $\frac{2+k^2z}{k+\bar{z}} = kz$ ,  $k \in \mathbb{R}$ , then the maximum distance of  $k + ik^2$  from the circle  $|z - (1 + 2i)| = 1$  is :

[JEE Main 2025 (Online) 2nd April Morning Shift]

- (1)  $\sqrt{5} + 1$  (2) 3  
(3)  $\sqrt{3} + 1$  (4) 2



Solution

**Q.49** Let  $P_n = \alpha^n + \beta^n$ ,  $n \in \mathbb{N}$ . If  $P_{10} = 123$ ,  $P_9 = 76$ ,  $P_8 = 47$  and  $P_1 = 1$ , then the quadratic equation having roots  $\frac{1}{\alpha}$  and  $\frac{1}{\beta}$  is :

[JEE Main 2025 (Online) 2nd April Morning Shift]

- (1)  $x^2 + x - 1 = 0$  (2)  $x^2 - x + 1 = 0$   
(3)  $x^2 + x + 1 = 0$  (4)  $x^2 - x - 1 = 0$

Scan or tap for the full solution



**Q.50** The number of solutions of the equation

$$\left(\frac{9}{x} - \frac{9}{\sqrt{x}} + 2\right)\left(\frac{2}{x} - \frac{7}{\sqrt{x}} + 3\right) = 0 \text{ is :}$$

[JEE Main 2025 (Online) 29th January Morning Shift]

- (1) 3 (2) 2 (3) 1 (4) 4

Scan or tap for the full solution



**Q.51** Let  $|z_1 - 8 - 2i| \leq 1$  and  $|z_2 - 2 + 6i| \leq 2$ ,  $z_1, z_2 \in \mathbb{C}$ . Then the minimum value of  $|z_1 - z_2|$  is :

[JEE Main 2025 (Online) 29th January Morning Shift]

- (1) 3 (2) 10 (3) 7 (4) 13

Scan or tap for the full solution



**Q.52** If the set of all  $a \in \mathbb{R}$ , for which the equation  $2x^2 + (a - 5)x + 15 = 3a$  has no real root, is the interval  $(\alpha, \beta)$ , and  $X = \{x \in \mathbb{Z}; \alpha < x < \beta\}$ , then  $\sum_{x \in X} x^2$  is equal to:

[JEE Main 2025 (Online) 29th January Evening Shift]

- (1) 2139 (2) 2119 (3) 2109 (4) 2129

Scan or tap for the full solution



**Q.53** The sum, of the squares of all the roots of the equation  $x^2 + |2x - 3| - 4 = 0$ , is

[JEE Main 2025 (Online) 28th January Morning Shift]

- (1)  $6(2 - \sqrt{2})$  (2)  $3(3 - \sqrt{2})$   
(3)  $3(2 - \sqrt{2})$  (4)  $6(3 - \sqrt{2})$

Scan or tap for the full solution



**Q.54** Let  $O$  be the origin, the point  $A$  be  $z_1 = \sqrt{3} + 2\sqrt{2}i$ , the point  $B(z_2)$  be such that  $\sqrt{3}|z_2| = |z_1|$  and  $\arg(z_2) = \arg(z_1) + \frac{\pi}{6}$ . Then

[JEE Main 2025 (Online) 28th January Morning Shift]

(1) area of triangle  $ABO$  is  $\frac{11}{4}$

(2) area of triangle  $ABO$  is  $\frac{11}{\sqrt{3}}$

(3)  $ABO$  is a scalene triangle

(4)  $ABO$  is an obtuse angled isosceles triangle

Scan or tap for the full solution



**Q.55** If  $\alpha + i\beta$  and  $\gamma + i\delta$  are the roots of  $x^2 - (3 - 2i)x - (2i - 2) = 0$ ,  $i = \sqrt{-1}$ , then  $\alpha\gamma + \beta\delta$  is equal to:

[JEE Main 2025 (Online) 28th January Evening Shift]

- (1) 2 (2) -6 (3) 6 (4) -2

Scan or tap for the full solution



**Q.56** The product of all the rational roots of the equation  $(x^2 - 9x + 11)^2 - (x - 4)(x - 5) = 3$ , is equal to

[JEE Main 2025 (Online) 24th January Morning Shift]

- (1) 7 (2) 21 (3) 28 (4) 14

Scan or tap for the full solution



**Q.57** If  $\alpha$  and  $\beta$  are the roots of the equation  $2z^2 - 3z - 2i = 0$ , where  $i = \sqrt{-1}$ , then

$$16 \cdot \operatorname{Re}\left(\frac{\alpha^{19} + \beta^{19} + \alpha^{11} + \beta^{11}}{\alpha^{15} + \beta^{15}}\right) \cdot \operatorname{Im}\left(\frac{\alpha^{19} + \beta^{19} + \alpha^{11} + \beta^{11}}{\alpha^{15} + \beta^{15}}\right)$$

is equal to

[JEE Main 2025 (Online) 24th January Morning Shift]

- (1) 441 (2) 312 (3) 409 (4) 398

Scan or tap for the full solution



**Q.58** Let  $\left|\frac{\bar{z}-i}{2\bar{z}+i}\right| = \frac{1}{3}$ ,  $z \in \mathbb{C}$ , be the equation of a circle with center at  $C$ . If the area of the triangle, whose vertices are at the points  $(0,0)$ ,  $C$  and  $(\alpha,0)$  is 11 square units, then  $\alpha^2$  equals:

[JEE Main 2025 (Online) 23rd January Morning Shift]

- (1)  $\frac{121}{25}$  (2) 100 (3)  $\frac{81}{25}$  (4) 50

Scan or tap for the full solution



**Q.59** The number of complex numbers  $z$ , satisfying  $|z| = 1$  and  $\left|\frac{z}{\bar{z}} + \frac{\bar{z}}{z}\right| = 1$ , is :

[JEE Main 2025 (Online) 23rd January Evening Shift]

- (1) 8 (2) 10 (3) 4 (4) 6

Scan or tap for the full solution



**Q.60** Let  $z_1, z_2$  and  $z_3$  be three complex numbers on the circle  $|z| = 1$  with  $\arg(z_1) = \frac{-\pi}{4}, \arg(z_2) = 0$  and  $\arg(z_3) = \frac{\pi}{4}$ . If

$|z_1 \bar{z}_2 + z_2 \bar{z}_3 + z_3 \bar{z}_1|^2 = \alpha + \beta \sqrt{2}, \alpha, \beta \in \mathbb{Z}$ , then the value of  $\alpha^2 + \beta^2$  is :

[JEE Main 2025 (Online) 22nd January Morning Shift]

- (1) 41 (2) 29 (3) 24 (4) 31

Scan or tap for the full solution



**Q.61** Let  $\alpha_\theta$  and  $\beta_\theta$  be the distinct roots of  $2x^2 + (\cos \theta)x - 1 = 0, \theta \in (0, 2\pi)$ . If  $m$  and  $M$  are the minimum and the maximum values of  $\alpha_\theta^4 + \beta_\theta^4$ , then  $16(M + m)$  equals :

[JEE Main 2025 (Online) 22nd January Evening Shift]

- (1) 27 (2) 17 (3) 25 (4) 24

Scan or tap for the full solution



**Q.62** Let the curve  $z(1+i) + \bar{z}(1-i) = 4, z \in \mathbb{C}$ , divide the region  $|z - 3| \leq 1$  into two parts of areas  $\alpha$  and  $\beta$ . Then  $|\alpha - \beta|$  equals :

[JEE Main 2025 (Online) 22nd January Evening Shift]

- (1)  $1 + \frac{\pi}{3}$  (2)  $1 + \frac{\pi}{6}$  (3)  $1 + \frac{\pi}{2}$  (4)  $1 + \frac{\pi}{4}$

Scan or tap for the full solution



**Q.63** Let  $\alpha, \beta$  be the roots of the equation  $x^2 + 2\sqrt{2}x - 1 = 0$ . The quadratic equation, whose roots are  $\alpha^4 + \beta^4$  and  $\frac{1}{10}(\alpha^6 + \beta^6)$ , is:

[JEE Main 2024 (Online) 9th April Morning Shift]

- (1)  $x^2 - 180x + 9506 = 0$   
 (2)  $x^2 - 195x + 9506 = 0$   
 (3)  $x^2 - 190x + 9466 = 0$   
 (4)  $x^2 - 195x + 9466 = 0$



Solution

**Q.64** Let  $z$  be a complex number such that the real part of  $\frac{z-2i}{z+2i}$  is zero. Then, the maximum value of  $|z - (6 + 8i)|$  is equal to

[JEE Main 2024 (Online) 9th April Evening Shift]

- (1) 8 (2) 12 (3) 10 (4)  $\infty$

Scan or tap for the full solution



**Q.65** Let  $\alpha, \beta; \alpha > \beta$ , be the roots of the equation  $x^2 - \sqrt{2}x - \sqrt{3} = 0$ . Let  $P_n = \alpha^n - \beta^n, n \in \mathbb{N}$ . Then  $(11\sqrt{3} - 10\sqrt{2})P_{10} + (11\sqrt{2} + 10)P_{11} - 11P_{12}$  is equal to [JEE Main 2024 (Online) 9th April Evening Shift]

- (1)  $10\sqrt{3}P_9$  (2)  $11\sqrt{3}P_9$   
 (3)  $11\sqrt{2}P_9$  (4)  $10\sqrt{2}P_9$

Scan or tap for the full solution



**Q.66** Let  $z$  be a complex number such that  $|z + 2| = 1$  and  $\operatorname{Im}\left(\frac{z+1}{z+2}\right) = \frac{1}{5}$ . Then the value of  $|\operatorname{Re}(\bar{z} + 2)|$  is

[JEE Main 2024 (Online) 8th April Morning Shift]

- (1)  $\frac{2\sqrt{6}}{5}$  (2)  $\frac{24}{5}$  (3)  $\frac{\sqrt{6}}{5}$  (4)  $\frac{1+\sqrt{6}}{5}$

Scan or tap for the full solution



**Q.67** The sum of all the solutions of the equation  $(8)^{2x} - 16 \cdot (8)^x + 48 = 0$  is :

[JEE Main 2024 (Online) 8th April Morning Shift]

- (1)  $1 + \log_8(6)$  (2)  $1 + \log_6(8)$   
 (3)  $\log_8(6)$  (4)  $\log_8(4)$

Scan or tap for the full solution



**Q.68** If the set  $R = \{(a, b) : a + 5b = 42, a, b \in \mathbb{N}\}$  has  $m$  elements and  $\sum_{n=1}^m (1 - i^{n!}) = x + iy$ , where  $i = \sqrt{-1}$ , then the value of  $m + x + y$  is

[JEE Main 2024 (Online) 8th April Morning Shift]

- (1) 12 (2) 4 (3) 8 (4) 5

Scan or tap for the full solution



**Q.69** The sum of all possible values of  $\theta \in [-\pi, 2\pi]$ , for which  $\frac{1 + i \cos \theta}{1 - 2i \cos \theta}$  is purely imaginary, is equal to :

[JEE Main 2024 (Online) 8th April Evening Shift]

- (1)  $4\pi$  (2)  $3\pi$  (3)  $2\pi$  (4)  $5\pi$

Scan or tap for the full solution



**Q.70** Let  $\alpha, \beta$  be the distinct roots of the equation  $x^2 - (t^2 - 5t + 6)x + 1 = 0, t \in \mathbb{R}$  and  $a_n = \alpha^n + \beta^n$ . Then the minimum value of  $\frac{a_{2023} + a_{2025}}{a_{2024}}$  is

[JEE Main 2024 (Online) 6th April Morning Shift]

- (1)  $-1/2$  (2)  $-1/4$  (3)  $1/4$  (4)  $1/2$

Scan or tap for the full solution



**Q.71** If  $z_1, z_2$  are two distinct complex numbers such that  $\left| \frac{z_1 - 2z_2}{\frac{1}{2} - z_1 \bar{z}_2} \right| = 2$ , then

[JEE Main 2024 (Online) 6th April Evening Shift]

- (1) either  $z_1$  lies on a circle of radius  $\frac{1}{2}$  or  $z_2$  lies on a circle of radius 1.
- (2)  $z_1$  lies on a circle of radius  $\frac{1}{2}$  and  $z_2$  lies on a circle of radius 1.
- (3) either  $z_1$  lies on a circle of radius 1 or  $z_2$  lies on a circle of radius  $\frac{1}{2}$ .
- (4) both  $z_1$  and  $z_2$  lie on the same circle.

Scan or tap for the full solution



**Q.72** Consider the following two statements :

Between the above two statements,

**Statement-I:** For any two non-zero complex numbers  $z_1, z_2$ ,  $(|z_1| + |z_2|) \left| \frac{z_1}{|z_1|} + \frac{z_2}{|z_2|} \right| \leq 2(|z_1| + |z_2|)$

**Statement-II:** If  $x, y, z$  are three distinct complex numbers and  $a, b, c$  are three positive real numbers

such that  $\frac{a}{|y-z|} = \frac{b}{|z-x|} = \frac{c}{|x-y|}$ , then  $\frac{a^2}{y-z} + \frac{b^2}{z-x} + \frac{c^2}{x-y} = 1$ .

[JEE Main 2024 (Online) 5th April Morning Shift]

- (1) both Statement-I and Statement-II are incorrect.
- (2) Statement-I is correct but Statement-II is incorrect.
- (3) Statement-I is incorrect but Statement-II is correct.
- (4) both Statement-I and Statement-II are correct.

Scan or tap for the full solution



**Q.73** Let  $S_1 = \{z \in \mathbb{C} : |z| \leq 5\}$ ,

$$S_2 = \left\{ z \in \mathbb{C} : \operatorname{Im} \left( \frac{z+1-\sqrt{3}i}{1-\sqrt{3}i} \right) \geq 0 \right\} \text{ and}$$

$S_3 = \{z \in \mathbb{C} : \operatorname{Re}(z) \geq 0\}$ . Then the area of the region  $S_1 \cap S_2 \cap S_3$  is :

[JEE Main 2024 (Online) 5th April Evening Shift]

- (1)  $\frac{125\pi}{24}$
- (2)  $\frac{125\pi}{6}$
- (3)  $\frac{125\pi}{12}$
- (4)  $\frac{125\pi}{4}$

Scan or tap for the full solution



**Q.74** If 2 and 6 are the roots of the equation  $ax^2 + bx + 1 = 0$ , then the quadratic equation, whose roots are  $\frac{1}{2a+b}$  and  $\frac{1}{6a+b}$ , is :

[JEE Main 2024 (Online) 4th April Morning Shift]

- (1)  $x^2 + 8x + 12 = 0$
- (2)  $2x^2 + 11x + 12 = 0$
- (3)  $4x^2 + 14x + 12 = 0$
- (4)  $x^2 + 10x + 16 = 0$

Scan or tap for the full solution



**Q.75** Let  $\alpha$  and  $\beta$  be the sum and the product of all the non-zero solutions of the equation

$$(\bar{z})^2 + |z| = 0, z \in \mathbb{C}. \text{ Then } 4(\alpha^2 + \beta^2) \text{ is equal to :}$$

[JEE Main 2024 (Online) 4th April Morning Shift]

- (1) 4
- (2) 2
- (3) 6
- (4) 8

Scan or tap for the full solution



**Q.76** The area (in sq. units) of the region  $S = \{z \in \mathbb{C} : |z-1| \leq 2; (z+\bar{z}) + i(z-\bar{z}) \leq 2, \operatorname{Im}(z) \geq 0\}$  is

[JEE Main 2024 (Online) 4th April Evening Shift]

- (1)  $\frac{7\pi}{4}$
- (2)  $\frac{3\pi}{2}$
- (3)  $\frac{7\pi}{3}$
- (4)  $\frac{17\pi}{8}$

Scan or tap for the full solution



**Q.77** Let

$$S = \{z \in \mathbb{C} : |z-1| = 1 \text{ and } (\sqrt{2}-1)(z+\bar{z}) - i(z-\bar{z}) = 2\sqrt{2}\}.$$

Let  $z_1, z_2 \in S$  be such that  $|z_1| = \max_{z \in S} |z|$  and

$|z_2| = \min_{z \in S} |z|$ . Then  $|\sqrt{2}z_1 - z_2|^2$  equals :

[JEE Main 2024 (Online) 1st February Morning Shift]

- (1) 1
- (2) 4
- (3) 3
- (4) 2

Scan or tap for the full solution



**Q.78** Let  $S = \{x \in \mathbb{R} : (\sqrt{3} + \sqrt{2})^x + (\sqrt{3} - \sqrt{2})^x = 10\}$ .

Then the number of elements in  $S$  is :

[JEE Main 2024 (Online) 1st February Morning Shift]

- (1) 4
- (2) 0
- (3) 2
- (4) 1

Scan or tap for the full solution



**Q.79** If  $z$  is a complex number such that  $|z| \geq 1$ , then the minimum value of  $\left| z + \frac{1}{2}(3+4i) \right|$  is :

[JEE Main 2024 (Online) 1st February Evening Shift]

- (1) 2
- (2)  $\frac{5}{2}$
- (3)  $\frac{3}{2}$
- (4) 3

Scan or tap for the full solution



- Q.80** Let  $\alpha$  and  $\beta$  be the roots of the equation  $px^2 + qx - r = 0$ , where  $p \neq 0$ . If  $p$ ,  $q$  and  $r$  be the consecutive terms of a non constant G.P. and  $\frac{1}{\alpha} + \frac{1}{\beta} = \frac{3}{4}$ , then the value of  $(\alpha - \beta)^2$  is :

[JEE Main 2024 (Online) 1st February Evening Shift]

- (1) 8      (2) 9      (3)  $\frac{20}{3}$       (4)  $\frac{80}{9}$

Scan or tap for the full solution



- Q.81** Let  $S$  be the set of positive integral values of  $a$  for which  $\frac{ax^2 + 2(a+1)x + 9a + 4}{x^2 - 8x + 32} < 0, \forall x \in \mathbb{R}$ . Then, the number of elements in  $S$  is :

[JEE Main 2024 (Online) 31st January Morning Shift]

- (1) 0      (2)  $\infty$       (3) 3      (4) 1

Scan or tap for the full solution



- Q.82** For  $0 < c < b < a$ , let  $(a + b - 2c)x^2 + (b + c - 2a)x + (c + a - 2b) = 0$  and  $\alpha \neq 1$  be one of its roots. Then, among the two statements

**Statement-I:** If  $\alpha \in (-1, 0)$ , then  $b$  cannot be the geometric mean of  $a$  and  $c$

**Statement-II:** If  $\alpha \in (0, 1)$ , then  $b$  may be the geometric mean of  $a$  and  $c$

[JEE Main 2024 (Online) 31st January Morning Shift]

- (1) only (II) is true  
(2) Both (I) and (II) are true  
(3) only (I) is true  
(4) Neither (I) nor (II) is true



Solution

- Q.83** Let  $a$  be the sum of all coefficients in the expansion of  $(1 - 2x + 2x^2)^{2023}(3 - 4x^2 + 2x^3)^{2024}$  and

$b = \lim_{x \rightarrow 0} \left( \frac{\int_0^x \frac{\log(1+t)}{t^{2024} + 1} dt}{x^2} \right)$ . If the equations  $cx^2 + dx + e = 0$  and  $2bx^2 + ax + 4 = 0$  have a common root, where  $c, d, e \in \mathbb{R}$ , then  $d:c:e$  equals

[JEE Main 2024 (Online) 31st January Morning Shift]

- (1) 2:1:4      (2) 1:1:4      (3) 1:2:4      (4) 4:1:4

Scan or tap for the full solution



- Q.84** Let  $z_1$  and  $z_2$  be two complex numbers such that  $z_1 + z_2 = 5$  and  $z_1^3 + z_2^3 = 20 + 15i$ . Then,  $|z_1^4 + z_2^4|$  equals -

[JEE Main 2024 (Online) 31st January Evening Shift]

- (1)  $15\sqrt{15}$       (2)  $30\sqrt{3}$   
(3)  $25\sqrt{3}$       (4) 75

Scan or tap for the full solution



- Q.85** If  $z = x + iy$ ,  $xy \neq 0$ , satisfies the equation  $z^2 + i\bar{z} = 0$ , then  $|z^2|$  is equal to :

[JEE Main 2024 (Online) 30th January Morning Shift]

- (1) 9      (2)  $\frac{1}{4}$       (3) 4      (4) 1

Scan or tap for the full solution



- Q.86** If  $z$  is a complex number, then the number of common roots of the equations  $z^{1985} + z^{100} + 1 = 0$  and  $z^3 + 2z^2 + 2z + 1 = 0$ , is equal to

[JEE Main 2024 (Online) 30th January Evening Shift]

- (1) 0      (2) 2      (3) 1      (4) 3

Scan or tap for the full solution



- Q.87** If  $z = \frac{1}{2} - 2i$  is such that  $|z + 1| = \alpha z + \beta(1 + i)$ ,  $i = \sqrt{-1}$  and  $\alpha, \beta \in \mathbb{R}$ , then  $\alpha + \beta$  is equal to

[JEE Main 2024 (Online) 29th January Morning Shift]

- (1) 2      (2) -4      (3) 3      (4) -1

Scan or tap for the full solution



- Q.88** Let  $r$  and  $\theta$  respectively be the modulus and amplitude of the complex number

$z = 2 - i \left( 2 \tan \frac{5\pi}{8} \right)$ , then  $(r, \theta)$  is equal to

[JEE Main 2024 (Online) 29th January Evening Shift]

- (1)  $\left( 2 \sec \frac{11\pi}{8}, \frac{11\pi}{8} \right)$       (2)  $\left( 2 \sec \frac{3\pi}{8}, \frac{3\pi}{8} \right)$   
(3)  $\left( 2 \sec \frac{5\pi}{8}, \frac{3\pi}{8} \right)$       (4)  $\left( 2 \sec \frac{3\pi}{8}, \frac{5\pi}{8} \right)$

Scan or tap for the full solution



- Q.89** If  $S = \{z \in \mathbb{C} : |z - i| = |z + i| = |z - 1|\}$ , then,  $n(S)$  is :

[JEE Main 2024 (Online) 27th January Morning Shift]

- (1) 1      (2) 2      (3) 3      (4) 0

Scan or tap for the full solution



- Q.90** If  $\alpha, \beta$  are the roots of the equation,  $x^2 - x - 1 = 0$  and  $S_n = 2023\alpha^n + 2024\beta^n$ , then :

[JEE Main 2024 (Online) 27th January Evening Shift]

- (1)  $2S_{12} = S_{11} + S_{10}$       (2)  $S_{12} = S_{11} + S_{10}$   
(3)  $S_{11} = S_{10} + S_{12}$       (4)  $2S_{11} = S_{12} + S_{10}$

Scan or tap for the full solution



## Section B (Numerical) — 25 questions

- Q.91** Let  $z = (1 + i)(1 + 2i)(1 + 3i) \dots (1 + ni)$ , where  $i = \sqrt{-1}$ . If  $|z|^2 = 44200$ , then  $n$  is equal to \_\_\_\_\_.

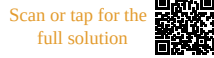
[JEE Main 2026 (Online) 24th January Evening Shift]

Scan or tap for the full solution



**Q.92** Let  $\alpha = \frac{-1+i\sqrt{3}}{2}$  and  $\beta = \frac{-1-i\sqrt{3}}{2}$ ,  $i = \sqrt{-1}$ . If  $(7 - 7\alpha + 9\beta)^{20} + (9 + 7\alpha - 7\beta)^{20} + (-7 + 9\alpha + 7\beta)^{20} + (14 + 7\alpha + 7\beta)^{20} = m^{10}$ , then  $m$  is \_\_\_\_\_.

[JEE Main 2026 (Online) 22nd January Morning Shift]



**Q.93** For  $t > -1$ , let  $\alpha_t$  and  $\beta_t$  be the roots of the equation  $((t+2)^{1/7} - 1)x^2 + ((t+2)^{1/6} - 1)x + ((t+2)^{1/21} - 1) = 0$ . If  $\lim_{t \rightarrow -1^+} \alpha_t = a$  and  $\lim_{t \rightarrow -1^+} \beta_t = b$ , then  $72(a+b)^2$  is equal to \_\_\_\_\_.

[JEE Main 2025 (Online) 7th April Evening Shift]



**Q.94** Let  $A = \{z \in \mathbb{C} : |z - 2 - i| = 3\}$ ,  $B = \{z \in \mathbb{C} : \operatorname{Re}(z - iz) = 2\}$  and  $S = A \cap B$ . Then  $\sum_{z \in S} |z|^2$  is equal to \_\_\_\_\_.

[JEE Main 2025 (Online) 4th April Morning Shift]



**Q.95** If  $\alpha$  is a root of the equation  $x^2 + x + 1 = 0$  and  $\sum_{k=1}^n \left( \alpha^k + \frac{1}{\alpha^k} \right)^2 = 20$ , then  $n$  is equal to \_\_\_\_\_.

[JEE Main 2025 (Online) 4th April Evening Shift]



**Q.96** If the set of all  $a \in \mathbb{R} - \{1\}$ , for which the roots of the equation  $(1 - a)x^2 + 2(a - 3)x + 9 = 0$  are positive is  $(-\infty, -\alpha] \cup [\beta, \gamma)$ , then  $2\alpha + \beta + \gamma$  is equal to \_\_\_\_\_.

[JEE Main 2025 (Online) 2nd April Evening Shift]



**Q.97** Let integers  $a, b \in [-3, 3]$  be such that  $a + b \neq 0$ . Then the number of all possible ordered pairs  $(a, b)$ , for which  $\left| \frac{z-a}{z+b} \right| = 1$  and  $\begin{vmatrix} z+1 & \omega & \omega^2 \\ \omega & z+\omega^2 & 1 \\ \omega^2 & 1 & z+\omega \end{vmatrix} = 1$ ,  $z \in \mathbb{C}$ , where  $\omega$  and  $\omega^2$  are the roots of  $x^2 + x + 1 = 0$ , is equal to \_\_\_\_\_.

[JEE Main 2025 (Online) 29th January Evening Shift]



**Q.98** If the equation  $a(b - c)x^2 + b(c - a)x + c(a - b) = 0$  has equal roots, where  $a + c = 15$  and  $b = \frac{36}{5}$ , then  $a^2 + c^2$  is equal to \_\_\_\_\_.

[JEE Main 2025 (Online) 23rd January Morning Shift]



**Q.99** Let  $\alpha, \beta$  be the roots of the equation  $x^2 - ax - b = 0$  with  $\operatorname{Im}(\alpha) < \operatorname{Im}(\beta)$ . Let  $P_n = \alpha^n - \beta^n$ . If  $P_3 = -5\sqrt{7}i$ ,  $P_4 = -3\sqrt{7}i$ ,  $P_5 = 11\sqrt{7}i$  and  $P_6 = 45\sqrt{7}i$ , then  $|\alpha^4 + \beta^4|$  is equal to \_\_\_\_\_.

[JEE Main 2025 (Online) 23rd January Evening Shift]



**Q.100** The sum of the square of the modulus of the elements in the set  $\{z = a + ib : a, b \in \mathbb{Z}, z \in \mathbb{C}, |z - 1| \leq 1, |z - 5| \leq |z - 5i|\}$  is \_\_\_\_\_.

[JEE Main 2024 (Online) 9th April Morning Shift]



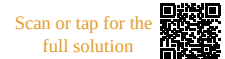
**Q.101** The number of distinct real roots of the equation  $|x + 1||x + 3| - 4|x + 2| + 5 = 0$ , is \_\_\_\_\_.

[JEE Main 2024 (Online) 8th April Evening Shift]



**Q.102** Let  $x_1, x_2, x_3, x_4$  be the solution of the equation  $4x^4 + 8x^3 - 17x^2 - 12x + 9 = 0$  and  $(4 + x_1^2)(4 + x_2^2)(4 + x_3^2)(4 + x_4^2) = \frac{125}{16}m$ . Then the value of  $m$  is \_\_\_\_\_.

[JEE Main 2024 (Online) 6th April Morning Shift]



**Q.103** Let  $\alpha, \beta$  be roots of  $x^2 + \sqrt{2}x - 8 = 0$ . If  $U_n = \alpha^n + \beta^n$ , then  $\frac{U_{10} + \sqrt{2}U_9}{2U_8}$  is equal to \_\_\_\_\_.

[JEE Main 2024 (Online) 6th April Evening Shift]



**Q.104** The number of distinct real roots of the equation  $|x||x + 2| - 5|x + 1| - 1 = 0$  is \_\_\_\_\_.

[JEE Main 2024 (Online) 5th April Morning Shift]



**Q.105** The number of real solutions of the equation  $x|x + 5| + 2|x + 7| - 2 = 0$  is \_\_\_\_\_.

[JEE Main 2024 (Online) 5th April Evening Shift]



**Q.106** Let  $S = \{\sin^2 2\theta : (\sin^4 \theta + \cos^4 \theta)x^2 + (\sin 2\theta)x + (\sin^6 \theta + \cos^6 \theta) = 0 \text{ has real roots}\}$ . If  $\alpha$  and  $\beta$  be the smallest and largest elements of the set  $S$ , respectively, then  $3((\alpha - 2)^2 + (\beta - 1)^2)$  equals \_\_\_\_\_.

[JEE Main 2024 (Online) 4th April Evening Shift]

Scan or tap for the full solution



**Q.107** Let  $P = \{z \in \mathbb{C} : |z + 2 - 3i| \leq 1\}$  and  $Q = \{z \in \mathbb{C} : z(1+i) + \bar{z}(1-i) \leq -8\}$ . Let in  $P \cap Q$ ,  $|z - 3 + 2i|$  be maximum and minimum at  $z_1$  and  $z_2$  respectively. If  $|z_1|^2 + 2|z_2|^2 = \alpha + \beta\sqrt{2}$ , where  $\alpha, \beta$  are integers, then  $\alpha + \beta$  equals \_\_\_\_\_.

[JEE Main 2024 (Online) 1st February Morning Shift]

Scan or tap for the full solution



**Q.108** If  $\alpha$  denotes the number of solutions of  $|1 - i|^x = 2^x$  and  $\beta = \left(\frac{|z|}{\arg(z)}\right)$ , where

$$z = \frac{\pi}{4}(1+i)^4 \left[ \frac{1 - \sqrt{\pi}i}{\sqrt{\pi} + i} + \frac{\sqrt{\pi} - i}{1 + \sqrt{\pi}i} \right], i = \sqrt{-1}, \text{ then}$$

the distance of the point  $(\alpha, \beta)$  from the line  $4x - 3y = 7$  is \_\_\_\_\_.

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**Q.109** Let  $a, b, c$  be the lengths of three sides of a triangle satisfying the condition  $(a^2 + b^2)x^2 - 2b(a+c)x + (b^2 + c^2) = 0$ . If the set of all possible values of  $x$  is the interval  $(\alpha, \beta)$ , then  $12(\alpha^2 + \beta^2)$  is equal to \_\_\_\_\_.

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**Q.110** Let  $\alpha, \beta \in \mathbb{N}$  be roots of the equation  $x^2 - 70x + \lambda = 0$ , where  $\frac{\lambda}{2}, \frac{\lambda}{3} \notin \mathbb{N}$ . If  $\lambda$  assumes the minimum possible value, then  $\frac{(\sqrt{\alpha-1} + \sqrt{\beta-1})(\lambda+35)}{|\alpha-\beta|}$  is equal to :

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**Q.111** The number of real solutions of the equation  $x(x^2 + 3|x| + 5|x-1| + 6|x-2|) = 0$  is \_\_\_\_\_.

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**Q.112** Let  $\alpha, \beta$  be the roots of the equation  $x^2 - x + 2 = 0$  with  $\text{Im}(\alpha) > \text{Im}(\beta)$ . Then  $\alpha^6 + \alpha^4 + \beta^4 - 5\alpha^2$  is equal to \_\_\_\_\_.

[JEE Main 2024 (Online) 29th January Morning Shift]

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**Q.113** Let  $\alpha, \beta$  be the roots of the equation  $x^2 - \sqrt{6}x + 3 = 0$  such that  $\text{Im}(\alpha) > \text{Im}(\beta)$ . Let  $a, b$  be integers not divisible by 3 and  $n$  be a natural number such that  $\frac{\alpha^{99}}{\beta} + \alpha^{98} = 3^n(a + ib), i = \sqrt{-1}$ . Then  $n + a + b$  is equal to \_\_\_\_\_.

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**Q.114** If  $\alpha$  satisfies the equation  $x^2 + x + 1 = 0$  and  $(1 + \alpha)^7 = A + B\alpha + C\alpha^2, A, B, C \geq 0$ , then  $5(3A - 2B - C)$  is equal to \_\_\_\_\_.

[JEE Main 2024 (Online) 27th January Morning Shift]

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**Q.115** Let the complex numbers  $\alpha$  and  $\frac{1}{\alpha}$  lie on the circles  $|z - z_0|^2 = 4$  and  $|z - z_0|^2 = 16$  respectively, where  $z_0 = 1 + i$ . Then, the value of  $100|\alpha|^2$  is \_\_\_\_\_.

[JEE Main 2024 (Online) 27th January Evening Shift]

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## ANSWER KEY

### Section A (MCQ) — 90 questions

| Ques. | 1  | 2  | 3  | 4  | 5  |
|-------|----|----|----|----|----|
| Ans.  | 2  | 3  | 1  | 1  | 2  |
| Ques. | 6  | 7  | 8  | 9  | 10 |
| Ans.  | 3  | 4  | 2  | 1  | 4  |
| Ques. | 11 | 12 | 13 | 14 | 15 |
| Ans.  | 2  | 3  | 4  | 4  | 3  |
| Ques. | 16 | 17 | 18 | 19 | 20 |
| Ans.  | 2  | 4  | 4  | 1  | 1  |
| Ques. | 21 | 22 | 23 | 24 | 25 |
| Ans.  | 1  | 3  | 1  | 2  | 4  |
| Ques. | 26 | 27 | 28 | 29 | 30 |
| Ans.  | 1  | 4  | 4  | 1  | 4  |
| Ques. | 31 | 32 | 33 | 34 | 35 |
| Ans.  | 2  | 3  | 2  | 1  | 1  |
| Ques. | 36 | 37 | 38 | 39 | 40 |
| Ans.  | 3  | 1  | 1  | 3  | 4  |
| Ques. | 41 | 42 | 43 | 44 | 45 |
| Ans.  | 4  | 1  | 1  | 3  | 2  |
| Ques. | 46 | 47 | 48 | 49 | 50 |
| Ans.  | 1  | 1  | 1  | 1  | 4  |

|       |    |    |    |              |    |
|-------|----|----|----|--------------|----|
| Ques. | 51 | 52 | 53 | 54           | 55 |
| Ans.  | 3  | 1  | 1  | 4            | 1  |
| Ques. | 56 | 57 | 58 | 59           | 60 |
| Ans.  | 4  | 1  | 2  | 1            | 2  |
| Ques. | 61 | 62 | 63 | 64           | 65 |
| Ans.  | 3  | 3  | 2  | 2            | 1  |
| Ques. | 66 | 67 | 68 | 69           | 70 |
| Ans.  | 1  | 1  | 1  | 2            | 2  |
| Ques. | 71 | 72 | 73 | 74           | 75 |
| Ans.  | 3  | 2  | 3  | 1            | 1  |
| Ques. | 76 | 77 | 78 | 79           | 80 |
| Ans.  | 2  | 4  | 3  | <b>BONUS</b> | 4  |
| Ques. | 81 | 82 | 83 | 84           | 85 |
| Ans.  | 1  | 2  | 2  | 4            | 4  |
| Ques. | 86 | 87 | 88 | 89           | 90 |
| Ans.  | 2  | 3  | 2  | 1            | 2  |

## Section B (Numerical) — 25 questions

|       |     |     |     |     |     |     |     |
|-------|-----|-----|-----|-----|-----|-----|-----|
| Ques. | 91  | 92  | 93  | 94  | 95  | 96  | 97  |
| Ans.  | 5   | 49  | 98  | 22  | 11  | 7   | 10  |
| Ques. | 98  | 99  | 100 | 101 | 102 | 103 | 104 |
| Ans.  | 117 | 31  | 9   | 2   | 221 | 4   | 3   |
| Ques. | 105 | 106 | 107 | 108 | 109 | 110 | 111 |
| Ans.  | 3   | 4   | 36  | 3   | 36  | 60  | 1   |
| Ques. | 112 | 113 | 114 | 115 |     |     |     |
| Ans.  | 13  | 49  | 5   | 20  |     |     |     |