

## JEE MAIN COMPLEX NUMBERS AND QUADRATIC EQUATIONS — RELATION BETWEEN ROOTS AND COEFFICIENTS, FORMATION OF EQUATIONS — PYQS

Max. Marks: 44

Questions: 11

### Section A (MCQ) — 9 questions

- Q.1** 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

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- Q.2** 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

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- Q.3** 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

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- Q.4** 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

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- Q.5** 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

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- Q.6** 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

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- Q.7** 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)  $19 + 2i$

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- Q.8** 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)  $x^2 - x - 1 = 0$

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- Q.9** 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

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### Section B (Numerical) — 2 questions

- Q.10** 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]

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- Q.11** Let  $\alpha, \beta$  be the roots of the equation  $x^2 - ax - b = 0$  with  $\text{Im}(\alpha) < \text{Im}(\beta)$ . 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]

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## ANSWER KEY

### Section A (MCQ) — 9 questions

| Ques. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |  |  |
|-------|---|---|---|---|---|---|---|---|---|--|--|
| Ans.  | 2 | 3 | 3 | 4 | 1 | 3 | 2 | 1 | 3 |  |  |

### Section B (Numerical) — 2 questions

| Ques. | 10 | 11 |  |  |  |  |  |  |  |  |  |
|-------|----|----|--|--|--|--|--|--|--|--|--|
| Ans.  | 98 | 31 |  |  |  |  |  |  |  |  |  |