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Solution of Complex Equation - Pattern 3 · JEE Main 2024 · Shift-I View Solution on Crucible ↗

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

(A) 9
(B) 1
(C) 4
(D) $\frac{1}{4}$

Conjugate Roots · JEE Main 2021 · Shift-II View Solution on Crucible ↗

2. If $\alpha, \beta \in \mathbb{R}$ are such that $1 - 2i$ (here $i^2 = -1$) is a root of $z^2 + \alpha z + \beta = 0$, then $(\alpha - \beta)$ is equal to:

(A) -7
(B) 7
(C) -3
(D) 3

JEE Main 2025 · Shift-II View Solution on Crucible ↗

3. Let a_n be the n^{th} term of an A.P. If $S_n = a_1 + a_2 + a_3 + \cdots + a_n = 700, a_6 = 7$ and $S_7 = 7$, then a_n is equal to:

(A) 56
(B) 65
(C) 64
(D) 70

Dictionary Rank / Serial Order · JEE Main 2025 · Shift-II View Solution on Crucible ↗

4. If all the words with or without meaning made using all the letters of the word "KANPUR" are arranged as in a dictionary, then the word at 440^{th} position in this arrangement, is :

(A) PRNAUK
(B) PRKANU
(C) PRKAUN
(D) PRNAKU

Term independent of x · JEE Main 2025 · Shift-I View Solution on Crucible ↗

5. The term independent of x in the expansion of $\left(\frac{(x+1)}{(x^{2/3}+1-x^{1/3})} - \frac{(x-1)}{(x-x^{1/2})}\right)^{10}, x > 1$ is:

(A) 210
(B) 150
(C) 240
(D) 120

Identifying a Tautology · JEE Main 2021 · Shift-I View Solution on Crucible ↗

6. Which of the following Boolean expressions is not a tautology?

(A) $(p \Rightarrow q) \vee (\sim q \Rightarrow p)$
(B) $(q \Rightarrow p) \vee (\sim q \Rightarrow p)$
(C) $(p \Rightarrow \sim q) \vee (\sim q \Rightarrow p)$
(D) $(\sim p \Rightarrow q) \vee (\sim q \Rightarrow p)$

Correcting Misread Data · JEE Main 2023 · Shift-I View Solution on Crucible ↗

7. The mean and standard deviation of 10 observations are 20 and 8 respectively. Later on, it was observed that one observation was recorded as 50 instead of 40. Then the correct variance is

(A) 11
(B) 13
(C) 12
(D) 14

JEE Main 2021 · Shift-II View Solution on Crucible ↗

8. A seven digit number is formed using digits $3, 3, 4, 4, 4, 5, 5$. The probability, that number so formed is divisible by 2 , is

(A) $\frac{4}{7}$
(B) $\frac{3}{7}$
(C) $\frac{1}{7}$
(D) $\frac{6}{7}$

Venn Diagrams - Type 1 · JEE Main 2020 · Shift-I View Solution on Crucible ↗

9. A survey shows that 73% of the persons working in an office like coffee, whereas 65% like tea. If x denotes the percentage of them, who like both coffee and tea, then x cannot be:

(A) 63
(B) 36
(C) 54
(D) 38

Real & Imaginary Part - Pattern 3 · JEE Main 2022 · Shift-I View Solution on Crucible ↗

10. If $z = 2 + 3i$, then $z^5 + (\bar{z})^5$ is equal to:

(A) 244
(B) 224
(C) 245
(D) 265

Sign of Quadratic · JEE Main 2021 · Shift-I View Solution on Crucible ↗

11. The integer k, for which the inequality $x^2 - 2(3k-1)x + 8k^2 - 7 > 0$ is valid for every x in $\mathbb{R}$ is:

(A) 4 **(B)** 2

(C) 3 **(D)** 0

JEE Main PYQ View Solution on Crucible ↗

12. Let $a_1, a_2, a_3, \ldots$ be in an A.P. such that $\sum_{k=1}^{12} a_{2k-1} = -\frac{72}{5}a_1, a_1 \neq 0$. If $\sum_{k=1}^{n} a_k = 0$, then n is:

(A) 11 **(B)** 10

(C) 18 **(D)** 17

Dictionary Rank / Serial Order · JEE Main 2024 · Shift-II View Solution on Crucible ↗

13. If all the words with or without meaning made using all the letters of the word "NAGPUR" are arranged as in a dictionary, then the word at 315^{th} position in this arrangement is :

(A) NRAGUP **(B)** NRAPUG

(C) NRAPGU **(D)** NRAGPU

Ratio of two consecutive terms · JEE Main 2023 · Shift-II View Solution on Crucible ↗

14. The sum of the coefficients of three consecutive terms in the binomial expansion of $(1+x)^{n+2}$, which are in the ratio $1 : 3 : 5$, is equal to

(A) 92 **(B)** 63

(C) 41 **(D)** 25

Negation using De Morgan's Laws · JEE Main 2021 · Shift-II View Solution on Crucible ↗

15. The negation of the statement $\sim p \wedge (p \vee q)$ is:

(A) $\sim p \vee q$ **(B)** $\sim p \wedge q$

(C) $p \vee \sim q$ **(D)** $p \wedge \sim q$

Mean & Variance: Two Unknowns - Type 1 · JEE Main 2020 · Shift-II View Solution on Crucible ↗

16. If the mean and the standard deviation of the data $3, 5, 7, a, b$ are 5 and 2 respectively, then a and b are the roots of the equation:

(A) $x^2 - 10x + 18 = 0$
(B) $2x^2 - 20x + 19 = 0$
(C) $x^2 - 10x + 19 = 0$
(D) $x^2 - 20x + 18 = 0$

JEE Main 2023 · Shift-II View Solution on Crucible ↗

17. Three dice are rolled. If the probability of getting different numbers on the three dice is $\frac{p}{q}$, where p and q are co-prime, then $q - p$ is equal to

(A) 2
(B) 1
(C) 3
(D) 4

Set Representation & Cardinality - Type 2 · JEE Main 2023 · Shift-I View Solution on Crucible ↗

18. Let the number of elements in sets A and B be five and two respectively. Then the number of subsets of $A \times B$ each having at least 3 and at most 6 elements is

(A) 752
(B) 782
(C) 792
(D) 772

Circle & Perpendicular Bisector - Pattern 1 · JEE Main 2022 · Shift-II View Solution on Crucible ↗

19. If $z = x + iy$ satisfies $|z| - 2 = 0$ and $|z - i| - |z + 5i| = 0$, then

(A) $x + 2y - 4 = 0$
(B) $x^2 + y - 4 = 0$
(C) $x + 2y + 4 = 0$
(D) $x^2 - y + 3 = 0$

Location of Roots - Pattern 1 · JEE Main 2025 · Shift-I View Solution on Crucible ↗

20. 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

(A) 0
(B) 9
(C) 5
(D) 20

JEE Main 2025 · Shift-I View Solution on Crucible ↗

21. If the first term of an A.P. is 3 and the sum of its first four terms is equal to one-fifth of the sum of the next four terms, then the sum of the first 20 terms is equal to

(A) -1080 **(B)** -1020

(C) -1200 **(D)** -120

Dictionary Rank / Serial Order · JEE Main 2023 · Shift-II View Solution on Crucible ↗

22. All the letters of the word PUBLIC are written in all possible orders and these words are written as in a dictionary with serial numbers. Then the serial number of the word PUBLIC is

(A) 576 **(B)** 578

(C) 580 **(D)** 582

Coefficients in Complex Expansions - Type 3 · JEE Main 2023 · Shift-II View Solution on Crucible ↗

23. If the coefficients of x^7 in $\left(ax^2+\frac{1}{2bx}\right)^{11}$ and x^{-7} in $\left(ax-\frac{1}{3bx^2}\right)^{11}$ are equal, then

(A) $729ab=32$ **(B)** $32ab=729$

(C) $64ab=243$ **(D)** $243ab=64$

Boolean Algebra Simplification · JEE Main 2023 · Shift-II View Solution on Crucible ↗

24. The statement $(p\wedge(\sim q))\vee((\sim p)\wedge q)\vee((\sim p)\wedge(\sim q))$ is equivalent to _____

(A) $(\sim p)\vee q$ **(B)** $(\sim p)\vee(\sim q)$

(C) $p\vee(\sim q)$ **(D)** $p\vee q$

Correcting Misread Data · JEE Main 2024 · Shift-I View Solution on Crucible ↗

25. The mean and standard deviation of 20 observations are found to be 10 and 2 respectively. On rechecking, it was found that an observation by mistake was taken 8 instead of 12. The correct standard deviation is

(A) 1.8 **(B)** 1.94

(C) $\sqrt{3.96}$ **(D)** $\sqrt{3.86}$

Bayes' Theorem (Reverse Probability) - Type 1 · JEE Main 2020 · Shift-I View Solution on Crucible ↗

26. Box 1 contains 30 cards numbered 1 to 30 and Box 2 contains 20 cards numbered 31 to 50. A box is selected at random and a card is drawn from it. The number on the card is found to be a non-prime number. The probability that the card was drawn from Box 1 is

(A) $\frac{2}{3}$ **(B)** $\frac{8}{17}$

(C) $\frac{4}{17}$ **(D)** $\frac{2}{5}$

Number of relations - Type 3 · JEE Main 2023 · Shift-II View Solution on Crucible ↗

27. Let $A = \{1, 3, 4, 6, 9\}$ and $B = \{2, 4, 5, 8, 10\}$. Let R be a relation defined on $A \times B$ such that $R = \{(a_1, b_1), (a_2, b_2) : a_1 \leq b_2$ and $b_1 \leq a_2\}$. Then the number of elements in the set R is

(A) 160 **(B)** 52

(C) 26 **(D)** 180

Real & Imaginary Part - Pattern 4 · JEE Main 2024 · Shift-I View Solution on Crucible ↗

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

(A) $\frac{2\sqrt{6}}{5}$ **(B)** $\frac{24}{5}$

(C) $\frac{1+\sqrt{6}}{5}$ **(D)** $\frac{\sqrt{6}}{5}$

Quadratic Equations with Modulus Function · JEE Main 2025 · Shift-II View Solution on Crucible ↗

29. 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

(A) 26 **(B)** 36

(C) 30 **(D)** 24

JEE Main 2025 · Shift-II View Solution on Crucible ↗

30. In an arithmetic progression, if $S_{40} = 1030$ and $S_{12} = 57$, then $S_{30} - S_{10}$ is equal to:

(A) 525 **(B)** 510

(C) 515 **(D)** 505

Answer Key (Q1 to Q30)

Click any question number below to open its exact step-by-step solution on The Crucible ↗

1: (B)	2: (A)	3: (C)	4: (C)	5: (A)	6: (D)	7: (B)	8: (B)	9: (B)	10: (A)
11: (C)	12: (A)	13: (C)	14: (B)	15: (C)	16: (C)	17: (D)	18: (C)	19: (C)	20: (C)
21: (A)	22: (D)	23: (A)	24: (B)	25: (C)	26: (B)	27: (A)	28: (A)	29: (A)	30: (C)

Sample Solution — Question 1 (Correct Option: B)

Open Full Solution on Crucible ↗

Q1. If $z = x + iy, xy \neq 0$, satisfies the equation $z^2 + i\bar{z} = 0$, then $|z^2|$ is equal to :

The question asks only for a modulus. So take the modulus of both sides straight away, before touching x and y.

$z^2 + i\bar{z} = 0$ gives $z^2 = -i\bar{z}$

Take modulus on both sides. Note $|-i| = 1$ and $|\bar{z}| = |z|$:

$|z|^2 = |z|$

$|z|\,(|z| - 1) = 0$

Here $xy \neq 0$, so z is not 0. That leaves

$|z| = 1$

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