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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

Mixed properties of triangle · JEE Main 2025 · Shift-I — View Solution on Crucible ↗

5. Let the area of a ΔPQR with vertices $P(5, 4), Q(-2, 4)$ and $R(a, b)$ be 35square units. If its orthocenter and centroid are $O(2, \frac{14}{5})$ and $C(c, d)$ respectively, then $c + 2d$ is equal to

(A) $8/3$ **(B)** $7/3$

(C) 2 **(D)** 3

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

6. 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

Make Same Base And Then Quadratic · JEE Main 2025 · Shift-I View Solution on Crucible ↗

7. The product of all solutions of the equation $e^{5(\log_e x)^2+3}=x^8, x>0$, is :

(A) $e^{8/5}$ **(B)** $e^{6/5}$

(C) e^2 **(D)** e

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

8. 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)** $(\sim p \Rightarrow q) \vee (\sim q \Rightarrow p)$

Continuity at a Given Point · JEE Main 2024 · Shift-I View Solution on Crucible ↗

9. If the function $f(x)=\frac{\sin 3x+\alpha \sin x-\beta \cos 3x}{x^3}, x \in \mathbb{R}$, is continuous at $x=0$, then $f(0)$ is equal to :

(A) 2 **(B)** -2

(C) 4 **(D)** -4

Differentiation of f(x) with respect to g(x) · JEE Main 2020 · Shift-II View Solution on Crucible ↗

10. The derivative of $\tan^{-1}\left(\frac{\sqrt{1+x^2}-1}{x}\right)$ with respect to $\tan^{-1}\left(\frac{2x\sqrt{1-x^2}}{1-2x^2}\right)$ at $x=\frac{1}{2}$ is :

(A) $\frac{2\sqrt{3}}{5}$ **(B)** $\frac{\sqrt{3}}{12}$

(C) $\frac{2\sqrt{3}}{3}$ **(D)** $\frac{\sqrt{3}}{10}$

Correcting Misread Data · JEE Main 2023 · Shift-I
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11. 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

Maximum & Minimum Value Problems · JEE Main 2022 · Shift-II
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12. The sum of the absolute maximum and absolute minimum values of the function $f(x) = \tan^{-1}(\sin x - \cos x)$ in the interval $[0, \pi]$ is

(A) 0
(B) $\tan^{-1}\left(\frac{1}{\sqrt{2}}\right) - \frac{\pi}{4}$
(C) $\cos^{-1}\left(\frac{1}{\sqrt{3}}\right) - \frac{\pi}{4}$
(D) $\frac{-\pi}{12}$

JEE Main 2022 · Shift-II
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13. Let A and B be any two 3×3 symmetric and skew symmetric matrices respectively. Then which of the following is **NOT** true?

(A) $A^4 - B^4$ is a symmetric matrix
(B) $AB - BA$ is a symmetric matrix
(C) $B^5 - A^5$ is a skew-symmetric matrix
(D) $AB + BA$ is a skew-symmetric matrix

Partial fractions Direct Problems · JEE Main 2023 · Shift-I
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14. Let $f(x) = \int \frac{2x}{(x^2+1)(x^2+3)}\,dx$. If $f(3) = \frac{1}{2}(\log_e 5 - \log_e 6)$, then $f(4)$ is equal to

(A) $\frac{1}{2}(\log_e 17 - \log_e 19)$
(B) $\log_e 17 - \log_e 18$
(C) $\frac{1}{2}(\log_e 19 - \log_e 17)$
(D) $\log_e 19 - \log_e 20$

JEE Main 2024 · Shift-II
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15. The value of $\int_0^1 (2x^3 - 3x^2 - x + 1)^{\frac{1}{3}}\,dx$ is equal to:

(A) 0
(B) 1
(C) 2
(D) -1

JEE Main 2023 · Shift-I
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16. Let S denote the set of all real values of λ such that the system of equations $\lambda x+y+z=1,\ x+\lambda y+z=1,\ x+y+\lambda z=1$ is inconsistent, then $\sum_{\lambda \in S}\left(|\lambda|^2+|\lambda|\right)$ is equal to

(A) 2
(B) 12
(C) 4
(D) 6

JEE Main 2021 · Shift-II
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17. 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) $\frac{6}{7}$

Area of curve involving line and curve · JEE Main 2019 · Shift-I
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18. The area (in sq. units) of the region bounded by the parabola, $y=x^2+2$ and the lines, $y=x+1, x=0$ and $x=3$, is

(A) $\frac{17}{4}$
(B) $\frac{21}{2}$
(C) $\frac{15}{2}$
(D) $\frac{15}{4}$

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

19. The solution curve, of the differential equation $2y\frac{dy}{dx}+3=5\frac{dy}{dx}$, passing through the point $(0,1)$ is a conic, whose vertex lies on the line:

(A) $2x+3y=9$
(B) $2x+3y=-9$
(C) $2x+3y=-6$
(D) $2x+3y=6$

Venn Diagrams - Type 1 · JEE Main 2020 · Shift-I
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20. 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

Types of Functions (Mapping) - Direct problems · JEE Main 2024 · Shift-I

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21. The function $f : \mathbb{R} \to \mathbb{R}, f(x) = \frac{x^2+2x-15}{x^2-4x+9}, x \in \mathbb{R}$ is

(A) one-one but not onto.

(B) both one-one and onto.

(C) onto but not one-one.

(D) neither one-one nor onto.

Limit using Trigonometry & Algebraic forms · JEE Main 2025 · Shift-I

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22. $\lim_{x\to 0} \operatorname{cosec} x \left(\sqrt{2\cos^2 x + 3\cos x} - \sqrt{\cos^2 x + \sin x + 4}\right)$ is:

(A) 0

(B) $\frac{1}{\sqrt{15}}$

(C) $\frac{1}{2\sqrt{5}}$

(D) $-\frac{1}{2\sqrt{5}}$

JEE Main 2024 · Shift-I

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23. A square is inscribed in the circle $x^2 + y^2 - 10x - 6y + 30 = 0$. One side of this square is parallel to $y = x + 3$. If (x_i, y_i) are the vertices of the square, then $\Sigma(x_i^2 + y_i^2)$ is equal to:

(A) 148

(B) 152

(C) 160

(D) 156

Intersection of parabola and other curves · JEE Main 2025 · Shift-I

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24. Two parabolas have the same focus $(4, 3)$ and their directrices are the x-axis and the y-axis, respectively. If these parabolas intersects at the points A and B, then $(AB)^2$ is equal to :

(A) 392

(B) 384

(C) 192

(D) 96

Finding missing parameters · JEE Main 2022 · Shift-II

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25. If the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ meets the line $\frac{x}{7} + \frac{y}{2\sqrt{6}} = 1$ on the x-axis and the line $\frac{x}{7} - \frac{y}{2\sqrt{6}} = 1$ on the y-axis, then the eccentricity of the ellipse is

(A) $\frac{5}{7}$

(B) $\frac{2\sqrt{6}}{7}$

(C) $\frac{3}{7}$

(D) $\frac{2\sqrt{5}}{7}$

JEE Main 2025 · Shift-I

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26. If $\frac{\pi}{2} \leq x \leq \frac{3\pi}{4}$, then $\cos^{-1}\left(\frac{12}{13}\cos x + \frac{5}{13}\sin x\right)$ is equal to

(A) $x - \tan^{-1}\frac{4}{3}$

(B) $x + \tan^{-1}\frac{4}{5}$

(C) $x - \tan^{-1}\frac{5}{12}$

(D) $x + \tan^{-1}\frac{5}{12}$

Equation & Standard forms · JEE Main 2019 · Shift-II

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27. If $5x + 9 = 0$ is the directrix of the hyperbola $16x^2 - 9y^2 = 144$, then its corresponding focus is:

(A) $(-5, 0)$

(B) $(5, 0)$

(C) $\left(-\frac{5}{3}, 0\right)$

(D) $\left(\frac{5}{3}, 0\right)$

Solving Equations by Reduction · JEE Main 2024 · Shift-II

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28. The number of solutions of the equation $4\sin^2 x - 4\cos^3 x + 9 - 4\cos x = 0; x \in [-2\pi, 2\pi]$ is:

(A) 1

(B) 3

(C) 2

(D) 0

Questions on Finding Principal Value · JEE Main 2023 · Shift-I

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29. $\tan^{-1}\left(\frac{1+\sqrt{3}}{3+\sqrt{3}}\right) + \sec^{-1}\sqrt{\frac{8+4\sqrt{3}}{6+3\sqrt{3}}}$ is equal to

(A) $\frac{\pi}{4}$

(B) $\frac{\pi}{2}$

(C) $\frac{\pi}{3}$

(D) $\frac{\pi}{6}$

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30. If the four points, whose position vectors are $3\hat{i} - 4\hat{j} + 2\hat{k}, \hat{i} + 2\hat{j} - \hat{k}, -2\hat{i} - \hat{j} + 3\hat{k}$ and $5\hat{i} - 2\alpha\hat{j} + 4\hat{k}$ are coplanar, then α is equal to

(A) $\frac{73}{17}$

(B) $-\frac{107}{17}$

(C) $-\frac{73}{17}$

(D) $\frac{107}{17}$

Problems on Heights and Distances · JEE Main 2020 · Shift-I

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31. Two vertical poles $AB = 15$ m and $CD = 10$ m are standing apart on a horizontal ground with points A and C on the ground. If P is the point of intersection of BC and AD, then the height of P (in m) above the line AC is :

(A) $20/3$

(B) 5

(C) $10/3$

(D) 6

Circumference and Its Formula · JEE Main 2021 · Shift-I

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32. If in a triangle ABC, $AB = 5$ units, $\angle B = \cos^{-1}\left(\frac{3}{5}\right)$ and radius of circumcircle of $\triangle ABC$ is 5 units, then the area (in sq. units) of $\triangle ABC$ is:

(A) $10 + 6\sqrt{2}$

(B) $8 + 2\sqrt{2}$

(C) $6 + 8\sqrt{3}$

(D) $4 + 2\sqrt{3}$

Line - Intersection of Two Lines · JEE Main 2025 · Shift-II

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33. The distance of the line $\frac{x-2}{2} = \frac{y-6}{3} = \frac{z-3}{4}$ from the point $(1, 4, 0)$ along the line $\frac{x}{1} = \frac{y-2}{2} = \frac{z+3}{3}$ is :

(A) $\sqrt{17}$

(B) $\sqrt{15}$

(C) $\sqrt{14}$

(D) $\sqrt{13}$

Real & Imaginary Part - Pattern 3 · JEE Main 2022 · Shift-I

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34. 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

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35. 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
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36. 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
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37. 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

JEE Main 2024 · Shift-I
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38. A variable line L passes through the point $(3, 5)$ and intersects the positive coordinate axes at the points A and B. The minimum area of the triangle OAB, where O is the origin, is :

(A) 30
(B) 25
(C) 40
(D) 35

Ratio of two consecutive terms · JEE Main 2023 · Shift-II
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39. 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

Solving Multiple Equations · JEE Main 2022 · Shift-II
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40. Let $S = \{x \in [-6, 3] - \{-2, 2\} : \frac{|x+3|-1}{|x|-2} \geq 0\}$ and $T = \{x \in \mathbb{Z} : x^2 - 7|x| + 9 \leq 0\}$. Then the number of elements in $S \cap T$ is

(A) 7
(B) 5
(C) 4
(D) 3

Negation using De Morgan's Laws · JEE Main 2021 · Shift-II

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41. 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) $p \wedge \sim q$

JEE Main 2024 · Shift-II

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42. Let $f : [-1, 2] \to \mathbb{R}$ be given by $f(x) = 2x^2 + x + [x^2] - [x]$, where $[t]$ denotes the greatest integer less than or equal to t. The number of points, where f is not continuous, is :

(A) 5

(B) 6

(C) 3

(D) 4

Higher order differentials · JEE Main 2024 · Shift-II

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43. If $y(\theta) = \frac{2\cos\theta + \cos 2\theta}{\cos 3\theta + 4\cos 2\theta + 5\cos\theta + 2}$, then at $\theta = \frac{\pi}{2}$, $y'' + y' + y$ is equal to :

(A) $\frac{1}{2}$

(B) 1

(C) 2

(D) $\frac{3}{2}$

Mean & Variance: Two Unknowns - Type 1 · JEE Main 2020 · Shift-II

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44. 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) $x^2 - 20x + 18 = 0$

Maximum & Minimum Value Problems · JEE Main 2021 · Shift-I

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45. The local maximum of the slope of the curve $y = \frac{1}{2}x^4 - 5x^3 + 18x^2 - 19x$ occurs at the point

(A) $\left(3, \frac{21}{2}\right)$

(B) $(2, 2)$

(C) $(2, 9)$

(D) $(0, 0)$

Nested Adjoints Involved · JEE Main 2025 · Shift-I

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46. Let A be a 3×3 matrix such that $|\text{adj}(\text{adj}(\text{adj}\, A))| = 81$. If $S = \left\{n \in \mathbb{Z} : (|\text{adj}(\text{adj}\, A)|)^{\frac{(n-1)^2}{2}} = |A|^{(3n^2-5n-4)}\right\}$, then $\sum_{n\in S} \left|A^{(n^2+n)}\right|$ is equal to

(A) 866

(B) 750

(C) 820

(D) 732

Partial fractions Direct Problems · JEE Main 2019 · Shift-I

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47. The integral $\int \frac{2x^3-1}{x^4+x}\,dx$, is equal to

(A) $\frac{1}{2}\log_e \frac{(x^3+1)^2}{|x^3|} + C$

(B) $\log_e \frac{|x^3+1|}{x^2} + C$

(C) $\log_e \left|\frac{(x^3+1)}{x}\right| + C$

(D) $\frac{1}{2}\log_e \frac{|x^3+1|}{x^2} + C$

JEE Main 2024 · Shift-II

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48. For $0 < a < 1$, the value of the integral $\int_0^{\pi} \frac{dx}{1-2a\cos x+a^2}$ is :

(A) $\frac{\pi^2}{\pi+a^2}$

(B) $\frac{\pi^2}{\pi-a^2}$

(C) $\frac{\pi}{1-a^2}$

(D) $\frac{\pi}{1+a^2}$

JEE Main 2023 · Shift-I

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49. Let S_1 and S_2 be respectively the sets of all $a \in R - \{0\}$ for which the system of linear equations $ax + 2ay - 3az = 1,\ (2a+1)x + (2a+3)y + (a+1)z = 2,\ (3a+5)x + (a+5)y + (a+2)z = 3$ has unique solution and infinitely many solutions. Then

(A) $n(S_1) = 2$ and S_2 is an infinite set

(B) S_1 is an infinite set and $n(S_2) = 2$

(C) $S_1 = \phi$ and $S_2 = R - \{0\}$

(D) $S_1 = R - \{0\}$ and $S_2 = \phi$

JEE Main 2023 · Shift-II

View Solution on Crucible ↗

50. 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

Answer Key (Q1 to Q50)

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: (D)	6: (A)	7: (A)	8: (D)	9: (D)	10: (D)
11: (B)	12: (C)	13: (C)	14: (A)	15: (A)	16: (D)	17: (B)	18: (C)	19: (A)	20: (B)
21: (D)	22: (D)	23: (B)	24: (C)	25: (A)	26: (C)	27: (A)	28: (D)	29: (C)	30: (A)
31: (D)	32: (C)	33: (C)	34: (A)	35: (C)	36: (A)	37: (C)	38: (A)	39: (B)	40: (D)
41: (C)	42: (D)	43: (C)	44: (C)	45: (B)	46: (D)	47: (C)	48: (C)	49: (D)	50: (D)

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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