

JEE MAIN BINOMIAL THEOREM — PROPERTIES OF BINOMIAL COEFFICIENTS, SUM OF SERIES (JEE) — PYQS

Max. Marks: 64
Questions: 16

Section A (MCQ) — 12 questions

- Q.1** If $26\left(\frac{2^3}{3}({}^{12}C_2) + \frac{2^5}{5}({}^{12}C_4) + \frac{2^7}{7}({}^{12}C_6) + \dots + \frac{2^{13}}{13}({}^{12}C_{12})\right) = 3^{13} - \alpha$, then α is equal to :
- [JEE Main 2026 (Online) 8th April Evening Shift]
- (1) 45 (2) 48 (3) 51 (4) 54

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- Q.2** The number of elements in the set $S = \left\{ (r, k) : k \in \mathbb{Z} \text{ and } {}^{36}C_{r+1} = \frac{6({}^{35}C_r)}{(k^2 - 3)} \right\}$, is :
- [JEE Main 2026 (Online) 2nd April Morning Shift]
- (1) 2 (2) 4 (3) 8 (4) 16

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- Q.3** If for $3 \leq r \leq 30$, $({}^{30}C_{30-r}) + 3({}^{30}C_{31-r}) + 3({}^{30}C_{32-r}) + ({}^{30}C_{33-r}) = mC_r$, then m equals :
- [JEE Main 2026 (Online) 2nd April Evening Shift]
- (1) 31 (2) 32 (3) 33 (4) 34

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- Q.4** The sum of the coefficients of x^{499} and x^{500} in $(1+x)^{1000} + x(1+x)^{999} + x^2(1+x)^{998} + \dots + x^{1000}$ is :
- [JEE Main 2026 (Online) 28th January Evening Shift]
- (1) ${}^{1002}C_{501}$ (2) ${}^{1001}C_{501}$ (3) ${}^{1000}C_{501}$ (4) ${}^{1002}C_{500}$

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- Q.5** Let $S = \frac{1}{25!} + \frac{1}{3!23!} + \frac{1}{5!21!} + \dots$ up to 13 terms. If $13S = \frac{2^k}{n!}$, $k \in \mathbb{N}$, then $n + k$ is equal to
- [JEE Main 2026 (Online) 24th January Morning Shift]
- (1) 50 (2) 52 (3) 49 (4) 51

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- Q.6** The value of $\frac{{}^{100}C_{50}}{51} + \frac{{}^{100}C_{51}}{52} + \dots + \frac{{}^{100}C_{100}}{101}$ is:
- [JEE Main 2026 (Online) 23rd January Morning Shift]
- (1) $\frac{2^{101}}{101}$ (2) $\frac{2^{100}}{101}$ (3) $\frac{2^{100}}{100}$ (4) $\frac{2^{101}}{100}$

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- Q.7** The coefficient of x^{48} in $(1+x) + 2(1+x)^2 + 3(1+x)^3 + \dots + 100(1+x)^{100}$ is equal to
- [JEE Main 2026 (Online) 22nd January Morning Shift]
- (1) $100 \cdot {}^{100}C_{49} - {}^{100}C_{48}$ (2) $100 \cdot {}^{101}C_{49} - {}^{101}C_{50}$
 (3) ${}^{100}C_{50} + {}^{101}C_{49}$ (4) $100 \cdot {}^{100}C_{49} - {}^{100}C_{50}$

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- Q.8** Let C_r denote the coefficient of x^r in the binomial expansion of $(1+x)^n$, $n \in \mathbb{N}$, $0 \leq r \leq n$. If $P_n = C_0 - C_1 + \frac{2^2}{3}C_2 - \frac{2^3}{4}C_3 + \dots + \frac{(-2)^n}{n+1}C_n$, then the value of $\sum_{n=1}^{25} \frac{1}{P_{2n}}$ equals
- [JEE Main 2026 (Online) 22nd January Evening Shift]
- (1) 675 (2) 580 (3) 525 (4) 650

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- Q.9** For an integer $n \geq 2$, if the arithmetic mean of all coefficients in the binomial expansion of $(x+y)^{2n-3}$ is 16, then the distance of the point $P(2n-1, n^2-4n)$ from the line $x+y=8$ is
- [JEE Main 2025 (Online) 4th April Morning Shift]
- (1) $\sqrt{2}$ (2) $2\sqrt{2}$ (3) $5\sqrt{2}$ (4) $3\sqrt{2}$

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- Q.10** If $1^2 \cdot ({}^{15}C_1) + 2^2 \cdot ({}^{15}C_2) + 3^2 \cdot ({}^{15}C_3) + \dots + 15^2 \cdot ({}^{15}C_{15}) = 2^m \cdot 3^n \cdot 5^k$, where $m, n, k \in \mathbb{N}$, then $m+n+k$ is equal to :
- [JEE Main 2025 (Online) 4th April Evening Shift]
- (1) 20 (2) 19 (3) 18 (4) 21

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Q.11 If $\sum_{r=1}^9 \left(\frac{r+3}{2^r} \right) \cdot {}^9C_r = \alpha \left(\frac{3}{2} \right)^9 - \beta$, $\alpha, \beta \in \mathbb{N}$, then $(\alpha + \beta)^2$ is equal to

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

- (1) 27 (2) 81 (3) 18 (4) 9

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Q.12 If $\sum_{r=0}^{10} \left(\frac{10^{r+1} - 1}{10^r} \right) \cdot {}^{11}C_{r+1} = \frac{\alpha^{11} - 11^{11}}{10^{10}}$, then α is equal to :

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

- (1) 11 (2) 20 (3) 24 (4) 15

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Section B (Numerical) — 4 questions

Q.13 If $\left(\frac{1}{{}^{15}C_0} + \frac{1}{{}^{15}C_1} \right) \left(\frac{1}{{}^{15}C_1} + \frac{1}{{}^{15}C_2} \right) \cdots \left(\frac{1}{{}^{15}C_{12}} + \frac{1}{{}^{15}C_{13}} \right) = \frac{\alpha^{13}}{{}^{14}C_0 {}^{14}C_1 \cdots {}^{14}C_{12}}$, then 30α is equal to _____.

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

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Q.14 The sum of the series $2 \times 1 \times {}^{20}C_4 - 3 \times 2 \times {}^{20}C_5 + 4 \times 3 \times {}^{20}C_6 - 5 \times 4 \times {}^{20}C_7 + \dots + 18 \times 17 \times {}^{20}C_{20}$, is equal to _____.

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

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Q.15 Let $(1 + x + x^2)^{10} = a_0 + a_1x + a_2x^2 + \dots + a_{20}x^{20}$. If $(a_1 + a_3 + a_5 + \dots + a_{19}) - 11a_2 = 121k$, then k is equal to _____.

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

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Q.16 If $\alpha = 1 + \sum_{r=1}^6 (-3)^{r-1} {}^{12}C_{2r-1}$, then the distance of the point $(12, \sqrt{3})$ from the line $\alpha x - \sqrt{3}y + 1 = 0$ is _____.

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

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ANSWER KEY

Section A (MCQ) — 12 questions

Ques.	1	2	3	4	5	6	7	8	9	10	11
Ans.	3	2	3	4	3	2	2	1	4	2	2
Ques.	12										
Ans.	2										

Section B (Numerical) — 4 questions

Ques.	13	14	15	16			
Ans.	32	34	239	5			