



MATHS

BOOKS - MODERN PUBLISHERS MATHS (HINGLISH)

BINOMIAL THEOREM

Illustrative Examples

1. Find the number of integral terms in the expansion of $\left(5^{\frac{1}{2}} + 7^{\frac{1}{8}}\right)^{1024}$.

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2. Expand the following by binomial theorem: $\left(\frac{x}{3} + \frac{1}{x}\right)^5$

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3. If the first three terms in the expansion of $(1 + ax)^n$ are $1, 12x, 64x^2$,
find 'n' and 'a'

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4. If the third term in the expansion of $\left(\frac{1}{x} + x^{\log_{10} x}\right)^5$ is 100, find x .

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5. Find a if 17th and 18th terms in the expansion of $(2 + a)^{50}$ are equal.

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6. Using binomial theorem, find the value of $(0.99)^{15}$ up to four places of decimal.

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7. Using binomial theorem, prove that $(101)^{50} > (100^{50} + 99^{50})$.

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8. The $(n + 1)^{th}$ term from the end in $\left(x - \frac{1}{x}\right)^{3n}$ is

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9. If t_r is the r th term in the expansion of $(1 + a)^n$, in ascending power of a , prove that $r(r + 1)t_{r+2} = (n - r + 1)(n - r)a^2t_r$

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10. Evaluate : ${}^{10}C_1 + {}^{10}C_2 + {}^{10}C_3 + \dots + {}^{10}C_{10}$

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11. Evaluate : $\sum_{r=1}^n {}^n C_r 2^r$

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12. If $(1 + x)^n = C_0 + C_1x + C_2x^2 + \dots + C_nx^n$, prove that :

$$C_0 + 2C_1 + \dots + 2^n C_n = 3^n$$

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13. If $(1 + x)^n = C_0 + C_1x + C_2x^2 + \dots + C_nx^n$, prove that :

$$C_0 + \frac{C_1}{2} + \frac{C_2}{3} + \dots + \frac{C_n}{n+1} = \frac{2^{n+1} - 1}{n+1}$$

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14. Prove : $C_0 + \frac{1}{3}C_2 + \frac{1}{5}C_4 + \frac{1}{7}C_6 + \dots = \frac{2^n}{n+1}$

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$$15. 2C_0 + 2^2 \frac{C_1}{2} + 2^3 \frac{C_2}{3} + \dots + 2^{n+1} \frac{C_n}{n+1} = \frac{3^{n+1} - 1}{n+1}$$

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$$16. 2C_0 + 5C_1 + 8C_2 + \dots + (3n + 2)C_n = (3n + 4)2^{n-1}$$

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17. Prove that

$$C_0 C_r + C_1 C_{r+1} + C_2 C_{r+2} + \dots + C_{n-r} C_n = \frac{(2n)!}{(n-r)!(n+r)!}$$

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18. Find the coefficient of x^4 in the expansion of $(1+x)^n \cdot (1-x)^n$

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Frequently Asked Question

1. Determine the two middle terms in the expansion of $(x^2 + a^2)^5$

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2. Show that the middle term in the expansion of $(1 + x)^{2n}$ is $\frac{(1 \cdot 3 \cdot 5 \cdots (2n - 1))}{n!} 2^n x^n$, where n is a positive integer.

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3. Show that the term containing x does not exist in the expansion of

$$\left(3x - \frac{1}{2x}\right)^8$$

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4. The co-efficient of x^5 in the expansion of $(1 + x)^{21} + (1 + x)^{22} + (1 + x)^{23} + \dots + (1 + x)^{30}$ is

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5. Find the coefficient of x^6y^3 in the expansion of $(x + 2y)^9$.

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6. The sum of the coefficients of the first three terms in the expansion of $\left(x - \frac{3}{x^2}\right)^m$, $x \neq 0$, m being a natural number, is 559. Find the term of the expansion containing x^3 .

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7. The value of m , for which the coefficients of the $(2m + 1)$ th terms in the expansion of $(1 + x)^{10}$ are equal is 3 b. 1 c. 5 d. 8

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8. Find the term, which is independent of x in the expansion of

$$\left(x^2 + \frac{1}{x}\right)^9$$

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9. Find the term of x in the following binomial expansions

$$(x \neq 0): \left(\sqrt[3]{x} + \frac{1}{2 \cdot \sqrt[3]{x}}\right)^{18}$$

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10. The coefficient of the term independent of x in the

$$\text{expansion of } \left(\frac{x+1}{x^{2/3} - x^{1/3} + 1} - \frac{x-1}{x - x^{1/2}}\right)^{10}$$

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11. The second, third and fourth terms in the binomial expansion $(x + a)^n$ are 240, 720 and 1080, respectively. Find x , a and n .

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12. If the coefficients of a^{r-1} , a^r and a^{r+1} in the binomial expansion of $(1 + a)^n$ are in A.P., prove that $n^2 - n(4r + 1) + 4r^2 - 2 = 0$.

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13. Find the greatest term in expansion of $(3x + 4y)^{28}$, when $x = 6$, $y = 3$

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14. Show that $2^{4n} + 4 - 15n - 16$, where $n \in \mathbb{N}$ is divisible by 225.

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Exercise 8 A Short Answer Type Question

1. Expand the following by binomial theorem: $(x + y)^5$

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2. Find the $(3x - 2y)^5$

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3. Expand the following by binomial theorem: $(1 - x)^6$

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4. Expand the following:

$$(y^2 + 3x)^8$$

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5. Expand the following:

$$(x^2 + 2y^3)^6$$

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6. $\left(x + \frac{1}{x}\right)^6$

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7. find the $\left(x^2 + \frac{3}{x}\right)^4, x \neq 0$

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8. Find the $\left(\frac{2}{x} - \frac{x}{2}\right)^5, x \neq 0$

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9. Expand: $\left(x - \frac{1}{y}\right)^{11}$, $y \neq 0$

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10. Expand $(1 + x + x^2)^3$ using binomial expansion.

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11. Find the expansion of $(3x^2 - 2ax + 3a^2)^3$ using binomial theorem.

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12. Find the $\left(1 + \frac{x}{2} - \frac{2}{x}\right)^4$, $x \neq 0$

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13. Evaluate: $(\sqrt{3} + \sqrt{2})^6 - (\sqrt{3} - \sqrt{2})^6$



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14. Evaluate: $(\sqrt{3} + 1)^5 - (\sqrt{3} - 1)^5$



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15. Use Binomial theorem to find : $(51)^6$



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16. Using binomial theorem, evaluate : $(96)^3$



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17. Using binomial theorem evaluate each of the following: $(98)^{65}$



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18. Using binomial theorem, evaluate : $(99)^5$

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19. Using binomial theorem, evaluate : $(101)^4$

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20. Using binomial theorem, evaluate : $(102)^5$

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21. Use Binomial theorem to find : $(10.1)^4$

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22. Use Binomial theorem to find $(1.02)^6$, , correct to five decimal places.



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23. Which is larger $(1.01)^{100000}$ or , 10, 000?



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24. Find the third term in the expansion of

$$\left(x + \frac{2}{5}y\right)^4$$



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25. Find the fourth term in the expansion of $(x - 2y)^{12}$



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26. Find the fourth term in the expansion of $\left(\frac{4}{7}x - y^2\right)^5$



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27. Find the 13th term in the expansion of $\left(9x - \frac{1}{3\sqrt{x}}\right)^{18}$. Find the middle terms in the expansions:

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Exercise 8 A Long Answer Type Question

1. Find the 5th term from the end of :

$$\left(\frac{x^3}{2} - \frac{2}{x^2}\right)^{12}, x \neq 0$$

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2. Find the r^{th} term from the end in the expansion of $(x + a)^n$.

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3. If the third term in the expansion of $\left(\frac{1}{x} + {}_x(\log)_{10}x\right)^5$ is 1000, then find x .

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4. For what value of x is the ninth term in the expansion of $\left(3^{\log_3 \sqrt{25^{x-1}+7}} + 3^{-\frac{1}{8}\log_3(5^{x-1}+1)}\right)^{10}$ is equal to 180

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5. Find $(x+1)^6 + (x-1)^6$. Hence or otherwise evaluate $(\sqrt{2}+1)^6 + (\sqrt{2}-1)^6$.

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Exercise 8 B Long Answer Type Question I

1. Find the middle in the expansion of :

(i) $\left(\frac{x}{3} + 9y\right)^{10}$

(ii) $\left(\frac{x}{y} + \frac{y}{x}\right)^{2n+1}$



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2. Show that the coefficient of the middle term in the expansion of $(1 + x)^{2n}$ is equal to the sum of the coefficients of two middle terms in the expansion of $(1 + x)^{2n-1}$.



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3. Write and simplify the term involving x^5 in the expansion of

$\left(x - \frac{1}{x}\right)^{11}$.



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4. Determine the term involving x^3 in $(5 - 2x)^6$

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5. Find the coefficient of x^{10} in the expansion of $\left(2x^2 - \frac{3}{x}\right)^{11}$, $x \neq 0$

Also, prove that there is no term involving x^6

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6. Find the coefficient of x^{40} in the expansion of $(1 + 2x + x^2)^{54}$

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7. Which term contains x^8 in the expansion of $\left(x^2 - \frac{1}{x}\right)^{10}$? Also, find

its coefficient.

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8. If the coefficients of a^m and a^n in the expansion of $(1 + a)^{m+n}$ are α and β then which one of the following is correct ?

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9. Find a if the coefficient of x^2 and x^3 in the expansion of $(3 + ax)^9$ are equal

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10. Find the coefficient of a^4 in the product $(1 + 2a)^4(2 - a)^5$ using binomial theorem.

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11. In the binomial expansion of $(a + b)^n$, coefficients of the fourth and thirteenth terms are equal to each other. Find n .



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12. In the expansion of $(1 + a)^{34}$, if the coefficient of $(r - 5)^{th}$ and $(2r -)^{th}$ terms are equal, then find value of r .



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13. Which term is independent of 'x' in the expansion of $\left(2x^2 + \frac{1}{x}\right)^{12}$?

Also, find its value.



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14. Write and simplify the term independent of 'x' in the expansion of

$\left(x^2 - \frac{2}{x^3}\right)^5$. Also find its value.



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15. Find the term independent of x in the expansion of: $\left(x - \frac{1}{x}\right)^{12}$.

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16. Find the term independent of x in the expression $\left(x - \frac{1}{x}\right)^{14}$

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17. Find the term independent of x in the expansion of $\left(\frac{3}{2}x^2 - \frac{1}{3x}\right)^6$.

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18. Find the term independent of 'x' , $x \neq 0$ in the expansion of

$$\left(x^2 + \frac{3}{x}\right)^6$$

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19. Find the term independent of 'x' , $x \neq 0$ in the expansion of

$$\left(3 - \frac{x^3}{6}\right)^7$$



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20. Write and simplify the coefficient of the term independent of 'x' in the

expansion of $\left(x^3 - \frac{1}{x}\right)^{12}$, $x \neq 0$



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21. Find the greatest term in $(x + y)^n$, when $x = 11$, $y = 4$, $n = 30$



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22. If $x = 1/3$, find the greatest term in the expansion of $(1 + 4x)^8$.



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23. Find a, b and n in the expansion of $(a + b)^n$ if the first three terms of the expansion are 729, 7290 and 30375, respectively.

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24. The first three terms in the Binomial expansion of $(x + y)^n$ are 1,56 and 1372 respectively . Find the value of x and y

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25. The coefficients of three consecutive terms in the expansion of $(1 + a)^n$ are in the ratio 1: 7 : 42. Find n.

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26. The coefficient of 5th, 6th and 7th terms in the expansion of $(1 + x)^n$ are in A.P. Find the value of n.

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27. if the coefficients of x , x^2 and x^3 in the binomial expansion $(1 + x)^{2n}$ are in arithmetic progression then prove that $2n^2 - 9n + 7 = 0$

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28. If the three consecutive in the expansion of $(1 + x)^n$ are 28, 56, and 70, then the value of n is.

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29. In the expansion of $(x + a)^n$ if the sum of odd terms is P and the sum of even terms is Q , then $P^2 - Q^2 = (x^2 - a^2)^n$
 $4PQ = (x + a)^{2n} - (x - a)^{2n}$ $2(P^2 + Q^2) = (x + a)^{2n} + (x - a)^{2n}$
 none of these

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30. Show that $9^{n+1} - 8n - 9$ is divisible by 64, where n is a positive integer.

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31. Using binomial theorem, prove that $6^n - 5n$ always leaves the remainder 1 when divided by 25.

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Objective Type Question A Multiple From Ncert Exemplar Questions From Ncert Exemplar

1. The total number of terms in the expansion of $(x + a)^{51} - (x - a)^{51}$ after simplification is :

A. 102

B. 23

C. 26

D. none of these

Answer: C



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2. If the coefficients of x^7 and x^8 in the expansion of $\left[2 + \frac{x}{3}\right]^n$ are equal, then the value of n is :

A. 56

B. 55

C. 45

D. 15

Answer: B



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3. The coefficient of x^4 in the expansion of $(1 + x + x^2 + x^3)^n$ is

A. $\frac{3^n + 1}{2}$

B. $\frac{3^n - 1}{2}$

C. $\frac{1 - 3^n}{2}$

D. $3^n + \frac{1}{2}$

Answer: A



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4. If the coefficients of x^{39} and x^{40} are equal in the expansion of $(p + qx)^{49}$. then the possible values of p and q are

A. equal

B. equal with opposite sign

C. reciprocal of each other

D. none of these

Answer: A



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5. The number of terms in the expansion of $(a + b + c)^n$, where $n \in \mathbb{N}$.

A. $\frac{(n + 1)(n + 2)}{2}$

B. $n + 1$

C. $n + 2$

D. $(n + 1)n$

Answer: A



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6. The ratio of the coefficient of x^{15} to the term independent of x in the expansion of $\left(x^2 + \frac{2}{x}\right)^{15}$ is

A. 12 : 32

B. 1 : 32

C. 32 : 12

D. 32 : 1

Answer: B



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7. If $z = \left(\frac{\sqrt{3}}{2} + \frac{i}{2}\right)^5 + \left(\frac{\sqrt{3}}{2} - \frac{i}{2}\right)^5$, then

A. $\text{Re}(z) = 0$

B. $\text{Im}(z) = 0$

C. $\text{Re}(z) > 0, \text{Im}(z) > 0$

D. $\text{Re}(z) > 0, \text{Im}(z) < 0$

Answer: B



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Objective Type Question A Multiple From Ncert Exemplar For Board Examination

1. The number of terms in the expansion of $(x + a)^{100} + (x - a)^{100}$ after simplification

A. 50

B. 51

C. 202

D. none of these

Answer: B



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2. The coefficient of x^{17} in the expansion of $(x - 1)(x - 2)(x - 3) \dots (x - 18)$ is

A. 342

B. -171

C. $\frac{171}{2}$

D. 648

Answer: B



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3. In the expansion of $(1 + x)^n$ the coefficient of x^p and x^q terms are respectively S_p and S_q . Then $p + q =$

A. $S_p \neq S_q$

B. $S_p = \frac{p}{q} S_q$

C. $S_p = \frac{q}{p} S_q$

D. $S_p = S_q$

Answer: D



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4. The coefficient of x^5 in the expansion of $(x + 3)^6$, is

A. 18

B. 6

C. 12

D. none of these

Answer: A



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5. The middle term in the expansion of $(1 + x)^{2n}$ is

A. $\frac{(2n)!}{n!} x^n$

B. $\frac{(2n)!}{n!(n-1)!} x^{n+1}$

C. $\frac{(2n)!}{(n!)^2} x^n$

D. $\frac{(2n)!}{(n+1)!(n-1)!} x^n$

Answer: C



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6. The term independent of x in $\left(2x - \frac{1}{3x}\right)^6$ is

A. $\frac{160}{9}$

B. $\frac{80}{9}$

C. $\frac{160}{27}$

D. $\frac{80}{3}$

Answer: C



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7. The fourth term in the binomial expansion of $\left(x^2 - \frac{1}{x^3}\right)^n$ is independent of x , when n is equal to

A. 2

B. 3

C. 4

D. none of these

Answer: D



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8. If the coefficients of 5th, 6th, 7th terms of $(1 + x)^n$ are in A.P. then

$n =$

A. 7

B. 5

C. 3

D. 10

Answer: D



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Objective Type Question A Multiple From Ncert Exemplar Additional Question

1. The total number of terms in the expansion of $(x + a)^{47} - (x - a)^{47}$ after simplification is :

A. 24

B. 96

C. 47

D. 48

Answer: A



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2. Let $(1 + x + x^2)^9 = a_0 + a_1x + a_2x^2 + \dots + a_{18}x^{18}$. Then

A. $a_0 + a_2 + \dots + a_{18} = a_1 + a_3 + \dots + a_{17}$

B. $a_0 + a_2 + \dots + a_{18}$ is even

C. $a_0 + a_2 + \dots + a_{18}$ is divisible by 9

D. $a_0 + a_2 + \dots + a_{18}$ is divisible by 3 but not by 9.

Answer: B



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3. The coefficient of x^5 in the expansion of $(1 + x^2)^5(1 + x)^4$ is

A. 30

B. 60

C. 40

D. 10

Answer: B



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4. If in the expansion of $(1 + ax)^n$, $n \in \mathbb{N}$, the coefficient of x and x^2 are 8 and 24 respectively, then

A. $n = 3$, $p = 2$

B. $n = 5$, $p = 3$

C. $n = 4$, $p = 3$

D. $n = 4$, $p = 2$

Answer: D

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5. The middle term in the expansion of $\left(\frac{10}{x} + \frac{x}{10}\right)^{10}$ is :

A. 7C_5

B. 8C_5

C. 9C_5

D. ${}^{10}C_5$

Answer: D

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6. The middle term in the expansion of $\left(\frac{10}{x} + \frac{x}{10}\right)^{10}$ is :

A. ${}^{10}C_5$

B. ${}^{10}C_6$

C. ${}^{10}C_5 \frac{1}{x^{10}}$

D. ${}^{10}C_5 x^{10}$

Answer: A



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7. If $f(x) = (x - 1)(x - 2)(x - 3)\dots(x - 50)$ find coeff. of x^{50} and x^{49}

A. -2250

B. -1275

C. 1275

D. 2250

Answer: B



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8. The sum of the coefficients in the binomial expansion of $\left(\frac{1}{x} + 2x\right)^6$ is equal to :

A. 1024

B. 729

C. 243

D. 512

Answer: B



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9. If the coefficient of x^8 in $\left(ax^2 + \frac{1}{bx}\right)^{13}$ is equal to the coefficient of x^{-8} in $\left(ax - \frac{1}{bx^2}\right)^{13}$, then a and b will satisfy the relation :

A. $ab+1=0$

B. $ab=1$

C. $a=1-b$

D. $a+b=-1$

Answer: A



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10. If the 21st and 22nd terms in the expansion of $(1+x)^{44}$ are equal then x is equal to

A. $\frac{8}{7}$

B. $\frac{21}{22}$

C. $\frac{7}{8}$

D. $\frac{23}{24}$

Answer: C



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1. The number of terms in the expansion of $\left[(2x + y)^8 - (2x - y)^8\right]$ is

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2. Expand using binomial theorem $(4x - 5y)^5 = \dots\dots\dots$

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3. Expand using binomial theorem $\left(x + \frac{1}{x}\right)^2 (x \neq 0) = \dots\dots\dots$

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4. General term of $(1 - x^2)^{12}$ is

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5. The value of $(\sqrt{3} + \sqrt{2})^3 + (\sqrt{3} - \sqrt{2})^3$ is

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6. Third term in the expansion of $\left(3x - \frac{y^3}{6}\right)$ is

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7. Find the 4th term from the end in the expansion of $\left(\frac{4x}{5} - \frac{5}{2x}\right)^9$.

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8. The middle term in the expansion of $(1 + x)^{2n}$ is

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9. If r^{th} term in the expansion of $\left(x^2 + \frac{1}{x}\right)^{12}$ is independent of x , then r is equal to

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10. If the coefficients of $(2r + 4)^{\text{th}}$ and $(r - 2)^{\text{th}}$ terms in the expansion of $(1 + x)^{18}$ are equal. Find r ?

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Objective Type Question C True False Question

1. The number of terms in the expansion of $(1 + 2x + x^2)^{20}$ is 40

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2. Value of $(10.1)^4$, using binomial theorem is 10406.0401



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3. Middle term of $\left(x + \frac{1}{x}\right)^4$ is 6



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4. The coefficient of the term involving x^2 in the expansion of $\left(3x - \frac{1}{x}\right)^6$ is 1210



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5. Theorem 3 (Total number of subset of a finite set containing n elements is 2^n)



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1. Find the number of terms in the expansion of $\left(\frac{2}{p} + \frac{p}{2}\right)^8$

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2. Find the number of terms in the expansion of $(x^2 - y)^{16}$

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3. Find the number of terms in the expansions of the following:

$$\left(\sqrt{x} + \sqrt{y}\right)^{10} + \left(\sqrt{x} - \sqrt{y}\right)^{10}$$

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4. Expand $(x^2 - y)^7$

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5. Expand $(2x - 3x^2)^5$



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6. Expand $(1 - x^2)^4$



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7. Write the general term in the following expansion:

$$\left(x^2 - \frac{1}{x}\right)^{12}, x \neq 0$$



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8. Find the middle term in the expansion of: $\left(2x^2 - \frac{1}{3x^2}\right)^{10}$



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9. Find the middle is the expansion of : $\left(\frac{1}{2}a + \frac{1}{3}b\right)^8$

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10. Find the middle term in the expansion of $\left(2x + \frac{3}{x}\right)^{20}$

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11. Find the coefficient of the term involving x^{10} in the expansion of $(x^2 - 2)^{11}$

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12. Evaluate the ${}^{12}C_0 + {}^{12}C_1 + {}^{12}C_2 + \dots + {}^{12}C_{12}$

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13. Evaluate the ${}^{12}C_0 + {}^{12}C_2 + {}^{12}C_4 + \dots + {}^{12}C_{12}$

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14. Evaluate the ${}^{16}C_1 + {}^{16}C_3 + {}^{16}C_5 + \dots + {}^{16}C_{15}$

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15. If $(1 + x)^n = C_0 + C_1x + C_2x^2 + \dots + C_nx^n$, find the value of $C_0 - 2C_1 + 3C_2 - \dots + (-1)^n(n + 1)C_n$

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16. Evaluate $\sum_{r=0}^n 3^r C_r$

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Exercise 8 1

1. Expand of the expression : $(1 - 2x)^5$

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2. Expand of the expression : $\left(\frac{2}{5} - \frac{x}{2}\right)^5$

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3. Expand of the expression : $(2x - 3)^6$

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4. Expand of the expression : $\left(\frac{x}{3} + \frac{1}{x}\right)^5$

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5. Expand of the expression : $\left(x + \frac{1}{x}\right)^6$



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6. Using binomial theorem, evaluate each of the following: $(96)^3, (102)^5$



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7. Using binomial theorem evaluate each of the following: $(102)^5$



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8. Using binomial theorem evaluate each of the following: $(101)^4$



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9. Using binomial theorem evaluate each of the following: $(101)^4$



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10. Using binomial theorem, indicate which number is larger $(1.1)^{10000}$ or 1000.



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11. Find $(a + b)^4 - (a - b)^4$. Hence, evaluate $(\sqrt{3} + \sqrt{2})^4 - (\sqrt{3} - \sqrt{2})^4$.



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12. Find $(x + 1)^6 + (x - 1)^6$. hence, or otherwise evaluate $(\sqrt{2} + 1)^6 + (\sqrt{2} - 1)^6$



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13. Show that $9^{n+1} - 8n - 9$ is divisible by 64, where n is a positive integer.

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14. Prove that $\sum_{r=0}^n 3^r \binom{n}{r} = 4^n$.

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Exercise 8 2

1. Find the coefficient of x^5 in $(x + 3)^8$

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2. Find the coefficient of $a^5 b^7$ in $(a - 2b)^{12}$

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3. Write the general term in the expansion of $(x^2 - y)^6$

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4. Write the general term in the expansion of $(x^2 - yx)^{12}$, $x \neq 0$

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5. Find middle term in the expansion of $(x - 2y)^8$.

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6. Find the 13th term in the expansion of $\left(9x - \frac{1}{3\sqrt{x}}\right)^{18}$, $x \neq 0$

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7. $\left(3 - \frac{x^3}{6}\right)^7$



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8. Find the middle term in the expansion of: $\left(\frac{x}{3} + 9y\right)^{10}$



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9. In the binomial expansion of $(1 + a)^{m+n}$, prove that the coefficient of a^m and a^n are equal.



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10. The coefficients of $(r - 1)^{th}$, r^{th} and $(r + 1)^{th}$ terms in the expansion of $(x + 1)^n$ are in the ratio 1:3:5. Find n and r .



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11. prove that the coefficient of x^n in the expansion of $(1 + x)^{2n}$ is twice the coefficient of x^n in the expansion of $(1 + x)^{2n-1}$

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12. Find a positive value of m for which the coefficient of x^2 in the expansion of $(1 + x)^m$ is 6.

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Miscellaneous Exercise

1. Find a , b and n in the expansion of $(a + b)^n$ if the first three terms of the expansion are 729, 7290 and 30375, respectively.

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2. Find a if the coefficient of x^2 and x^3 in the expansion of $(3 + ax)^9$ are equal

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3. Find the coefficient of x^5 in the expansion of the product $(1 + 2x)^6(1 - x)^7$.

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4. If a and b are distinct integers then prove that $(a-b)$ is a factor of $(a^n - b^n)$, whenever n is a positive integer.

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5. Evaluate: $(\sqrt{3} + \sqrt{2})^6 - (\sqrt{3} - \sqrt{2})^6$

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6. Find the value of $(a^2 + \sqrt{a^2 - 1})^4 + (a^2 - \sqrt{a^2 - 1})^4$.



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7. Find an approximation of $(0.99)^5$ using the first three terms of its expansion.



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8. Find n , if the ratio of the fifth term from the beginning to the fifth term from the end in the expansion of $(24 + \frac{1}{34})^n$ is $\sqrt{6}:1$.



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9. Expand using Binomial Theorem $(1 + \frac{x}{2} - \frac{2}{x})^4$, $x \neq 0$.



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10. Find the expansion of $(3x^2 - 2ax + 3a^2)^3$ using binomial theorem.

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Questions From Ncert Exemplar

1. Evaluate $(x^2 - \sqrt{1-x^2})^4 + (x^2 + \sqrt{1-x^2})^4$

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2. Determine whether the expansion of $(x^2 - \frac{2}{x})^{18}$ will contain a term containing x^{10} ?

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3. find the term independent of x in the expansion of $\left(\frac{\sqrt{x}}{\sqrt{3}} + \frac{\sqrt{3}}{2x^2}\right)^{10}$

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4. Find the middle term in the expansion of: $\left(\frac{p}{x} + \frac{x}{p}\right)^9$

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5. If n is a positive integer, find the coefficient of x^{-1} in the expansion of $(1+x)^n \left(1 + \frac{1}{x}\right)^n$.

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Exercise

1. Find the term independent of x , where $x \neq 0$, in the expansion of

$$\left(\frac{3x^2}{2} - \frac{1}{3x}\right)^{15}.$$



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2. If the constant terms in the expansion of $\left(\sqrt{x} - \frac{k}{x^2}\right)^{10}$ is 405 then

$$|k| =$$



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3. Find the middle term in the expansion of: $\left(\frac{x}{a} - \frac{a}{x}\right)^{10}$



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4. Find the middle term in the expansion of $\left(3x - \frac{x^3}{6}\right)^9$



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5. The coefficient of x^{-17} in the expansion of $\left(x^4 - \frac{1}{x^3}\right)^{15}$ is

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6. Find the sixth term in the expansion $\left(y^{\frac{1}{2}} + x^{\frac{1}{3}}\right)^n$, if the binomial coefficient of the third term of the end is 45.

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7. If the middle term in the expansion of $\left(\frac{p}{2} + 2\right)^8$ is 1120, find p.

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8. Prove that the middle term in the expansion of $\left(x + \frac{1}{x}\right)^{2n}$ is $\frac{(2n-1)!}{(n!)^2} 2^{n-1}$

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9. In $\left(33 + \frac{1}{33}\right)^n$ if the ratio of 7th term from the beginning to the 7th term from the end is $\frac{1}{6}$, then find the value of n .

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Revision Exercise

1. Write and simplify the term involving a^2b^5 in $(a - 2b)^4(a + b)^3$

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2. Expand using Binomial Theorem $\left(1 + \frac{x}{2} - \frac{2}{x}\right)^4$, $x \neq 0$.

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3. Find an approximation of $(0.99)^5$ using the first three terms of its expansion.



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4. If 6th , 7th , 8th, and 9th terms of $(x + y)^n$ are a,b,c and d respectively ,

then prove that :

$$\frac{b^2 - ac}{c^2 - bd} = \frac{4}{3} \cdot \frac{a}{c}$$



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5. Find the coefficient of x^{10} in the expansion of $(1 + x + x^2 + x^3 + \dots + x^{10})^4$.



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6. If k_r is the coefficient of y^{r-1} in the expansion of $(1 + 2y)^{10}$, in ascending powers of y , determine 'r' when $\frac{k_{r+2}}{k_r} = 4$



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7. If x^p occurs in the expansion of $(x^2 + 1/x)^{2n}$, prove that its coefficient is $\frac{(2n)!}{\left[\frac{1}{3}(4n - p)\right]! \left[\frac{1}{3}(2n + p)\right]!}$.

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8. Determine the term independent of 'x' in the expansion of $(1 + x + x^{-2} + x^{-3})^{10}$

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9. Find the value of $(a^2 + \sqrt{a^2 - 1})^4 + (a^2 - \sqrt{a^2 - 1})^4$.

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10. If the fourth term in the expansion of $\left\{ \sqrt{\frac{1}{x \log^{x+1}} + \frac{1}{-x12}} \right\}$ is equal to 200 and $x > 1$, then find x .

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11. The sixth term in the expansion of $\left(\sqrt{2^{\log(10-3^x)}} + \left(2^{(x-2)\log 3}\right)^{\frac{1}{5}}\right)^m$ is equal to 21, if it is known that the binomial coefficient of the 2nd 3rd and 4th terms in the expansion represent, respectively, the first, third and fifth terms of an A.P. (the symbol log stands for logarithm to the base 10) The value of m is

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12. If C_1, C_2, C_3, C_4 are the coefficients of any consecutive terms in the expansion of $(1+x)^n$, prove that :

$$\frac{C_1}{C_1 + C_2} + \frac{C_3}{C_3 + C_4} = \frac{2C_2}{C_2 + C_3}$$

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13. If

$$(1+x)^n = C_0 + C_1x + C_2x^2 + \dots + C_nx^n, \text{ then } C_0 - (C_0 + C_1 + \dots)(C_0 + C_1 + \dots)$$

is even integer is a positive value a negative value divisible by 2^{n-1}
divisible by 2^n

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14. Find the coefficients of x^{50} in the expression
 $(1+x)^{1000} + 2x(1+x)^{999} + 3x^2(1+x)^{998} + \dots + 1001x^{1000}$.

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Check Your Understanding

1. Derive Binomial theorem

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2. In the expansion of $(x+y)^n$, $T_{r+1} =$ _____

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3. What is the number of term in the expansion of

$$\left[(2x + y)^8 - (2x - y)^8 \right] ?$$

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4. Find the middle term in the expansion of $\left(x + \frac{1}{x} \right)^4$

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5. $\left(3 - \frac{x^3}{6} \right)^7$

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6. Find the coefficient of x^5 in $(x + 3)^6$

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7. Find the term independent of x in the expression $\left(x - \frac{1}{x}\right)^{14}$

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8. Evaluate ${}^{10}C_1 + {}^{10}C_2 + {}^{10}C_3 + \dots + {}^{10}C_{10}$

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9. Evaluate $\sum_{r=1}^n {}^nC_r 2^r$

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10. What is $C_0 + C_1 + \dots + C_n$ in $(1 + x)^n$

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1. The remainder left out when $8^{2n}(62)^{2n+1}$ is divided by 9 is

A. 0

B. 2

C. 7

D. 8

Answer: b



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2. The coefficient of x^7 in the expansion of $(1 - x - x^2 + x^3)^6$ is :

A. 144

B. - 132

C. - 144

D. 132

Answer: C



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3. If n is a positive integer, then $(\sqrt{3} + 1)^{2n} - (\sqrt{3} - 1)^{2n}$ is

- A. an irrational number
- B. an odd positive integer
- C. an even positive integer
- D. a rational number other than positive integers

Answer: a



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4. The coefficient of the term independent of x in the

expansion of $\left(\frac{x + 1}{x^{2/3} - x^{1/3} + 1} - \frac{x - 1}{x - x^{1/2}} \right)^{10}$

A. 120

B. 210

C. 310

D. 4

Answer: b



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5. If the coefficients of x^3 and x^4 in the expansion of $(1 + ax + bx^2)(1 - 2x)^{18}$ in powers of x are both zero, then (a, b) is equal to

A. $\left(14, \frac{251}{3}\right)$

B. $\left(14, \frac{272}{3}\right)$

C. $\left(16, \frac{272}{3}\right)$

D. $\left(16, \frac{251}{3}\right)$

Answer: c



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6. The sum of coefficients of integral powers of x in the binomial expansion of $(1 - 2\sqrt{x})^{50}$ is:

A. $\frac{1}{2}(3^{50} + 1)$

B. $\frac{1}{2}(3^{50})$

C. $\frac{1}{2}(3^{50} - 1)$

D. $\frac{1}{2}(2^{50} + 1)$

Answer: a



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7. If the number of terms in the expansion of $\left(1 - \frac{2}{x} + \frac{4}{x^2}\right)^n$, $x \neq 0$, is 28, then the sum of the coefficients of all the terms in this expansion, is

: (1) 64 (2) 2187 (3) 243 (4) 729

A. 2187

B. 243

C. 729

D. 64

Answer: c



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8. The value of

$({}^{21}C_1 - {}^{10}C_1) + ({}^{21}C_2 - {}^{10}C_2) + \dots + ({}^{21}C_{10} - {}^{10}C_{10})$ is

A. $2^{21} - 2^{10}$

B. $2^{20} - 2^9$

C. $2^{20} - 2^{10}$

D. $2^{21} - 2^{11}$

Answer: c



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9. The sum of the coefficients of all odd degree terms in the expansion of

$$\left(x + \sqrt{x^3 - 1}\right)^5 + \left(x - \sqrt{x^3 - 1}\right)^5, (x > 1) \text{ is :}$$

A. -1

B. 1

C. 0

D. 2

Answer: d



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10. The ratio of the 5th term from the beginning to the 5th term from the end in the binominal expansion of $\left(2^{\frac{1}{3}} + \frac{1}{2 \cdot \frac{(3)^1}{3}}\right)$ is

A. $1.4(16)^{\frac{1}{3}}$

B. $1:2 \frac{(6)^1}{3}$

C. $2(36)^{\frac{1}{3}}:1$

D. $4(36)^{\frac{1}{3}}:1$

Answer: d



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11. In the expansion at $\left(\frac{2}{x} + x^{\log_e x}\right)^6$ if $T_4 = 20 \times 8^7$ then value of x is

A. $8^{1/2}$

B. 8^2

C. 8^3

D. 8^4

Answer: b



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