



MATHS

BOOKS - NEW JYOTHI MATHS (TAMIL ENGLISH)

BINOMIAL THEOREM

Examples

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



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



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3. Expand the expression $(1 - x + x^2)^4$

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4. Compute $(99)^5$

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

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6. Show that $9^n + 1 - 8n - 9$ is divisible by 64, whenever n is a positive integer.

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7. Using Binomial Theorem, indicate which number is larger $(1.1)^{10000}$ or 1000.

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8. Prove that $\sum_{r=0}^n 3^r C_r = 4^n$

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

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

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11. Consider the expansion of $(x + 3)^8$.

(i) Write general term.

(ii) Hence find the third term.

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12. (i) Find the general term in the expansion of $\left(3x^2 - \frac{1}{3x}\right)^9$.

(ii) Find the term independent of x in the above expansion.

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13. 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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14. Find the term independent of x in the expansion of $\left(\sqrt[3]{x} + \frac{1}{2\sqrt[3]{x}}\right)^{18}$,

$x > 0$.



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



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16. (i) What is the second term in the expansion of $(1 + x)^n$?

(ii) Write the 3^{rd} and 4^{th} terms in the expansion of $(1 + x)^n$.

(iii) If the coefficients of 2^{nd} , 3^{rd} and 4^{th} terms in the expansion of $(1 + x)^n$ are in A.P, then show that $n^2 - 9n + 14 = 0$.



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



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18. 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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19. If the coefficients of $a^r - 1$, a^r and $a^r + 1$ in the expansion of $(1 + a)^n$ are in arithmetic progression, prove that $n^2 - n(4r+1) + 4r^2 - 2 = 0$.



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20. If the coefficients of $(r - 5)^{th}$ and $(2r - 1)^{th}$ terms in the expansion of $(1 + x)^{34}$ are equal, find r.



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

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22. Show that the middle term in the expansion of $(1 + x)^{2n}$ is $\frac{1.3.5.....(2n - 1)}{n!} 2^n x^n$, where n is a positive integer.

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

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24. Find the middle terms in the expansion of $\left(3 - \frac{x^3}{6}\right)^7$



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

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

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

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

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

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

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

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34. In the expansion of $(1 + a)^{m+n}$, Prove that coefficients of a^m and a^n are equal.

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35. Find the middle terms in the expansions of $\left(\frac{x}{3} + 9Y\right)^{10}$.

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1. The coefficient of x^4 in the expansion of $\left(\frac{x}{2} - \frac{3}{x^2}\right)^{10}$ is

A. $\frac{504}{259}$

B. $\frac{405}{256}$

C. $\frac{450}{263}$

D. $\frac{540}{295}$

Answer: B



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

A. 9

B. 21

C. 4

D. 6

Answer: D



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3. The coefficient of x^4 in the expansion of $(1 + x + x^2 + x^3)^{11}$ is

A. 7282

B. 6369

C. 990

D. 7062

Answer: A



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4. The constant term in the expansion of $\left(x - \frac{2}{x^2}\right)^9$ is

A. -160

B. 170

C. -672

D. 185

Answer: C



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5. The term independent of x in the expansion of $\left(\frac{3}{2}x^2 - \frac{1}{3x}\right)^9$ is

A. $\frac{7}{18}$

B. $\frac{5}{18}$

C. $\frac{11}{18}$

D. $\frac{13}{18}$

Answer: A



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6. If $|x| < 1$, then the coefficient of x^5 in the expansion of $(1 + 2x + 3x^2 + \dots)^{\frac{-3}{2}}$ is

A. 0

B. 25

C. 26

D. 24

Answer: D



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7. The coefficient of x^n in the expansion of $(1 - 9x + 20x^2)^{-1}$ is

A. $5^n - 4^n$

B. $5^{n+1} - 4^{n+1}$

C. $5^{n-1} - 4^{n-1}$

D. 20^n

Answer: B



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8. The middle term in the expansion of $\left(\frac{x}{3} - \frac{2}{\sqrt{x}}\right)^6$ is

A. $\frac{-160}{27}x^{\frac{3}{2}}$

B. $\frac{20}{27}x^3$

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

D. $\frac{-120}{27}x^{\frac{1}{2}}$

Answer: A



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9. The number of terms in the expansion of $(1 + 5\sqrt{2}x)^9 + (1 - 5\sqrt{2}x)^9$ is

- A. 4
- B. 5
- C. 9
- D. 10

Answer: B



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10. The number of terms in the expansion of $(x + a)^{100} + (x - a)^{100}$ is

- A. 100
- B. 101
- C. 50
- D. 51

Answer: D



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

$x =$

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

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

C. $\frac{11}{7}$

D. $\frac{7}{11}$

Answer: A



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12. In the expansion of $(1 + x)^{50}$ the sum of the coefficients of the odd power of x is

A. 0

B. 2^{49}

C. 2^{50}

D. 2^5

Answer: B



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13. If the sum of the coefficients in the expansion of $(1 - 3x + 10x^2)^n$ is a and the sum of the coefficients in the expansion of $(1 - x^2)^n$ is b , then

A. $a = 3b$

B. $b = a^3$

C. $a = b^3$

D. $a = b$

Answer: C



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14. If $(1 - x)^n = C_0 + C_1x + C_2x^2 + \dots + C_nx^n$, then the value of

1. $C_1 + 2. C_3 + 3. C_3 + \dots + n. C_n =$

A. $2^n - 1$

B. $n. (2^n - 1)$

C. $n. 2^{n-1}$

D. 2^n

Answer: C



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15. The value of

$C(n, 0) - C(n, 1) + C(n, 2) - C(n, 3) + \dots + (-1)^n C(n, n) =$

A. 2^n

B. 0

C. $\frac{1}{n}$

D. 2^{n-1}

Answer: B



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16. $C_1 + 4 \cdot C_2 + 7 \cdot C_3 + \dots + (3n - 2) \cdot C_n =$

A. $(3n - 4)2^{n+1}$

B. $(3n - 4)2^{n-1} + 2$

C. $(3n - 4) \cdot 2^n$

D. $(3n - 4) \cdot 2^{n-1} + 1$

Answer: B



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17. When x is large $\sqrt{1 + x^2}$ is nearly equal to

A. $x + \frac{1}{2x}$

B. $1 + \frac{x^2}{2}$

C. $1 - \frac{x^2}{2}$

D. $x - \frac{1}{2x}$

Answer: A



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18. When x is small, $\sqrt{1 + 2^x}$ is nearly equal to

A. $1 + x + \frac{x^2}{2}$

B. $1 + x - \frac{x^2}{2}$

C. $1 - x + \frac{x^2}{2}$

D. $1 - x - \frac{x^2}{2}$

Answer: B



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19. The value of $(1.01)^{-2}$ correct to two decimal place is

A. 0.98

B. 0.97

C. 0.96

D. 0.99

Answer: A



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20. Find the value of e^2 , rounded off to one decimal place.

A. 1.171

B. 1.172

C. 1.17

D. 1.169

Answer: B



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21. If the coefficient of the 2^{nd} , 3^{rd} and 4^{th} terms in the expansion of $(1 + x)^n$ are in A.P, then $n =$

A. 7

B. 8

C. 9

D. 4

Answer: C



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22. The remainder when 5^{99} is divided by 13 is

A. 6

B. 8

C. 9

D. 10

Answer: B



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23. The number of integral terms in the expansion of $\left(3^{\frac{1}{2}} + 5^{\frac{1}{3}}\right)^{1296}$ is

A. 217

B. 216

C. 432

D. 433

Answer: A



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24. The value of

$$\frac{18^3 + 7^3 + 3 \cdot 18 \cdot 7 \cdot 25}{3^6 + 6(243)2 + 15(81)4 + 20 \cdot 27 \cdot 8 + 15(9) \cdot 16 + 6(3)(32) + 64}$$
 is

A. 15

B. 25

C. 5

D. 100

Answer: A



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25. The term independent of x in the expansion of $\left(x^2 - \frac{1}{3x}\right)^9$ is equal to

A. $\frac{28}{81}$

B. $\frac{28}{243}$

C. $\frac{-28}{243}$

D. $\frac{-28}{81}$

Answer: B



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Questions From Competitive Exams

1. If T_r denotes the r^{th} term in the expansion of $\left[x + \frac{1}{x}\right]^{23}$, then

A. $T_{12} = T_{13}$

B. $x^2 T_{13} = T_{12}$

C. $T_{12} = x T_{13}$

D. $T_{12} + T_{13} = 25$

Answer: B



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2. If the coefficient of the 2^{nd} , 3^{rd} and 4^{th} terms in the expansion of $(1 + x)^n$ are in A.P, then n=

A. 7

B. 4

C. 5

D. 6

Answer: D



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3. The number of terms in the expansion of $(1 + 5\sqrt{2}x)^9 + (1 - 5\sqrt{2}x)^9$ is

A. 9

B. 0

C. 10

D. 6

Answer: D

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4. The term independent of x in the expansion of $\left(x + \frac{1}{x}\right)^6$ is

A. $C_0^2 + 2C_1^2 + 3C_2^2 + \dots + (n + 1)C_n^2$

B. $C_1 + C_2 + \dots + C_n$

C. $C_0^2 + C_1^2 + C_2^2 + \dots + C_n^2$

D. $C_1 + 2C_2 + 3C_3 + \dots + nC_n$

Answer: C

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5. The coefficient of x^{-9} in the expansion of $\left(\frac{x^2}{2} - \frac{2}{x}\right)^9$ is

A. 512

B. -512

C. 521

D. 251

Answer: B



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6. If the coefficients of the r^{th} term and the $(r + 1)^{th}$ term in the expansion of $(1 + x)^{20}$ are in the ratio 1 : 2, then r is equal to

A. 6

B. 7

C. 8

D. 9

Answer: B



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7. If $(1 + ax)^n = 1 + 6x + \frac{27}{2}x^2 + \dots + a^n x^n$, then the values of a and n are respectively

A. 2 and 9

B. 3 and 2

C. $2/3$ and 9

D. $3/2$ and 6

Answer: C



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8.

If

$$x = \frac{729 + 6(2)(243) + 15(4)(81) + 20(8)(27) + 15(16)(9) + 6(32)3 + 64}{1 + 4(4) + 6(16) + 4(64) + 256}$$

$$\text{then } \sqrt{x} - \frac{1}{\sqrt{x}} =$$

A. 0.2

B. 4.8

C. 1.02

D. 5.2

Answer: B



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9. The number of terms in the expansion of $(a + b + c)^{10}$ is

A. 11

B. 21

C. 55

Answer: D



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10. If $|x| < 1$, then the coefficient of x^n in $(1 + 2x + 3x^2 + 4x^3 + \dots)^{1/2}$, is

A. n

B. $n + 1$

C. $-n$

D. 1

Answer: D



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11. The sum of the rational terms in the expansion of $(\sqrt{2} + 3^{\frac{1}{5}})^{10}$ is

A. 41

B. 32

C. 18

D. 9

Answer: A



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12. if $\left(1 + \frac{C_1}{C_0}\right)\left(1 + \frac{C_2}{C_1}\right)\left(1 + \frac{C_3}{C_2}\right)\dots\dots\left(1 + \frac{C_n}{C_{n-1}}\right)$ is

A. $\frac{n+1}{\lfloor n}$

B. $\frac{(n+1)^n}{\lfloor n-1}$

C. $\frac{(n-1)^n}{\lfloor n}$

D. $\frac{(n+1)^n}{\lfloor n}$

Answer: D



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13. In the expansion of $(1 + 3x + 2x^2)^6$ the coefficient of x^n is

A. 144

B. 288

C. 216

D. 576

Answer: D



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14. If $(2x^2 - x - 1)^5 = a_0 + a_1x + a_2x^2 + \dots + a_{10}x^{10}$ then,

$$a_2 + a_4 + a_6 + a_8 + a_{10} =$$

A. 15

B. 30

C. 16

D. 32

Answer: D



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15. If $(1 + x - 3x^2)^{10} = a_0 + a_1x + a_2x^2 + \dots + a_{20}x^{20}$, then

$a_2 + a_4 + a_6 + \dots + a_{20} =$

A. $\frac{3^{10} + 1}{2}$

B. $\frac{3^9 + 1}{2}$

C. $\frac{3^{10} - 1}{2}$

D. $\frac{3^9 - 1}{2}$

Answer: C

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16. (i) What is the second term in the expansion of $(1 + x)^n$?

(ii) Write the 3^{rd} and 4^{th} terms in the expansion of $(1 + x)^n$.

(iii) If the coefficients of 2^{nd} , 3^{rd} and 4^{th} terms in the expansion of $(1 + x)^n$ are in A.P, then show that $n^2 - 9n + 14 = 0$.

A. 130

B. 120

C. 128

D. 125

Answer: B

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17. The coefficient of $a^5b^6c^7$ in the expansion of $(bc + ca + ab)^9$ is

A. 100

B. 120

C. 720

D. 1260

Answer: D



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18. If the expansion of $\left(3\frac{\sqrt{x}}{7} - \frac{5}{2x\sqrt{x}}\right)^{13n}$ contains a term independent of x , then n should be a multiple of

A. 10

B. 5

C. 6

D. 4

Answer: D



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19. Prove that ${}^{10}C_2 + 2 \times {}^{10}C_3 + {}^{10}C_4 = {}^{12}C_4$

A. $2^{20} - 2^5$

B. $\frac{20!}{5!15!}$

C. $\frac{20!}{5!15!} - 1$

D. $\frac{20!}{5!15!} - \frac{15!}{5!10!}$

Answer: D



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20. Let $f(x) = [x]$, where $[x]$ denotes the greater integer less than or equal to x . if $a = \sqrt{2011^2 + 2012}$ then the value of $f(a)$ is equal to

A. 175

B. 152

C. 176

D. 151

Answer: D



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21. If $n \in \mathbb{N}$, then $3^{2n+2} - 8n - 9$ is divisible by

A. 574

B. 575

C. 675

D. 674

Answer: D



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22. Let T_n denote the number of triangles which can be formed by using the vertices of a regular polygon of n sides. If $T_{n+1} - T_n = 36$, then n is equal to

- A. 4
- B. 5
- C. 6
- D. 7

Answer: D



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23. The coefficient of the middle term in the expansion of $(x + 2y)^6$ is

- A. 6C_3
- B. $8({}^6C_3)$
- C. $8({}^6C_4)$

D. 6C_4

Answer: B



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24. Let $(1 + x)^n = 1 + a_1x + a_2x^2 + \dots + a_nx^n$. If a_1, a_2 and a_3 are in A.P., then the value of n is

A. 4

B. 5

C. 6

D. 7

Answer: D



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25. If the sum of the coefficients in the expansion of $(a^2x^2 - 6ax + 11)^{10}$, where a is constant, is 1024, then the value of a is

- A. 5
- B. 1
- C. 2
- D. 3

Answer: D



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26. The sum of coefficients in the expansion of

$$\left(x^2 - \frac{1}{3}\right)^{199} \times \left(x^3 + \frac{1}{2}\right)^{200} \text{ is}$$

- A. $\frac{1}{3}$
- B. $-\frac{1}{3}$
- C. $\frac{2}{3}$

D. $\frac{3}{2}$

Answer: D



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27. If $(1 + ax)^n = 1 + 6x + \frac{27}{2}x^2 + \dots + a^n x^n$, then the values of a and n are respectively

A. 2,3

B. 3,2

C. $\frac{3}{2}, 4$

D. 1,6

Answer: C



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28. Which one of the following is true?

A. $\left(1 + \frac{1}{n}\right)^n < n^2, n$ is a positive integer

B. $\left(1 + \frac{1}{n}\right)^n < 2, n$ is a positive integer

C. $\left(1 + \frac{1}{n}\right)^n < n^3, n$ is a positive integer

D. $\left(1 + \frac{1}{n}\right)^n > 2, n$ is a positive integer

Answer: D



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29. When 2^{1505} is divided by 9, the remainder is

A. 8

B. 7

C. 5

D. 6

Answer: C



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30. The term independent of x in the expansion of $\left(x + \frac{1}{x}\right)^6$ is

A. 20

B. 15

C. 6

D. 1

Answer: B



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31. The sum of coefficients in the expansion of $(1 + 3x - 3x^2)^{1143}$ is equal to

A. -1

B. 0

C. 1

D. 2^{1143}

Answer: C



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32. The constant term in the expansion of $\left[1 - (x - 2)^2\right]^{10}$ is equal to

A. 2^{10}

B. 3^{10}

C. 4^{10}

D. 5^{10}

Answer: A



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33. Let t_n denote the n^{th} term in a binomial expansion. If $\frac{t_6}{t_5}$ in the expansion of $(a + b)^{n+4}$ and $\frac{t_5}{t_4}$ in the expansion of $(a + b)^n$ are equal, then n is

- A. 9
- B. 11
- C. 13
- D. 15

Answer: C

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34. 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: D



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35. The coefficient of x^{49} in the product $(x - 1)(x - 2)(x - 3)\dots\dots(x - 50)$ is

A. -2250

B. -1275

C. 1275

D. 2250

Answer: B



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36. 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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37. The value of ${}^2P_1 + {}^3P_1 + \dots + {}^nP_1$ equal to

A. $\frac{n^2 - n + 2}{2}$

B. $\frac{n^2 + n + 2}{2}$

C. $\frac{n^2 + n - 2}{2}$

D. $\frac{n^2 - n - 2}{2}$

Answer: D



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38. The positive integer just greater than $(1 + .0001)^{10000}$ is

A. 4

B. 5

C. 2

D. 3

Answer: C



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39. r and n are positive integers $r > 1, n > 2$ and coefficient of $(r + 2)^{th}$ term and $3r^{th}$ term in the expansion of $(1 + x)^{2n}$ are equal, then n equals

A. $3r$

B. $3r + 1$

C. $2r$

D. $2r + 1$

Answer: C



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40. The coefficients of x^p and x^q in the expansion of $(1 + x)^{p+q}$ are

A. equal

B. equal with opposite signs

C. reciprocals of each other

D. none of these

Answer: A



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41. If the sum of the coefficients in the expansion of $(a + b)^n$ is 4096, then the greatest coefficient in the expansion is

A. 1594

B. 792

C. 924

D. 2924

Answer: C



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42. If x is positive, the first negative term in the expansion of $(1 + x)^{\frac{27}{5}}$ is

A. 5th term

B. 8th term

C. 6th term

D. 7th term

Answer: D



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43. The number of integral terms in the expansion of $(\sqrt{3} + \sqrt[8]{5})^{256}$ is

A. 33

B. 34

C. 35

D. 32

Answer: A



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44. The coefficient of the middle term in the binomial expansion in powers of x of $(1 + \alpha x)^4$ and of $(1 - \alpha x)^6$ is the same if α equals

A. $\frac{-3}{10}$

B. $\frac{10}{3}$

C. $\frac{-5}{3}$

D. $\frac{3}{5}$

Answer: A



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45. The coefficient of x^n in expansion of $(1 + x)(1 - x)^n$ is

A. $(-1)^{n-1}(n-1)^2$

B. $(-1)^n(1-n)$

C. $(n-1)$

D. $(-1)^{n-1}n$

Answer: B

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46. If $s_n = \sum_{r=0}^n \frac{1}{{}^n C_r}$ and $t_n = \sum_{r=0}^n \frac{r}{{}^n C_r}$, then $\frac{t_n}{s_n}$ is equal to

A. $n - 1$

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

C. $\frac{1}{2}n$

D. $\frac{2n - 1}{2}$

Answer: C

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47. If the coefficient of x^7 in $\left[ax^2 + \left(\frac{1}{bx}\right)\right]^{11}$ equals the coefficient of x^{-7} in $\left[ax - \left(\frac{1}{bx^2}\right)\right]^{11}$, then a and b satisfy the relation

A. $a + b = 1$

B. $a - b = 1$

C. $ab = 1$

D. $\frac{a}{b} = 1$

Answer: C



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48. If x is so small that x^3 and higher power of x may neglected, then

$$\frac{(1+x)^{\frac{3}{2}} - \left(1 + \frac{1}{2}x\right)^3}{(1-x)^{\frac{1}{2}}}$$
 may be approximated as

A. $3x + \frac{3}{8}x^2$

B. $1 - \frac{3}{8}x^2$

C. $\frac{x}{2} - \frac{3}{8}x^2$

D. $-\frac{3}{8}x^2$

Answer: D



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49. The sum of the series $1 + \frac{1}{4.2!} + \frac{1}{16.4!} + \frac{1}{64.6!} + \dots \infty$ is

A. $\frac{e + 1}{\sqrt{e}}$

B. $\frac{e - 1}{\sqrt{e}}$

C. $\frac{e + 1}{2\sqrt{e}}$

D. $\frac{e - 1}{2\sqrt{e}}$

Answer: C



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50. If $(1 + x - 3x^2)^{10} = a_0 + a_1x + a_2x^2 + \dots + a_{20}x^{20}$, then

$$a_2 + a_4 + a_6 + \dots + a_{20} =$$

A. $\frac{b^n - a^n}{b - a}$

B. $\frac{a^n - b^n}{b - a}$

C. $\frac{a^{n+1} - b^{n+1}}{b - a}$

D. $\frac{b^{n+1} - a^{n+1}}{b - a}$

Answer: D



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51. In the binomial expansion of $(a - b)^n$, $n \geq 5$, the sum of 5^{th} and 6^{th} term $\frac{a}{b}$ equals

A. $\frac{n - 5}{6}$

B. $\frac{n - 4}{5}$

C. $\frac{5}{n - 4}$

D. $\frac{6}{n - 5}$

Answer: B



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