



## MATHS

### BOOKS - CENGAGE

### BINOMIAL THEOREM

#### Examples

1. Prove that

$$\sum_{r=0}^n {}^n C_r (-1)^r [i^r + i^{2r} + i^{3r} + i^{4r}] = 2^n + 2^{\frac{n}{2}+1} \cos(n\pi/4), \text{ where } i = \sqrt{-1}$$

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2. In the expansion of  $\left(3\sqrt{\frac{a}{b}} + 3\sqrt{\frac{b}{\sqrt{a}}}\right)^{21}$ , the term containing same powers of a & b is

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3. 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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4. 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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5. The number of terms in the expansion of  $(a + b + c)^n$ , where  $n \in \mathbb{N}$ .

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6. Find the number of terms which are free from radical signs in the expansion of  $(x^{1/5} + y^{1/10})^{55}$ .

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7. Prove that 
$$\sum_{k=1}^n \frac{1}{k(k+1)} = 1 - \frac{1}{n+1}.$$

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8. Prove that 
$$\sum_{r=0}^n {}^n C_r \sin rx \cos(n-r)x = 2^{n-1} \sin(nx).$$

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9. Prove that 
$$2 \leq \left(1 + \frac{1}{n}\right)^n < 3 \text{ for all } n \in \mathbb{N}.$$

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

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11. Prove that  $\sqrt{10} \left[ (\sqrt{10} + 1)^{100} - (\sqrt{10} - 1)^{100} \right]$ .

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12. If  $9^7 - 7^9$  is divisible by  $2^n$ , then find the greatest value of  $n$ , where  $n \in \mathbb{N}$ .

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13. Find the degree of the polynomial

$$\frac{1}{\sqrt{4x+1}} \left\{ \left( \frac{1 + \sqrt{4x+1}}{2} \right)^7 - \left( \frac{1 - \sqrt{4x+1}}{2} \right)^7 \right\}$$

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14. If  $T_0, T_1, T_2, \dots, T_n$  represent the terms in the expansion of  $(x+a)^n$ , then find the value of

$$(T_0 - T_2 + T_4 - \dots)^2 + (T_1 - T_3 + T_5 - \dots)^2 n \in N.$$

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15. If  $n = 12m(m \in N)$ , prove that

$${}^n C_0 - \frac{{}^n C_2}{(2 + \sqrt{3})^2} + \frac{{}^n C_4}{(2 + \sqrt{3})^4} - \frac{{}^n C_6}{(2 + \sqrt{3})^6} + \dots = \left( \frac{2\sqrt{2}}{1 + \sqrt{3}} \right)^n.$$

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16. Prove that  $\sum_{r=1}^k (-3)^{r-1} {}^{3n} C_{2r-1} = 0$ , where  $k = 3n/2$  and  $n$  is an even integer.

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17. If the middle term in the expansion of  $(x^2 + 1/x)^n$  is  $924x^6$ , then find the value of  $n$ .

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

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19. If the coefficient of the middle term in the expansion of  $(1 + x)^{2n+2}$  is  $\alpha$  and the coefficients of middle terms in the expansion of  $(1 + x)^{2n+1}$  are  $\beta$  and  $\gamma$  then relate  $\alpha$ ,  $\beta$  and  $\gamma$ .

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20. Find the coefficient of  $a^3 b^4 c$  in the expansion of  $(1 + a - b + c)^9$ .

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21. Find the coefficient of  $a^3 b^4 c^5$  in the expansion of  $(bc + ca + ab)^6$ .



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22. Find the coefficient of  $x^7$  in the expansion of  $(a + 3x - 2x^3)^{10}$ .



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



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24. Using the binomial theorem, evaluate  $(102)^5$ .



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25. Which is larger :  $(99^{50} + 100^{50})$  or  $(101)^{50}$ .



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26. Find (i) the last digit, (ii) the last two digits, and (iii) the last three digits of  $17^{256}$ .

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27. Using Binomial theorem, prove that  $6^n - 5n$  always leaves remainder 1 when divided by 25 for all positive interger n .

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28. Using binomial theorem, prove that  $2^{3n} - 7^n - 1$  is divisible by 49 , where  $n \in N$ .

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

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30. Find the remainder when  $27^{40}$  is divided by 12.

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31. Find the remainder when  $1690^{2608} + 2608^{1690}$  is divided by 7.

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32. If  $(2 + \sqrt{3})^n = I + f$ , where  $I$  and  $n$  are positive integers and  $0$

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33. Statement 1: If  $p$  is a prime number ( $p \neq 2$ ), then

$\left[ (2 + \sqrt{5})^p \right] - 2^{p+1}$  is always divisible by  $p$  (where  $[.]$  denotes the greatest integer function). Statement 2: if  $n$  prime, then

${}^n C_1, {}^n C_2, {}^n C_3, \dots, {}^n C_{n-1}$  must be divisible by  $n$ .



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34. Find the coefficient of  $x^{20}$  in  $\left(x^2 + 2 + \frac{1}{x^2}\right)^{-5} (1 + x^2)^{40}$ .



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



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36. Find the coefficient of  $x^{13}$  in the expansion of  $(1 - x)^5 \times (1 + x + x^2 + x^3)^4$ .



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37. Find the coefficient of  $x^{25}$  in expansion of expression

$$\sum_{r=0}^{50} {}^{50}C_r (2x - 3)^r (2 - x)^{50-r}.$$



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38. Find the coefficient of  $x^k$  in

$$1 + (1 + x) + (1 + x)^2 + \dots + (1 + x)^n (0 \leq k \leq n).$$



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39. Find the coefficient of  $x^{50}$  in the expansion of

$$(1 + x)^{101} \times (1 - x + x^2)^{100}.$$



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40. Find the term independent of  $x$  in the expansion of

$$(2^x + 2^{-x} + \log_e e^{x+2})^{30}.$$

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41. Find the coefficient of  $x^4$  in the expansion of  $(2 - x + 3x^2)^6$ .

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42. Find the term independent of  $x$  in the expansion of  $(1 + x + 2x^3) [(3x^2/2) - (1/3)]^9$

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43. Prove that in the expansion of  $(1 + x)^n(1 + y)^n(1 + z)^n$ , the sum of the coefficients of the terms of degree  $r$  is  $3^n C_r$ .

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44. Find the coefficient of  $x^n$  in  $\left(1 + \frac{x}{1!} + \frac{x^2}{2!} + \dots + \frac{x^n}{n!}\right)^2$ .

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45. Find the sum  ${}^n C_1 + 2 \times {}^n C_2 + 3 \times {}^n C_3 + \dots + n \times {}^n C_n$ .

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46. Find the sum  $\sum_{k=0}^{10} {}^{(20)}C_k$ .

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47. Find the sum of the series  ${}^{10}C_0 + {}^{10}C_1 + {}^{10}C_2 + \dots + {}^{10}C_7$ .

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48. If  $n$  is a positive integer, prove that

$$1 - 2n + \frac{2n(2n-1)}{2!} - \frac{2n(2n-1)(2n-2)}{3!} + \dots + (-1)^{n-1} \frac{2n(2n-1)\dots(n-1)}{(n-1)!}$$

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49. Prove that  $\sum_{k=0}^n (-1)^k \cdot {}^{3n}C_k = (-1)^n \cdot {}^{3n-1}C_n$

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50. Find the sum of the coefficients of all the integral powers of  $x$  in the expansion of  $(1 + 2\sqrt{x})^{40}$ .

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51. Find the sum  $\sum_{i=0}^n \sum_{j=0}^i \binom{n}{i} \binom{i}{j}$

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52. Find the sum  $\sum_{i=0}^n \sum_{j=0}^i \binom{n}{i} \binom{i}{j} \binom{j}{k}$

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53. Evaluate  $\int(x^3 + 4x^2 + 5)dx$



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54. Find the following sums :

(i)  ${}^n C_0 - {}^n C_2 + {}^n C_4 - {}^n C_6 + \dots$

(ii)  ${}^n C_1 - {}^n C_3 + {}^n C_5 - {}^n C_7 + \dots$

(iii)  ${}^n C_0 + {}^n C_4 + {}^n C_8 + {}^n C_{12} + \dots$

(iv)  ${}^n C_2 + {}^n C_6 + {}^n C_{10} + {}^n C_{14} + \dots$

(v)  ${}^n C_1 + {}^n C_5 + {}^n C_9 + {}^n C_{13} + \dots$

(vi)  ${}^n C_3 + {}^n C_7 + {}^n C_{11} + {}^n C_{15} + \dots$



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55. Differentiate  $y = \cos^3(2x)$ .



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56. If the sum of the coefficient in the expansion of  $(\alpha^2 x^2 - 2\alpha x + 1)^{51}$  vanishes, then find the value of  $\alpha$

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57. If  $(1 + x - 2x^2)^{20} = a_0 a_1 x + a_2 x^2 + a_3 x^3 + \dots + a_{40} x^{40}$ , then find the value of  $a_1 + a_3 + a_5 + \dots + a_{39}$ .

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58. If  $(1 + x + x^2)^n = a_0 + a_1 x + a_2 x^2 + \dots + a_{2n} x_{2n}$ , find the value of  $a_0 + a_6 + \dots$ ,  $n \in \mathbb{N}$ .

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59. Prove that  $\frac{\sum_{\alpha+\beta+\gamma=10} 10!}{\alpha! \beta! \gamma!} = 3^{10}$ .

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60. If the binomial coefficients of three consecutive terms in the expansion of  $(a + x)^n$  are in the ratio 1:7:42, then find  $n$ .

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61. In the coefficients of  $r$ th,  $(r + 1)$ th, and  $(r + 2)$ th terms in the binomial expansion of  $(1 + y)^m$  are in A.P., then prove that  $m^2 - m(4r + 1) + 4r^2 - 2 = 0$ .

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62. If  $C_r = {}^n C_r$  then prove that  $(C_0 + C_1)(C_1 + C_2) \dots (C_{n-1} + C_n) = (C_1 C_2 \dots C_{n-1} C_n)(n + 1)^n / n!$

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63. If  $a_1, a_2, a_3, a_4$  be the coefficient of four consecutive terms in the expansion of  $(1 + x)^n$ , then prove that:

$$\frac{a_1}{a_1 + a_2} + \frac{a_3}{a_3 + a_4} = \frac{2a_2}{a_2 + a_3}.$$

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64. Find the sum of  $\sum_{r=1}^n \frac{r^n C_r}{n C_{r-1}}$ .

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65. Find the numerically Greatest Term In the expansion of  $(3 - 5x)^{15}$  when  $x=1/5$

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66. Find the value of the second largest term in the expansion of  $(4 + 5x)^{20}$  when  $x = 1/3$

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67. Find the greatest coefficient in the expansion of  $(1 + 2x/3)^{15}$ .

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68. Given that the 4th term in the expansion of  $[2 + (3/8x)]^{10}$  has the maximum numerical value. Then find the range of value of  $x$ .

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69. Prove that  ${}^n C_1 + 2 \cdot {}^n C_2 + 3 \cdot {}^n C_3 + \dots + n \cdot {}^n C_n = n2^{n-1}$ .

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70. Find the sum  $1 \cdot {}^n C_0 + 3 \cdot {}^n C_1 + 5 \cdot {}^n C_2 + \dots + (2n + 1) \cdot {}^n C_n$ .

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71. If  $(1 + x + x^2 + \dots + x^p)^n = a_0 + a_1x + a_2x^2 + \dots + a_{np}x^{np}$ , then find the value of  $a_1 + 2a_2 + 3a_3 + \dots + npa_{np}$ .

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72. Evaluate  $\int (1 + x)^2 dx$

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73. If  $n > 2$ , then prove that

$C_1(a - 1) - C_2 \times (a - 2) + \dots + (-1)^{n-1} C_n(a - n) = a$ , where  $C_r = {}^n C_r$

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74. Find the sum  $3^n C_0 - 8^n C_1 + 13^n C_2 - \dots + (-1)^n C_n$ .

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75. If  $x + y = 1$ , prove that  $\sum_{r=0}^n r \cdot {}^n C_r x^r y^{n-r} = nx$ .

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76. Prove that  $\frac{C_1}{2} + \frac{C_3}{3} + \frac{C_5}{6} + \dots = \frac{2^{n+1} - 1}{n + 1}$ .

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77. Prove that  $\frac{C_1}{2} + \frac{C_3}{3} + \frac{C_5}{6} + \dots = \frac{2^{n+1} - 1}{n + 1}$ .

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78. Find the sum

$$2 \cdot {}^{10} C_0 + \frac{2^2}{2} \cdot {}^{10} C_1 + \frac{2^3}{3} \cdot {}^{10} C_2 + \frac{2^4}{4} \cdot {}^{10} C_3 + \dots + \frac{2^{11}}{11} \cdot {}^{10} C_{10}.$$

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79. Prove that

$$\frac{C_1}{1} - \frac{C_2}{2} + \frac{C_3}{3} - \frac{C_4}{4} + \dots + \frac{(-1)^{n-1}}{n} C_n = 1 + \frac{1}{2} + \frac{1}{3} + \dots + \frac{1}{n}.$$

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80. Prove that 
$$\sum_{r=1}^n (-1)^{r-1} \left( 1 + \frac{1}{2} + \frac{1}{3} + \dots + \frac{1}{r} \right)^n C_r = \frac{1}{n}.$$

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81. Prove that 
$$\frac{3!}{2(n+3)} = \sum_{r=0}^n (-1)^r \left( \frac{{}^n C_r}{{}^{n+3} C_r} \right)$$

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82. There are two bags each of which contains  $n$  balls. A man has to select an equal number of balls from both the bags. Prove that the number of ways in which a man can choose at least one ball from each bag is  $2^n C_n - 1$ .



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83. Find the sum  $\sum_{i=0}^r \binom{n_1}{r-i} C_i$ .



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84. Prove that  $\sum_{r=0}^{2n} r \binom{2n}{r}^2 = n^{4n} C_{2n}$ .



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85. Using binomial theorem (without using the formula for  $\binom{n}{r}$ ),

prove that

$${}^n C_4 + {}^m C_2 - {}^m C_1 {}^n C_2 = {}^m C_4 - {}^{m+n} C_1 {}^m C_3 + {}^{m+n} C_2 {}^m C_2 - {}^{m+n} C_3 {}^m C_1 + {}^{m+n} C_4$$



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86. Evaluate  $\int (x^2 + 8x + 3) dx$



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87. Prove that

$${}^{100}C_2 + {}^{100}C_4 + {}^{100}C_6 + \dots + {}^{100}C_{98} = \frac{1}{2} [ {}^{100}C_0 + {}^{100}C_{100} ]$$



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88. Let  $m, n \in \mathbb{N}$  and  $C_r = {}^n C_r$ , for  $0 \leq r \leq n$

Statement-1:

$$\frac{1}{m!} C_0 + \frac{n}{(m+1)!} C_1 + \frac{n(n-1)}{(m+2)!} C_2 + \dots + \frac{n(n-1)(n-2)\dots 2.1}{(m+n)!} C_n$$

$$= \frac{(m+n+1)(m+n+2)\dots(m+2n)}{(m+n)!}$$

Statement-2: For  $r \leq 0$

$${}^m C_r {}^n C_0 + {}^m C_{r-1} {}^n C_1 + {}^m C_{r-2} {}^n C_2 + \dots + {}^m C_0 {}^n C_r = {}^{m+n} C_r$$



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89. Statement 1: if  $n \in \mathbb{N}$  and  $n$  is not a multiple of 3 and

$(1 + x + x^2)^{2n} = \sum_{r=0}^{2n} a_r x^r$ , then the value of  $\sum_{r=0}^n (-1)^r a_r C_r$  is zero

Statement 2: The coefficient of  $x^n$  in the expansion of  $(1 - x^3)^n$  is zero, if

$n = 3k + 1$  or  $n = 3k + 2$ .

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90. Find the sum  $\sum_{r=0}^n (n+r) C_r$ .

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91. Prove that

$${}^n C_0 {}^{2n} C_n - {}^n C_1 {}^{2n-1} C_n + {}^n C_2 {}^{2n-2} C_n + \dots + (-1)^n {}^n C_n {}^n C_n = 1.$$

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92. Prove that  ${}^m C_1 C_m - {}^m C_2 C_m + {}^m C_3 C_m \equiv (-1)^{m-1} n^m$ .



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93. If  $(18x^2 + 12x + 4)^n = a_0 + a_1x + a_2x^2 + \dots + a_{2n}x^{2n}$ , prove that

$$a_r = 2^n 3^r \left( \binom{2n}{r} C_r + \binom{2n-2}{r} C_1^{2n-2} C_r + \binom{2n-4}{r} C_2^{2n-4} C_r + \dots \right).$$



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94. Find the value of  $x$ , for which  $1/(\sqrt{5+4x})$  can be expanded as infinite series.



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95. Prove that  $\lim_{x \rightarrow 0} \frac{(1+x)^n - 1}{x} = n$ .



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96. Find the fourth term in the expansion of  $(1 - 2x)^{3/2}$ .

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97. Prove that the coefficient of  $x^r$  in the expansion of  $(1 - 2x)^{1/2}$  is  $(2r)! / [2^r (r!)^2]$ .

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98. Find the sum  $1 - \frac{1}{8} + \frac{1}{8} \times \frac{3}{16} - \frac{1 \times 3 \times 5}{8 \times 16 \times 24} +$

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

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100. Assuming  $x$  to be so small that  $x^2$  and higher power of  $x$  can be neglected, prove that

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101. If  $x$  is very large as compare to  $y$ , then prove that

$$\sqrt{\frac{x}{x+y}} \sqrt{\frac{x}{x-y}} = 1 + \frac{y^2}{2x^2}.$$

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102. Prove that the coefficient of  $x^n$  in the expansion of

$$\frac{1}{(1-x)(1-2x)(1-3x)} \text{ is } \frac{1}{2}(3^{n+2} - 2^{n+3} + 1).$$

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103. Prove that

$${}^n C_0 - {}^n C_1 + {}^n C_2 - {}^n C_3 + \dots + (-1)^r + {}^n C_r + \dots = (-1)^r \times {}^{n-1}$$

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**104.** Find the value of

$${}^{20}C_0 \times {}^{13}C_{10} - {}^{20}C_1 \times {}^{12}C_9 + {}^{20}C_2 \times {}^{11}C_8 - \dots + {}^{20}C_{10}.$$

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**105.** If  $U_n = (\sqrt{3} + 1)^{2n} + (\sqrt{3} - 1)^{2n}$ , then prove that

$$U_{n+1} = 8U_n - 4U_{n-1}.$$

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**106.** Evaluate  $\int (x^{10} - 6x^5 + 2x^3) dx$

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**107.** 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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108.

Given,

$$s_n = 1 + q + q^2 + \dots + q^n, S_n = 1 + \frac{q+1}{2} + \left(\frac{q+1}{2}\right)^2 + \dots + \left(\frac{q+1}{2}\right)^n,$$

prove that  $\binom{n}{1} C_1 + \binom{n+1}{2} C_2 s_1 + \binom{n+1}{3} C_3 s_2 + \dots + \binom{n+1}{n+1} C_{n+1} s_n 2^n S_n$ .



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109. Find the derivative of  $y = 3 \sin^3(2x^4 + 1)$ .



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110. Evaluate  $\int \frac{x+1}{x^2+2x+1} dx$



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111. Evaluate  $\int \frac{x^4 + x - 4}{x^2 + 2} dx$



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112. Solve the differential equation  $\frac{dx}{dy} = xy + 3x + y + 3$



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113. Prove that  $\frac{{}^n C_1 \sin 2x + {}^n C_2 \sin 4x + {}^n C_3 \sin 6x + \dots}{1 + {}^n C_1 \cos 2x + {}^n C_2 \cos 4x + {}^n C_3 \cos 6x + \dots}$



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114. Evaluate  $\int \frac{(a^x + b^x)^2}{a^x b^x} dx$



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## Exercise 8.1

1. The first three terms in the expansion of  $(1 + ax)^n$  ( $n \neq 0$ ) are 1,  $6x$  and  $16x^2$ . Then find the value of  $a$  and  $n$ .



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3. 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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4. If the number of terms in the expansion of  $(x + y + z)^n$  are 36, then find the value of  $n$ .

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5. Find the value of

$$\frac{1}{81^n} - \frac{10}{(81^n)^{2n}} C_1 + \frac{10^2}{(81^n)^{2n}} C_2 - \frac{10^3}{(81^n)^{2n}} C_3 + \dots + \frac{10^{2n}}{81^n}$$





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6.

Prove

that

$$\sum_{r=0}^n (-1)^r \binom{n}{r} \left[ \frac{1}{2^r} + \frac{3}{2^{2r}} + \frac{7}{2^{3r}} + \frac{15}{2^{4r}} + \dots \right] = \frac{2^{mn}}{2^{mn}(2^n)}$$



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



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9. Find the number of irrational terms in the expansion of  $(5^{1/6} + 2^{1/8})^{100}$ .

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10. Represent  $\cos 6\theta$  in terms of  $\cos \theta$ .

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11. Find the number of nonzero terms in the expansion of  $(1 + 3\sqrt{2}x)^9 + (1 - 3\sqrt{2}x)^9$ .

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

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13.

If

$$\frac{1}{\sqrt{4x+1}} \left\{ \left( \frac{1 + \sqrt{4x+1}}{2} \right)^n - \left( \frac{1 - \sqrt{4x+1}}{2} \right)^n \right\} = a_0 + a_1x$$

then find the possible value of  $n$ .

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14. Let  $R = (5\sqrt{5} + 11)^{2n+1}$  and  $f = R - [R]$  where  $[ ]$  denotes the greatest integer function, prove that  $Rf = 4^{2n+1}$

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15. If the middle term in the binomial expansion of  $\left( \frac{1}{x} + x \sin x \right)^{10}$  is equal to  $\frac{63}{8}$ , find the value of  $x$ .

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16. Find the middle term in the expansion of  $\left( x^2 + \frac{1}{x^2} + 2 \right)^n$ .



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17. If the number of terms in the expansion  $(1 + 2x - 3y + 4z)^n$  is 286, then find the coefficient of term containing  $xyz$ .



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## Exercise 8.2

1. Let  $n$  be an odd natural number greater than 1. Then, find the number of zeros at the end of the sum  $99^n + 1$ .



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2. By mathematical induction prove that  $2^{3n}-1$  is divisible by 7.



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3. Find the last three digits of the number  $27^{27}$ .

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4. If  $10^m$  divides the number  $101^{100} - 1$  then, find the greatest value of  $m$ .

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

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6. Show that  $2^{4n+4} - 15n - 16$ , *wheren*  $\in N$  is divisible by 225.

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7. Find the remainder when  $27^{40}$  is divided by 12.



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8. Find the value of  $\{3^{2003}/28\}$ , where  $\{.\}$  denotes the fractional part.



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9. Statement 1: Remainder when  $3456^{2222}$  is divided by 7 is 4. Statement 2: Remainder when  $5^{2222}$  is divided by 7 is 4  
*option1*: BOTH the statement are TRUE and STATEMENT 2 is the correct explanation  
*option2*: BOTH the statement are TRUE and STATEMENT 2 is NOT the correct explanation  
*option3*: STATEMENT 1 is TRUE and STATEMENT 2 is FALSE  
*option4*: STATEMENT 1 is FALSE and STATEMENT 2 is TRUE



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10. Show that the integer next above  $(\sqrt{3} + 1)^{2m}$  contains  $2^{m+1}$  as a factor.

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### Exercise 8.3

1. If  $x^4$  occurs in the  $r$ th term in the expansion of  $\left(x^4 + \frac{1}{x^3}\right)^{15}$ , then find the value of  $r$ .

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2. 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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3. Find the coefficient of  $t^8$  in the expansion of  $(1 + 2t^2 - t^3)^9$ .

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

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5. The coefficient of the term independent of  $x$  in the expansion of

$$\left( \frac{x+1}{x^{2/3} - x^{1/3} + 1} - \frac{x-1}{x - x^{1/2}} \right)^{10}$$
 is 210 b. 105 c. 70 d. 112

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6. In the expansion of  $(1 + 3x + 2x^2)^6$ , the coefficient of  $x^{11}$  is a. 144 b.

288 c. 216 d. 576

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7. Find the coefficient of  $x^{12}$  in expansion of  $(1 - x^2 + x^4)^3(1 - x)^7$ .



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## Exercise 8.4

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



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2. Find the following sum:  $\frac{1}{n!} + \frac{1}{2!(n-2)!} + \frac{1}{4!(n-4)!} + \dots$



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3. Find the sum of the coefficients in the expansion of  $(1 + 2x + 3x^2 + nx^n)^2$ .

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4. Find the sum  $\sum_{j=0}^n ({}^{4n+1}C_j + {}^{4n+1}C_{2n-j})$ .

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5. Find the remainder when  $\left(\sum_{r=1}^5 {}^{20}C_{2r-1}\right)^6$  is divided by 11.

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6. Prove that

$${}^n C_0 + 5 \times {}^n C_1 + 9 \times {}^n C_2 + \dots + (4n + 1) \times {}^n C_n = (2n + 1)2^n.$$

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7. Prove that  ${}^n C_0 + {}^n C_3 + {}^n C_6 + \dots = \frac{1}{3} \left( 2^n + 2 \frac{\cos(n\pi)}{3} \right)$ .



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8. Find the value of  ${}^{4n}C_0 + {}^{4n}C_4 + {}^{4n}C_8 + \dots + {}^{4n}C_{4n}$ .

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9. Prove that 
$$\sum_{r=0}^s \sum_{\substack{s=1 \\ r \leq s}}^n {}^nC_s {}^sC_r = 3^n - 1.$$

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10. Find the sum of coefficients in  $(1 + x - 3x^2)^{4163}$ .

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11. Find the sum of coefficients in the expansion of  $(x - 2y + 3z)^n$  is 128, then find the greatest coefficients in the expansion of  $(1 + x)^n$ .

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12. Find the sum of the coefficients in the expansion of  $(1 + 2x + 3x^2 + nx^n)^2$ .

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13. If  $(1 + x - 2x^2)^6 = 1 + a_1x + a_2x^2 + a_3x^3 + \dots$ , then the value of  $a_2 + a_4 + a_6 + \dots + a_{12}$  will be

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## Exercise 8.5

1. In the expansion of  $(1 + x)^n$ , 7th and 8th terms are equal. Find the value of  $(7/x + 6)^2$ .

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2. Find the sum  $\sum_{r=1}^n r^2 \frac{{}^n C_r}{{}^n C_{r-1}}$ .

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3. Statement 1: Three consecutive binomial coefficients are always in A.P.

Statement 2: Three consecutive binomial coefficients are not in H.P. or G.P.

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4. If the 3rd, 4th, 5th and 6th term in the expansion of  $(x + \alpha)^n$  be, respectively,  $a$ ,  $b$ ,  $c$  and  $d$ , prove that  $\frac{b^2 - ac}{c^2 - bd} = \frac{5a}{3c}$ .

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5. Find the largest term in the expansion of  $(3 + 2x)^{50}$ , where  $x = 1/5$ .

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

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7. If  $n$  is an even positive integer, then find the value of  $x$  if the greatest term in the expansion of  $1 + x^n$  may have the greatest coefficient also.

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8. If in the expansion of  $2x + 5^{10}$ , the numerically greatest term is equal to the middle term, then find the values of  $x$ .

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## Exercise 8.6

1. Find the value of

$$({}^{10}C_{10}) + ({}^{10}C_0 + {}^{10}C_1) + ({}^{10}C_0 + {}^{10}C_1 + {}^{10}C_2) + \dots + ({}^{10}C_0 +$$

.



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2. Prove that

$$\frac{1^2}{3} \cdot {}^n C_1 + \frac{1^2 + 2^2}{7} \cdot {}^n C_2 + \frac{1^2 + 2^2 + 3^2}{7} \cdot {}^n C_3 + \dots$$
$$+ \frac{1^2 + 2^3 + \dots + n^2}{2n + 1} \cdot {}^n C_n = \frac{n(n + 3)}{6} 2^{n-2}.$$



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3. If  $p + q = 1$ , then show that  $\sum_{r=0}^n r^2 \cdot {}^n C_r p^r q^{n-r} = npq + n^2 p^2$ .



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4. Prove that  $1 - {}^n C_1 \frac{1+x}{1+nx} + {}^n C_2 \frac{1+2x}{(1+nx)^2} - {}^n C_3 \frac{1+3x}{(1+nx)^3} + \dots + (n+1)\text{terms} = 0$

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5. Prove that

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

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6. If  $(1+x)^{15} = C_0 + C_1x + C_2x^2 + \dots + C_{15}x^{15}$ , then find the sum of  $C_1 + 2C_3 + 3C_4 + \dots + 14C_{15}$ .

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7. Find the coefficient of  $x^n$  in the polynomial  $(x + {}^n C_0)(x + 3^n C_1) \times (x + 5^n C_2) \dots [x + (2n+1)^n C_n]$ .



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8. Find the value of  ${}^{20}C_0 - \frac{{}^{20}C_1}{2} + \frac{{}^{20}C_2}{3} - \frac{{}^{20}C_3}{4} + \dots$

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

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10. If  $\frac{dy}{dx} = \frac{1}{x}$  then  $y =$  .

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## Exercise 8.7

1. Prove that  $\sum_{r=0}^{2n} r \binom{2n}{r}^2 = n \binom{4n}{2n}$ .



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2. Prove that

$$(2nC_0)^2 + (2nC_1)^2 + (2nC_2)^2 + \dots + (2nC_{2n})^2 = (-1)^n 2nC_n.$$



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3. Find the sum of the series

$${}^{84}C_4 + 6 \times {}^{84}C_5 + 15 \times {}^{84}C_6 + 20 \times {}^{84}C_7 + 15 \times {}^{84}C_8 + 6 \times {}^{84}C_9 + \dots$$



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4. Find an anti derivative (or integral) of the given function by the method of inspection.  $(ax + b)$ .



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5. Prove that

$$C_0 - 2^2 C_1 + 3^2 C_2 - 4^2 C_3 + \dots + (-1)^n (n+1)^2 \times C_n = 0 \text{ where } C_r = {}^n C_r$$

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6. Find the value of  $\sum_{i=1}^n i \binom{n}{i}$

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7. Prove that  $\sum_{r=0}^n r \binom{n}{r} = n 2^{n-1}$

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8. Prove that  $\sum_{r=0}^n r \binom{2n}{r} = n 2^{2n-1}$

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9. Find the value of  $\sum_{p=1}^n \left( \sum_{m=p}^n {}^n C_m^m C_p \right)$ . And hence, find the value of  $\left( \lim \right)_{n \rightarrow \infty} \frac{1}{3^n} \sum_{p=1}^n \left( \sum_{m=p}^n {}^n C_m^m C_p \right)$ .

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## Exercise 8.8

1. If the third term in the expansion of  $(1+x)^m$  is  $-\frac{1}{8}x^2$ , then find the value of  $m$ .

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2. Find the cube root of 217, correct to two decimal places.

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3. Show that  $\sqrt[3]{3} = 1 + (1/3) + (1/3) \cdot (3/6) + (1/3) \cdot (3/6) \cdot (5/9) + \dots$

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4. Find the coefficient of  $x^2$  in  $\left(\frac{a}{a+x}\right)^{1/2} + \left(\frac{a}{a-x}\right)^{1/2}$

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5. If  $|x| < 1$ , then find the coefficient of  $x^n$  in the expansion of  $(1 + x + x^2 + x^3 + \dots)^2$ .

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6. If  $|x| > 1$ , then expand  $(1 + x)^{-2}$ .

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

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8. If  $(r + 1)$ th term is the first negative term in the expansion of  $(1 + x)^{7/2}$ , then find the value of  $r$ .

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9. Prove that the coefficient of  $x^n$  in the expansion of  $\frac{1}{(1-x)(1-2x)(1-3x)}$  is  $\frac{1}{2}(3^{n+2} - 2^{n+3} + 1)$ .

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10. Prove that

$$(r + 1) \times {}^n C_0 - r \times {}^n C_1 + (r - 1) \times {}^n C_2 - (r - 2) \times {}^n C_3 + \dots + (-1)^{n-1} \times {}^n C_{n-1} = 1$$

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## Exercise (Single)

1. If the coefficients of 5th, 6th , and 7th terms in the expansion of  $(1 + x)^n$  are in A.P., then  $n =$  a. 7 only b. 14 only c. 7 or 14 d. none of these

A. 7 only

B. 14 only

C. 7 or 14

D. none of these

**Answer: C**



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2. 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  $\alpha$  equals

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

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

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

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

**Answer: C**



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3. If  $(1 + x)^5 = a_0 + a_1x + a_2x^2 + a_3x^3 + a_4x^4 + a_5x^5$ , then the value of  $(a_0 - a_2 + a_4)^2 + (a_1 - a_3 + a_5)^2$  is equal to 243 b. 32 c. 1 d.  $2^{10}$

A. 243

B. 32

C. 1

D.  $2^{10}$

**Answer: B**



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4. The expression

$$\left( \sqrt{2x^2 + 1} + \sqrt{2x^2 - 1} \right)^6 \left( \frac{2}{\left( \sqrt{2x^2 + 1} + \sqrt{2x^2 - 1} \right)^{\square}} \right)^6 \quad \text{is}$$

polynomial of degree 6 b. 8 c. 10 d. 12

A. 6

B. 8

C. 10

D. 12

**Answer: A**



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5. If the 6th term in the expansion of  $\left( \frac{1}{x^{\frac{8}{3}}} + x^2 (\log)_{10} x \right)^8$  is 5600, then

$x$  equals

A. 1

B.  $\log_e 10$

C. 10

D.  $x$  does not exist

**Answer: C**



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6. If in the expansion of  $(a - 2b)^n$ , the sum of  $5^{th}$  and  $6^{th}$  terms is 0, then the values of  $a/b =$

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

B.  $\frac{2(n - 4)}{5}$

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

D.  $\frac{5}{2(n - 4)}$

**Answer: B**

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7. The number of real negative terms in the binomial expansion of  $(1 + ix)^{4n-2}$ ,  $n \in N$ ,  $x > 0$  is

A.  $n$

B.  $n+1$

C.  $n-1$

D.  $2n$

**Answer: A**

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8. The sum of rational term in  $(\sqrt{2} + {}^3\sqrt{3} + {}^6\sqrt{5})^{10}$  is equal to 12632 b. 1260 c. 126 d. none of these

A. 12632

B. 1260

C. 126

D. 11792

**Answer: D**



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9. The value of  $x$  for which the sixth term in the expansion of

$$\left[ 2^{\log} - 2^{\sqrt{9^{(x-1)}+7}} + \frac{1}{2^{\frac{1}{5}(\log)_2(3^{(x-1)}+1)}} \right]^7 \text{ is } 84 \text{ is}$$

A. 4

B. 1 or 2

C. 0 or 1

D. 3

**Answer: B**



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10. The number of distinct terms in the expansion of  $\left(x + \frac{1}{x} + \frac{1}{x^2}\right)^{15}$  is/are (with respect to different power of  $x$ ) 255 b. 61 c. 127 d. none of these

A. 255

B. 61

C. 127

D. none of these

Answer: B



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11. The value of  $2 \times {}^n C_1 + 2^3 \times {}^n C_3 + 2^5 + \dots$  is

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

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

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

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

**Answer: B**



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12. If  $(4x^2 + 1)^n = \sum_{r=0}^n a_r (1 + x^2)^{n-r} x^{2r}$ , then the value of

A.  $3^n$

B.  $4^n$

C.  $5^n$

D.  $6^n$

**Answer: B**



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13. The fractional part of  $2^{4n}/15$  is ( $n \in \mathbb{N}$ )  $\frac{1}{15}$  b.  $\frac{2}{15}$  c.  $\frac{4}{15}$  d. none of these

A.  $\frac{1}{15}$

B.  $\frac{2}{15}$

C.  $\frac{4}{15}$

D. none of these

**Answer: A**



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14. If  $p = (8 + 3\sqrt{7})^n$  and  $f = p - [p]$ , where  $[.]$  denotes the greatest integer function, then the value of  $p(1 - f)$  is equal to 1 b. 2 c.  $2^n$  d.  $2^{2n}$

A. 1

B. 2

C.  $2^n$

D.  $2^{2n}$

**Answer: A**



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15. The remainder when the number  $3^{256} - 3^{12}$  is divided by 8 is

A. 0

B. 3

C. 4

D. 7

**Answer: A**



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16. The smallest integer larger than  $(\sqrt{3} + \sqrt{2})^6$  is



A. 969

B. 970

C. 971

D. 972

**Answer: B**

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17. Find the coefficient of  $x^5$  in the expansion of  $(1 + x^2)^5(1 + x)^4$

A. 12

B. 5

C. 4

D. 56

**Answer: C**

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18. Coefficient of  $x^2$  in the expansion of  $(x^3 + 2x^2 + x + 4)^{15}$  is

- A. Prime
- B. Composite
- C. 0
- D. Perfect square

**Answer: D**



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19. If the coefficients of  $r$ th and  $(r + 1)$ th terms in the expansion of  $(3 + 7x)^{29}$  are equal, then  $r$  equals a. 15 b. 21 c. 14 d. none of these

- A. 15
- B. 21
- C. 14

D. none of these

**Answer: B**



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20. In the expansion of  $\left(x^3 - \frac{1}{x^2}\right)^n$ ,  $n \in N$ , if the sum of the coefficients of  $x^5$  and  $x^{10}$ , then  $n$  is a. 25 b. 20 c. 15 d. none of these

A. 25

B. 20

C. 15

D. None of these

**Answer: C**



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21. If  $(1 + 2x + x^2)^n = \sum_{r=0}^{2n} a_r x^r$ , then  $a =$   $({}^n C_2)^2$  b.  
 ${}^n C_r$  c.  ${}^n C_{r+1}$  d.  ${}^{2n} C_r$  e.  ${}^{2n} C_{r+1}$

A.  $({}^n C_r)^2$

B.  ${}^n C_r \cdot {}^n C_{r+1}$

C.  ${}^{2n} C_r$

D.  ${}^{2n} C_{r+1}$

Answer: C



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22. If the term independent of  $x$  in the  $\left(\sqrt{x} - \frac{k}{x^2}\right)^{10}$  is 405, then  $k$  equals 2, -2 b. 3, -3 c. 4, -4 d. 1, -1

A. 2, -2

B. 3, -3

C. 4, - 4

D. 1, - 1

**Answer: B**



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23. The coefficient of  $x^{53}$  in the expansion

$$\sum_{m=0}^{100} {}^{100}C_m (x-3)^{100-m} 2^m$$

is  ${}^{100}C_{47}$  b.  ${}^{100}C_{53}$  c.  $-{}^{100}C_{53}$  d.

none of these

A.  ${}^{100}C_{47}$

B.  ${}^{100}C_{53}$

C.  $-{}^{100}C_{53}$

D.  $-{}^{53}C_{100}$

**Answer: C**



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

A.  $-83$

B.  $0$

C.  ${}^{30}C_{10}$

D. none of these

**Answer: D**

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26. The term independent of  $a$  in the expansion of

$\left(1 + \sqrt{a} + \frac{1}{\sqrt{a}-1}\right)^{-30}$  is  ${}^{30}C_{20}$  b. 0 c.  ${}^{30}C_{10}$  d. none of these

A.  ${}^{30}C_{20}$

B. 0

C.  ${}^{30}C_{10}$

D. none of these

**Answer: B**

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27. The coefficient of  $x^{10}$  in the expansion of  $(1 + x^2 - x^3)^8$  is 476 b. 496  
c. 506 d. 528

A. 476

B. 496

C. 506

D. 528

**Answer: A**



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28. The coefficient of  $x^n$  in  $(1 + x)^{101}(1 - x + x^2)^{100}$  is nonzero, then  $n$   
cannot be of the form  $3r + 1$  b.  $3r$  c.  $3r + 2$  d. none of these

A.  $3r + 1$

B.  $3r$

C.  $3r + 2$



D. none of these

**Answer: C**



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29. The coefficient of  $x^{28}$  in the expansion of  $(1 + x^3 - x^6)^{30}$  is 1 b. 0 c.

$30C_6$  d.  $30C_3$

A. 1

B. 0

C.  ${}^{30}C_6$

D.  ${}^{30}C_3$

**Answer: B**



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30. The coefficient of  $a^8b^4c^9d^9$  in  $(abc + abd + acdd + bcd)^{10}$  is 10! b.

$\frac{10!}{8!4!9!9!}$  c. 2520 d. none of these

A. 10!

B.  $\frac{10!}{8!4!9!9!}$

C. 2520

D. none of these

Answer: C



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31. In the expansion of  $\left(1 + x + \frac{7}{x}\right)^{11}$  find the term not containing x.

A.  $\sum_{r=0}^5 {}^{11}C_r \cdot {}^{11-r}C_{2r} 7^r$

B.  $\sum_{r=0}^5 {}^{11}C_r \cdot {}^{11-r}C_{11-2r} 7^r$

C.  $\sum_{r=0}^5 {}^{11}C_r \cdot {}^{11-r}C_{11-2r} 7^r$

D. none of these

**Answer: C**



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32. The coefficient of  $x^7$  in the expansion of  $(1 - x - x^3 + x^4)^8$  is equal to

A.  $-648$

B.  $792$

C.  $-792$

D.  $648$

**Answer: C**



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33. Sum of the coefficients of terms of degree 13 in the expansion of  $(1 + x)^{11}(1 + y^2 - z)^{10}$  is

A.  ${}^{10}C_3$

B.  ${}^{10}C_4$

C.  ${}^{11}C_3$

D.  ${}^{11}C_4$

**Answer: B**



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34. The coefficient of  $x^2y^3$  in the expansion of  $(1 - x + y)^{20}$  is  $\frac{20!}{2!3!}$  b.  $-\frac{20!}{2!3!}$  c.  $\frac{20!}{15!2!3!}$  d. none of these

A.  $\frac{20!}{2!3!}$

B.  $-\frac{20!}{2!3!}$

C.  $\frac{20!}{5!2!3!}$

D.  $\frac{20!}{15!2!3!}$

**Answer: D**



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35. If coefficient of  $a^2b^3c^4 \in (a + b + c)^m$  (where  $m \in N$ ) is  $L$  ( $L \neq 0$ ), then in same expansion coefficient of  $a^4b^4c^1$  will be  $L$  b.  $\frac{L}{3}$  c.  $\frac{mL}{4}$  d.  $\frac{L}{2}$

A.  $L$

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

C.  $\frac{mL}{4}$

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

**Answer: D**



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36. The coefficient of  $x^r$  [ $0 \leq r \leq (n-1)$ ] in the expansion of  $(x+3)^{n-1} + (x+3)^{n-2}(x+2) + (x+3)^{n-3}(x+2)^2 + \dots + (x+2)^{n-1}$  is  ${}^n C_r(3^r - 2^n)$  b.  ${}^n C_r(3^{n-r} - 2^{n-r})$  c.  ${}^n C_r(3^r + 2^{n-r})$  d. none of these

A.  ${}^n C_r(3^r - 2^n)$

B.  ${}^n C_r(3^{n-r} - 2^{n-r})$

C.  ${}^n C_r(3^r + 2^{n-r})$

D. none of these

**Answer: B**

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37. If  $(1 + 2x + 3x^2)^{10} = a_0 + a_1x + a_2x^2 + \dots + a_{20}x^{20}$ , then  $a_1$  equals

10 b. 20 c. 210 d. none of these

A. 10

B. 20

C. 210

D. none of these

**Answer: B**



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38. If  $f(x) = 1 - x + x^2 - x^3 + \dots + x^{15} + x^{16} - x^{17}$ , then the coefficient of  $x^2 \in f(x - 1)$  is 826 b. 816 c. 822 d. none of these

A. 826

B. 816

C. 822

D. none of these

**Answer: B**



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39. Let  $f(x) = a_0 + a_1x + a_2x^2 + \dots + a_nx^n + \dots$  and  $\frac{f(x)}{1-x} = b_0 + b_1x + b_2x^2 + \dots + b_nx^n + \dots$ , then  $b_n + b_{n-1} = a_n$  b.  $b_n - b_{n-1} = a_n$  c.  $b_n/b_{n-1} = a_n$  d. none of these

A.  $b_n + b_{n-1} = a_n$

B.  $b_n - b_{n-1} = a_n$

C.  $b_n/b_{n-1} = a_n$

D. none of these

Answer: B



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40. Statement 1: The coefficient of  $x^n$  is  $\left(1 + x + \frac{x^2}{2!} + \frac{x^3}{3!} + \dots + \frac{x^n}{n!}\right)^3$  is  $\frac{3^n}{n!}$  Statement 2: The coefficient of  $x^n$  in  $e^{3x}$  is  $\frac{3^n}{n!}$

A.  $\frac{3^n}{n!}$



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

C.  $\frac{3^n}{(n-1)!}$

D.  $\frac{1}{3^n \cdot n!}$

**Answer: A**



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41. In the expansion of  $\left(3^{-x/4} + 3^{5x/4}\right)^n$  the sum of binomial coefficient is 64 and term with the greatest binomial coefficient exceeds the third by  $(n-1)$ , the value of  $x$  must be

A. 0

B. 1

C. 2

D. 3

**Answer: A**



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42. The sum of the coefficients of even power of  $x$  in the expansion of  $(1 + x + x^2 + x^3)^5$  is a. 256 b. 128 c. 512 d. 64

A. 256

B. 128

C. 512

D. 64

Answer: C



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43. Maximum sum of coefficient in the expansion of  $(1 - x \sin \theta + x^2)^n$  is 1 b.  $2^n$  c.  $3^n$  d. 0

A. 1

B.  $2^n$

C.  $3^n$

D. 0

**Answer: C**



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

A. 924

B. 792

C. 1594

D. none of these

**Answer: A**



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45. The value of  ${}^{20}C_0 + {}^{20}C_1 + {}^{20}C_2 + {}^{20}C_3 + {}^{20}C_4 + {}^{20}C_{12} + {}^{20}C_{13} + {}^{20}C_{14} + {}^{20}C_{15}$  is

a.  $2^{19} - \frac{{}^{(20)}C_{10} + {}^{20}C_9}{2}$     b.  $2^{19} - \frac{{}^{(20)}C_{10} + 2 \times {}^{20}C_9}{2}$     c.  $2^{19} - \frac{{}^{(20)}C_{10}}{2}$     d. none of these

A.  $2^{19} - \frac{{}^{20}C_{10} + {}^{20}C_9}{2}$

B.  $2^{19} - \frac{{}^{20}C_{10} + 2 \times {}^{20}C_9}{2}$

C.  $2^{19} - \frac{{}^{20}C_{10}}{2}$

D. none of these

Answer: B



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46. The sum of series  ${}^{20}C_0 - {}^{20}C_1 + {}^{20}C_2 - {}^{20}C_3 + \dots + {}^{20}C_{10}$  is

A.  $\frac{1}{2} \cdot {}^{20}C_{10}$

B. 0

C.  ${}^{20}C_{10}$

D.  $-{}^{20}C_{10}$

**Answer: A**



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47. If  $(3 + x^{2008} + x^{2009})^{2010} = a_0 + a_1x + a_2x^2 + \dots + a_nx^n$ , then the value of  $a_0 - \frac{1}{2}a_1 - \frac{1}{2}a_2 + a_3 - \frac{1}{2}a_4 - \frac{1}{2}a_5 + a_6 - \dots$  is  $3^{2010}$  b. 1 c.  $2^{2010}$  d. none of these

A.  $3^{2010}$

B. 1

C.  $2^{2010}$

D. none of these

**Answer: C**



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48. Value of  $\sum_{k=1}^{\infty} \sum_{r=0}^k \frac{1}{3^k} ({}^k C_r)$  is  $\frac{2}{3}$  b.  $\frac{4}{3}$  c. 2 d. 1

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

B.  $\frac{4}{3}$

C. 2

D. 1

Answer: C



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49. The value of  $\sum_{r=0}^{10} ({}^r C_r)^{20}$  is equal to  $20(2^{18} + {}^{19} C_{10})$  b.  $10(2^{18} + {}^{19} C_{10})$  c.  $20(2^{18} + {}^{19} C_{11})$  d.  $10(2^{18} + {}^{19} C_{11})$

A.  $20(2^{18} + {}^{19} C_{10})$

B.  $10(2^{18} + {}^{18} C_{10})$

C.  $20(2^{16} + {}^{19}C_{11})$

D.  $10(2^{18} + {}^{19}C_{11})$

**Answer: A**



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**50.**

$$\left[ ({}^nC_0 + {}^nC_3 + \dots) \right] \frac{1}{2} \left[ ({}^nC_1 + {}^nC_2 + {}^nC_4 + {}^nC_5 + \dots) \right]^2 + \frac{3}{4} ({}^nC_1 - {}^nC_2 + \dots)$$

3 b. 4 c. 2 d. 1

A. 3

B. 4

C. 2

D. 1

**Answer: D**



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51. The value of  $\sum_{r=1}^{n+1} \left( \sum_{k=1}^n {}^k C_{r-1} \right)$  (where  $r, k, n \in N$ ) is equal to  $2^{n+1} - 2$  b.  $2^{n+1} - 1$  c.  $2^{n+1}$  d. none of these

A.  $2^{n+1} - 2$

B.  $2^{n+1} - 1$

C.  $2^{n+1}$

D. none of these

**Answer: A**



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52. The sum  $\sum_{0 \leq i \leq j \leq 10} ({}^{10}C_j) ({}^j C_{r-1})$  is equal to

A.  $2^{10} - 1$

B.  $2^{10}$

C.  $3^{10} - 1$



D.  $3^{10}$

**Answer: C**



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53. The value of  ${}^{1000}C_{50} + {}^{999}C_{49} + {}^{998}C_{48} + \dots + {}^{950}C_0$  is

A.  ${}^{1001}C_{50}$

B.  ${}^{1002}C_{951}$

C.  ${}^{1001}C_{950}$

D.  ${}^{1002}C_{50}$

**Answer: A**



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54. If  $\sum_{r=0}^n \{a_r(x - \alpha + 2)^r - b_r(\alpha - x - 1)^r\} = 0$ , then prove that

$$b_n - (-1)^n a_n = 0.$$

A.  $b_n = 1 + a_n$

B.  $b_n = (-1)^n \times a_n$

C.  $b_n = (-1)^{n-1} \times a_n$

D.  $b_n + 1 = a_n$

**Answer: B**



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55. If  $\sum_{r=0}^{2n} a_r(x - 2)^r = \sum_{r=0}^{2n} b_r(x - 3)^r$  and  $a_k = 1$  for all  $k \geq n$ , then

show that  $b_n = {}^{2n+1}C_{n+1}$ .

A.  ${}^{2n+1}C_{n-1}$

B.  ${}^{2n}C_{n+1}$

C.  $2^n C_n$

D.  $2^{n+1} C_{n+1}$

**Answer: D**



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56. The value of  $\sum_{r=0}^{40} r \cdot {}^{40}C_r \cdot {}^{30}C_r$  is

A. 10460

B. 11240

C. 11520

D. 12640

**Answer: C**



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57. If  ${}^{n+1}C_{r+1} : {}^nC_r : {}^{n-1}C_{r-1} = 11:6:3$ , then  $nr =$

A. 20

B. 30

C. 40

D. 50

**Answer: D**



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

A.  $\frac{ac + ab + bc}{b^2 + ac}$

B.  $\frac{2ac + ab + bc}{b^2 - ac}$

C.  $\frac{ab + ac}{b^2 - ac}$

D. none of these

**Answer: B**



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59. Which term in the expansion of  $(2 - 3x)^{19}$  has algebraically the last coefficients ?

A.  $10^{th}$

B.  $11^{th}$

C.  $12^{th}$

D.  $13^{th}$

**Answer: C**



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60. The value of  $\frac{{}^nC_0}{n} + \frac{{}^nC_1}{n+1} + \frac{{}^nC_2}{n+2} + \dots + \frac{{}^nC_n}{2n}$  is equal to

- A.  $\int_0^1 x^{n-1}(1-x)^n dx$
- B.  $\int_1^2 x^n(x-1)^{n-1} dx$
- C.  $\int_1^2 (1+x)^n dx$
- D.  $\int_0^1 (1-x)^n x^{n-1} dx$

**Answer: B**



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61. The value of  $\sum_{r=1}^n (-1)^{r+1} \binom{n}{r} \frac{1}{r+1}$  is equal to  $-\frac{1}{n+1}$  b.  $\frac{1}{n}$  c.

$\frac{1}{n+1}$  d.  $\frac{n}{n+1}$

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

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

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

D.  $\frac{n}{n+1}$

Answer: D

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62. If  $\sum_{r=0}^{10} \left( \frac{r+2}{r+1} \right) \wedge n C_r = \frac{2^8 - 1}{6}$ , then  $n$  is 8 b. 4 c. 6 d. 5

A. 8

B. 4

C. 6

D. 5

Answer: D

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63. The value of  $\sum_{r=0}^{10} (-1)^r \cdot 4^{10-r} \cdot C_r^{30-r} C_{10-r}^{30-r}$  is equal to

A.  ${}^{30}C_{10} \times 2^{10}$

B.  ${}^{30}C_9 \times 4^{10}$

C.  ${}^{30}C_{10} \times 3^{10}$

D.  ${}^{30}C_9 \times 4^{10}$

**Answer: C**



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64. The value of  $\sum_{r=0}^{10} r {}^{10}C_r \cdot 3^r \cdot (-2)^{10-r}$  is -

A. 20

B. 10

C. 300

D. 30

**Answer: D**



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65.  ${}^{15}C_0 =$

A. 15

B. -15

C. 0

D. 51

**Answer: C**



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66.

If

$(1 + x)^n = C_0 + C_1x + C_2x^2 + \dots + C_nx^n$ , then  $C_0C_2 + C_1C_3 + C_2C_4 + \dots +$

$\frac{(2n)!}{(n!)^2}$  b.  $\frac{(2n)!}{(n-1)!(n+1)!}$  c.  $\frac{(2n)!}{(n-2)!(n+2)!}$  d. none of these

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

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

C.  $\frac{(2n)!}{(n-2)!(n+2)!}$

D. none of these

**Answer: C**



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67.  ${}^{404}C_4 - {}^{303}C_4 + {}^{202}C_4 - {}^{101}C_4 =$

A.  $(401)^4$

B.  $(101)^4$

C. 0

D.  $(201)^4$

**Answer: B**



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68. The value of  $\sum_{r=0}^{40} r^{40} C_r^{30} C_r$  is

A.  $40 \cdot {}^{69} C_{29}$

B.  $40 \cdot {}^{70} C_{30}$

C.  ${}^{60} C_{29}$

D.  ${}^{70} C_{30}$

**Answer: A**



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69. The value of  $\sum_{r=0}^{50} (-1)^r \frac{{}^{(50)}C_r}{r+2}$  is equal to  $\frac{1}{50 \times 51}$  b.  $\frac{1}{52 \times 50}$  c.  $\frac{1}{52 \times 51}$  d. none of these

A.  $\frac{(17)! - 2^{16}}{(17)!}$

B.  $\frac{(18)! 2^{17}}{(18)!}$

C.  $\frac{(16)! - 2^{15}}{(16)!}$

D.  $\frac{(15)! - 2^{14}}{(15)!}$

**Answer: A**



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70.  $(n + 2)nC_0(2^{n+1}) - (n + 1)nC_1(2^n) + (n)nC_2(2^{n-1}) - \dots$  is equal to

A. 4

B. 4n

C. 4(n+1)

D. 2(n+2)

**Answer: C**



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71. The value of  $\sum_{r=0}^{50} (-1)^r \binom{50}{r}$  is equal to  $\frac{1}{50 \times 51}$  b.  $\frac{1}{52 \times 50}$  c.  $\frac{1}{52 \times 51}$  d. none of these

A.  $\frac{1}{50 \times 51}$

B.  $\frac{1}{52 \times 50}$

C.  $\frac{1}{52 \times 51}$

D. none of these

**Answer: C**



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72.  $\sum_{r=0}^{300} a_r x^r = (1 + x + x^2 + x^3)^{100}$ . If  $a = \sum_{r=0}^{300} a_r$ , then  $\sum_{r=0}^{300} r a_r$  is equal to  $300a$  b.  $100a$  c.  $150a$  d.  $75a$

A.  ${}^n C_r$

B.  ${}^n C_r 3^r$

C.  ${}^{2n}C_r$

D.  ${}^nC_r 2^r$

**Answer: D**

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73.  $\sum_{r=0}^{300} a_r x^r = (1 + x + x^2 + x^3)^{100}$ . If  $a = \sum_{r=0}^{300} a_r$ , then  $\sum_{r=0}^{300} r a_r$  is equal to  $300a$  b.  $100a$  c.  $150a$  d.  $75a$

A.  $300a$

B.  $100a$

C.  $150a$

D.  $75a$

**Answer: C**

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74. The value of  $\sum_{r=0}^{20} r(20-r) \binom{20}{r}^2$  is equal to  $400^{39} C_{20}$  b.  $400^{40} C_{19}$  c.  $400^{39} C_{19}$  d.  $400^{38} C_{20}$

A.  $400^{39} C_{20}$

B.  $400^{40} C_{19}$

C.  $400^{39} C_{19}$

D.  $400^{38} C_{20}$

**Answer: D**



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75.

If

$$f(x) = {}^{40}C_1 \cdot x(1-x)^{39} + 2 \cdot {}^{40}C_2 x^2(1-x)^{38} + 3 \cdot {}^{40}C_3 x^3(1-x)^{37} + \dots$$

, then the value of  $f(3)$  is

A. 120

B. 150

C. 200

D. 240

**Answer: A**



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76. If  $a_n = \sum_{r=0}^n \frac{1}{{}^nC_r}$ , then the value of  $\left(\sum \sum\right)_{0 \leq i < j \leq n} \left(\frac{i}{{}^nC_i} + \frac{j}{{}^nC_j}\right)$

A.  $an^2$

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

C.  $a^2n$

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

**Answer: D**



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77. In the expansion of  $[(1 + x)/(1 - x)]^2$ , the coefficient of  $x^n$  will be  
4n b.  $4n - 3$  c.  $4n + 1$  d. none of these

A.  $4n$

B.  $4n - 3$

C.  $4n + 1$

D. none of these

**Answer: A**



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78. Show that  $x^n = 1 + n\left(1 - \frac{1}{x}\right) + \frac{n(n+1)}{1.2}\left(1 - \frac{1}{x}\right)^2 + \dots$

A.  $x^n$

B.  $x^{-n}$

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

D. none of these

**Answer: A**



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$$79. \sum_{k=1}^{\infty} k \left(1 - \frac{1}{n}\right)^{k-1} = n(n-1) \quad \text{b. } n(n+1) \quad \text{c. } n^2 \quad \text{d. } (n+1)^2$$

A.  $n(n-1)$

B.  $n(n+1)$

C.  $n^2$

D.  $(n+1)^2$

**Answer: C**



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80. The coefficient of  $x^4$  in the expansion of  $\left\{\sqrt{1+x^2} - x\right\}^{-1}$  in ascending powers of  $x$ , when  $|x| < 1$ , is 0 b.  $\frac{1}{2}$  c.  $-\frac{1}{2}$  d.  $-\frac{1}{8}$

A. 0

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

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

D.  $-\frac{1}{8}$

**Answer: D**



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81.  $1 + \frac{1}{3}x + \frac{1 \times 4}{3 \times 6}x^2 + \frac{1 \times 4 \times 7}{3 \times 6 \times 9}x^3 + \dots$  is equal to

A.  $x$

B.  $(1+x)^{1/3}$

C.  $(1-x)^{1/3}$

D.  $(1-x)^{-1/3}$

**Answer: D**



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82.  $1 + \frac{1}{4} + \frac{1 \times 3}{4 \times 8} + \frac{1 \times 3 \times 5}{4 \times 8 \times 12} + \dots$  is equal to

A.  $\sqrt{2}$

B.  $\frac{1}{\sqrt{2}}$

C.  $\sqrt{3}$

D.  $\frac{1}{\sqrt{3}}$

**Answer: A**



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83. If  $|x| < 1$ , then  $1 + n \left( \frac{2x}{1+x} \right) + \frac{n(n+1)}{2!} \left( \frac{2x}{1+x} \right)^2 + \dots$  is equal to

A.  $\left(\frac{2x}{1+x}\right)^n$

B.  $\left(\frac{1+x}{2x}\right)^n$

C.  $\left(\frac{1-x}{1+x}\right)^n$

D.  $\left(\frac{1+x}{1-x}\right)^n$

**Answer: D**



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**84.** Find the coefficient of  $x^5$  in  $(1 + 2x + 3x^2 \dots \dots \dots)^{-\frac{3}{2}}$

A. 21

B. 25

C. 26

D. none of these

**Answer: D**



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85. If  $|x| < 1$ , then find the coefficient of  $x^n$  in the expansion of  $(1 + x + x^2 + x^3 + \dots)^2$ .

A.  $n$

B.  $n-1$

C.  $n+2$

D.  $n+1$

**Answer: D**



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

A. 5<sup>th</sup> term

B. 8<sup>th</sup> term

C. 6<sup>th</sup> term

D. 7<sup>th</sup> term

Answer: B



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87. 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.  $3x + \frac{3}{x^2}$

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

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

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

Answer: D



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88. If the expansion in power of  $x$  of the function

$$\frac{1}{(1-ax)(1-bx)} \text{ is } a_0 + a_1x + a_2x^2 + a_3x^3 + \dots, \text{ then } a_n \text{ is}$$

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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89. If  $\frac{x^2 + x + 1}{1 - x} = a_0 + a_1x + a_2x^2 + \dots$ , the  $\sum_{r=1}^{50} a_r$  equal to

A. 148

B. 146

C. 149



D. none of these

Answer: C



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90.

If

$(1 - x)^{-n} = a_0 + a_1x + a_2x^2 + \dots + a_r x^r + \dots$ , then  $a_0 + a_1 + a_2 + \dots + a_r$

is equal to (a)  $\frac{n(n+1)(n+2)\dots(n+r)}{r!}$  (b)  $\frac{(n+1)(n+2)\dots(n+r)}{r!}$  (c)  $\frac{n(n+1)(n+2)\dots(n+r-1)}{r!}$  (d) none of these

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

B.  $\frac{(n+1)(n+2)\dots(n+r)}{r!}$

C.  $\frac{n(n+1)(n+2)\dots(n+r-1)}{r!}$

D. none of these

Answer: B



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## Exercise (Multiple)

1. The value of  $x$  in the expression  $(x + x^{(\log)_{10}})^5$  if third term in the expansion is 10,00,000 is/are a. 10 b. 100 c.  $10^{-5/2}$  d.  $10^{-3/2}$

A. 10

B. 100

C.  $10^{-5/2}$

D.  $10^{-3/2}$

**Answer: A:C**



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2. The value of  $x$  for which the sixth term in the expansion of

$$\left[ 2^{\log} - 2^{\sqrt{9^{(x-1)}+7}} + \frac{1}{2^{\frac{1}{5}(\log)_2(3^{(x-1)}+1)}} \right]^7 \text{ is } 84 \text{ is}$$

A. 4

B. 3

C. 2

D. 1

**Answer: C::D**



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3. If the 4th term in the expansion of  $(ax + 1/x)^n$  is  $5/2$ , then (a)  $a = \frac{1}{2}$   
b.  $n = 8$  c.  $a = \frac{2}{3}$  d.  $n = 6$

A.  $a = \frac{1}{2}$

B.  $n = 8$

C.  $a = \frac{2}{3}$

D.  $n = 6$

**Answer: A::D**



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4. In the expansion of  $(x + a)^n$  if the sum of odd terms is  $P$  and the sum of even terms is  $Q$ , then
- (a)  $P^2 - Q^2 = (x^2 - a^2)^n$  (b)
- $4PQ = (x + a)^{2n} - (x - a)^{2n}$  (c)
- $2(P^2 + Q^2) = (x + a)^{2n} + (x - a)^{2n}$  (d) all of these

A.  $P^2 - Q^2 = (x^2 - a^2)^n$

B.  $4PQ = (x + a)^{2n} - (x - a)^{2n}$

C.  $2(P^2 + Q^2) = (x + a)^{2n} + (x - a)^{2n}$

D. none of these

**Answer: A::B::C**



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5. If  $(4 + \sqrt{15})^n = I + f$ , where  $n$  is an odd natural number,  $I$  is an integer and  $f > 0$

A.  $I$  is an odd integer

B.  $I$  is an even integer

C.  $(I + f)(I - f) = 1$

D.  $I - f = (4 - \sqrt{15})^n$

**Answer: A::C::D**



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6. 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. 4,16

B. 1,4

C. 5,20

D. 3,9

**Answer: A::B::C**

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7. The sum of coefficient in the expansion of  $(1 + ad - 2x^2)^n$  is positive, when  $a < 1$  and  $n = 2k, k \in N$  negative, when  $a < 1$  and  $n = 2k + 1, k \in N$  positive, when  $a < 1$  and  $n \in N$  zero, when  $a = 1$

A. positive, when  $a < 1$  and  $n = 2k, k \in N$

B. negative, when  $a < 1$  and  $n = 2k + 1, k \in N$

C. positive, when  $a > 1$  and  $n \in N$

D. zero, when  $a = 1$

Answer: A::B::C::D

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8. Let  $(1 + x^2)^2(1 + x)^n = \sum_{k=0}^{n+4} a_k x^k$  If  $a_1, a_2$  and  $a_3$  are in arithmetic

progression, then the possible value/values of  $n$  is/are a. 5 b. 4 c. 3 d. 2

A. 5

B. 4

C. 3

D. 2

**Answer: B::C::D**



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9. For natural numbers

$m, n$ , if  $(1 - y)^m(1 + y)^n = 1 + a_1y + a_2y^2 + \dots$ , and  $a_1 = a_2 = 10$ , then

`m nc. m+n=80d. m-n=20`

A.  $m < n$

B.  $m > n$

C.  $m + n = 80$

D.  $m - n = 20$

**Answer: A::C**

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10. The middle term in the expansion of  $(x/2 + 2)^8$  is 1120, then  $x \in R$  is equal to a. -2 b. 3 c. -3 d. 2

A. -2

B. 3

C. -3

D. 2

**Answer: A::D**

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11. In the expansion of  $\left(3 - \sqrt{\frac{17}{4} + 3\sqrt{2}}\right)^{15}$  the 11th term is a



- A. an irrational number
- B. a rational number
- C. a positive integer
- D. a negative integer

**Answer: A**

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12. For the expansion  $(x \sin p + x^{-1} \cos p)^{10}$ , ( $p \in R$ ),

- A. the greatest value of the term independent of x is  $10! / 2^5 (5!)^2$
- B. the least value of sum of coefficient is zero
- C. the greatest value of sum of coefficient is 12
- D. the last value of the term independent of x occurs when

$$p = (2n + 1) \cdot \frac{\pi}{4}, n \in Z$$

**Answer: A::B::C**



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13. For which of the following values of  $x$ , 5th term is the numerically greatest term in the expansion of  $(1 + x/3)^{10}$ , a. -2 b. 1.8 c. 2 d. -1.9

A. -2

B. 1.8

C. 2

D. -19

Answer: A::B::C::D



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14. Which of the following is/are true ?

A.  $1000^{1000} > 1002^{999}$

B.  $1000^{1000} < 1002^{999}$

C.  $1000^{1002} < 1002^{1000}$

D.  $1000^{1002} > 1002^{1000}$

**Answer: A:D**



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15. If  $\sum_{r=0}^n \frac{r}{{}^n C_r} = \sum_{r=0}^n \frac{n^2 - 3n + 3}{2 \cdot {}^n C_r}$ , then a.  $n = 1$  b.  $n = 2$  c.  $n = 3$

d. none of these

A.  $n = 1$

B.  $n = 2$

C.  $n = 3$

D. none of these

**Answer: A:C**



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16. The value of  ${}^m C_1 + {}^{m+1} C_2 + {}^{m+2} C_3 + \dots + {}^{m+n-1} C_m$  is equal to

$${}^{m+n} C_{n-1} - {}^m C_0$$

A.  ${}^{m+n} C_n - 1$

B.  ${}^{m+n} C_{n-1}$

C.  ${}^m C_1 + {}^{m+1} C_2 + {}^{m+2} C_3 + \dots + {}^{m+n-1} C_n$

D.  ${}^{m+n} C_m - 1$

Answer: A::C::D



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

A. number of terms is  $2n + 1$

B. constant term is  $2^{n-1}$

C. coefficient of  $x^{2n-2}$  is n

D. coefficient of  $x^2$  in n

**Answer: A::C**



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18. In the expansion of  $\left(7^{1/3} + 11^{1/9}\right)^{6561}$ ,

A. there are exactly 730 rational terms

B. there are exactly 5832 irrational terms

C. the term which involves greatest binomial coefficients is irrational

D. the term which involves greatest binomial coefficients is rational

**Answer: A::B::C**



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19. 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. a positive value

B. a negative value

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

D. divisible by  $2^n$

**Answer: B::C**



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20. In the expansion of  $(a + b)^n$ , if two consecutive terms are equal, then which of the following is/are always integer ?

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

B.  $\frac{(n + 1)a}{a + b}$

C.  $\frac{na}{a - b}$

D.  $\frac{na}{a+b}$

Answer: A::B



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21. If for  $z$  as real or complex,

$$(1 + z^2 + z^4)^8 = C_0 + C_1z^2 + C_2z^4 + \dots + C_{16}z^{32} \text{ then}$$

$$C_0 - C_1 + C_2 - C_3 + \dots + C_{16} = 1$$

$$C_0 + C_3 + C_6 + C_9 + C_{12} + C_{15} = 3^7$$

$$C_2 + C_5 + C_8 + C_{11} + C_{14} = 3^6$$

$$C_1 + C_4 + C_7 + C_{10} + C_{13} + C_{16} = 3^7$$

A.  $C_0 - C_1 + C_2 - C_3 + \dots + C_{16} = 1$

B.  $C_0 + C_3 + C_6 + C_{12} + C_{15} = 3^7$

C.  $C_2 + C_5 + C_8 + C_{11} + C_{14} = 3^6$

D.  $C_1 + C_4 + C_7 + C_{10} + C_{13} + C_{16} = 3^7$

Answer: A::B::D



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22. If  $f(m) = \sum_{i=0}^m (-1)^i \binom{30}{30-i} \binom{20}{m-i}$  where  $\binom{p}{q} = {}^p C_q$ , then

A. maximum value of  $f(m)$  is  ${}^{50} C_{25}$

B.  $f(0) + f(1) + \dots + f(50) = 2^{50}$

C.  $f(m)$  is always divisible by 50 ( $1 \leq m \leq 49$ )

D. The value of  $\sum_{m=0}^{50} (f(m))^2 = {}^{100} C_{50}$

Answer: A::B::D



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23.

If

$(1+x)^n = C_0 + C_1 x + C_2 x^2 + \dots + C_n x^n, n \in N$ , then  $C_0 - C_1 + C_2 - \dots + (-1)^m C_m$

is equal to

A.  $\frac{(n-1)(n-2)\dots(n-m+1)}{(m-1)!} (-1)^{m-1}$



B.  ${}^{n-1}C_{m-1}(-1)^{m-1}$

C.  $\frac{(n-1)(n-2)\dots(n-m)}{(m-1)!}(-1)^{m-1}$

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

**Answer: A::B::D**



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24. If  $\sum_{r=0}^n (pr + 2) \cdot {}^nC_r = (25)(64)$  where  $n, p \in N$ , then

A.  $p = 3$

B.  $p = 4$

C.  $n = 7$

D.  $n = 6$

**Answer: A::C**



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25.

If

$$\left(x + \frac{1}{x} + 1\right)^6 = a_0 + \left(a_1x + \frac{b_1}{x}\right) + \left(a_2x^2 + \frac{b_2}{x^2}\right) + \dots + \left(a_6x^6 + \frac{b_6}{x^6}\right)$$

, then

A.  $a = 141$

B.  $a_5 = 6$

C.  $\sum_{i=1}^6 a_i + b_i = 588$

D.  $\sum_{i=1}^6 a_i + b_i = 3^6$

Answer: A::B::C


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26.

The

value

of

 ${}^n C_0 \times {}^{2n} C_r - {}^n C_1 \times {}^{2n-2} C_r + {}^n C_2 \times {}^{2n-4} C_r + \dots$  is equal to

A.  ${}^n C_{r-n} \times 2^{2n-r}$  if  $r \geq n$

B. 0, if  $r < n$

C.  ${}^n C_{r-n} \times 2^{n-r}$  if  $r \geq n$

D.  ${}^{-n} C_{r-n} \times 2^{2n-r}$  if  $r < n$

**Answer: A::B**

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27. The sum  $2 \times {}^{40} C_2 + 6 \times {}^{40} C_3 + 12 \times {}^{40} C_4 + 20 \times {}^{40} C_5 + \dots + 1560 \times {}^{40} C_{40}$  is divisible by

A. 3

B. 5

C. 13

D.  $2^{41}$

**Answer: A::B::C::D**

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## Exercise (Comprehension)

1. 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

- A. 6
- B. 7
- C. 8
- D. 9

**Answer: B**



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2. 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 sum of possible value of x is

A. 1

B. 3

C. 4

D. 2

**Answer: D**



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3. 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

A. 6

B. 7

C. 8

D. 9

**Answer: C**



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4. If the 2nd, 3rd and 4th terms in the binomial expansion of  $(x + a)^n$  are 240, 720 and 1080 for a suitable values of  $x$ ,  $a$  and  $n$ .



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5. If the 2nd, 3rd and 4th terms in the binomial expansion of  $(x + a)^n$  are 240, 720 and 1080 for a suitable values of  $x$ , find  $x$ ,  $a$  and  $n$ .

A. 16

B. 160

C. 32

D. 81

**Answer: C**



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6. If the 2nd, 3rd and 4th terms in the binomial expansion of  $(x + a)^n$  are 240, 720 and 1080 for a suitable values of  $x$ , find  $x$ ,  $a$  and  $n$ .

A. 1664

B. 2376

C. 1562

Answer: C



7. An equation  $a_0 + a_1x + a_2x^2 + \dots + a_{99}x^{99} + x^{100} = 0$  has roots  ${}^{99}C_0, {}^{99}C_1, {}^{99}C_2, \dots, {}^{99}C_{99}$ . Find the value of  $a_{99}$



8. An equation  $a_0 + a_2x^2 + \dots + a_{99}x^{99} + x^{100} = 0$  has roots  ${}^{99}C_0, {}^{99}C_1, {}^{99}C_2, \dots, {}^{99}C_{99}$

The value of  $a_{99}$  is equal to





9. An equation  $a_0 + a_2x^2 + \dots + a_{99}x^{99} + x^{100} = 0$  has roots  ${}^{99}C_0, {}^{99}C_1, {}^{99}C_2, \dots, {}^{99}C_{99}$

The value of  $({}^{99}C_0)^2 + ({}^{99}C_1)^2 + \dots + ({}^{99}C_{99})^2$  is equal to

A.  $2a_{98} - a_{99}^2$

B.  $a_{99}^2 - a_{98}$

C.  $a_{99}^2 - 2a_{98}$

D. none of these

**Answer: C**



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10.

If

$$a = {}^{20}C_0 + {}^{20}C_3 + {}^{20}C_6 + {}^{20}C_9 + \dots, b = {}^{20}C_1 + {}^{20}C_4 + {}^{20}C_7 + \dots$$

and  $c = {}^{20}C_2 + {}^{20}C_5 + {}^{20}C_8 + \dots$ , then

Value of  $a^3 + b^3 + c^3 - 3abc$  is



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11.

If

$$a = {}^{20}C_0 + {}^{20}C_3 + {}^{20}C_6 + {}^{20}C_9 + \dots, b = {}^{20}C_1 + {}^{20}C_4 + {}^{20}C_7 + \dots$$

and  $c = {}^{20}C_2 + {}^{20}C_5 + {}^{20}C_8 + \dots$ , then

Value of  $(a - b)^2 + (b - c)^2 + (c - a)^2$  is

A. 1

B. 2

C.  $2^{20}$

D.  $2^{40}$

**Answer: B**



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12. The sum of all the coefficients of the terms in the expansion of  $(x + y + z + w)^6$  which contain  $x$  but not  $y$ , is

A. 4096

B. 1560

C. 3367

D. 670

**Answer: B**



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**13.** Consider the expansion of  $(a + b + c + d)^6$ . Then the sum of all the coefficients of the term

Which contains all of  $a, b, c,$  and  $d$  is

A. 729

B. 3367

C. 665

D. 1024

**Answer: C**



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**14.** Consider the expansion of  $(a + b + c + d)^6$ . Then the sum of all the coefficients of the term

Which contains all of  $a, b, c,$  and  $d$  is

A. 2884

B. 4032

C. 1974

D. 2702

**Answer: D**



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15.

Let

$$P = \sum_{r=1}^{50} \frac{{}^{50+r}C_r(2r-1)}{{}^{50}C_r(50+r)}, Q = \sum_{r=1}^{50} (r-1)^{50} ({}^{50}C_r)^2, R = \sum_{r=0}^{100} (-1)^r ({}^{100}C_r)$$

The value of  $P - Q$  is equal to



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16.

Let

$$P = \sum_{r=1}^{50} \frac{{}^{50+r}C_r(2r-1)}{{}^{50}C_r(50+r)}, Q = \sum_{r=0}^{50} ({}^{50}C_r)^2, R = \sum_{r=0}^{100} (-1)^r ({}^{100}C_r)^2$$

The value of  $P - R$  is equal to

A. 1

B. -1

C.  $2^{50}$ D.  $2^{100}$ 

Answer: B



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17.

Let

$$P = \sum_{r=1}^{50} \frac{{}^{50+r}C_r(2r-1)}{{}^{50}C_r(50+r)}, Q = \sum_{r=0}^{50} ({}^{50}C_r)^2, R = \sum_{r=0}^{100} (-1)^r ({}^{100}C_r)^2$$

The value of  $Q + R$  is equal to

A.  $2P + 1$

B.  $2P - 1$

C.  $2P + 2$

D.  $2P - 2$

**Answer: C**



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18. If  $(1 + x + x^2)^{20} = a_0 + a_1x^2 + \dots + a_{40}x^{40}$ , then following questions.

The value of  $a_0 + a_1 + a_2 + \dots + a_{19}$  is



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19. If  $(1 + x + x^2)^{20} = a_0 + a_1x^2 + \dots + a_{40}x^{40}$ , then following questions.

The value of  $a_0^2 - a_1^2 + a_2^2 - \dots - a_{19}^2$  is

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20. If  $(1 + x + x^2)^{20} = a_0 + a_1x^2 + \dots + a_{40}x^{40}$ , then following questions.

The value of  $a_0 + 3a_1 + 5a_2 + \dots + 81a_{40}$  is

A.  $161 \times 3^{20}$

B.  $41 \times 3^{40}$

C.  $41 \times 3^{20}$

D. none of these

**Answer: C**

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## Matrix

1. Evaluate  $\int_1^3 (2x - 3)dx$

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2. Evaluate  $\int \frac{x - 1}{x^2 - 2x + 1} dx$

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3. Evaluate  $\int_0^3 (x^2 - 6x + 5) dx$

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4. If the second term of the expansion  $\left[ a^{\frac{1}{13}} + \frac{a}{\sqrt{a^{-1}}} \right]^n$  is  $14a^{5/2}$ , then the value of  $\frac{{}^n C_3}{{}^n C_2}$  is.

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## Exercise (Numerical)

1. Evaluate  $\int_0^3 (x^2 - 6x + 5) dx$

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2. 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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3. Least positive integer just greater than  $(1 + 0.00002)^{50000}$  is.



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4. If the second term of the expansion  $\left[ a^{\frac{1}{13}} + \frac{a}{\sqrt{a^{-1}}} \right]^n$  is  $14a^{5/2}$ , then the value of  $\frac{{}^n C_3}{{}^n C_2}$  is.



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5. If the constant term in the binomial expansion of  $\left( x^2 - \frac{1}{x} \right)^n$ ,  $n \in N$  is 15, then the value of  $n$  is equal to.



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6. The largest value of  $x$  for which the fourth term in the expansion  $\left( \frac{5^2}{3} (\log)_5 \sqrt{4^{x+44}} + \frac{1}{5^{\log_{-5} 2^{(x-1)+73}}} \right)$  is 336 is.



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7. Let  $a$  and  $b$  be the coefficients of  $x^3$  in  $(1 + x + 2x^2 + 3x^3)^4$  and  $(1 + x + 2x^2 + 3x^3 + 4x^4)^4$ , then respectively. Then the value of  $4a/b$  is.

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8. If  $R$  is remainder when  $6^{83} + 8^{83}$  is divided by 49, then the value of  $R/5$  is.

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9. The remainder, if  $1 + 2 + 2^2 + \dots + 2^{1999}$  is divided by 5 is.

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10. Given  $(1 - 2x + 5x^2 - 10x^3)(1 + x)^n = 1 + a_1x + a_2x^2 + \dots$  and that  $a_{12} = 2a_2$  then the value of  $n$  is.

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11. The largest real value of  $x$  such that  $\sum_{k=0}^4 \left( \frac{3^{4-k}}{(4-k)!} \right) \left( \frac{x^k}{k!} \right) = \frac{32}{3}$

is.



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12. Coefficient of  $x^{2009}$  in  $(1 + x + x^2 + x^3 + x^4)^{1001} (1 - x)^{1002}$  is



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13. The total number of different terms in the product

$({}^{101}C_0 - {}^{101}C_1x + {}^{101}C_2x^2 - \dots - {}^{101}C_{101}x^{101})(1 + x + x^2 + \dots + x^{101})$

is \_\_\_\_.



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



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15. The value of  $\sum_{r=0}^3 {}^8C_r ({}^5C_{r+1} - {}^4C_r)$  is \_\_\_\_\_.



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16. The value of  $({}^{.21}C_1 - {}^{.10}C_1) + ({}^{.21}C_2 - {}^{.10}C_2) + ({}^{.21}C_3 - {}^{.10}C_3) + ({}^{.21}C_4 - {}^{.10}C_4)$  is



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17. Let  $a = 3^{\frac{1}{223}} + 1$  and for all  $n \geq 3, n \leq t$

$$f(n) = {}^nC_0 a^{n-1} - {}^nC_1 a^{n-2} + {}^nC_2 a^{n-3} - \dots + (-1)^{n-1} {}^nC_{n-1} a^0.$$

If the value of  $f(2007) + f(2008) = 3^k$  where  $k \in \mathbb{N}$ , then the value of  $k$  is.



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18. Let  $1 + \sum_{r=1}^{10} \binom{10}{r} (3^r + r) = 2^{10} (\alpha \cdot 4^5 + \beta)$  where  $\alpha, \beta \in \mathbb{N}$

and  $f(x) = x^2 - 2x - k^2 + 1$ . If  $\alpha, \beta$  lies between the roots of  $f(x) = 0$ , then find the smallest positive integral value of  $k$ .

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19. The value of  $(\lim)_{n \rightarrow \infty} \sum_{r=1}^{r-1} \left( \sum_{t=0}^{r-1} \frac{1}{5^n} \binom{r-1}{t} n^t \right)$  is equal to

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20. If  $\sum_{r=0}^{10} \binom{r+2}{r+1} \binom{10}{r} = \frac{2^8 - 1}{6}$ , then  $n$  is 8 b. 4 c. 6 d. 5

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21. If  $S_n = ({}^n C_0)^2 + ({}^n C_1)^2 + ({}^n C_n)^n$ , then maximum value of  $\left[ \frac{S_{n+1}}{S_n} \right]$  is \_\_\_\_\_.

(where  $[\cdot]$  denotes the greatest integer function)

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22. The value of  ${}^{40}C_0 \times {}^{100}C_{40} - {}^{40}C_1 \times {}^{99}C_{40} + {}^{40}C_2 \times {}^{98}C_{40} \dots \dots + {}^{40}C_{40} \times {}^{60}C_{40}$  is equal to \_\_\_\_\_.

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23. The value of  $\sum_{0 \leq i < j \leq 5} ({}^5 C_j) ({}^j C_i)$  is equal to \_\_\_\_\_

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24. If  $(1 - x - x^2)^{20} = \sum_{r=0}^{40} a_r \cdot x^r$ , then value of  $a_1 + 3a_3 + 5a_5 + \dots + 39a_{39}$  is

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25. The value of  $\sum_{r=1}^{11} \tan^2\left(\frac{r\pi}{24}\right)$  is

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## JEE Previous Year

1. The remainder left out when  $8^{2n}(62)^{2n+1}$  is divided by 9 is (1) 0 (2) 2 (3) 7 (4) 8

A. 0

B. 2

C. 7



Answer: B



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2. Let  $S_1 = \sum_{j=1}^{10} (j-1)^{10} j(j-1)^{10} C_j$ ,  $S_2 = \sum_{j=1}^{10} {}^{10}C_j$ , and

$$S_3 = \sum_{j=1}^{10} j^2 \cdot {}^{10}C_j.$$

Statement 1:  $S_3 \times 2^9$ .

Statement 2:  $S_1 = 90 \times 2^8$  and  $S_2 = 10 \times 2^8$ .

A. Statement 1 is false, statement 2 is true.

B. Statement 1 is true, statement 2 is true, statement 2 is a correct explanation for statement 1.

C. Statement 1 is true, statement 2 is true, statement 2 is not a correct explanation for statement 2.

D. statement 1 is true, statement 2 is false.

**Answer: B**



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

A. 132

B. 144

C. -132

D. -144

**Answer: D**



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4. If  $n$  is a positive integer, then  $(\sqrt{3} + 1)^{2n} - (\sqrt{3} - 1)^{2n}$  is (1) an irrational number (2) an odd positive integer (3) an even positive integer (4) a rational number other than positive integers

- 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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5. The coefficient of the term independent of  $x$  in the expansion of

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

is 210 b. 105 c. 70 d. 112

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6. 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 (1)  $\left(16, \frac{251}{3}\right)$  (3)  $\left(14, \frac{251}{3}\right)$  (2)  $\left(14, \frac{272}{3}\right)$  (4)  $\left(16, \frac{272}{3}\right)$

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

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

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

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

**Answer: D**



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7. The sum of coefficients of integral powers of  $x$  in the binomial expansion of  $(1 - 2\sqrt{x})^{50}$  is: (1)  $\frac{1}{2}(3^{50} + 1)$  (2)  $\frac{1}{2}(3^{50})$  (3)  $\frac{1}{2}(3^{50} - 1)$  (4)  $\frac{1}{2}(2^{50} + 1)$

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

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

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

D.  $\frac{1}{2}(2^{10} + 1)$

**Answer: A**



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8. 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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9. The value of

$$\left({}^{21}C_1 - {}^{10}C_1\right) + \left({}^{21}C_2 - {}^{10}C_2\right) + \left({}^{21}C_3 - {}^{10}C_3\right) + \left({}^{21}C_4 - {}^{10}C_4\right)$$

is

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

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

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

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

**Answer: A**



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10. The sum of the co-efficients of all odd degree terms in the expansion of  $(x + \sqrt{x^3 - 1})^5 + (x - \sqrt{x^3 - 1})^5$ , ( $x > 1$ )

A. 2

B. -1

C. 0

D. 1

**Answer: A**



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11. For  $r = 0, 1, \dots, 10$ , let  $A_r$ ,  $B_r$ , and  $C_r$  denote, respectively, the coefficient of  $x^r$  in the expansion of  $(1+x)^{10}$ ,  $(1+x)^{20}$  and  $(1+x)^{30}$ .

Then  $\sum_{r=1}^{10} A_r(B_{10}B_r - C_{10}A_r)$  is equal to

A.  $B_{10} - C_{10}$

B.  $A_1(B_{10}^2 - C_{10}A_{10})$

C. 0

D.  $C_{10} - B_{10}$

**Answer: D**



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12. Coefficient of  $x^{11}$  in the expansion of  $(1 + x^2)(1 + x^3)^7(1 + x^4)^{12}$  is

1051 b. 1106 c. 1113 d. 1120

A. 1051

B. 1106

C. 1113

D. 1120

**Answer: C**



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13. The coefficients of three consecutive terms of  $(1 + x)^{n+5}$  are in the ratio 5:10:14. Then  $n =$  \_\_\_\_\_.



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14. The coefficient of  $x^9$  in the expansion of  $(1+x)(16x^2)(1+x^3)(1+x^{100})$  is

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15. Let  $m$  be the smallest positive integer such that the coefficient of  $x^2$  in the expansion of  $(1+x)^2 + (1+x)^3 + (1+x)^4 + \dots + (1+x)^{49} + (1+mx)^{50}$  is  $(3n+1) \cdot {}^{51}C_3$  for some positive integer  $n$ . Then the value of  $n$  is

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16. Let  $X = ({}^{10}C_1)^2 + 2({}^{10}C_2)^2 + 3({}^{10}C_3)^2 + \dots + 10({}^{10}C_{10})^2$ , where  ${}^{10}C_r, r \in \{1, 2, \dots, 10\}$  denote binomial coefficients. Then, the value of  $\frac{1}{1430} X$  is \_\_\_\_\_.

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1. Coefficient of  $x^6$  in  $(1+x)(1+x^2)^2(1+x^3)^3 \dots (1+x^n)^n$  is

A. 26

B. 28

C. 30

D. 35

**Answer: B**



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2. The term independent of  $x$  in the product  $(4+x+7x^2)\left(x-\frac{3}{x}\right)^{11}$

is

A.  $7 \cdot {}^{11}C_6$

B.  $36 \cdot {}^{11}C_6$

C.  $3^5 \cdot {}^{11}C_5$

D.  $-12 \cdot 2^{11}$

**Answer: B**



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3. The  $13^{\text{th}}$  term in the expansion of  $(x^2 + 2/x)^n$  is independent of  $x$  then the sum of the divisors of  $n$  is

A. 36

B. 37

C. 39

D. 51

**Answer: D**



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4. Coefficient of  $x^{2009}$  in  $(1 + x + x^2 + x^3 + x^4)^{1001}(1 - x)^{1002}$  is

A. 0

B.  $4 \cdot {}^{1001}C_{501}$

C.  $-2009$

D. none of these

**Answer: A**



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5. If the constant term in the binomial expansion of  $\left(x^2 - \frac{1}{x}\right)^n$ ,  $n \in N$

is 15, then the value of  $n$  is equal to.

A. 6

B. 9

C. 12

D. 15

**Answer: A**



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6. If  $p^4 + q^3 = 2$  ( $p > 0, q > 0$ ), then the maximum value of term independent of  $x$  in the expansion of  $\left(px^{\frac{1}{12}} + qx^{-\frac{1}{9}}\right)^{14}$  is

A.  ${}^{14}C_4$

B.  ${}^{14}C_6$

C.  ${}^{14}C_7$

D.  ${}^{14}C_{12}$

**Answer: B**



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7. In the expansion of  $\left(x^3 - \frac{1}{x^2}\right)^n$ ,  $n \in N$ , if the sum of the coefficients of  $x^5$  and  $x^{10}$ , then  $n$  is a. 25 b. 20 c. 15 d. none of these

A. 25

B. 20

C. 15

D. None of these

**Answer: C**

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8. Find the coefficient of  $t^8$  in the expansion of  $(1 + 2t^2 - t^3)^9$ .

A. 1680

B. 2140

C. 2520

D. 2730

**Answer: C**

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

A. 3

B.  $\frac{1}{3}$

C.  $-\frac{1}{3}$

D. 1

**Answer: D**



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10. In the expansion of  $\left(\frac{x}{\cos \theta} + \frac{1}{x \sin \theta}\right)^{16}$ , if  $l_1$  is the least value of the term independent of  $x$  when  $\frac{\pi}{8} \leq \theta \leq \frac{\pi}{4}$  and  $l_2$  is the least value of the term independent of  $x$  when  $\frac{\pi}{16} \leq \theta \leq \frac{\pi}{8}$ , then the value of  $\frac{l_2}{l_1}$  is

A. 8

B. 32

C. 16

D. 64

**Answer: C**



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11. If  $A_{i,j}$  be the coefficient of  $a^i b^j c^{2010-i-j}$  in the expansion of  $(a + b + c)^{2010}$ , then

A.  $A_{i,i}$  is defined for  $i \geq 1010$

B.  $A_{i,j} = A_{j,i}$

C.  $A_{2i,3i}$  is defined for  $i \geq 405$

D.  $A_{0,1} = 2000$

**Answer: B**



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12. The coefficient of  $x^{301}$  in the expansion of  $(1+x)^{500} + x(1+x)^{499} + x^2(1+x)^{498} + \dots + x^{500}$  is

A.  ${}^{501}C_{301}$

B.  ${}^{500}C_{301}$

C.  ${}^{501}C_{300}$

D. none of these

**Answer: A**



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13. The coefficient of  $x^{70}$  in the product  $(x-1)(x^2-2)(x^3-3)\dots(x^{12}-12)$  is

A. 4

B. 6

C. 8

D. 12

**Answer: A**



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14. Given  $(1 - x^3)^n = \sum_{k=0}^n a_k x^k (1 - x)^{3n-2k}$  then the value of  $3 \cdot a_{k-1} + a_k$  is

A.  ${}^n C_k \cdot 3^k$

B.  ${}^{n+1} C_k \cdot 3^k$

C.  ${}^{n+1} C_k \cdot 3^{k-1}$

D.  ${}^n C_{k-1} \cdot 3^k$

**Answer: B**



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15. Find the sum of the roots (real or complex) of the equation

$$x^{2001} + \left(\frac{1}{2} - x\right)^{2001} = 0.$$

A. 2000

B. 2001

C. 1000

D. 500

**Answer: D**



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16. If the 4<sup>th</sup> term of  $\left\{ \sqrt{x^{\frac{1}{1+\log_{10} x}}} + \sqrt[12]{x} \right\}^6$  is equal to 200,  $x > 1$  and the

logarithm is common logarithm, then  $x$  is not divisible by

A. 2

B. 5

C. 10

D. 4

**Answer: D**



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17. The number of distinct terms in the expansion of

$$(x + y^2)^{13} + (x^2 + y)^{14} \text{ is}$$

A. 27

B. 29

C. 28

D. 25

**Answer: C**



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18. The value of  $\sum_{r=1}^n \left( \sum_{p=0}^{r-1} {}^n C_r {}^r C_p 2^p \right)$  is equal to

A.  $4^n - 3^n + 1$

B.  $4^n - 3^n - 1$

C.  $4^n - 3^n + 2$

D.  $4^n - 3^n$

**Answer: D**



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19. If in the expansion of  $\left( x^3 - \frac{2}{\sqrt{x}} \right)^n$  a term like  $x^2$  exists and 'n' is a double digit number, then least value of 'n' is

A. 10

B. 11

C. 12

D. 13

**Answer: A**



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20. 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  $n$ .

A. 6

B. 9

C. 12

D. 15

**Answer: B**



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21. The number of distinct terms in the expansion of is

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

A. 201

B. 400

C. 401

D. 500

**Answer: C**



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22. If  $r^{\text{th}}$  and  $(r + 1)^{\text{th}}$  term in the expansion of  $(p + q)^n$  are equal, then

$$\frac{(n + 1)q}{r(p + q)} \text{ is}$$

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

B.  $\frac{1}{4}$

C. 1

D. 0

**Answer: C**



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23. If  $(3 + a\sqrt{2})^{100} + (3 + b\sqrt{2})^{100} = 7 + 5\sqrt{2}$  number of pairs (a, b) for which the equation is true is, (a, b are rational numbers)

A. 1

B. 6

C. 0

D. infinite

**Answer: C**



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

A.  $\frac{(6n)!x^n}{(3n)!(3n)!}$

B.  $\frac{(6n)!x^{3n}}{(3n)!}$

C.  $\frac{(6n)}{(3n)!(3n)!}(-x)^{3n}$

D. None of these

**Answer: C**



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25. The algebraically second largest term in the expansion of  $(3 - 2x)^{15}$

at  $x = \frac{4}{3}$ .

A. 5

B. 7

C. 9

D. 11

**Answer: B**



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26. If  $6^{\text{th}}$  term in the expansion of  $\left(\frac{3}{2} + \frac{x}{3}\right)^n$  is numerically greatest, when  $x = 3$ , then the sum of possible integral values of 'n' is

A. 23

B. 24

C. 25

D. 26

**Answer: C**



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27. Let  $(5 + 2\sqrt{6})^n = p + f$ , where  $n$  in  $\mathbb{N}$  and  $p$  in  $\mathbb{N}$  and  $0$

- A. a natural number
- B. a negative integer
- C. a prime number
- D. are irrational number

**Answer: B**

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**28.** The sum of last 3 digits of  $3^{100}$  is

- A. 1
- B. 2
- C. 3
- D. 4

**Answer: A**

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29. The remainder when  $27^{10} + 7^{51}$  is divided by 10

A. 4

B. 6

C. 9

D. 2

**Answer: D**



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30. Consider the sequence  $({}^nC_0)/(1.2.3), ({}^nC_1)/(2.3.4), ({}^nC_2)/(3.4.5), \dots$ , if  $n=50$  then greatest term is

A.  $30^{th}$

B.  $24^{th}$

C.  $26^{th}$

D.  $27^{th}$

**Answer: B**



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31. If  $P_n$  denotes the product of all the coefficients of  $(1 + x)^n$  and  $9!P_{n+1} = 10^9 P_n$  then  $n$  is equal to

A. 10

B. 9

C. 19

D. none of these

**Answer: B**



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32. If  $N$  is a prime number which divides  $S = {}^{39}P_{19} + {}^{38}P_{19} + {}^{37}P_{19} + \dots + {}^{20}P_{19}$ , then the largest possible value of  $N$  among following is

A. 41

B. 31

C. 37

D. 19

**Answer: A**



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33. If  $\sum_{r=0}^n \left\{ \frac{{}^nC_{r-1}}{{}^nC_r + {}^nC_{r-1}} \right\}^3 = \frac{25}{24}$ , then  $n$  is equal to

A. 3

B. 4

C. 5

D. 6

**Answer: C**



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**34.** If  $a, b, c, d$  be four consecutive coefficients in the binomial expansion of  $(1+x)^n$ , then value of the expression  $\left( \left( \frac{b}{b+c} \right)^2 - \frac{ac}{(a+b)(c+d)} \right)$  (where  $x > 0$  and  $n \in \mathbb{N}$ ) is

A. positive

B. negative

C. zero

D. depends on  $n$

**Answer: A**



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35.

$$({}^m C_0 + {}^m C_1 - {}^m C_2 - {}^m C_3) + ({}^m C_4 + {}^m C_5 - {}^m C_6 - {}^m C_7) + \dots = 0$$

if and only if for some positive integer  $k, m =$

- A.  $4k$
- B.  $4k + 1$
- C.  $4k - 1$
- D.  $4k + 2$

**Answer: C**



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36. The value of  $\sum_{r=0}^{3n-1} (-1)^r 6nC_{2r+1} 3^r$  is

- A.  $2^{3n}$
- B.  $2^{2n-1}$
- C.  $2^{6n-1}$



D. 0

**Answer: D**



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37. The coefficient of  $x^{50}$  in  $(x + {}^{101}C_0)(x + {}^{101}C_1)\dots(x + {}^{101}C_{50})$  is

A.  $4^{50}$

B.  $2^{50}$

C.  $2^{101} - 1$

D.  $2^{101}$

**Answer: A**



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38. In the expansion of  $(1 + x)^{70}$ , the sum of coefficients of odd powers of  $x$  is

A. 0

B.  $2^{69}$

C.  $2^{70}$

D.  $2^{71}$

**Answer: B**



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39. The sum of all the coefficients of the terms in the expansion of  $(x + y + z + w)^6$  which contain  $x$  but not  $y$ , is

A.  $3^6$

B.  $2^6$

C.  $3^6 - 2^6$

D. none of these

**Answer: C**



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**40.** The value of  ${}^{12}C_2 + {}^{13}C_3 + {}^{14}C_4 + \dots + {}^{999}C_{989}$  is

A.  ${}^{1000}C_{11} - 12$

B.  ${}^{1000}C_{11} + 12$

C.  ${}^{900}C_{11} - 12$

D.  ${}^{1000}C_{989}$

**Answer: A**



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41. If  $(1 + x + x^2)^{25} = a_0 + a_1x + a_2x^2 + \dots + a_{50} \cdot x^{50}$  then  $a_0 + a_2 + a_4 + \dots + a_{50}$  is :

A. even

B. odd and of the form  $3n$

C. odd and of the form  $(3n - 1)$

D. odd and of the form  $(3n + 1)$

**Answer: A**



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42. If the sum of the coefficients in the expansion of  $(q + r)^{20}(1 + (p - 2)x)^{20}$  is equal to square of the sum of the coefficients in the expansion of  $[2rqx - (r + q) \cdot y]^{10}$ , where  $p, r, q$  are positive constants, then

A.  $\leq P$

B.  $\frac{r + q}{2} \geq p$

C.  $r, p$  and  $q$  are in  $G. P.$

D.  $1/r, 1/p$  and  $1/q$  are in  $H. P.$

**Answer: B**



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43. The sum  $S_n = \sum_{k=0}^n (-1)^k \cdot {}^{3n}C_k$ , where  $n = 1, 2, \dots$  is

A.  $(-1)^n \cdot {}^{3n-1}C_{n-1}$

B.  $(-1)^n \cdot {}^{3n-1}C_n$

C.  $(-1)^n \cdot {}^{3n-1}C_{n+1}$

D. None of these

**Answer: B**



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44.

If

for

$$n \in I, n > 10; 1 + (1 + x) + (1 + x)^2 + \dots + (1 + x)^n = \sum_{k=0}^n a_k \cdot x^k, x \neq 0$$

then

$$\text{A. } a_{n-2} = \frac{n(n+1)}{2}$$

$$\text{B. } a_9^2 - a_8^2 = {}^{n+2}C_{10} ({}^{n+1}C_{10} - {}^{n+1}C_9)$$

$$\text{C. } a_p > a_{p-1} \text{ for } p < \frac{n}{2}$$

$$\text{D. } \sum_{k=0}^n a_k = 2^{n+1}$$

**Answer: D****Watch Video Solution**

45.

Given

$${}^8C_1 x(1-x)^7 + 2 \cdot {}^8C_2 x^2(1-x)^6 + 3 \cdot {}^8C_3 x^3(1-x)^5 + \dots + 8 \cdot x^8 = ax$$

, then  $a + b$  is

A. 4

B. 6

C. 8

D. 10

**Answer: C**



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46. The value of  $99^{50} - \frac{99}{1} \cdot 98^{50} + \frac{99.98}{1.2} 97^{50} - \dots - \frac{99.98}{1.2} \cdot 2^{50} + \frac{99}{1} \cdot 1^{50}$  is

A. 0

B. -1

C. -2

D. -3

**Answer: A**



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47. Let  $f(n) = \sum_{k=1}^n k^2 (nC_k)^2$  then the value of  $f(5)$  equals

A. 1000

B. 1250

C. 1750

D. 2500

**Answer: C**



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48. The value of  $\sum_{r=1}^n (-1)^{r-1} \left( \frac{r}{r+1} \right) \cdot {}^n C_r$  is

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

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

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



D. 0

Answer: A

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49. The value of  $\binom{100}{0} \binom{200}{150} + \binom{100}{1} \binom{200}{151} + \dots + \binom{100}{50} \binom{200}{200}$  equals  
(where  $\binom{n}{r} = {}^n C_r$ )

A.  $\binom{300}{50}$

B.  $\binom{100}{50} \binom{200}{150}$

C.  $\binom{100}{50}^2$

D.  $\binom{300}{50}^2$

Answer: A

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50. Let  $t_{100} = \sum_{r=0}^{100} \frac{1}{({}^{100}C_r)^5}$  and  $S_{100} = \sum_{r=0}^{100} \frac{r}{({}^{100}C_r)^5}$ , then the value of  $\frac{100t_{100}}{S_{100}}$  is

- A. 1
- B. 2
- C. 3
- D. 4

**Answer: B**



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51. Let  $S_1 = \sum_{0 \leq i < j \leq 100} C_i C_j$ ,  $S_2 = \sum_{0 \leq j < i \leq 100} C_i C_j$  and  $S_3 = \sum_{0 \leq i = j \leq 100} C_i C_j$  where  $C_r$  represents coefficient of  $x^r$  in the binomial expansion of  $(1+x)^{100}$

If  $S_1 + S_2 + S_3 = a^b$  where  $a, b \in N$ , then the least value of  $(a+b)$  is

- A. 66

B. 72

C. 46

D. 52

**Answer: A**



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52.  ${}^{74}C_{37} - 2$  is divisible by

A.  $37^2$

B. 38

C. 36

D. none of these

**Answer: A**



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53. If  ${}^n C_0 - {}^n C_1 + {}^n C_2 - {}^n C_3 + \dots + (-1)^r \cdot {}^n C_r = 28$ , then  $n$  is equal to .....

A. 7

B. 8

C. 9

D. 11

**Answer: C**



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54. If the value of  ${}^n C_0 + 2 \cdot {}^n C_1 + 3 \cdot {}^n C_2 + \dots + (n + 1) \cdot {}^n C_n = 576$ ,

then  $n$  is

A. 7

B. 5

C. 6

D. 9

Answer: A



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55. The value of

$$\binom{50}{6} - \binom{5}{1} \binom{40}{6} + \binom{5}{2} \binom{30}{6} - \binom{5}{3} \binom{20}{6} + \binom{5}{4} \binom{10}{6}$$

where  $\binom{n}{r}$  denotes  ${}^n C_r$ , is

A. 15625

B. 0

C. 1000000

D. 2250000

Answer: D



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56. The value of the expansion

$$\left( \sum \sum \right)_{0 \leq i < j \leq n} (-1)^{i+j-1} {}^n C_i \cdot {}^n C_j =$$

A.  $2^{n-1} C_n$

B.  $2^n C_n$

C.  $2^{n+1} C_n$

D. None of these

Answer: A



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$$57. \sum_{m=1}^n \left( \sum_{k=1}^m \left( \sum_{p=k}^m {}^n C_m \cdot {}^m C_p \cdot {}^p C_k \right) \right) =$$

A.  $3^n - 2^n$

B.  $4^n - 3^n$

C.  $3^n + 2^n$

D.  $4^n - 1$

**Answer: B**



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58. If  $\frac{(1 - 3x)^{1/2} + (1 - x)^{5/3}}{\sqrt{4 - x}}$  is approximately equal to  $a + bx$  for small values of  $x$ , then  $(a, b) =$

A.  $\left(1, \frac{35}{24}\right)$

B.  $\left(1, -\frac{35}{24}\right)$

C.  $\left(2, \frac{35}{12}\right)$

D.  $\left(2, -\frac{35}{12}\right)$

**Answer: B**



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59. The sum of the series

$$1 + \frac{1}{3^2} + \frac{1 \cdot 4}{1 \cdot 2} \frac{1}{3^4} + \frac{1 \cdot 4 \cdot 7}{1 \cdot 2 \cdot 3} \frac{1}{3^6} + \dots, \text{ is}$$

A.  $\left(\frac{3}{2}\right)^{\frac{1}{3}}$

B.  $\left(\frac{5}{4}\right)^{\frac{1}{3}}$

C.  $\left(\frac{3}{2}\right)^{\frac{1}{6}}$

D. None of these

**Answer: A**



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60. Coefficient of  $x^{2^{m+1}}$  in the expansion of  $\frac{1}{(1+x)(1+x^2)(1+x^4)(1+x^8)\dots(1+x^{2^m})}$  ( $|x| < 1$ ) is

A. 0

B. 1

C.  $2^m$

D. none of these

**Answer: B**





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61. Let  $(2x^2 + 3x + 4)^{10} = \sum_{r=0}^{20} a_r x^r$ , then the value of  $\frac{a_7}{a_{13}}$  is

A. 6

B. 8

C. 12

D. 16

Answer: B



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62.  ${}^{30}C_0 \cdot {}^{20}C_{10} + {}^{31}C_1 \cdot {}^{19}C_{10} + {}^{32}C_2 \cdot {}^{18}C_{10} + \dots + {}^{40}C_{10} \cdot {}^{10}C_{10}$  is equal to

A.  ${}^{51}C_{41}$

B.  ${}^{50}C_{40}$

C.  ${}^{51}C_{21}$

D.  ${}^{50}C_{40}$

**Answer: A**



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### Multiple Correct Answer

1. Prove that  $\sum_{r=0}^n {}^nC_r 2^r = 2^{n+1}$ .

A.  $\binom{n}{m-n} 2^{2n-m}$  if  $m \geq n$

B. 0 if  $m < n$

C.  $\binom{n}{m-n} 2^{2n+m}$  if  $m \geq n$

D. 1 if  $m < n$

**Answer: A::B**



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2. Which of the following is/are correct ?

(I) Density of all the nuclei is same.

(II) Heavy elements exhibit radioactivity.

(III) Amongst alpha, beta and gamma rays,  $\alpha$ -particle has minimum penetrating power.

(IV) Isobars are the atoms of same elements having the different mass number.

A.  ${}^{20}C_0 - {}^{20}C_1 + {}^{20}C_2 - \dots - {}^{20}C_{15} = -{}^{19}C_{15}$

B.  ${}^{20}C_0 - {}^{20}C_1 + {}^{20}C_2 - \dots - {}^{20}C_{15} = -{}^{20}C_{14}$

C.  $16{}^{20}C_0 - 15{}^{20}C_1 + 14{}^{20}C_2 - \dots + 2{}^{20}C_{14} - {}^{20}C_{15} = {}^{19}C_{14}$

D.  $16{}^{20}C_0 - 15{}^{20}C_1 + 14{}^{20}C_2 - \dots + 2{}^{20}C_{14} - {}^{20}C_{15} = {}^{18}C_{15}$

Answer: A:D



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3. The value of  $\sum_{k=0}^7 \left[ \frac{\binom{7}{k}}{\binom{14}{k}} \sum_{r=k}^{14} \binom{r}{k} \binom{14}{r} \right]$ , where  $\binom{n}{r}$  denotes  ${}^n C_r$  is

A.  $6^7$

B. greater than  $7^6$

C.  $8^7$

D. greater than  $7^8$

**Answer: A:B**



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4. The value of  ${}^{1000} C_{50} + {}^{999} C_{49} + {}^{998} C_{48} + \dots + {}^{950} C_0$  is

A.  ${}^{1001} C_{50}$

B.  ${}^{1002} C_{951} - {}^{1001} C_{51}$

C.  ${}^{1001}C_{951}$

D.  ${}^{1002}C_{51} - {}^{1001}C_{95}$

**Answer: A::B::C::D**



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## Comprehension

1. Consider a *G. P.* with first term  $(1+x)^n$ ,  $|x| < 1$ , common ratio  $\frac{1+x}{2}$  and number of terms  $(n+1)$ . Let '*S*' be sum of all the terms of the *G. P.*, then

The coefficient of  $x^n$  in '*S*' is

A.  $2^n$

B.  $2^{n+1}$

C.  $2^{2n}$

D.  $2^{2n+1}$

**Answer: A**



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2. Consider a *G. P.* with first term  $(1 + x)^n$ ,  $|x| < 1$ , common ratio  $\frac{1 + x}{2}$  and number of terms  $(n + 1)$ . Let '*S*' be sum of all the terms of the *G. P.*, then

$$\sum_{r=0}^n {}^{n+r}C_r \left(\frac{1}{2}\right)^r \text{ equals}$$

A.  $(3/4)$

B. 1

C.  $2^n$

D.  $3^n$

**Answer: C**



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3. A path of length  $n$  is a sequence of points  $(x_1, y_1), (x_2, y_2), \dots, (x_n, y_n)$  with integer coordinates such that for all  $i$  between 1 and  $n - 1$  both inclusive,

either  $x_{i+1} = x_i + 1$  and  $y_{i+1} = y_i$  (in which case we say the  $i^{\text{th}}$  step is rightward)

or  $x_{i+1} = x_i$  and  $y_{i+1} = y_i + 1$  (in which case we say that the  $i^{\text{th}}$  step is upward).

This path is said to start at  $(x_1, y_1)$  and end at  $(x_n, y_n)$ . Let  $P(a, b)$ , for  $a$  and  $b$  non-negative integers, denotes the number of paths that start at  $(0, 0)$  and end at  $(a, b)$ .

The value of  $\sum_{i=0}^{10} P(i, 10 - i)$  is

A. 1024

B. 512

C. 256

D. 128

**Answer: A**



4. A path of length  $n$  is a sequence of points  $(x_1, y_1), (x_2, y_2), \dots, (x_n, y_n)$  with integer coordinates such that for all  $i$  between 1 and  $n - 1$  both inclusive,

either  $x_{i+1} = x_i + 1$  and  $y_{i+1} = y_i$  (in which case we say the  $i^{\text{th}}$  step is rightward)

or  $x_{i+1} = x_i$  and  $y_{i+1} = y_i + 1$  (in which case we say that the  $i^{\text{th}}$  step is upward).

This path is said to start at  $(x_1, y_1)$  and end at  $(x_n, y_n)$ . Let  $P(a, b)$ , for  $a$  and  $b$  non-negative integers, denotes the number of paths that start at  $(0, 0)$  and end at  $(a, b)$ .

Number of ordered pairs  $(i, j)$  where  $i \neq j$  for which  $P(i, 100 - i) = P(i, 100 - j)$  is

A. 50

B. 99

C. 100



**Answer: C** **Watch Video Solution**

5. A path of length  $n$  is a sequence of points  $(x_1, y_1), (x_2, y_2), \dots, (x_n, y_n)$  with integer coordinates such that for all  $i$  between 1 and  $n - 1$  both inclusive,

either  $x_{i+1} = x_i + 1$  and  $y_{i+1} = y_i$  (in which case we say the  $i^{\text{th}}$  step is rightward)

or  $x_{i+1} = x_i$  and  $y_{i+1} = y_i + 1$  (in which case we say that the  $i^{\text{th}}$  step is upward).

This path is said to start at  $(x_1, y_1)$  and end at  $(x_n, y_n)$ . Let  $P(a, b)$ , for  $a$  and  $b$  non-negative integers, denotes the number of paths that start at  $(0, 0)$  and end at  $(a, b)$ .

The sum  $P(43, 4) + \sum_{j=1}^5 P(49 - j, 3)$  is equal to

A.  $P(4, 48)$

B.  $P(3, 49)$

C.  $P(4, 47)$

D.  $P(5, 47)$

**Answer: A**



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6. The expansion  $1 + x, 1 + x + x^2, 1 + x + x^2 + x^3, \dots, 1 + x + x^2 + \dots + x^{20}$  are multiplied together and the terms of the product thus obtained are arranged in increasing powers of  $x$  in the form of  $a_0 + a_1x + a_2x^2 + \dots$ , then,

Number of terms in the product

A. 200

B. 211

C. 231

D. none of these

**Answer: B**



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7. The expressions  $1 + x, 1 + x + x^2, 1 + x + x^2 + x^3, \dots, 1 + x + x^2 + \dots + x^6$  are multiplied together and the terms of the product thus obtained are arranged in increasing powers of  $x$  in the form of  $a_0 + a_1x + a_2x^2 + \dots$ , then sum of even coefficients?

A.  $20!$

B.  $21!$

C.  $\frac{21!}{2}$

D.  $19!$

**Answer: C**



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8. The expansion  $1 + x, 1 + x + x^2, 1 + x + x^2 + x^3, \dots, 1 + x + x^2 + \dots + x^{20}$  are multiplied together and the terms of the product thus obtained are arranged in increasing powers of  $x$  in the form of  $a_0 + a_1x + a_2x^2 + \dots$ , then,

The value of  $\frac{a_r}{a_{n-r}}$ , where  $n$  is the degree of the product.

A. (a)2

B. (b)1

C. (c)1/2

D. (d)depends on  $r$

**Answer: B**



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9. If  $(1 + px + x^2)^n = 1 + a_1x + a_2x^2 + \dots + a_{2n}x^{2n}$ .

Which of the following is true for  $1 < r < 2n$

A.  $(np + pr)a_r = (r + 1)a_{r+1} + (r - 1)a_{r-1}$

B.  $(np - pr)a_r = (r + 1)a_{r+1} + (r - 1 - 2n)a_{r-1}$

C.  $(np - pr)a_r = (r + 1)a_{r+1} + (r - 1 - n)a_{r-1}$

D.  $(2np + pr)a_r = (r + 1 + n)a_{r+1} + (r + 1 - n)a_{r-1}$

**Answer: B**



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10. If  $(1 + px + x^2)^n = 1 + a_1x + a_2x^2 + \dots + a_{2n}x^{2n}$ .

The remainder obtained when

$a_1 + 5a_2 + 9a_3 + 13a_4 + \dots + (8n - 3)a_{2n}$  is divided by  $(p + 2)$  is

A. 1

B. 2

C. 3

D. 0

**Answer: C**



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11. If  $(1 + px + x^2)^n = 1 + a_1x + a_2x^2 + \dots + a_{2n}x^{2n}$ .

The value of  $a_1 + 3a_2 + 5a_3 + 7a_4 + \dots + (4n - 1)a_{2n}$  when  $p = -3$

and  $n \in$  even is

A.  $n$

B.  $2n - 1$

C.  $2n - 2$

D.  $2n$

**Answer: D**



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