Class 11 Mathematics · Chapter 7: Binomial Theorem

Answer key and marking scheme · 20 marks · about 40 minutes · based on NCERT

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1. The number of terms in the expansion of $(3x - 5y)^9$ is [1]

(a) 9 (b) 10
(c) 18 (d) 8

Answer: (b) $(a + b)^n$ has $n + 1$ terms, so $(3x - 5y)^9$ has $9 + 1 = 10$ terms. 9 is the index itself, not the count of terms.

2. The value of ${}^{10}C_0 - {}^{10}C_1 + {}^{10}C_2 - {}^{10}C_3 + \ldots + {}^{10}C_{10}$ is [1]

(a) 0 (b) 1
(c) 1024 (d) −1

Answer: (a) Putting $x = 1$ in $(1 - x)^{10} = {}^{10}C_0 - {}^{10}C_1x + {}^{10}C_2x^2 - \ldots + {}^{10}C_{10}x^{10}$ gives $0^{10} = 0$. 1024 is the sum without the signs.

3. The binomial coefficient of the third term in the expansion of $(a + b)^{10}$ is [1]

(a) 120 (b) 10
(c) 45 (d) 90

Answer: (c) The third term is T_{2+1}, with coefficient ${}^{10}C_2 = (10 \times 9)/2 = 45$. ${}^{10}C_3 = 120$ belongs to the fourth term.

4. The fourth term of $(y + 3)^5$ is $k\,y^2$. The value of k is [1]

(a) 90 (b) 405
(c) 135 (d) 270

Answer: (d) $T_4 = T_{3+1} = {}^5C_3\,y^2\,3^3 = 10 \times 27\,y^2 = 270y^2$. 90 is the coefficient of the third term, which has y^3.

5. The row of Pascal's triangle for index 6 is 1 6 15 20 15 6 1. The fourth entry of the row for index 7 is [1]

(a) 21 (b) 70
(c) 35 (d) 30

Answer: (c) Each entry is the sum of the two entries above it; the fourth entry of the next row is 15 + 20 = 35 (that is, ${}^7C_3$). 21 = 6 + 15 is the third entry.

6. Find the sum of all the coefficients in the expansion of $(3x - 2y)^5$. [2]

$(3x - 2y)^5 = \Sigma\, c_k\, x^{5-k}y^k$; putting $x = y = 1$ adds all the coefficients: $(3 - 2)^5 = 1^5 = 1$.

- puts $x = 1$ and $y = 1$ (1)
- sum = 1 (1)

7. Find the 5th term in the expansion of $(3 + \frac{x}{2})^6$. [2]

$T_5 = T_{4+1} = {}^6C_4\,(3)^2\,(\frac{x}{2})^4 = 15 \times 9 \times \frac{x^4}{16} = \frac{135}{16}x^4$, that is, $135/16\,x^4$.

- uses $T_{r+1} = {}^6C_r\,3^{6-r}(x/2)^r$ with $r = 4$ (1)
- $T_5 = 135/16\,x^4$ (1)

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8. The row of Pascal's triangle for index 5 is 1 5 10 10 5 1. Write the row for index 6, and use it to find the coefficient of a^2b^4 in $(a - b)^6$. [2]

Adding neighbours, with 1 at each end: 1, 1 + 5 = 6, 5 + 10 = 15, 10 + 10 = 20, 15, 6, 1. The term in a^2b^4 is the fifth, $15a^2(-b)^4 = 15a^2b^4$, so the coefficient is 15.

- row 1 6 15 20 15 6 1 (1)
- coefficient 15, with the sign of $(-b)^4$ positive (1)

9. Writing $(1 + x + x^2)^4$ as $[(1 + x) + x^2]^4$, find the coefficient of x^3 in its expansion. [3]

$[(1 + x) + x^2]^4 = {}^4C_0(1 + x)^4 + {}^4C_1(1 + x)^3x^2 + {}^4C_2(1 + x)^2x^4 + \ldots$; only the first two terms reach x^3. From $(1 + x)^4$: ${}^4C_3 = 4$. From $4(1 + x)^3x^2$: $4 \times {}^3C_1 = 12$. Coefficient of $x^3 = 4 + 12 = 16$.

- expands the grouped binomial (1)
- finds 4 and 12 from the two terms (1)
- 16 (1)

10. Find the term independent of x in the expansion of $(3x - \frac{1}{6x^2})^9$. [3]

$T_{r+1} = {}^9C_r\,(3x)^{9-r}(-\frac{1}{6x^2})^r = {}^9C_r\,3^{9-r}(-\frac{1}{6})^r\,x^{9-3r}$. For x^0, $r = 3$: $T_4 = {}^9C_3 \times 3^6 \times (-\frac{1}{216}) = -\frac{84 \times 729}{216} = -567/2$.

- general term with power x^{9-3r} (1)
- $r = 3$, the 4th term (1)
- $T_4 = -567/2$ (1)

11. For the expansion of $(x + 2y)^9$, find (a) the number of terms, (b) which term contains y^4, (c) that term. [3]

(a) 9 + 1 = 10 terms. (b) The index of y in T_{r+1} is r, so y^4 is in T_5. (c) $T_5 = {}^9C_4\,x^5(2y)^4 = 126 \times 16x^5y^4 = 2016x^5y^4$.

- 10 terms (1)
- the 5th term (1)
- $2016x^5y^4$ (1)