

Topic: Few more questions of Binomial theorem

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2 Corrections to previous video:

(1) Page number 55 (Question 3) Time 24:58

(2) Page number 58 (Question 4) Time 30:30

Review

$${}^n C_x = {}^n C_{n-x}$$



Then

$${}^n C_x = {}^n C_y ; x \neq y$$
$$x + y = n$$

Q.1:  $n_{C_{12}} = n_{C_{15}}$ , तब  $n_{C_{25}}$  तथा  ${}^{30}C_n$  का मान बतायें।

If  $n_{C_{12}} = n_{C_{15}}$ , find the value of  $n_{C_{25}}$  and  ${}^{30}C_n$

Solution:

$$n_{C_{12}} = n_{C_{15}}$$

$$12 + 15 = n$$

$$27 = n$$

$$n = 27$$

$$n_{C_{25}} = {}^{27}C_{25}$$

$$= \frac{27!}{25! (27-25)!} = \frac{27 \times 26 \times 25!}{25! \cdot 2!}$$

$$= \frac{27 \times 26}{2 \times 1} = 351 \quad \underline{\text{Ans}}$$

$${}^{30}C_n = {}^{30}C_{27} = \frac{30!}{27! (30-27)!}$$

$$= \frac{30 \times 29 \times 28 \times 27!}{27! \cdot 3!}$$

$$= \frac{30 \times 29 \times 28}{3 \times 2 \times 1}$$

$$= 4060 \quad \underline{\text{Ans}}$$

Q.2 : यदि  $(1+x)^{24}$  के विस्तार में  $r$  वाँ एवं  $(r+4)$  वाँ पद के गुणांक बराबर हैं, तो  $r$  का मान ज्ञात कीजिए।

In the expansion of  $(1+x)^{24}$ , coefficient of  $r^{\text{th}}$  term is equal to the coefficient of  $(r+4)^{\text{th}}$  term, then find the value of  $r$ .

Solution :

$$(1+x)^{24} \quad \therefore T_{r+1} = {}^n C_r x^{n-r} a^r$$

$$T_r = {}^{24} C_{r-1} (1)^{24-(r-1)} x^{r-1}$$

$$T_r = {}^{24} C_{r-1} x^{r-1}$$

$$T_{r+4} = {}^{24} C_{r+3} (1)^{24-(r+3)} x^{r+3}$$

$$T_{r+4} = {}^{24} C_{r+3} x^{r+3}$$

Given

$${}^{24} C_{r-1} = {}^{24} C_{r+3}$$

$$r-1 + r+3 = 24$$

$$2r+2 = 24$$

$$2r = 22$$

$$r = 11$$

Ans

Q.3: यदि  $(x+a)^n$  के प्रसार में दूसरा, तीसरा और चौथा पद क्रमशः 240, 720 और 1080 हों तो  $x$ ,  $a$  तथा  $n$  का मान ज्ञात करें।

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

Solution :

$$T_2 = {}^n C_1 x^{n-1} a^1 = 240 \quad ; \quad {}^n C_1 = \frac{n!}{1!(n-1)!} = \frac{n(n-1)!}{(n-1)!} = n$$

$$n x^{n-1} a = 240 \quad \text{--- (1)}$$

$$T_3 = {}^n C_2 x^{n-2} a^2 = 720 \quad ; \quad {}^n C_2 = \frac{n!}{2!(n-2)!} = \frac{n(n-1)(n-2)!}{2 \times 1(n-2)!} = \frac{n(n-1)}{2}$$

$$\frac{n(n-1)}{2} x^{n-2} a^2 = 720$$

$$n(n-1) x^{n-2} a^2 = 1440 \quad \text{--- (2)}$$

$$T_4 = {}^n C_3 x^{n-3} a^3 = 1080 \quad ; \quad {}^n C_3 = \frac{n!}{3!(n-3)!} = \frac{n(n-1)(n-2)(n-3)!}{3 \times 2 \times 1(n-3)!} = \frac{n(n-1)(n-2)}{6}$$

$$\frac{n(n-1)(n-2)}{6} x^{n-3} a^3 = 1080$$

$$n(n-1)(n-2) x^{n-3} a^3 = 6480 \quad \text{--- (3)}$$

$$n x^{n-1} a = 240 \quad \text{--- (1)}$$

$$n(n-1)x^{n-2} a^2 = 1440 \quad \text{--- (2)}$$

$$n(n-1)(n-2)x^{n-3} a^3 = 6480 \quad \text{--- (3)}$$

eq (1)  $\div$  eq (2) we get

$$\frac{n x^{n-1} a}{n(n-1)x^{n-2} a^2} = \frac{240}{1440} \Rightarrow$$

$$\frac{x^{n-1-n+2}}{(n-1)a} = \frac{1}{6}$$

$$x = \frac{1}{6} (n-1)a \quad \text{--- (4)}$$

eq (2)  $\div$  eq (3)

$$\frac{n(n-1)x^{n-2} a^2}{n(n-1)(n-2)x^{n-3} a^3} = \frac{1440}{6480}$$

$$\frac{x^{n-2-n+3}}{(n-2)a} = \frac{2}{9}$$

$$x = \frac{2}{9} (n-2)a \quad \text{--- (5)}$$

From eq. (4) and (5)

$$\frac{1}{6} (n-1)a = \frac{2}{9} (n-2)a$$

$$9n - 9 = 12(n-2)$$

$$9n - 9 = 12n - 24$$

$$24 - 9 = 12n - 9n$$

$$15 = 3n \Rightarrow 5 = n$$

$$n = 5 \quad \text{--- (6)}$$

From eq. (5)

$$x = \frac{2}{9} (5-2)a$$

$$x = \frac{2}{3} a \quad \text{--- (7)}$$

From eq. ①

$$n x^{n-1} a = 240$$

$$5 \left( \frac{2a}{3} \right)^{5-1} a = 240$$

$$\frac{2^4 a^4 a}{3^4} = 48$$

$$a^5 = \frac{2 \times 2 \times 2 \times 2 \times 3 \times 3^4}{2^4}$$

$$a^5 = 3^5$$

$$a = 3$$

⑧

From eq. ⑦

$$x = \frac{2}{3} \times 3$$

$$x = 2$$

Ans:  $x = 2$ ,  $a = 3$ , and  $n = 5$

Verify the solution:

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