



Binomial Theorem Ex 18.2 Q15(i)

$$\left(x - \frac{1}{x}\right)^{10}$$

Here, $n = 10$, which is even, \therefore it has 11 terms

\therefore middle term is $\left(\frac{n}{2} + 1\right) = 6^{\text{th}}$ term

$$T_n = T_{r+1} = (-1)^r {}^nC_r x^{n-r} y^r$$

$$\begin{aligned} T_6 = T_{5+1} &= (-1)^5 {}^{10}C_5 (x)^{10-5} \left(\frac{1}{x}\right)^5 \\ &= \frac{-10 \times 9 \times 8 \times 7 \times 6}{5 \times 4 \times 3 \times 2} x \frac{x^5}{x^5} \\ &= -3 \times 2 \times 7 \times 6 \\ &= -252 \end{aligned}$$

Binomial Theorem Ex 18.2 Q15(ii)

$$(1 - 2x + x^2)^n$$

Here, n is odd, $\therefore (1 - 2x + x^2)$ has $n+1 = \text{even}$ term

\therefore middle term is $\left(\frac{n+1}{2}\right)^{\text{th}}$ term

$$T_n = T_{r+1} = {}^nC_r x^{n-r} y^r$$

$$\begin{aligned} T_{\frac{n+1}{2}} = T_{\frac{n}{2}} &= {}^nC_{\frac{n}{2}} (1 - 2x)^{n-\frac{n}{2}} (x^2)^{\frac{n}{2}} \\ &= \frac{n!}{\frac{n}{2}! \frac{n}{2}!} (1 - 2x)^{\frac{n}{2}} x^{\frac{2n}{2}} \\ &= \frac{(2n)!}{(n!)^2} (-1)^n x^n \quad \left[\because (1-x)^n = 1 - nx \right] \end{aligned}$$

Binomial Theorem Ex 18.2 Q15(iii)

$$(1 + 3x + 3x^2 + x^3)^{2n}$$

This expansion is $((1+x)^3)^{2n} = (1+x)^{6n}$

Since $6n$ is even \therefore it has $6n+1 = \text{odd}$ terms has middle term is

$$\left(\frac{6n}{2} + 1\right)^{\text{th}} = (3n + 1)^{\text{th}} \text{ term}$$

$$T_n = T_{r+1} = {}^nC_r x^{n-r} y^r$$

$$\begin{aligned} T_{3n} = T_{3n+1} &= {}^{6n}C_{3n} (1)^{6n-3n} (x)^{3n} \\ &= \frac{(6n)!}{(3n)!(3n)!} x^{3n} \quad \left[\because 1^{6n-3n} = 1 \right] \end{aligned}$$

Binomial Theorem Ex 18.2 Q15(iv)

$$\left(2x - \frac{x^2}{4}\right)^9$$

4th and 5th terms are middle terms

$$\binom{9}{4}(2x)^5\left(-\frac{x^2}{4}\right)^4 + \binom{9}{5}(2x)^4\left(-\frac{x^2}{4}\right)^5$$

$$\frac{63}{4}x^{13}, -\frac{63}{32}x^{14}$$

Binomial Theorem Ex 18.2 Q15(v)

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

$2n+1$ is odd hence this expansion will have $2n+2 = \text{even terms}$.

Hence, middle terms is $\frac{2n+1}{2} = n+1, n+2$

Term formula is

$$T_r = T_{r+1} = (-1)^r {}^nC_r x^{n-r} y^r$$

$$T_{n+1} = T_{n+1} = (-1)^n {}^{2n+1}C_n (x)^{2n+1-n} \left(\frac{1}{x}\right)^n$$

$$= (-1)^n {}^{2n+1}C_n x^{n+1-n}$$

$$= (-1)^n {}^{2n+1}C_n x$$

$$T_{n+2} = T_{n+1+1} = (-1)^{n+1} {}^{2n+1}C_{n+1} (x)^{2n+1-n-1} \left(\frac{1}{x}\right)^{n+1}$$

$$= (-1)^{n+1} {}^{2n+1}C_{n+1} x^{-1}$$

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

$$= (-1)^{n+1} {}^{2n+1}C_n \frac{1}{x} \quad \left[\because {}^nC_r = {}^nC_{r-1} \right]$$

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