Binomial Theorem Ex 18.2 Q14(i)

$$\left(3x - \frac{x^3}{6}\right)^9$$

Here, $n = 9$, which is odd number

$\therefore \left(\frac{9+1}{2}\right)^{th}$ **and** $\left(\frac{9+1}{2}+1\right)^{th}$ **i.e., 5^{th}, 6^{th} term are the middle term.**

Here, the term formula is

$$T_5 = T_{4+1} = (-1)^4\, {}^9C_4 (3x)^5 \left(\frac{x^3}{6}\right)^4$$

$$= {}^9C_4 \frac{3^5}{6^4} \times x^5 \times x^{12}$$

$$= \frac{9 \times 8 \times 7 \times 6 \times 3^5}{4 \times 3 \times 2 \times 3^4 \times 2^4} x^{17}$$

$$= \frac{189}{8} x^{17}$$

$$T_6 = T_{5+1} = (-1)^5\, {}^9C_5 (3x)^4 \left(\frac{x^3}{6}\right)^5$$

$$= -\frac{9 \times 8 \times 7 \times 6}{5 \times 4 \times 3 \times 2} \times \frac{3^4}{6^5} \times x^4 \times x^{15}$$

$$= -\frac{9 \times 8 \times 7 \times 6 \times 3^4}{5 \times 4 \times 3 \times 2 \times 3^5 \times 2^5} x^{19}$$

$$= \frac{-21}{16} x^{19}$$

Binomial Theorem Ex 18.2 Q14(ii)

$$\left(3x^2 - \frac{1}{x}\right)^7$$

Here, $n = 7$, which is odd

$\therefore \left(\frac{7+1}{2}\right)^{th}$ **and** $\left(\frac{7+1}{2}+1\right)^{th} = 4^{th}$, 5^{th} **term are middle term or** $\left(2x^2 - \frac{1}{x}\right)^7$

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

$$T_4 = T_{3+1} = (-1)^3\, {}^7C_3 \left(2x^2\right)^{7-3} \left(\frac{1}{x}\right)^3$$

$$= -{}^7C_3 \frac{2^4 x^8}{x^3}$$

$$= -560x^5$$

$$T_5 = T_{4+1} = (-1)^4\, {}^7C_4 \left(2x^2\right)^{7-4} \left(\frac{1}{x}\right)^4$$

$$= {}^7C_4 \frac{2^3 x^6}{x^4}$$

$$= {}^7C_4 \frac{7 \times 6 \times 5 \times 8}{3 \times 2} x^2$$

$$= 280x^2$$

Binomial Theorem Ex 18.2 Q14(iii)

$$\left(3x-\frac{2}{x^2}\right)^{15}$$

7^{th} and 8^{th} terms are middle terms

$$\binom{15}{7}(3x)^8\left(-\frac{2}{x^2}\right)^7, \binom{15}{8}(3x)^7\left(-\frac{2}{x^2}\right)^8$$

$$\frac{-6435\times 3^8\times 2^7}{x^6}, \frac{6437\times 3^7\times 2^8}{x^9}$$

Binomial Theorem Ex 18.2 Q14(iv)

$$\left(x^4-\frac{1}{x^3}\right)^{11}$$

Here, $n = 11$, which is odd number

$\therefore \left(\frac{11+1}{2}\right)^{th}$ **and** $\left(\frac{11+1}{2}+1\right)^{th} = 6^{th}, 7^{th}$ **term are the middle terms in** $\left(x^4-\frac{1}{x^3}\right)^{11}$

The term formula is

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

$$T_6 = T_{5+1} = (-1)^5\ {}^{11}C_5 \left(x^4\right)^{11-5}\left(\frac{1}{x^3}\right)^5$$

$$= -{}^{11}C_5 x^{24}\frac{1}{x^{15}}$$

$$= \frac{-11\times 10\times 9\times 8\times 7}{5\times 4\times 3\times 2\times 1}x^9$$

$$= -11\times 3\times 2\times 7\ \ x^9$$

$$= -462\ x^9$$

$$T_7 = T_{6+1} = (-1)^6\ {}^{11}C_6\left(x^4\right)^{11-6}\left(\frac{1}{x^3}\right)^6$$

$$= 462\frac{x^{20}}{x^{18}}$$

$$= 462x^2$$

*********** END **********