EXERCISE

SHORT ANSWER TYPE QUESTIONS

Q1. Find the term independent of x, $x \neq 0$ in the expansion of $\left(\frac{3x^2}{2} - \frac{1}{3x}\right)^{15}$

Sol. General Term $T_{r+1} = {}^nC_r x^{n-r} y^r$

$$= {}^{15}C_r \left(\frac{3x^2}{2}\right)^{15-r} \left(-\frac{1}{3x}\right)^r = {}^{15}C_r \left(\frac{3}{2}\right)^{15-r} \cdot (x)^{30-2r} \cdot \left(-\frac{1}{3}\right)^r \cdot \frac{1}{x^r}$$

$$= {}^{15}C_r \left(\frac{3}{2}\right)^{15-r} \cdot (x)^{30-2r-r} (-1)^r \cdot \frac{1}{(3)^r}$$

$$= {}^{15}C_r \left(\frac{3}{2}\right)^{15-r} \cdot x^{30-3r} (-1)^r \cdot \frac{1}{(3)^r}$$

for getting the term independent of x,

$$30 - 3r = 0 \quad \Rightarrow \quad r = 10$$

On putting the value of r in the above expression, we get

$$= {}^{15}C_{10} \left(\frac{3}{2}\right)^{15-10} (-1)^{10} \cdot \frac{1}{(3)^{10}} = {}^{15}C_{10} \frac{(3)^5}{(2)^5} \cdot \frac{1}{(3)^{10}}$$

$$= {}^{15}C_{10} \cdot \frac{1}{(2)^5 \cdot (3)^5} = {}^{15}C_{10} \left(\frac{1}{6}\right)^5$$

Hence, the required term $= {}^{15}C_{10} \left(\frac{1}{6}\right)^5$

Q2. If the term free from x in the expansion of $\left(\sqrt{x} - \frac{K}{x^2}\right)^{10}$ is 405, find the value of K.

Sol. The given expression is $\left(\sqrt{x} - \frac{K}{x^2}\right)^{10}$

General term $\quad T_{r+1} = {}^nC_r x^{n-r} y^r$

$$= {}^{10}C_r \left(\sqrt{x}\right)^{10-r} \left(\frac{-K}{x^2}\right)^r = {}^{10}C_r (x)^{\frac{10-r}{2}} (-K)^r \left(\frac{1}{x^{2r}}\right)$$

$$= {}^{10}C_r (x)^{\frac{10-r}{2}-2r} (-K)^r = {}^{10}C_r (x)^{\frac{10-r-4r}{2}} (-K)^r$$

$$= {}^{10}C_r (x)^{\frac{10-5r}{2}} (-K)^r$$

For getting term free from x, $\frac{10-5r}{2} = 0$

$\Rightarrow r = 2$

On putting the value of r in the above expression, we get ${}^{10}C_2 (-K)^2$

According to the condition of the question, we have

$$ {}^{10}C_2K^2 = 405 \quad \Rightarrow \quad \frac{10 \cdot 9}{2.1} K^2 = 405$$

$$\Rightarrow \quad 45K^2 = 405 \quad \Rightarrow \quad K^2 = \frac{405}{45} = 9$$

$$\therefore \quad K = \pm 3$$

Hence, the value of $K = \pm 3$

Q3. Find the coefficient of x in the expansion of $(1 - 3x + 7x^2)(1 - x)^{16}$

Sol. The given expression is $(1 - 3x + 7x^2)(1 - x)^{16}$

$$= (1 - 3x + 7x^2)[{}^{16}C_0(1)^{16}(-x)^0 + {}^{16}C_1(1)^{15}(-x) + {}^{16}C_2(1)^{14}(-x)^2 + \cdots]$$

$$= (1 - 3x + 7x^2)(1 - 16x + 120x^2 \ldots)$$

Collecting the term containing x, we get $-16x - 3x = -19x$

Hence, the coefficient of $x = -19$

Q4. Find the term independent of x in the expansion of $\left(3x - \frac{2}{x^2}\right)^{15}$

Sol. Given expression is $\left(3x - \frac{2}{x^2}\right)^{15}$

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

$$= {}^{15}C_r (3x)^{15-r} \left(-\frac{2}{x^2}\right)^r = {}^{15}C_r (3)^{15-r} \cdot x^{15-r} (-2)^r \cdot \frac{1}{x^{2r}}$$

$$= {}^{15}C_r (3)^{15-r} \cdot x^{15-r-2r} \cdot (-2)^r = {}^{15}C_r (3)^{15-r} \cdot x^{15-3r} (-2)^r$$

For getting a term independent of x, put $15 - 3r = 0 \quad \Rightarrow \quad r = 5$

$\therefore$ The required term is ${}^{15}C_5(3)^{15-5}(-2)^5$

$$= -{}^{15}C_5 (3)^{10}(2)^5 = -\frac{15 \times 14 \times 13 \times 12 \times 11}{5 \times 4 \times 3 \times 2 \times 1} \cdot (3)^{10}(2)^5$$

$$= -7 \times 13 \times 3 \times 11. (3)^{10} (2)^5 = -3003 (3)^{10} (2)^5$$

Hence, the required term $= -3003 (3)^{10} (2)^5$

Q5. Find the middle term (Terms) in the expansion of

(i) $\left(\frac{x}{a}-\frac{a}{x}\right)^{10}$ (ii) $\left(3x-\frac{x^3}{6}\right)^9$

Sol. (*i*) Given expression is $\left(\frac{x}{a}-\frac{a}{x}\right)^{10}$

Number of terms = 10 + 1 = 11 (odd)

$\therefore$ Middle term = $\left(\frac{n+1}{2}\right)^{\text{th}}$ term $=\frac{11+1}{2}=\frac{12}{2}=$ 6th term

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

$$\Rightarrow T_{5+1}={}^{10}C_5\left(\frac{x}{a}\right)^{10-5}\left(-\frac{a}{x}\right)^5=-{}^{10}C_5\frac{x^5}{a^5}\cdot\frac{a^5}{x^5}=-{}^{10}C_5$$

$$=-\frac{10\times9\times8\times7\times6}{5\times4\times3\times2\times1}=-9\times7\times4=-252$$

Hence, the required middle term = – 252

(*ii*) Given expression is $\left(3x-\frac{x^3}{6}\right)^9$

Number of terms = 9 + 1 = 10 (even)

$\therefore$ Middle terms are $\frac{n}{2}^{\text{th}}$ term and $\left(\frac{n}{2}+1\right)^{\text{th}}$ term

$=\frac{10}{2}^{\text{th}}=5^{\text{th}}$ term and $(5+1)=6^{\text{th}}$ term

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

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

$$={}^9C_4(3)^5\cdot x^5\left(-\frac{1}{6}\right)^4\cdot x^{12}$$

$$=\frac{9\times8\times7\times6}{4\times3\times2\times1}\times\frac{3\times3\times3\times3\times3}{6\times6\times6\times6}x^{17}$$

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

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

$$={}^9C_5(3)^4x^4\left(-\frac{1}{6}\right)^5\cdot x^{15}$$

$$= \frac{9\times8\times7\times6\times5}{5\times4\times3\times2\times1}(3)^4\left(-\frac{1}{6}\right)^5\cdot x^{19} = -\frac{21}{16}x^{19}$$

Hence, the required middle terms are $\frac{189}{8}x^{17}$ and $-\frac{21}{16}x^{19}$

Q6. Find the coefficient of x^{15} in the expansion of $(x - x^2)^{10}$.

Sol. The given expression is $(x - x^2)^{10}$

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

$= {}^{10}C_r(x)^{10-r}(-x^2)^r = {}^{10}C_r(x)^{10-r}(-1)^r\cdot(x^2)^r$

$= (-1)^r\cdot{}^{10}C_r(x)^{10-r+2r} = (-1)^r\cdot{}^{10}C_r(x)^{10+r}$

To find the coefficient of x^{15}, Put $10 + r = 15 \quad\Rightarrow\quad r = 5$

$\therefore$ Coefficient of $x^{15} = (-1)^5\,{}^{10}C_5 = -\,{}^{10}C_5 = -252$

Hence, the required coefficient $= -252$

Q7. Find the coefficient of $\frac{1}{x^{17}}$ in the expansion of $\left(x^4 - \frac{1}{x^3}\right)^{15}$

Sol. The given expression is $\left(x^4 - \frac{1}{x^3}\right)^{15}$

General Term $T_{r+1} = {}^nC_r x^{n-r} y^r = {}^{15}C_r(x^4)^{15-r}\left(-\frac{1}{x^3}\right)^r$

$$= {}^{15}C_r(x)^{60-4r}(-1)^r\cdot\frac{1}{x^{3r}} = {}^{15}C_r(-1)^r\cdot\frac{1}{x^{3r-60+4r}}$$

$$= {}^{15}C_r(-1)^r\cdot\frac{1}{x^{7r-60}}$$

To find the coefficient of $\frac{1}{x^{17}}$, Put $7r - 60 = 17$

$\Rightarrow \quad 7r = 60 + 17 \Rightarrow 7r = 77$

$\therefore \quad r = 11$

Putting the value of r in the above expression, we get

$$= {}^{15}C_{11}(-1)^{11}\cdot\frac{1}{x^{17}} = -{}^{15}C_4\cdot\frac{1}{x^{17}}$$

$$= -\frac{15\times14\times13\times12}{4\times3\times2\times1}\cdot\frac{1}{x^{17}} = -1365\cdot\frac{1}{x^{17}}$$

Hence, the coefficient of $\frac{1}{x^{17}} = -1365$

Q8. Find the sixth term of the expansion $(y^{1/2} + x^{1/3})^n$, if the binomial coefficient of the third term from the end is 45.

Sol. The given expression is $(y^{1/2} + x^{1/3})^n$, since the binomial coefficient of third term from the end = Binomial coefficient of third term from the beginning $= {}^nC_2$

$\therefore \quad {}^nC_2 = 45$

$\Rightarrow \quad \dfrac{n(n-1)}{2} = 45 \quad \Rightarrow \quad n^2 - n = 90$

$\Rightarrow \quad n^2 - n - 90 = 0 \quad \Rightarrow \quad n^2 - 10n + 9n - 90 = 0$

$\Rightarrow \quad n(n-10) + 9(n-10) = 0 \quad \Rightarrow \quad (n-10)(n+9) = 0$

$\Rightarrow \quad n = 10, n = -9 \quad \Rightarrow \quad n = 10, n \neq -9$

So, the given expression becomes $(y^{1/2} + x^{1/3})^{10}$

Sixth term is this expression

$$T_6 = T_{5+1} = {}^{10}C_5 (y^{1/2})^{10-5} (x^{1/3})^5 = {}^{10}C_5 y^{5/2} \cdot x^{5/3}$$
$$= 252\, y^{5/2} x^{5/3}$$

Hence, the required term = $252\, y^{5/2} . x^{5/3}$

Q9. Find the value of r if the coefficients of $(2r+4)^{th}$ and $(r-2)^{th}$ terms in the expansion of $(1+x)^{18}$ are equal

Sol. General Term $T_{r+1} = {}^nC_r x^{n-r} y^r$

For coefficient of $(2r+4)^{th}$ term, we have

$$T_{2r+4} = T_{2r+3+1} = {}^{18}C_{2r+3} (1)^{18-2r-3} \cdot x^{2r+3}$$

$\therefore$ Coefficient of $(2r+4)^{th}$ term = ${}^{18}C_{2r+3}$

Similarly, $T_{r-2} = T_{r-3+1} = {}^{18}C_{r-3} (1)^{18-r+3} \cdot x^{r-3}$

$\therefore$ Coefficient of $(r-2)^{th}$ term = ${}^{18}C_{r-3}$

As per the condition of the questions, we have ${}^{18}C_{2r+3} = {}^{18}C_{r-3}$

$\Rightarrow \quad 2r + 3 + r - 3 = 18 \quad \Rightarrow \quad 3r = 18 \quad \Rightarrow \quad r = 6$

Q10. If the coefficient of second, third and fourth terms in the expansion of $(1+x)^{2n}$ are in A.P., show that $2n^2 - 9n + 7 = 0$

Sol. Given expression = $(1+x)^{2n}$

Coefficient of second term = ${}^{2n}C_1$

Coefficient of third term = ${}^{2n}C_2$

and coefficient of fourth term = ${}^{2n}C_3$

As the given condition, ${}^{2n}C_1$, ${}^{2n}C_2$ and ${}^{2n}C_3$ are in A.P.

$\therefore \quad {}^{2n}C_2 - {}^{2n}C_1 = {}^{2n}C_3 - {}^{2n}C_2$

$\Rightarrow \quad 2 \cdot {}^{2n}C_2 = {}^{2n}C_1 + {}^{2n}C_3$

$$\Rightarrow \quad 2 \cdot \frac{2n!}{2!(2n-2)!} = \frac{2n!}{(2n-1)!} + \frac{2n!}{3!(2n-3)!}$$

$$\Rightarrow \quad 2\left[\frac{2n(2n-1)(2n-2)!}{2 \times 1 \times (2n-2)!}\right] = \frac{2n(2n-1)!}{(2n-1)!} + \frac{2n(2n-1)(2n-2)(2n-3)!}{3 \times 2 \times 1 \times (2n-3)!}$$

$$\Rightarrow \quad n(2n-1) = n + \frac{n(2n-1)(2n-2)}{6}$$

$$\Rightarrow \quad 2n - 1 = 1 + \frac{(2n-1)(2n-2)}{6}$$

$\Rightarrow \quad 12n - 6 = 6 + 4n^2 - 4n - 2n + 2$

$\Rightarrow \quad 12n - 12 = 4n^2 - 6n + 2$

$\Rightarrow \quad 4n^2 - 6n - 12n + 2 + 12 = 0$

$\Rightarrow \quad 4n^2 - 18n + 14 = 0$

$\Rightarrow \quad 2n^2 - 9n + 7 = 0$

Hence proved.

Q11. Find the coefficient of x^4 in the expansion of $(1 + x + x^2 + x^3)^{11}$.

Sol. Given expression is $(1 + x + x^2 + x^3)^{11}$

$$= [(1 + x) + x^2 (1 + x)]^{11} = [(1 + x)(1 + x^2)]^{11}$$

$$= (1 + x)^{11} \cdot (1 + x^2)^{11}$$

Expanding the above expression, we get

$({}^{11}C_0 + {}^{11}C_1 x + {}^{11}C_2 x^2 + {}^{11}C_3 x^3 + {}^{11}C_4 x^4 + \cdots) \cdot$

$({}^{11}C_0 + {}^{11}C_1 x^2 + {}^{11}C_2 x^4 +)$

$=(1 + 11x + 55x^2 + 165x^3 + 330x^4 \cdots) \cdot (1 + 11x^2 + 55x^4 + \cdots)$

Collecting the terms containing x^4, we get

$(55 + 605 + 330)x^4 = 990x^4$

Hence, the coefficient of $x^4 = 990$

LONG ANSWER TYPE QUESTIONS

Q12. If P is a real number and if the middle term in the expansion of $\left(\frac{P}{2} + 2\right)^8$ is 1120, find P.

Sol. Given expression is $\left(\frac{P}{2} + 2\right)^8$

Number of terms = 8 + 1 = 9 (odd)

$\therefore$ Middle term $= \frac{9+1}{2}$th term = 5th term

$$\therefore \quad T_5 = T_{4+1} = {}^8C_4 \left(\frac{P}{2}\right)^{8-4} (2)^4$$

$$= {}^8C_4 \frac{P^4}{2^4} \times 2^4 = {}^8C_4 P^4$$

Now $\quad {}^8C_4 P^4 = 1120 \quad \Rightarrow \quad \frac{8 \times 7 \times 6 \times 5}{4 \times 3 \times 2 \times 1} P^4 = 1120$

$\Rightarrow \quad 70P^4 = 1120$

$\Rightarrow \quad P^4 = \frac{1120}{70} = 16 \quad \Rightarrow \quad P^4 = 2^4 \quad \Rightarrow \quad P = \pm 2$

Hence, the required value of P = ±2

Q13. Show that the middle term in the expansion of $\left(x - \frac{1}{x}\right)^{2n}$ is

$$\frac{1 \times 3 \times 5 \times \cdots (2n-1)}{n!} \times (-2)^n$$

Sol. Given expression is $\left(x-\frac{1}{x}\right)^{2n}$

Number of terms = $2n + 1$ (odd)

$\therefore$ Middle term = $\frac{2n+1+1}{2}$th term i.e., $(n + 1)^{\text{th}}$ term

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

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

$$= (-1)^n\cdot{}^{2n}C_n = (-1)^n\cdot\frac{2n!}{n!(2n-n)!}$$

$$= (-1)^n\cdot\frac{2n!}{n!n!} = (-1)^n\cdot\frac{2n(2n-1)(2n-2)(2n-3)\cdots1}{n!\,n(n-1)(n-2)(n-3)\cdots1}$$

$$= (-1)^n\frac{2n\cdot(2n-1)\cdot2(n-1)(2n-3)\cdots1}{n!\,n(n-1)(n-2)(n-3)\cdots1}$$

$$= \frac{(-1)^n\cdot2^n\cdot[n(n-1)(n-2)\cdots]\cdot[(2n-1)\cdot(2n-3)\cdots5\cdot3\cdot1]}{n!\cdot n(n-1)(n-2)\cdots1}$$

$$= \frac{(-2)^n[(2n-1)(2n-3)\cdots5\cdot3\cdot1]}{n!}$$

$$= \frac{1\times3\times5\times\cdots(2n-1)}{n!}\times(-2)^n$$

Hence, the middle term = $\frac{1\times3\times5\times\cdots(2n-1)}{n!}\times(-2)^n$

Q14. Find n in the binomial $\left(\sqrt[3]{2}+\frac{1}{\sqrt[3]{3}}\right)^n$ if the ratio of 7th term from the beginning to the 7th term from the end is 1/6.

Sol. The given expression is $\left(\sqrt[3]{2}+\frac{1}{\sqrt[3]{3}}\right)^n$

$$= \left(2^{1/3}+\frac{1}{3^{1/3}}\right)^n$$

General Term $T_{r+1} = {}^nC_rx^{n-r}y^r$

$$T_7 = T_{6+1} = {}^nC_6\left(2^{1/3}\right)^{n-6}\left(\frac{1}{3^{1/3}}\right)^6$$

$$= {}^nC_6(2)^{n-6/3}\cdot\left(\frac{1}{3^2}\right) = {}^nC_6(2)^{n-6/3}\cdot(3)^{-2}$$

7th term from the end = $(n - 7 + 2)^{\text{th}}$ term from the beginning

$= (n-5)^{\text{th}}$ term from the beginning

So, $T_{n-6+1} = {}^nC_{n-6}(2^{1/3})^{n-n+6}\left(\frac{1}{3^{1/3}}\right)^{n-6}$

$= {}^nC_{n-6}(2)^2 \cdot \left(\frac{1}{3^{n-6/3}}\right) = {}^nC_{n-6}(2)^2\,(3)^{6-n/3}$

According to the question, we get

$$\frac{{}^nC_6(2)^{\frac{n-6}{3}}(3)^{-2}}{{}^nC_{n-6}(2)^2(3)^{\frac{6-n}{3}}} = \frac{1}{6}$$

$$\Rightarrow \frac{{}^nC_{n-6}(2)^{\frac{n-6}{3}}(3)^{-2}}{{}^nC_{n-6}(2)^2(3)^{\frac{6-n}{3}}} = \frac{1}{6} \Rightarrow (2)^{\frac{n-6}{3}-2}\cdot(3)^{-2-\frac{6-n}{3}} = \frac{1}{6}$$

$$\Rightarrow (2)^{\frac{n-6-6}{3}}\cdot(3)^{\frac{-6-6+n}{3}} = \frac{1}{6} \Rightarrow (2)^{\frac{n-12}{3}}\cdot(3)^{\frac{n-12}{3}} = (6)^{-1}$$

$$\Rightarrow (6)^{\frac{n-12}{3}} = (6)^{-1}$$

$$\Rightarrow \frac{n-12}{3} = -1 \Rightarrow n-12 = -3 \Rightarrow n = 12-3 = 9$$

Hence, the required value of n is 9.

Q15. In the expansion of $(x+a)^n$ if the sum of odd terms is denoted by O and the sum of even terms by E then prove that

(*i*) $O^2 - E^2 = (x^2 - a^2)^n$ (*ii*) $4OE = (x+a)^{2n} - (x-a)^{2n}$

Sol. Given expression is $(x+a)^n$

$(x+a)^n = {}^nC_0x^na^0 + {}^nC_1x^{n-1}a + {}^nC_2x^{n-2}a^2 + {}^nC_3x^{n-3}a^3 + \cdots + {}^nC_na^n$

Sum of odd terms,

$$O = {}^nC_0x^n + {}^nC_2x^{n-2}a^2 + {}^nC_4x^{n-4}a^4 + \cdots$$

and the sum of even terms,

$$E = {}^nC_1x^{n-1}\cdot a + {}^nC_3x^{n-3}a^3 + {}^nC_5x^{n-5}a^5 + \cdots$$

Now $(x+a)^n = O + E$ ...(*i*)

Similarly $(x-a)^n = O - E$ ...(*ii*)

Multiplying eq. (*i*) and eq. (*ii*), we get,

$(x+a)^n(x-a)^n = (O+E)(O-E)$

$\Rightarrow (x^2-a^2)^n = O^2 - E^2$

Hence $O^2 - E^2 = (x^2-a^2)^n$

(*ii*) $4OE = (O+E)^2 - (O-E)^2$

$= [(x+a)^n]^2 - [(x-a)^n]^2$

$= [x+a]^{2n} - [x-a]^{2n}$

Hence, $4OE = (x+a)^{2n} - (x-a)^{2n}$

Q16. If x^p occurs in the expansion of $\left(x^2 + \frac{1}{x}\right)^{2n}$, then prove that its coefficient is $\dfrac{2n!}{\left(\frac{4n-p}{3}\right)!\left(\frac{2n+p}{3}\right)!}$

Sol. Given expression is $\left(x^2 + \frac{1}{x}\right)^{2n}$

General terms, $T_{r+1} = {}^nC_r x^{n-r} y^r$

$$= {}^{2n}C_r (x^2)^{2n-r} \cdot \left(\frac{1}{x}\right)^r = {}^{2n}C_r (x)^{4n-2r} \cdot \frac{1}{x^r}$$

$$= {}^{2n}C_r (x)^{4n-2r-r} = {}^{2n}C_r (x)^{4n-3r}$$

If x^p occurs in $\left(x^2 + \frac{1}{x}\right)^{2n}$

then $4n - 3r = p \Rightarrow 3r = 4n - p$

$\Rightarrow$ $r = \dfrac{4n-p}{3}$

$\therefore$ Coefficient of $x^p = {}^{2n}C_r = {}^{2n}C_{\frac{4n-p}{3}}$

$$= \frac{(2n)!}{\left(\frac{4n-p}{3}\right)!\left(2n - \frac{4n-p}{3}\right)!} = \frac{(2n)!}{\left(\frac{4n-p}{3}\right)!\left(\frac{6n-4n+p}{3}\right)!}$$

$$= \frac{(2n)!}{\left(\frac{4n-p}{3}\right)!\left(\frac{2n+p}{3}\right)!}$$

Hence, the coefficient of $x^p = \dfrac{(2n)!}{\left(\frac{4n-p}{3}\right)!\left(\frac{2n+p}{3}\right)!}$

Q17. Find the term independent of x in the expansion of $(1 + x + 2x^3)\left(\frac{3}{2}x^2 - \frac{1}{3x}\right)^9$

Sol. Given expression is $(1+x+2x^3)\left(\frac{3}{2}x^2 - \frac{1}{3x}\right)^9$

Let us consider $\left(\frac{3}{2}x^2 - \frac{1}{3x}\right)^9$

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

$$T_{r+1} = {}^9C_r \left(\frac{3}{2}x^2\right)^{9-r} \left(-\frac{1}{3x}\right)^r$$

$$= {}^9C_r \left(\frac{3}{2}\right)^{9-r} (x)^{18-2r} \cdot \left(-\frac{1}{3}\right)^r \cdot \frac{1}{(x)^r}$$

$$= {}^9C_r \left(\frac{3}{2}\right)^{9-r} (x)^{18-2r-r} \cdot \left(-\frac{1}{3}\right)^r$$

$$= {}^9C_r \left(\frac{3}{2}\right)^{9-r} \left(-\frac{1}{3}\right)^r \cdot x^{18-3r}$$

So, the general term in the expansion of

$$(1 + x + 2x^3)\left(\frac{3}{2}x^2 - \frac{1}{3x}\right)^9$$

$$= {}^9C_r \left(\frac{3}{2}\right)^{9-r} \left(-\frac{1}{3}\right)^r \cdot (x)^{18-3r} + {}^9C_r \left(\frac{3}{2}\right)^{9-r} \left(-\frac{1}{3}\right)^r \cdot (x)^{19-3r}$$

$$+ 2 \cdot {}^9C_r \left(\frac{3}{2}\right)^{9-r} \left(-\frac{1}{3}\right)^r \cdot (x)^{21-3r}$$

For getting the term independent of x,
Put $18 - 3r = 0$, $19 - 3r = 0$ and $21 - 3r = 0$, we get

$$r = 6,\ r = \frac{19}{3} \text{ and } r = 7$$

The possible value of r are 6 and 7 $\left(\because \quad r \neq \frac{19}{3}\right)$

$\therefore$ The term independent of x is

$$= {}^9C_6 \left(\frac{3}{2}\right)^{9-6} \left(-\frac{1}{3}\right)^6 + 2 \cdot {}^9C_7 \left(\frac{3}{2}\right)^{9-7} \left(-\frac{1}{3}\right)^7$$

$$= \frac{9 \times 8 \times 7 \times 6!}{3 \times 2 \times 1 \times 6!} \cdot \frac{3^3}{2^3} \cdot \frac{1}{3^6} - 2 \cdot \frac{9 \times 8 \times 7!}{7!2 \times 1} \cdot \frac{3^2}{2^2} \cdot \frac{1}{3^7}$$

$$= \frac{84}{8} \cdot \frac{1}{3^3} - \frac{36}{4} \cdot \frac{2}{3^5} = \frac{7}{18} - \frac{2}{27} = \frac{21 - 4}{54} = \frac{17}{54}$$

Hence, the required term $= \dfrac{17}{54}$

OBJECTIVE TYPE QUESTIONS

Q18. The total number of terms in the expansion of $(x + a)^{100} + (x - a)^{100}$ after simplification is

(*a*) 50 (*b*) 202
(*c*) 51 (*d*) None of these

Sol. Number of terms in the expansion of $(x + a)^{100} = 101$
Number of terms in the expansion of $(x - a)^{100} = 101$

Now 50 terms of expansion will cancel out with negative 50 terms of $(x - a)^{100}$

So, the remaining 51 terms of first expansion will be added to 51 terms of other.

Therefore, the number of terms = 51

Hence, the correct option is (*c*).

Q19. If the integers $r > 1$, $n > 2$ and coefficients of $(3r)^{th}$ and $(r + 2)^{th}$ terms in the Binomial expansion of $(1 + x)^{2n}$ are equal, then

(*a*) $n = 2r$ (*b*) $n = 3r$

(*c*) $n = 2r + 1$ (*d*) none of these

Sol. Given that $r > 1$ and $n > 2$

then $T_{3r} = T_{3r-1+1} = {}^{2n}C_{3r-1} \cdot x^{3r-1}$

and $T_{r+2} = T_{r+1+1} = {}^{2n}C_{r+1}x^{r+1}$

As per the question, we have

$${}^{2n}C_{3r-1} = {}^{2n}C_{r+1}$$

$\Rightarrow \quad 3r - 1 + r + 1 = 2n \qquad [\because \ {}^nC_p = {}^nC_q \Rightarrow n = p + q]$

$\Rightarrow \quad 4r = 2n$

$n = 2r$

Hence, the correct option is (*a*).

Q20. The two successive terms in the expansion of $(1 + x)^{24}$ whose coefficients are in the ratio 1 : 4 are

(*a*) 3^{rd} and 4^{th} (*b*) 4^{th} and 5^{th}

(*c*) 5^{th} and 6^{th} (*d*) 6^{th} and 7^{th}

Sol. Let r^{th} and $(r + 1)^{th}$ be two successive terms in the expansion $(1 + x)^{24}$

$\therefore \quad T_{r+1} = {}^{24}C_r \cdot x^r$

$T_{r+2} = T_{r+1+1} = {}^{24}C_{r+1}x^{r+1}$

As per the question, we have $\dfrac{{}^{24}C_r}{{}^{24}C_{r+1}} = \dfrac{1}{4}$

$$\Rightarrow \quad \frac{\dfrac{24!}{r!(24-r)!}}{\dfrac{24!}{(r+1)!\,(24-r-1)!}} = \frac{1}{4}$$

$$\Rightarrow \quad \frac{24!}{r!(24-r)!} \times \frac{(r+1)!\,(24-r-1)!}{24!} = \frac{1}{4}$$

$$\Rightarrow \quad \frac{(r+1)\cdot r!\,(24-r-1)!}{r!(24-r)\,(24-r-1)!} = \frac{1}{4}$$

$$\Rightarrow \quad \frac{r+1}{24-r} = \frac{1}{4}$$

$$\Rightarrow \quad 4r + 4 = 24 - r$$

$\Rightarrow \qquad 5r = 20 \Rightarrow r = 4$

$\therefore \qquad T_{4+1} = T_5$ and $T_{4+2} = T_6$

Hence, the correct option is (*c*).

Q21. The coefficient of x^n in the expansion of $(1 + x)^{2n}$ and $(1 + x)^{2n-1}$ are in the ratio.

(*a*) 1 : 2 (*b*) 1 : 3 (*c*) 3 : 1 (*d*) 2 : 1

Sol. General Term $T_{r+1} = {}^nC_r\, x^{n-r}\, y^r$

In the expansion of $(1 + x)^{2n}$, we get $T_{r+1} = {}^{2n}C_r\, x^r$

To get the coefficient of x^n, put $r = n$

$\therefore$ Coefficient of $x^n = {}^{2n}C_n$

In the expansion of $(1 + x)^{2n-1}$, we get $T_{r+1} = {}^{2n-1}C_r x^r$

$\therefore$ Coefficient of x^n is ${}^{2n-1}C_{n-1}$

The required ratio is $\dfrac{{}^{2n}C_n}{{}^{2n-1}C_{n-1}}$

$$= \frac{\dfrac{2n!}{n!(n!)}}{\dfrac{(2n-1)!}{(n-1)!\,(2n-1-n+1)!}} = \frac{\dfrac{2n!}{n!\cdot n!}}{\dfrac{(2n-1)!}{(n-1)!\,(n!)}}$$

$$= \frac{2n!}{n!n!} \times \frac{(n-1)!\cdot n!}{(2n-1)!} = \frac{2n(2n-1)!}{n!\,n(n-1)!} \times \frac{(n-1)!\cdot n!}{(2n-1)!}$$

$$= \frac{2}{1} = 2:1$$

Hence, the correct option is (*d*).

Q22. If the coefficients of 2nd, 3rd and the 4th terms in the expansion of $(1 + x)^n$ are in A.P. Then value of n is

(*a*) 2 (*b*) 7 (*c*) 1 (*d*) 14

Sol. Given expression is $(1 + x)^n$

$(1 + x)^n = {}^nC_0 + {}^nC_1 x + {}^nC_2 x^2 + {}^nC_3 x^3 + \dots\ {}^nC_n x^n$

Here, coefficient of 2nd term $= {}^nC_1$

Coefficient of 3rd term $= {}^nC_2$

and coefficient of 4th term $= {}^nC_3$

Given that ${}^nC_1$, ${}^nC_2$ and ${}^nC_3$ are in A.P.

$\therefore \qquad 2\,.\,{}^nC_2 = {}^nC_1 + {}^nC_3$

$$\Rightarrow \qquad 2\cdot\frac{n(n-1)}{2} = n + \frac{n(n-1)(n-2)}{3\cdot 2\cdot 1}$$

$$\Rightarrow \qquad n(n-1) = n + \frac{n(n-1)(n-2)}{6}$$

$$\Rightarrow \qquad n-1 = 1 + \frac{(n-1)(n-2)}{6}$$

$\Rightarrow \quad 6n - 6 = 6 + n^2 - 3n + 2$

$\Rightarrow \quad n^2 - 3n - 6n + 14 = 0 \quad \Rightarrow \quad n^2 - 9n + 14 = 0$

$\Rightarrow \quad n^2 - 7n - 2n + 14 = 0 \quad \Rightarrow \quad n(n-7) - 2(n-7) = 0$

$\Rightarrow \quad (n-2)(n-7) = 0 \quad \Rightarrow n = 2, 7 \quad \Rightarrow \quad n = 7$

whereas $n = 2$ is not possible

Hence, the correct option is (*b*).

Q23. If A and B are coefficient of x^n is the expansions of $(1 + x)^{2n}$ and $(1 + x)^{2n-1}$ respectively, then A/B equals

(*a*) 1 (*b*) 2 (*c*) 1/2 (*d*) $1/n$

Sol. Given expression is $(1 + x)^{2n}$

$$T_{r+1} = {}^{2n}C_r x^r$$

$\therefore$ Coefficient of $x^n = {}^{2n}C_n = A$ (Given)

In the expression $(1 + x)^{2n-1}$

$$T_{r+1} = {}^{2n-1}C_r x^r$$

$\therefore$ Coefficient of $x^n = {}^{2n-1}C_n = B$ (Given)

So, $$\frac{A}{B} = \frac{{}^{2n}C_n}{{}^{2n-1}C_n} = \frac{{}^{2n}C_n}{{}^{2n-1}C_n} = \frac{2}{1}$$ [from Q. no. 21]

Hence, the correct option is (*b*).

Q24. If the middle term of $\left(\frac{1}{x} + x \sin x\right)^{10}$ is equal to $7\frac{7}{8}$, then value of x is

(*a*) $2n\pi + \frac{\pi}{6}$ (*b*) $n\pi + \frac{\pi}{6}$

(*c*) $n\pi + (-1)^n \frac{\pi}{6}$ (*d*) $n\pi + (-1)^n \frac{\pi}{3}$

Sol. Given expression is $\left(\frac{1}{x} + x \sin x\right)^{10}$

Number of terms = 10 + 1 = 11 odd

$$\therefore \quad \text{Middle term} = \frac{11+1}{2}\text{th term} = 6\text{th term}$$

$$T_6 = T_{5+1} = {}^{10}C_5 \left(\frac{1}{x}\right)^{10-5} (x \sin x)^5$$

$$\therefore \quad {}^{10}C_5 \left(\frac{1}{x}\right)^5 \cdot x^5 \cdot \sin^5 x = 7\frac{7}{8} \quad \Rightarrow \quad {}^{10}C_5 \cdot \sin^5 x = \frac{63}{8}$$

$$\Rightarrow \quad \frac{10 \cdot 9 \cdot 8 \cdot 7 \cdot 6}{5 \cdot 4 \cdot 3 \cdot 2 \cdot 1} \cdot \sin^5 x = \frac{63}{8} \quad \Rightarrow \quad 252 \cdot \sin^5 x = \frac{63}{8}$$

$$\Rightarrow \quad \sin^5 x = \frac{63}{8 \times 252} \quad \Rightarrow \quad \sin^5 x = \frac{1}{32}$$

$$\Rightarrow \quad \sin^5 x = \left(\frac{1}{2}\right)^5 \quad \Rightarrow \quad \sin x = \frac{1}{2}$$

$$\Rightarrow \quad \sin x = \sin \frac{\pi}{6}$$

$$\therefore \quad x = n\pi + (-1)^n \cdot \frac{\pi}{6}$$

Hence, the correct option is (*c*).

FILL IN THE BLANKS

Q25. The largest coefficient in the expansion of $(1 + x)^{30}$ is __________.

Sol. Here $n = 30$ which is even

$\therefore$ the largest coefficient in $(1 + x)^n = {}^nC_{n/2}$

So, the largest coefficient in $(1 + x)^{30} = {}^{30}C_{15}$

Hence, the value of the filler is ${}^{30}C_{15}$.

Q26. The number of terms in the expansion of $(x + y + z)^n$ __________.

Sol. The expression $(x + y + z)^n$ can be written a $[x + (y + z)]^n$

$$\therefore \quad [x + (y + z)]^n = {}^nC_0 x^n (y + z)^0 + {}^nC_1 (x)^{n-1} (y + z) + {}^nC_2 (x)^{n-2} (y + z)^2 + \cdots + {}^nC_n (y + z)^n$$

$\therefore$ Number of terms $1 + 2 + 3 + 4 + \cdots (n + 1)$

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

Hence, the value of the filler is $\frac{(n+1)(n+2)}{2}$

Q27. In the expansion of $\left(x^2 - \frac{1}{x^2}\right)^{16}$, the value of constant term is __________.

Sol. Let T_{r+1} be the constant term in the expansion of $\left(x^2 - \frac{1}{x^2}\right)^{16}$

$$\therefore \quad T_{r+1} = {}^{16}C_r (x^2)^{16-r} \left(\frac{-1}{x^2}\right)^r = {}^{16}C_r (x)^{32-2r} (-1)^r \cdot \frac{1}{x^{2r}}$$

$$= (-1)^r \cdot {}^{16}C_r (x)^{32-2r-2r} \quad \Rightarrow \quad (-1)^r \cdot {}^{16}C_r (x)^{32-4r}$$

For getting constant term, $32 - 4r = 0$

$\Rightarrow \quad = r = 8$

$\therefore \quad T_{r+1} = (-1)^8 \,.\, {}^{16}C_8 = {}^{16}C_8$

Hence, the value of the filler is ${}^{16}C_8$.

Q28. If the seventh transform the beginning and the end in the expansion of $\left(\sqrt[3]{2} + \frac{1}{\sqrt[3]{3}}\right)^n$ are equal, then n equals __________.

Sol. The given expansion is $\left(\sqrt[3]{2}+\frac{1}{\sqrt[3]{3}}\right)^n$

$$\therefore \quad T_7 = T_{6+1} = {}^nC_6(2^{1/3})^{n-6}\cdot\frac{1}{(3^{1/3})^6} = {}^nC_6(2)^{\frac{n-6}{3}}\cdot\frac{1}{(3)^2}$$

Now the T_7 from the end = T_7 from the beginning in $\left(\frac{1}{\sqrt[3]{3}}+\sqrt[3]{2}\right)^n$.

$$\therefore \quad T_7 = T_{6+1} = {}^nC_6\left(\frac{1}{3^{1/3}}\right)^{n-6}\cdot(2^{1/3})^6$$

As per the questions, we get

$$ {}^nC_6(2)^{\frac{n-6}{3}}\cdot\left(\frac{1}{3^2}\right) = {}^nC_6\frac{1}{3^{\frac{n-6}{3}}}\cdot(2)^2$$

$$\Rightarrow \quad (2)^{\frac{n-6}{3}}\cdot(3)^{-2} = (3)^{-\left(\frac{n-6}{3}\right)}\cdot(2)^2$$

$$\Rightarrow \quad (2)^{\frac{n-6}{3}-2}\cdot(3)^{-2+\frac{n-6}{3}} = 1$$

$$\Rightarrow \quad 2^{\frac{n-12}{3}}\cdot(3)^{\frac{n-12}{3}} = 1$$

$$\Rightarrow \quad (6)^{\frac{n-12}{3}} = (6)^0$$

$$\Rightarrow \quad \frac{n-12}{3} = 0 \quad \Rightarrow \quad n = 12$$

Hence, the value of the filler is 12.

Q29. The coefficient of $a^{-6}b^4$ in the expansion of $\left(\frac{1}{a}-\frac{2b}{3}\right)^{10}$ is ________.

Sol. The given expansion is $\left(\frac{1}{a}-\frac{2b}{3}\right)^{10}$

from $a^{-6}b^4$, we can take $r = 4$

$$\therefore \quad T_5 = T_{4+1} = {}^{10}C_4\left(\frac{1}{a}\right)^{10-4}\left(-\frac{2b}{3}\right)^4 = {}^{10}C_4\left(\frac{1}{a}\right)^6\left(\frac{-2}{3}\right)^4\cdot b^4$$

$$= \frac{10\cdot 9\cdot 8\cdot 7}{4\cdot 3\cdot 2\cdot 1}\times\frac{16}{81}\cdot a^{-6}b^4 = 210\times\frac{16}{81}a^{-6}b^4$$

$$= \frac{1120}{27}a^{-6}b^4$$

Hence, the value of the filler = $\frac{1120}{27}$

Q30. Middle term in the expansion of $(a^3 + ba)^{28}$ is ________.

Sol. Number of term in the expansion $(a^3 + ba)^{28} = 28 + 1 = 29$ (odd)

$\therefore$ Middle term $= \dfrac{29+1}{2} = 15\text{th term}$

$\therefore$ $T_{15} = T_{14+1} = {}^{28}C_{14}\,(a^3)^{28-14} \cdot (ba)^{14} = {}^{28}C_{14}\,(a)^{42} \cdot b^{14} \cdot a^{14}$

$= {}^{28}C_{14}a^{56}b^{14}$

Hence, the value of the filler is ${}^{28}C_{14}\,a^{56}\,b^{14}$.

Q31. The ratio of the coefficient of x^p and x^q in the expansion of $(1 + x)^{p+q}$ is ________.

Sol. Given expansion is $(1 + x)^{p+q}$

$T_{r+1} = {}^{p+q}C_r\, x^r$

Put $r = p$ $\quad = {}^{p+q}C_p x^p$

$\therefore$ the coefficient of $x^p = {}^{p+q}C_p$

Similarly, coefficient of $x^q = {}^{p+q}C_q$

$${}^{p+q}C_p = \frac{(p+q)!}{p!\,(p+q-p)!} = \frac{(p+q)!}{p!\,q!}$$

and $${}^{p+q}C_q = \frac{(p+q)!}{q!(p+q-q)!} = \frac{(p+q)!}{p!q!}$$

So, the ratio is 1 : 1.

Q32. The position of the term independent of x in the expansion of $\left(\sqrt{\dfrac{x}{3}} + \dfrac{3}{2x^2}\right)^{10}$ is ________.

Sol. The given expansion is $\left(\sqrt{\dfrac{x}{3}} + \dfrac{3}{2x^2}\right)^{10}$

$$T_{r+1} = {}^{10}C_r\left(\sqrt{\frac{x}{3}}\right)^{10-r}\left(\frac{3}{2x^2}\right)^r = {}^{10}C_r\left(\frac{x}{3}\right)^{\frac{10-r}{2}}\left(\frac{3}{2}\right)^r \cdot \frac{1}{x^{2r}}$$

$$= {}^{10}C_r\left(\frac{1}{3}\right)^{\frac{10-r}{2}} \cdot x^{\frac{10-r}{2}}\left(\frac{3}{2}\right)^r \cdot \frac{1}{x^{2r}}$$

$$= {}^{10}C_r\left(\frac{1}{3}\right)^{\frac{10-r}{2}} \cdot x^{\frac{10-r}{2}-2r} \cdot \left(\frac{3}{2}\right)^r$$

$$= {}^{10}C_r\left(\frac{1}{3}\right)^{\frac{10-r}{2}} \cdot x^{\frac{10-r-4r}{2}}\left(\frac{3}{2}\right)^r$$

For independent of x, we get

$$\frac{10 - r - 4r}{2} = 0$$

$$10 - 5r = 0$$

$$r = 2$$

So, the position of the term independent of x is 3rd term.

Hence, the value of the filler is Third term

Q33. If 25^{15} is divided by 13, the remainder is ________.

Sol. Let $25^{15} = (26 - 1)^{15}$

$$= {}^{15}C_0(26)^{15}(-1)^0 + {}^{15}C_1(26)^{14}(-1)^1 + {}^{15}C_2(26)^{13}(-1)^2 + \cdots + {}^{15}C_{15}(-1)^{15}$$

$$= 26^{15} - 15(26)^{14} + \cdots - 1 - 13 + 13$$

$$= 26^{15} - 15 \cdot (26)^{14} + \cdots - 13 + 12$$

$$= 13\lambda + 12$$

$\therefore$ The remainder = 12

Hence, the value of the filler is 12.

TRUE OR FALSE

Q34. The sum of the series $\sum_{r=0}^{10} {}^{20}C_r$ is $2^{19} + \frac{{}^{20}C_{10}}{2}$

Sol. $\sum_{r=0}^{10} {}^{20}C_r = {}^{20}C_0 + {}^{20}C_1 + {}^{20}C_2 + {}^{20}C_3 + \cdots + {}^{20}C_{10}$

$$= {}^{20}C_0 + {}^{20}C_1 + \cdots + {}^{20}C_{10} + {}^{20}C_{11} + \cdots + {}^{20}C_{20} - ({}^{20}C_{11} + \cdots + {}^{20}C_{20})$$

$$= 2^{20} - ({}^{20}C_{11} + \cdots + {}^{20}C_{20})$$

Hence, the given statement is **False**.

Q35. The expression $7^9 + 9^7$ is divisible by 64.

Sol. $7^9 + 9^7 = (1 + 8)^7 - (1 - 8)^9$

$$= [{}^7C_0 + {}^7C_1 \cdot 8 + {}^7C_2(8)^2 + {}^7C_3(8)^3 + \cdots + {}^7C_7(8)^7] - [{}^9C_0 - {}^9C_1 8 + {}^9C_2(8)^2 - {}^9C_3(8)^3 + \cdots {}^9C_9(8)^9]$$

$$= (7 \times 8 + 9 \times 8) + (21 \times 8^2 - 36 \times 8^2) + \cdots$$

$$= (56 + 72) + (21 - 36)8^2 + \cdots = 128 + 64(21 - 36) + \cdots$$

$$= 64[2 + (21 - 36) + \cdots]$$

which is divisible by 64

Hence, the given statement is **True**.

Q36. The number of terms in the expansion of $[(2x + 3y)^4]^7$ is 8.

Sol. Given expression is $[(2x + 3y)^4]^7 = (2x + 3y)^{28}$

So, the number of terms = 28 + 1 = 29

Hence, the given statement is **False**.

Q37. The sum of coefficients of the two middle terms in the expansion of $(1 + x)^{2n-1}$ is equal to $^{2n-1}C_n$.

Sol. The given expression is $(1 + x)^{2n-1}$

Number of terms = $2n - 1 + 1 = 2n$ (even)

$\therefore$ Middle terms are $\frac{2n}{2}$th term and $\left(\frac{2n}{2}+1\right)^{\text{th}}$ terms

= nth terms and $(n + 1)$th terms

Coefficient of nth term = $^{2n-1}C_{n-1}$

and the coefficient of $(n + 1)$th term = $^{2n-1}C_n$

Sum of the coefficients = $^{2n-1}C_{n-1} + {}^{2n-1}C_n$

$= {}^{2n-1}C_{n-1} + {}^{2n-1}C_n = {}^{2n-1+1}C_n = {}^{2n}C_n$

Hence, the statement $[\because \ {}^nC_r + {}^nC_{r-1} = {}^{n+1}C_r]$ is **False**.

Q38. The last two digits of the numbers 3^{400} are 01.

Sol. Given that $3^{400} = (9)^{200} = (10 - 1)^{200}$

$$\therefore \quad (10-1)^{200} = {}^{200}C_0(10)^{200} - {}^{200}C_1(10)^{199} + \ldots - {}^{200}C_{199}(10)^1 + {}^{200}C_{200}(1)^{200}$$

$$= 10^{200} - 200 \times 10^{199} + \cdots - 10 \times 200 + 1$$

So, it is clear that last two digits are 01.

Hence, the given statement is **True**.

Q39. If the expansion of $\left(x - \frac{1}{x^2}\right)^{2n}$ contains a term independent of x, then n is a multiple of 2.

Sol. The given expression is $\left(x - \frac{1}{x^2}\right)^{2n}$

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

$$= {}^{2n}C_r(x)^{2n-r-2r}(-1)^r = {}^{2n}C_r(x)^{2n-3r}(-1)^r$$

For the term independent of x, $2n - 3r = 0$

$\therefore \ r = \frac{2n}{3}$ which not an integer and the expression is not possible to be true

Hence, the given statement is **False**.

Q40. The number of terms in the expansion of $(a + b)^n$ where $n \in N$ is one less than the power n.

Sol. Since, the number of terms in the given expression $(a + b)^n$ is 1 more than n i.e., $n + 1$

Hence, the given statement is **False**.