

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

Solution:

$$\text{Given } \left(\frac{3x^2}{2} - \frac{1}{3x}\right)^{15}$$

From the standard formula of T_{r+1} we can write given expression as

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

$$T_{r+1} = {}^{15}C_r (-1)^r 3^{15-2r} 2^{r-15} x^{30-3r}$$

For the term independent of x , we have

$$30 - 3r = 0$$

Which implies $r = 10$

By substituting the value of r in above obtained expression we get

$$\begin{aligned} T_{10+1} &= {}^{15}C_{10} 3^{-5} 2^{-5} \\ &= {}^{15}C_{10} \left(\frac{1}{6}\right)^5 \end{aligned}$$