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Teorema de Binômio

1.

$$\binom{6}{k} 1^{6-k} \cdot (2x^{2})^{k} = \binom{6}{k} \cdot 1 \cdot 2^{k} \cdot x^{2k} = \binom{6}{k} 2^{k} \cdot x^{2k}$$

$2k = 8$

$k = \frac{8}{2} = 4$

$$\binom{6}{4} 2^{4} \cdot x^{8} = \frac{6!}{4!\,2!} = 16 \cdot x^{8} = 15 \cdot 16x^{8} = \boxed{240x^{8}}$$

$$\frac{6!}{4!\,2!} = \frac{6 \cdot 5 \cdot \cancel{4}}{\cancel{4} \cdot 2 \cdot 1} = \frac{30}{2} = 15$$

2.

$(14x - 13y)^{237}$

$(14x - 13y)^{237}$ $\quad x = 1 \quad y = 1$

$(14.1 - 13.1)^{237}$

$14 - 13 = 1^{237}$ $\quad$ coeficiente $= 1$

3.

$(x + a)^{11} = 1386x^5$

Termo geral

$T_{K+1} = \binom{n}{K} \cdot x^{n-K} \cdot a^K$ $\quad 11 - K = 5$

$T_{K+1} = \binom{11}{K} \cdot x^{11-K} a^K = 1386x^5$ $\quad K = 5 - 11$

$\boxed{K = 6}$

$T_{6+1} \binom{11}{6} x^{11-6} a^6 = 1386x^5$ $\quad a^6 = 1386 = \frac{55440 a^6}{120} = 1386$

$T_7 = \binom{11}{6} x^5 \cdot a^6 = 1386x^5$ $\quad = 462 a^6 = 1386$

$462 a^6 = 1386$

$T_7 = \frac{11!}{6!5!} a^6 = 1386$ $\quad a^6 = \frac{1386}{462} = 3$

$T7 = \frac{11.10.9.8.7.\cancel{6}}{\cancel{6}!\,5.4.3.2.1}$ $\quad \boxed{a = \sqrt[6]{3}}$

4.

$$\left(x + \frac{1}{x^2}\right)^4 \qquad T_{9+1} = \binom{9}{K} x^{9-K} \cdot \left(\frac{1}{x^2}\right)^K$$

$$T_{9+1} = \binom{9}{K} x^{9-K} \cdot (x^{-2})^K = \binom{9}{K} x^{\frac{9-K}{2}} \cdot x^{-K} =$$

$$\frac{9-K}{2} - K = \qquad \binom{9}{K} x^{\frac{9-P}{2} - K}$$

$$\frac{9-K}{2} - \frac{2K}{2} = \frac{9-3K}{2} \qquad T_{9+1} = \binom{9}{K} x^{\frac{9-3K}{2}} \rightarrow \frac{9-3K}{2} = 0$$

$$9 - 3K = 0 \qquad K = \binom{9}{3}$$
$$9 = 3K \rightarrow$$

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

$$T_{n+1} = \binom{n}{K} \cdot x^{n-K} \cdot \left(\frac{1}{x^2}\right)^K \rightarrow T_{n+1} = \binom{n}{K} x^{n-K} (x^{2-1})^K = \binom{n}{K} x^{\frac{n-K}{2}} \cdot x^{K} = \binom{n}{K} x^{\frac{n-K}{2} - K}$$

$$\frac{n-K}{2} - K = \frac{n-3K}{2} \rightarrow T_{n+1} = \binom{n}{K} x^{\frac{n-3K}{2}} \rightarrow \frac{n-3K}{2} = 0$$

$n = 3K \rightarrow \frac{3}{3} = 1$ divisível por 3

3.

$(x+a)^{11} = 1386x^5$

Termo geral

$T_{K+1} = \binom{n}{K} \cdot x^{n-K} \cdot a^K$

$11 - K = 5$

$K = 5 - 11$

$\boxed{K = 6}$

$T_{K+1} = \binom{11}{K} \cdot x^{11-K} a^K = 1386x^5$

$T_{6+1} \binom{11}{6} x^{11-6} a^6 = 1386x^5$

$T_7 = \binom{11}{6} x^5 \cdot a^6 = 1386x^5$

$T_7 = \frac{11!}{6!5!} a^6 = 1386$

$T_7 = \frac{11 \cdot 10 \cdot 9 \cdot 8 \cdot 7 \cdot \cancel{6}}{\cancel{6}! \, 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1}$

$a^6 = 1386 = \frac{55440 a^6}{120} = 1386$

$= 462 a^6 = 1386$

$462 a^6 = 1386$

$a^6 = \frac{1386}{462} = 3$

$\boxed{a = \sqrt[6]{3}}$

7.

$$(2x+y)^5 = \binom{5}{0} 2x^5 \cdot y^0 + \binom{5}{1} 2x^{4} \cdot y^1 + \binom{5}{2} 2^{3} \cdot y^2 + \ldots \binom{5}{5} 2x^0 \cdot y^5$$

$$\binom{5}{0} 2^5 + \binom{5}{1} 2^4 + \binom{5}{2} 2^3 + \binom{5}{3} 2^2 + \binom{5}{4} 2^1 + \binom{5}{5} 2^0$$

$$= 2^5 + 5 \cdot 2^4 + 10 \cdot 2^3 + 10 \cdot 2^2 + 5 \cdot 2^1 + 1 \cdot 2^0$$

$$= 32 + 80 + 80 + 40 + 10 + 1$$

$$= \boxed{243}$$