

1. Determine the coefficients for x^5y^{13} and x^8y^9 in the expansion of $(3x - 4y)^{18}$.

2. Compute

$$\sum_{k=1}^n \binom{n}{k} 2^{n-k}$$

3. A bakery sells chocolate, cinnamon, and plain doughnuts and at a particular time has 6 chocolate, 6 cinnamon, and 3 plain. If a box contains 12 doughnuts, how many different options are there for a box of doughnuts?
4. Determine the number of integral solutions of the equation

$$x_1 + x_2 + x_3 + x_4 = 20$$

which satisfy

$$1 \leq x_1 \leq 6, \quad 0 \leq x_2 \leq 7, \quad 4 \leq x_3 \leq 8, \quad 2 \leq x_4 \leq 6$$

5. Determine the number of permutations of $\{1, 2, \dots, 8\}$ in which exactly four integers are in their natural positions.
6. Determine the number of ways to place rooks on a 6×6 chessboard such that no two rooks can attack each other and none are placed on forbidden positions (marked with X):

$$\begin{array}{cc} X & X \\ X & X \\ X & X \\ X & X \\ X & X \\ & X & X \end{array}$$