1. Determine the coefficients for $x^5 y^{13}$ and $x^8 y^9$ 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
$$1 \le x_1 \le 6, \quad 0 \le x_2 \le 7, \quad 4 \le x_3 \le 8, \quad 2 \le x_4 \le 6$$

5. Determine the number of permutations of $\{1, 2, \ldots, 8\}$ 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):