

For the questions below, you do not need to come up with a final numerical answer. You can and should leave your solution as a mathematical expression, including $\binom{n}{k}$ or $P(n, k)$ notation as appropriate.

1. The company that manufactures the cereal "Sugary Flakes" decides to include one prize in each box of cereal. The company uses three types of prizes to put into the cereal boxes. A family with five children wants to buy enough boxes so that they are sure they will have at least five prizes, all of the same type. They need to buy the boxes all at once, without opening them. How many boxes must they purchase to guarantee that they will have five prizes, all of the same type?

2. What is the coefficient of x^6y^3 in the expression $(2x - 5y)^9$?

3. The math club at a school has 8 girls and 3 boys. Four kids from the team are selected to compete in the next tournament. How many ways are there to select the four competitors so that at least one boy is in the group that competes?

4. How many binary strings of length 9 begin with "00" or end with "00"? For example, the following strings would all count: **00**1011110, **00**10101**00**, 101101**00**.

5. Define the set $S = \{1, 2, 3, 4, 5, 6, 7\}$.
 - (a) How many permutations are there of the set S ? (Recall, that a permutation of a set is just an ordering of all the elements in a set).

 - (b) In how many permutations of the set S is the number 1 next to at least one even number?