Leaves your answer for the questions below as an arithmetic expression, including the \( P(n, k) \) or \( \binom{n}{k} \) notation. You do not have to compute a final numeric value.

1. What is the coefficient of \( x^3y^4 \) in \((-3x + 4y)^7\)?
2. What is the coefficient of \( x^2y^7 \) in \((5x - y)^9\)?
3. What is the coefficient of \( x^5y^3 \) in \((3x - 4y)^8\)?
4. What is the coefficient of \( x^6y^3 \) in \((-2x + 5y)^9\)?
5. Use the Binomial Theorem to find the closed form for the following sums. Recall that a closed form is an expression without a summation.
   (a) \( \sum_{k=0}^{n} \binom{n}{k}3^k(-1)^{n-k} \).
   (b) \( \sum_{k=0}^{n} \binom{n}{k}2^k \).
6. The 6th row of Pascal’s triangle is 1, 6, 15, 20, 15, 6, 1.
   (a) What is the 7th row of Pascal’s triangle?
   (b) Use your answer to the previous part to write the expanded form of \((x + y)^7\).
7. Write the following 5-tuples in increasing lexicographic order:
   \[
   \begin{align*}
   (3, 100, 101, 3, 4) & \quad (1, 1, 2, 1, 2) & \quad (3, 4, 5, 1, 1) \\
   (1, 2, 100, 1, 1) & \quad (3, 4, 5, 2, 2) & \quad (2, 101, 100, 3, 4) \\
   (2, 100, 101, 3, 4) & \quad (3, 4, 5, 2, 1) & \quad (1, 1, 2, 2, 1)
   \end{align*}
   \]
8. For each permutation of \( \{1, 2, 3, 4, 5, 6, 7\} \), give the next largest permutation in lexicographic order:
   (a) \( (1, 2, 3, 4, 5, 6, 7) \)
   (b) \( (7, 6, 5, 3, 4, 2, 1) \)
   (c) \( (1, 7, 6, 4, 2, 3, 5) \)
   (d) \( (3, 7, 6, 5, 4, 2, 1) \)
   (e) \( (5, 4, 7, 6, 3, 2, 1) \)
9. Write the permutations of \( \{1, 2, 3\} \) in lexicographic order.
10. For each 7-subset of \( \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14\} \), give the next largest 7-subset in lexicographic order:
    (a) \( \{1, 2, 3, 4, 5, 6, 7\} \)
    (b) \( \{2, 4, 5, 9, 11, 12, 13\} \)
    (c) \( \{2, 4, 5, 11, 12, 13, 14\} \)
    (d) \( \{2, 4, 5, 6, 11, 12, 14\} \)
    (e) \( \{7, 8, 10, 11, 12, 13, 14\} \)
11. Write the 3-subsets of \( \{1, 2, 3, 4, 5, 6\} \) in lexicographic order.