1. Why does the formula \((a + x)^3 = \binom{3}{0}a^3 + \binom{3}{1}a^2x + \binom{3}{2}ax^2 + \binom{3}{3}x^3\) make sense?

2. What does the Binomial Theorem say?
3. Give a combinatorial argument to show why \( \binom{n}{k} = \binom{n-1}{k} + \binom{n-1}{k-1} \).

4. Give a combinatorial argument to show why \( \binom{n}{k} \binom{k}{m} = \binom{n}{m} \binom{n-m}{k-m} \).
5. How are binomial coefficients related to Pascal’s Triangle?

6. What is the “block-walking” model for binomial coefficients?
7. Use a “committee” type of combinatorial argument to show why \( \binom{n}{0} + \binom{n}{1} + \binom{n}{2} + \cdots + \binom{n}{n} = 2^n \).

8. Use the Binomial Theorem to prove the following identities.
   (a) \( \binom{n}{0} - \binom{n}{1} + \binom{n}{2} - \cdots + (-1)^n \binom{n}{n} = 0 \)

   (b) \( 1\binom{n}{1} + 2\binom{n}{2} + 3\binom{n}{3} + \cdots + n\binom{n}{n} = n2^{n-1} \)

9. Read and understand examples 2, 3, 4, and 5.