

1. Simplify $\sum_{i,j} \binom{n}{i, j, n-i-j} 2^i 3^j$.

2. Simplify $\sum_i \binom{n}{2a+2i+1} \binom{a+i}{i}$.

3. Give upper and lower bounds for $\left(1 + \frac{1}{n}\right)^n$ that are close for large n .
An ideal solution will have at least one common term in the upper and lower bound that goes to zero as n goes to infinity.

4. Approximate the value of x that solves the equation $x = e^{ax}$ for large a . Please carry your approximation out to enough terms for all parts of the equation to have an effect on the your solution.