Question 1.

Write a combinatorial proof of the identity

$$\sum_{i=0}^{n-1}\sum_{j=0}^{n-1}\binom{n}{i}\binom{n}{j} = \sum_{k=0}^{n-1}\binom{n}{k}\left(3^{n-k}-2\right)$$

for integer $n \geq 1$.