

1. Prove the following identity for whole numbers n and r ($r \leq n$):

$$\binom{n-1}{r-1} + \binom{n-1}{r} = \binom{n}{r}, \text{ where } \binom{n}{r} = \frac{n!}{r!(n-r)!}.$$

(This is often referred to Pascal's identity. It is the basis for Pascal's triangle.)

2. Using mathematical induction, prove the binomial expansion formula. You should look for where Pascal's identity, problem 1., gets used. n & i are whole numbers with $0 \leq i \leq n$.

$$(a + b)^n = \sum_{i=0}^n \binom{n}{i} a^i b^{n-i}$$