

The Binominal Theorem

We want to expand $(x + y)^n$. First, let us look at $(x + y)^2$.

$$\begin{array}{r} x + y \\ \underline{x + y} \\ x^2 + xy \\ \quad \underline{yx + y^2} \\ x^2 + 2xy + y^2 \end{array}$$

Now let us look at $(x + y)^4$.

To do this, we take one term (an x or a y) from each of the four factors.

E.g., let us look at one of the terms: x^2y^2 . We have to pick two x 's out of 4. How many ways can we pick two x 's? There are no repetitions. We say that order does not matter, as $xy = yx$. This means we have a combination, ${}_2C_2$.

Question: Why does this expansion use combinations and not permutations?

The answer is that we start from the left and move in sequence. For example, we can take an x from the first and third factors.

Remember that there are four factors $(x + y)$.

If the order is important, that means choosing from the third and first is different from choosing from the first and third, we use permutations.

Dr. S.Aranoff, 12/6/2007