

MATH 5710

1. Binomial Theorem: $(x + y)^n = \sum_{k=0}^n \binom{n}{k} x^k y^{n-k}$

2. Pascal's Triangle:

3. The Triangle of Rationals:

4. Combinatorial Identities:

a)
$$\binom{n}{k} = \binom{n-1}{k} + \binom{n-1}{k-1}$$

b)
$$\sum_{k=1}^n k \binom{n}{k} = n \cdot 2^{n-1}$$

5. Multinomial Coefficients:

$$\binom{n}{n_1, n_2, \dots, n_r} = \frac{n!}{n_1! n_2! \dots n_r!}$$

6. Multinomial Theorem:

$$(x_1 + x_2 + \dots + x_r)^n = \sum_{\substack{(n_1, n_2, \dots, n_r) \\ n_1 + n_2 + \dots + n_r = n}} \binom{n}{n_1, n_2, \dots, n_r} x_1^{n_1} x_2^{n_2} \dots x_r^{n_r}$$

7. Is there an analog of Pascal's triangle for multinomial coefficients?