

7.3 Polynomial Powers Notes

Goal: Find a polynomial to model a probability experiment and interpret expansions of its powers.

What are some methods used to expand polynomials?

Option #1: Binomial expansion through Pascal's Triangle or Combinatorics

Example: $(x + y)^3 = 1x^3 + 3x^2y + 3xy^2 + y^3$

Remember that the coefficients are values found in the 3rd row of Pascal's triangle or can also be derived through the use of the choose function $\binom{3}{0}\binom{3}{1}\binom{3}{2}\binom{3}{3}$.

What happens if it is not a binomial expression that is being expanded?

Example: $(x + x^2 + x^3 + x^4)^2$

In such cases, you may need to take the time to do the process by hand. When working a problem by hand, it is sometimes beneficial to use an expansion box.

Option #2: Expansion Boxes

The expansion box helps you to stay better organized when **multiplying two polynomials** together.

Example: $(-1 + x)(1 + x + x^2 + x^3)$

x	1	x	x^2	x^3
-1	-1	$-x$	$-x^2$	$-x^3$
x	x	x^2	x^3	x^4

Notice that all the like terms that can be combined are located diagonally from one another. Complete the expansion box below to find the expanded form of $(x + x^2 + x^3 + x^4 + x^5 + x^6)^2$ and write it in descending order.

\cdot	x	x^2	x^3	x^4	x^5	x^6
x	■	■	■	■	■	■
x^2	■	■	x^5	■	■	■
x^3	■	■	■	■	■	■
x^4	■	■	■	■	■	■
x^5	■	x^7	■	■	■	■
x^6	■	■	■	■	■	x^{12}

Compare this to the table that you saw in 7.2 that displayed sums of two dice. The tables should be isomorphic due to the fact that in order to obtain the values in the expansion table, you add the exponents, just as you add the values of the dice.

Expanding $(x + x^2 + x^3 + x^4 + x^5 + x^6)^2$ is isomorphic to rolling two dice.

+	1	2	3	4	5	6
1	2	3	4	5	6	7
2	3	4	5	6	7	8
3	4	5	6	7	8	9
4	5	6	7	8	9	10
5	6	7	8	9	10	11
6	7	8	9	10	11	12

What would $(x + x^2 + x^3 + x^4 + x^5 + x^6)^3$ represent?

Can you use an expansion table to cube a polynomial?

Option #3: Use a CAS program on a calculator to expand a polynomial.

On a TI-89, TI-Nspire, or TI-92 there is a command to expand polynomials.

Applications:

1. A spinner is composed of 5 equal wedges of values 1, 2, 3, 3, and 8. Determine the most likely sum of the numbers from 2 spins. Then from 4 spins. Determine the probability of obtaining each of these

2. You take a multiple choice test that is composed of 5 questions that each possess four possible choices. Determine the number of outcomes that could result in 2 correct responses and 3 wrong responses. Consider the situation isomorphic to $(r + w + w + w)^5$

Assignment: **Page 553: Problems 7-13 skip #10**