Algebra 2
138
04.02 – Adding Subtracting and Multiplying Polynomials

Several Examples of the expansion of $(x + y)^n$ for n = 0, 1, 2, 3, 4, 5 are:
$(x + y)^0 = 1$
$(x + y)^1 = x + y$
$(x + y)^2 = x^2 + 2xy + y^2$
$(x + y)^3 = x^3 + 3x^2y + 3xy^2 + y^3$
$(x + y)^4 = x^4 + 4x^3y + 6x^2y^2 + 4xy^3 + y^4$
$(x + y)^5 = x^5 + 5x^4y + 10x^3y^2 + 10x^2y^3 + 5xy^4 + y^5$

In each case:
1. The number of terms is n + 1
2. The powers of x decrease by 1 on each successive term
3. The powers of y increase by 1 on each successive term
4. The coefficients are symmetric about the center term
5. For each term The sum of the powers of x and y are n

Pascal's Triangle:

0											1										
1										1		1									
2									1		2		1								
3								1		3		3		1							
4							1		4		6		4		1						
5						1		5		10		10		5		1					
6					1		6		15		20		15		6		1				
7				1		7		21		35		35		21		7		1			
8			1		8		28		56		70		56		28		8		1		
9		1		9		36		84		126		126		84		36		9		1	
10	1		10		45		120		210		252		210		120		45		10		1

Pascal's Triangle can be used to find the coefficients of the above expansions.
Observe that each line starts and ends with 1 and all other values are the sums of the immediate above values.

Examples
1. $(2x – 3y)^4$ Use the 4 line of Pascal's Triangle. The powers of 2x descend and the powers of (-3y) ascend.
   $= 1(2x)^4 + 4(2x)^3(-3y) + 6(2x)^2(-3y)^2 + 4(2x)(-3y)^3 + 1(-3y)^4$
   $= 16x^4 + 4(8x^3)(-3y) + 6(4x^2)(9y^2) + 4(2x)(-27y^3) + 81y^4$
   $= \boxed{16x^4 – 96x^3y + 216x^2y^2 – 216xy^3 + 81y^4}$

2. $(3x – 2)^3$ Use the 3 line of Pascal's Triangle.
   $= 1(3x)^3 + 3(3x)^2(-2) + 3(3x)(-2)^2 + 1(-2)^3$
   $= 27x^3 + 3(9x^2)(-2) + (9x)(4) - 8$
   $= \boxed{27x^3 – 54x^2 + 36x – 8}$

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Simplify the following.

1. $(3x^2 + 4x - 1) + (-2x^2 - 3x + 2) =$

2. $(7x^6 + 2x^5 - 3x^2 + 9x) + (5x^5 + 8x^3 - 6x^2 + 2x - 5)$

3. $(3x^3 - 2x^2 + 4x - 8) - (5x^3 + 12x^2 - 3x - 4)$

4. $(5x^6 - 2x^4 + 9x^3 + 2x - 4) - (7x^5 - 8x^4 + 2x - 11)$

5. $(5x^2 - 4x + 6)(-2x + 3)$

6. $(3x^2 + x - 2)(-4x^2 - 2x - 1)$

7. $(4x^2 - 8x - 2)(x^4 + 3x^2 + 4x)$

8. $(x - 3)(x + 2)(x + 4)$

9. $(2x + 5)(x - 2)(3x + 4)$

10. $(x - 9)(x + 9)$

11. $(m + 6)^2$

12. $(3c - 5)^2$

13. $(2y - 5)(2y + 5)$

14. $(2k + 6)^3$

15. $(g + 2)^5$

16. $(np - 1)^4$