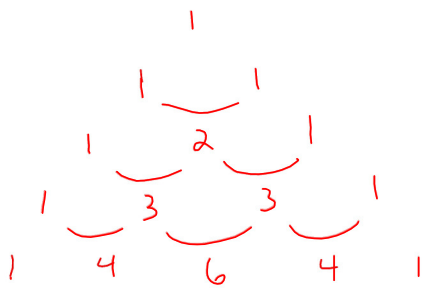


Pre-Calculus 12 Pascal's Triangle

Pascal's Triangle



Row 1	$0C_0$
Row 2	$1C_0 \quad 1C_1$
Row 3	$2C_0 \quad 2C_1 \quad 2C_2$
Row 4	$3C_0 \quad 3C_1 \quad 3C_2 \quad 3C_3$
Row 5	$4C_0 \quad 4C_1 \quad 4C_2 \quad 4C_3 \quad 4C_4$

binomial expansions: (if multiplied out would give)

$(x + y)^0 =$	1	1	coefficients (# in front of variables)
$(x + y)^1 =$	$x + y$	1 1	
$(x + y)^2 =$	$x^2 + 2xy + y^2$	1 2 1	
$(x + y)^3 =$	$x^3 + 3x^2y + 3xy^2 + y^3$	1 3 3 1	
$(x + y)^4 =$	$x^4 + 4x^3y + 6x^2y^2 + 4xy^3 + y^4$	1 4 6 4 1	

$n=4$ here

let n be the exponent of the binomial

Patterns

- The number of terms is always $n+1$ (one more than the exponent)
- The first term is $1x^n$ and the last term is $1y^n$. (coefficients of 1)
- The exponent of the first term begins with n and decreases by one for each term.
- The exponent of the second term begins with 0 and increases by one for each term.
- The sum of the exponents in each term is equal to n (the exponent of the binomial).
- The corresponding terms from either end have equal coefficients (except the middle term if there is an odd number of terms in the expansion).

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Finding the Coefficients

Pascal's Triangle

row	n	$(x+y)^n$	Coefficients														
1	0	$(x+y)^0$	1														
2	1	$(x+y)^1$	1		1												
3	2	$(x+y)^2$	1	2		1											
4	3	$(x+y)^3$	1	3		3			1								
5	4	$(x+y)^4$	1	4		6			4		1						
6	5	$(x+y)^5$	1	5		10			10		5		1				
7	6	$(x+y)^6$	1	6		15			20		15		6		1		
8	7	$(x+y)^7$	1	7		21			35		35		21		7		1

Ex. 1) Expand, using Pascal's Triangle

a.) $(x+y)^7$ $n=7$

row 8

coefficients 1 7 21 35 35 21 7 1

start at n and decrease
 ↓ start at 0 and increase

$$1x^7y^0 + 7x^6y^1 + 21x^5y^2 + 35x^4y^3 + 35x^3y^4 + 21x^2y^5 + 7x^1y^6 + 1x^0y^7$$

$$x^7 + 7x^6y + 21x^5y^2 + 35x^4y^3 + 35x^3y^4 + 21x^2y^5 + 7xy^6 + y^7$$

* Recall: anything to the power of 0 equals 1

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b.) $(3x - 1)^4$

1st term \uparrow 2nd term
 $3x$ (-1)

row 5
coefficients 1 4 6 4 1

$$\begin{aligned} & 1(3x)^4(-1)^0 + 4(3x)^3(-1)^1 + 6(3x)^2(-1)^2 + 4(3x)^1(-1)^3 + 1(3x)^0(-1)^4 \\ & 81x^4 + 4(27x^3)(-1) + 6(9x^2)(1) + 4(3x)(-1) + 1 \\ & 81x^4 - 108x^3 + 54x^2 - 12x + 1 \end{aligned}$$

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1a, 2a, 4a