1) Have out your test - fix problems you missed with quadrant 3 partner until the timer goes off.

2) Read chapter 3.7 Binomial Theorem

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Algebra 2 Section 3-7 the Binomial Theorem
Objectives

- Using Pascal's triangle with the Binomial Theorem to expand powers of binomials

- Can we answer $(x – 3)^5$ without multiplying 3 times?

$(x-3)(x-3) = x^2 - 6x + 9$

$(x^2 - 6x + 9)(x-3)$

$(x-3)$

$(x-3)$

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## Pascal's Triangle

1. The first and last numbers in each row is 1.

2. Every other number is the sum of the closest two numbers in the row directly above it.

| | | | | | | |
|---|---|---|---|---|---|---|
| Zero Row | 1 | | | | | |
| 1st Row | 1 | 1 | | | | |
| 2nd Row | 1 | 2 | 1 | | | |
| Third Row | 1 | 3 | 3 | 1 | | |
| 4th Row | 1 | 4 | 6 | 4 | 1 | |
| 5th Row | 1 | 5 | 10 | 10 | 5 | 1 |

1 _ _ + 5 _ _ + 10 _ + 10 _ _ + 5 _ +

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## Pascal's Triangle

| | | | | | | |
|---|---|---|---|---|---|---|
| N=0 oth row | 1 | | | | | |
| N=1 1st row | 1 | 1 | | | | |
| N=0 2nd row | 1 | 2 | 1 | | | |
| N=0 3rd row | 1 | 3 | 3 | 1 | | |
| N=0 4th row | 1 | 4 | 6 | 4 | 1 | |
| N=0 5th row | 1 | 5 | 10 | 10 | 5 | 1 |

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## Pascal's Triangle as combinations

$$
\begin{array}{c}
{}_0C_0 \\
{}_1C_0 \quad {}_1C_1 \\
{}_2C_0 \quad {}_2C_1 \quad {}_2C_2 \\
{}_3C_0 \quad {}_3C_1 \quad {}_3C_2 \quad {}_3C_3
\end{array}
$$

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## Binomial Theorem

- For any positive integer n, the binomial expansion of $(a + b)^n$ is:

$$ {}_nC_0 a^n b^0 + {}_nC_1 a^{n-1} b^1 + {}_nC_2 a^{n-2} b^2 + \dots {}_nC_n a^0 b^n $$

- * The C's come from Pascal's triangle
- * The a's are the first term in your binomial, notice the exponents start at n and go backwards to 0 (Decrease)
- * The b's are the second term in your binomial, notice the exponents start at 0 and go up to n (Increase)

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## Use the binomial theorem to expand

- $(x + y)^4$

$1\,x^4 y^0 + 4\,x^3 y^1 + 6\,x^2 y^2 + 4\,x^1 y^3 + 1\,x^0 y^4$

$1 \cdot x^4 \cdot 1 + 4x^3 y + 6x^2y^2 + 4xy^3 + 1 \cdot 1 \cdot y^4$

$x^4 + 4x^3y + 6x^2y^2 + 4xy^3 + y^4$

1
1 1
1 2 1
1 3 3 1
1 4 6 4 1

- $(x - 2)^3$

* $1\,x^3(-2)^0 + 3\,x^2(-2)^1 + 3\,x(-2)^2 + 1\,x^0(-2)^3$

$1 \cdot x^3 \cdot 1 + 3 \cdot x^2 \cdot -2 + 3 \cdot x \cdot 4 + 1 \cdot 1 \cdot -8$

$x^3 + -6x^2 + 12x - 8$

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## Use the binomial theorem to expand

- $(3x + y)^4$

$1\,3^4x^4 y^0 + 4\,3^3x^3\,y + 6\,3^2x^2\,y^2 + 4\,3x\,y^3 + 1\,3^0x^0\,y^4$

$1 \cdot 81 \cdot x^4 \cdot 1 + 4 \cdot 27 \cdot x^3 \cdot y + 6 \cdot 9 \cdot x^2 y^2 + 4 \cdot 3x \cdot y^3 + 1 \cdot 1 \cdot y^4$

$81x^4 + 108x^3y + 54x^2y^2 + 12xy^3 + y^4$

- $(a - 2b)^5$

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## You try!

- $(2x + 5)^4$

- $(3a - 2b)^3$

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