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POLYNOMIALS AND POLYNOMIAL OPERATIONS STUDY GUIDE

POLYNOMIALS

Polynomials are classified by two different categories: by the number of terms, and the degree of the leading exponent.

Number of Terms	Classification	Example
1	monomial	$4x^5$
2	binomial	$x^2 - 4$
3	trinomial	$x^2 - 3x + 2$

<u>Degree of a Polynomial</u>: the greatest sum of the exponents on the variables in each term.
<u>Examples</u>: $5x^4 + 3x^3$ is a fourth degree binomial.
$3x^3y^2 + 5y^4 - 3y^3$ is a fifth degree trinomial.

ADDING AND SUBTRACTING POLYNOMIALS

Add and Subtract Polynomials by doing the following:

- Combine like terms

  <u>Example</u>: $4x^2 - 3x^3 + 2x^2 - 4x + 3 - 6x = \mathbf{-3x^3 + 6x^2 - 10x + 3}$

- Distribute any subtraction signs

  <u>Example</u>: $(4x^2 - 3x + 2) - (2x^2 - 3x + 3) = \mathbf{4x^2 - 3x + 2 - 2x^2 + 3x - 3}$

- Rewrite in standard form

  <u>Example</u>: $3x - 3x^2 + 17 - 2x^4 = \mathbf{-2x^4 - 3x^2 + 3x + 17}$

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MULTIPLYING POLYNOMIALS

Use either distribution or an array model.

<table>
<tr><td>Use distribution</td><td>$(y-5)(y+3)$
$= y(y+3) - 5(y+3)$
$= y^2 + 3y - 5y - 15$

$= y^2 - 2y - 15$</td></tr>
<tr><td>Use an array model</td><td>$(y-5)(y+3)$

<table><tr><th></th><th>$\boldsymbol{y}$</th><th>$\mathbf{-5}$</th></tr><tr><td>$\boldsymbol{y}$</td><td>y^2</td><td>$-5y$</td></tr><tr><td>$\mathbf{3}$</td><td>$3y$</td><td>-15</td></tr></table></td></tr>
</table>

SOLVING FOR VARIABLES

Use properties of equality and properties of arithmetic to solve for variables.

**If necessary, factor out a variable.
Example: Solve for x:

$$3x + xy = 21y - z$$

$$x(3 + y) = 21y - z$$

$$x = \frac{21y - z}{3 + y}$$

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PASCAL'S TRIANGLE/BINOMIAL THEOREM

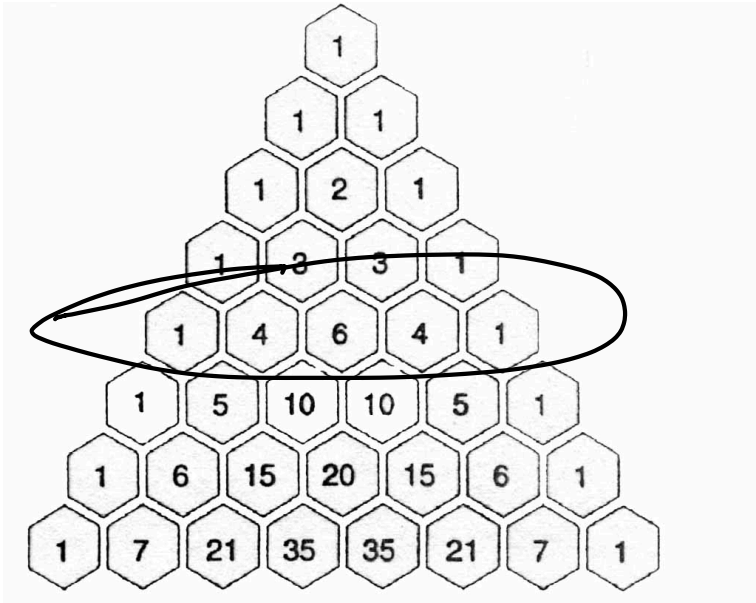
Pascal's triangle can help you determine the coefficients of variable terms in a binomial expansion.

Example:

$(x+y)^4$

$= (x+y)(x+y)(x+y)(x+y)$

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



A few other things about Pascal's Triangle:

- The number of terms in your expansion will be one more than the exponent (i.e. if you are multiplying a binomial by itself 14 times, there will be 15 terms in your expansion.

- The exponent in the leading term of the binomial will decrease by one in each term, and the exponent in the second term will increase by one in each term.

Example:

$(x+3)^5$

$= 1x^5 3^0 + 5x^4 3^1 + 10x^3 3^2 + 10x^2 3^3 + 5x^1 3^4 + 1x^0 3^5$

…and then simplify as needed.

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PROBLEM SET

Finish all problems by April 17. Let me know if you have any questions or difficulties in solving these problems. Please read all questions and follow instructions. Thanks!

1. Consider the term:

$$(2x - 3y)^4$$

a. How many terms will there be in the expansion?

b. Expand using Pascal's Triangle, show your steps (Refer to the example on page 3 if needed).

c. Expand using distribution **by first obtaining two identical trinomials**.

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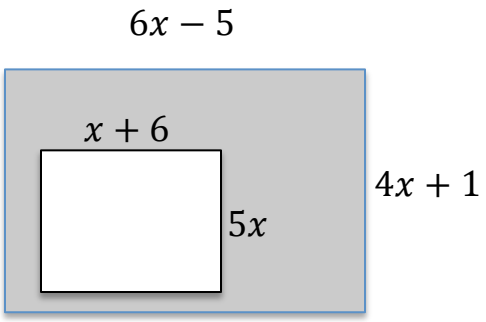
2. Find the variable expression that would best represent the area of the shaded region below.



3. Rewrite each of the expressions below by factoring out a common term. An example is shown below.
<u>*Example*</u>: $x^3 - 2x^2 + 12x = x(x^2 - 2x + 12)$

a. $12x^2 - 20x^3$

b. $3x(12y - 5z) + 3x(2a + 7b)$

c. $12(35x + 3y) + 24(3x - 2y)$

d. $(2z - 5)(w + 3) - (3w + 11)(2z - 5)$

e. $(3x - 5)(3y + 2) + (6x - 10)(5y + 12)$

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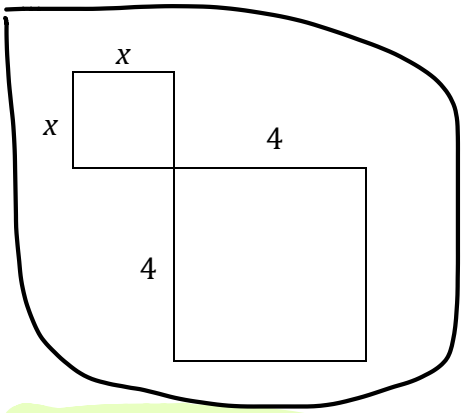
4. Consider the following array model:

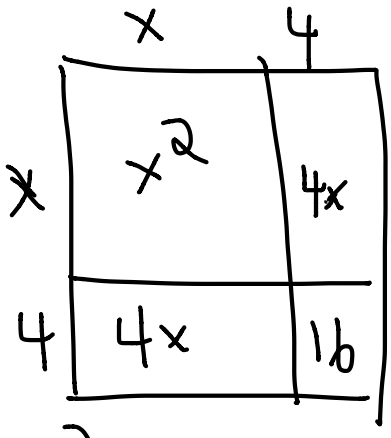


a. What is the correct **binomial expression** that represents this diagram?

x^2+16

b. Hunter thought the above diagram represented the expression: $(x+4)^2$. Use distribution AND an array model to demonstrate what he did incorrectly.

i. diagram:



$x^2+8x+16$

ii. Distribution:

$(x+4)(x+4)$

$(x\cdot x)+(x\cdot 4)+(4\cdot x)+(4\cdot 4)$

$x^2+4x+4x+16$

$x^2+8x+16$

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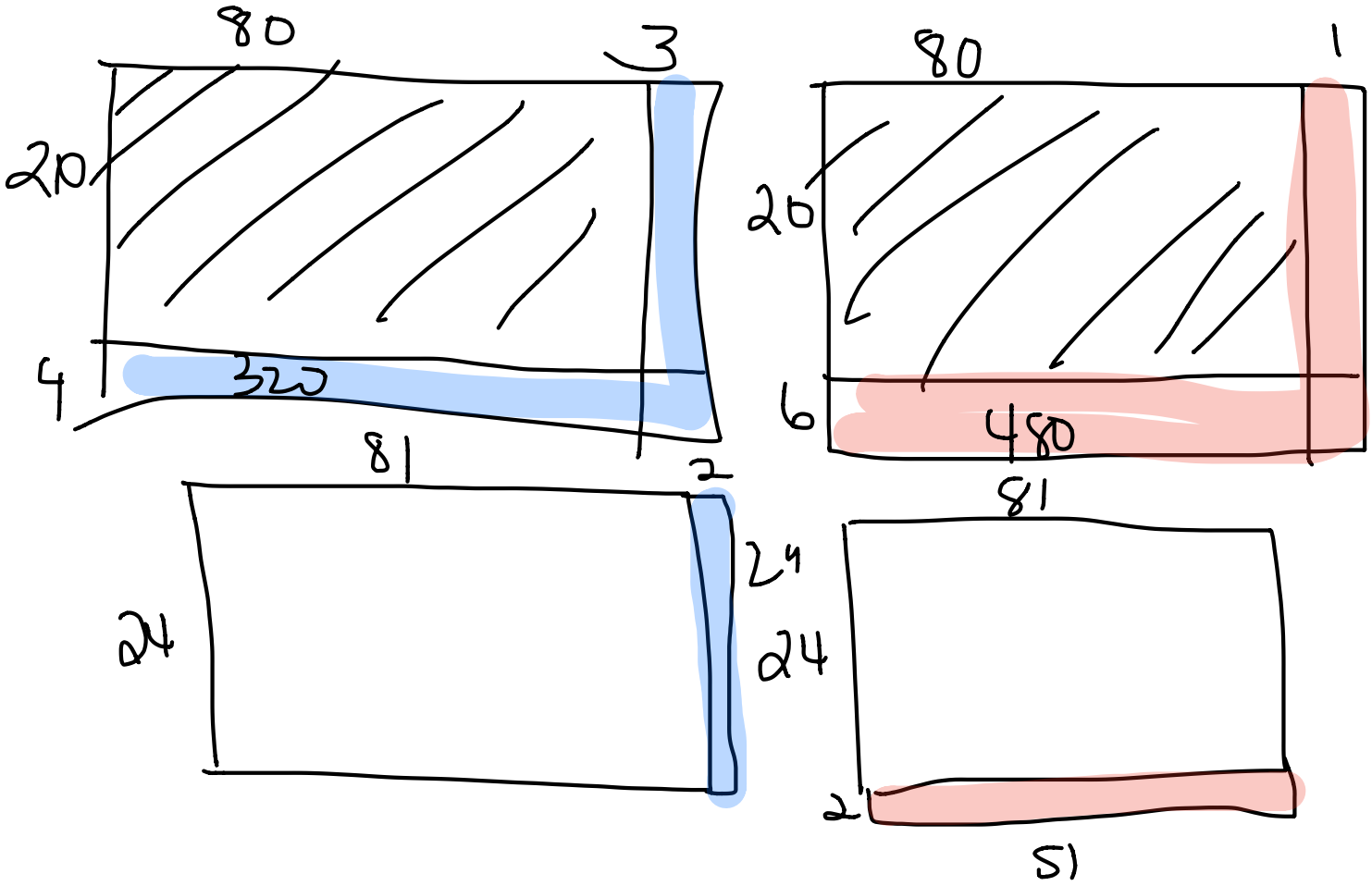
5. Which amount is greater: 24 × 83 or 26×81? Do NOT use the multiplication to answer this question!! **Draw two diagrams to explain your answer**.



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6. Answer parts (a)-(f).

a. Fill in the blanks: 8,943 = 8 ×1000 + 9 ×100 + 4 ×10 + 3 ×1.

b. Fill in the blanks: $7,427 =$ 7 $\times 10^3 +$ 4 $\times 10^2 +$ 2 $\times 10^1 +$ 7 $\times 10^0$.

c. What happens when we multiply each number above by 10? Explain using words. In the process of your explanation, please use the words "place value" and "base-10".

You add a zero at the end. Because we use base 10, multiplying by 10 means a shift to the left in place value by 1.

d. Multiply the following: $x(8x^3 + 9x^2 + 4x + 3)$.

$8x^4 + 9x^3 + 4x^2 + 3x$

e. What is the **base** of the polynomial? How is this similar/different to your answer in part (c)? "x"

f. Referring the part (d) above, what is the value of the expression if $x = 10$?

89,430