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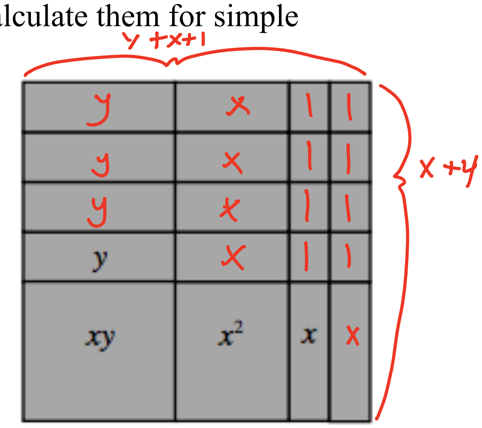
How can I find the product?

We just finished a unit about combining like terms, adding, subtracting, multiplying and dividing polynomials. And while many of your experiences of dividing have been through a step by step process without a lot of visualization, factoring can be a lot different.

Today, we'll learn about how to calculate ***factors*** of polynomials and how to calculate them for simple instances.

1. Review what you know about products and sums below:
   a. Write the area of the rectangle to the right as a product and as a sum. *(Remember that the product represents the* *area* *found by multiplying the length by the width.)*



   Area as a product: $(y+x+1)(x+4)$

   Area as a sum: $xy + x^2 + 4y + 6x + 8$

   b. Use the generic rectangle to multiply $(6x-1)(3x+2)$.

   $18x^2 + 9x - 2$

	$6x$	-1
$3x$	$18x^2$	$-3x$
$+2$	$12x$	-2

2. The process of changing a sum to a product is called **factoring.** Can every expression be factored? That is *does every sum have a product that can be represented with tiles?*

   Investigate this question by building rectangles with algebra tiles for the following expressions. For each one, write the area as a sum and as a product. If you cannot build a rectangle, be prepared to convince the class that no rectangle exists (and thus the expression cannot be **factored**).

   Skip this Section

   a. $2x^2 + 7x + 6$
   Area as product: ________

   b. $6x^2 + 7x + 2$
   Area as product: ________

   c. $x^2 + 4x + 1$
   Area as product: ________

   d. $2xy + 6x + y^2 + 3y$
   Area as product: ________

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Now that you're done with question #2, you may return the Algebra Tiles. Please do that now.

3. Work with your team to find the sum and product for the following *generic rectangles*. Are there any special strategies that you discovered that can help you determine the dimensions of the rectangle? Be sure to share these strategies with your teammates. **Write each as a product and a sum.**

	$2x$	5
$3x$	$6x^2$	$15x$
1	$2x$	5

Prod:
Sum: $6x^2+17x+5$

	y	3
$5x$	$5xy$	$15x$
-2	$-2y$	-6

Prod: $(y+3)(5x-2)$
Sum: $5xy+15x-2y-6$

	$3x$	4
$4x$	$12x^2$	$16x$
-3	$-9x$	-12

Prod: $(3x+4)(4x-3)$
Sum: $12x^2+7x-12$

What special strategies did you and your group use? ______________________________________

____

____

4. While working on problem #3, Ms. Spencer noticed a pattern with the diagonals of each generic rectangle. However, just before she shared her pattern, she was called to the office. The drawing on her paper looked like the diagram below. **Can you figure out what the two diagonals have in common?**

$2x$	5
$6x^2$	$15x$

When you multiply the diagonals the product results in the same thing; $30x^2$

5. Does Ms. Spencer's pattern always work? Verify that her pattern works for all of the 2-by-2 generic rectangles by writing your conclusion into your notebook. Be sure to include an example of this type of problem. Title this entry "Diagonals of a Generic Rectangle."

Yes, this works for all generic rectangles

Read this page and then tape it into your interactive notebook.

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METHODS AND MEANINGS

MATH NOTES

More Vocabulary for Expressions

Since algebraic expressions come in several different forms, there are special words used to help describe these expressions. For example, if the expression can be written in the form $ax^2 + bx + c$ and if a is not 0, it is called a **quadratic** expression. Review the examples of quadratic expressions below.

Examples of quadratic expressions: $x^2 - 15x + 26$

$16m^2 - 25$

$12 - 3k^2 + 5k$

The way an expression is written can also be named. When an expression is written in product form, it is said to be **factored**. When factored, each of the expressions being multiplied is called a **factor**. For example, the factored form of $x^2 - 15x + 26$ is $(x-13)(x-2)$, so $x-13$ and $x-2$ are each factors of the original expression.

Finally, if the expression is a polynomial (see Math Notes box in Lesson 3.1.2) the number of terms can help you name the polynomial. If the polynomial has one term, it is called a **monomial**, while a polynomial with two terms is called a **binomial**. If the polynomial has three terms, it is called a **trinomial**. Review the examples below.

Examples of monomials: $15y^2$ and -2

Examples of binomials: $16m - 25$ and $7h^9 + \frac{1}{2}$

Examples of trinomials: $12 - 3k^3 + 5k$ and $x^2 - 15x + 26$

In your own words, what do each of these words mean:

Factor of a polynomial:____

Factored form: ____

Monomial: ____

Binomial:____

Polynomial Term: ____

Homework:

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1. Write the area of the rectangle as a sum and as a product.

Prod: $(x-2y-4)(-3+2x)$

Sum: $2x^2+4xy-6y-11x+12$

	x	$-2y$	-4
-3	$-3x$	$-6y$	12
$2x$	$2x^2$	$4xy$	$-8x$

2. Multiply the expressions below using a generic rectangle (like the one above). Then verify Ms. Spencer's pattern from today's class activity (that the product of one diagonal equals the product of the other diagonal)

$(4x-1)(3x+5)$

	$4x$	-1
$3x$	$12x^2$	$-3x$
5	$20x$	-5

$-60x^2$ $-60x^2$

$(2x-7)^2$

	$2x$	-7
$2x$	$4x^2$	$-14x$
-7	$-14x$	49

3. In the past, you use the *Distributive Property* and common factors to change expressions written as sums into expressions written as products. For example:

I can make this conclusion:

$$12x+18=6(2x+3)$$

Since 6 is the greatest common factor of both terms I can rewrite the expression.

Here is a common factor of every term, so x^2+xy+x can be rewritten:

$$x^2+xy+x=x(x+y+1).$$

Use the greatest common factor to rewrite each sum as a product.

a. $4x+8$

$4(x+2)$

c. $2x^2-8x$

$2x(x-4)$

b. $10x+25y+5$

$5(2x+5y+1)$

d. $9x^2y+12x+3xy$

$3x(3xy+4+y)$