Algebra 1
Day 13
4/28/20

Standards	A1.ASE.1* Interpret the meanings of coefficients, factors, terms, and expressions based on their real-world contexts. Interpret complicated expressions as being composed of simpler expressions. (Limit to linear; quadratic; exponential.) A1.ASE.2* Analyze the structure of binomials, trinomials, and other polynomials in order to rewrite equivalent expressions.
Learning Targets/I Can Statements	1. I can factor polynomials by find the greatest common factor. 2. I can factor binomials using a difference of two squares
Essential Question(s)	1. What is a greatest common factor? 2. How can polynomials be factored using the greatest common factor? 3. What is a difference of two squares? 4. How is noticing a difference of two squares used in factoring?
Resources	*Algebra Success in 20 Minutes a Day* (retrieved from the Richland County Public Library Discus site)
Learning Activities or Experiences	1. Review the notes (Page 2) for factoring using the greatest common factor below (retrieved from *Algebra Success in 20 Minutes a Day* using the Richland County Public Library Discus site) 2. Review the notes (Page 3) factoring using the difference of two squares method (retrieved form *Algebra Success in 20 Minutes a Day* using the Richland County Public Library Discus site) 3. Complete **Practice Problems 1-15** on page 4.

What Is Factoring?

Factoring is the opposite of multiplying. It undoes what multiplication does. When you factor an algebraic expression, you end up with quantities called **factors** which, when multiplied, will give you the original expres- sion. In Lesson 13, you learned the rules for exponents to enable you to multiply polynomials that contain expo- nents. You will use these same skills to factor expressions. These skills are also used to solve quadratic equations, and equations are the tools that can help you solve real-life problems.

What are the factors of the number 6? Factors are the numbers you multiply to get 6, so the number 6 has two sets of factors: 1 and 6 and 2 and 3.

Finding the Greatest Common Factor

The first type of factoring you will learn is the **greatest common factor** method. With this method, you look for
the greatest factor of two or more expressions or numbers.

Example: What is the greatest common factor of 12
and 24? Factors of 12 are: 1, 2, 3, 4, 6, 12
Factors of 24 are: 1, 2, 3, 4, 6, 8, 12, 24

The greatest factor both numbers have is 12, so the greatest common factor of 12 and 24 is 12.

Example: What is the greatest common factor of 18
and 27? Factors of 18 are: 1, 2, 3, 6, 9, 18
Factors of 27 are: 1, 3, 9, 27

The greatest factor both numbers have is 9, so the greatest common factor of 18 and 27 is 9.

Another approach to finding the greatest common factor of two expressions is to factor a number until all its factors are prime factors. **Prime factors** are factors that cannot be factored further. The factors of a prime num- ber are 1 and the number itself. The number 5 is prime because its only factors are 1 and 5.

Both numbers have $2 \cdot 5 \cdot a \cdot a \cdot b$ in common, so the greatest common factor is $10a^2b$.

Factoring Using the Greatest Common Factor Method

To factor an expression like $2x + 6$, find the greatest common factor of both terms. In this expression, the factors of $2x$ are 2 and x, and the factors of 6 are 2 and 3, so the greatest common factor is 2. To factor the expression, put
the greatest common factor outside the parentheses and put what is left inside the parentheses.

Examples: $2x + 6 = 2(x + 3)$

When you use the distributive property on $2(x + 3)$, you will get the original expression, $2x + 6$. You can check your answer by multiplying the factors. You should get the expression you started with, or else you did not factor it correctly.

You can factor the expression $6x + 18$ in two ways:

$6x + 18 = 2(3x + 9)$

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

For which one did we factor out the *greatest* common factor? Remember that you are factoring using the great-
est common factor method. The greatest common factor is 6, so the correct answer is $6(x + 3)$.

Factoring Using the Difference of Two Squares Method

The second type of factoring is the difference of two squares. You will find this method easy to do. But before you learn this method, you need to review the concept of squares. What is a square? A number or expression multi- plied by itself equals a **perfect square**. Examples of perfect squares are:

4 because $2 \cdot 2 = 4$
9 because $3 \cdot 3 = 9$
25 because $5 \cdot 5 = 25$
a^2 because $a \cdot a = a^2$
$16b^2$ because $4b \cdot 4b = 16b^2$
d^{10} because $d^5 \cdot d^5 = d^{10}$

Tip

Any even numbered exponent is a perfect square because when you multiply, you add exponents.
Example: $c^{12} = c^6 \cdot c^6$.

The method of factoring using the difference of two squares is an easy pattern to remember. The pattern is $(x + y)(x - y)$, where x is the square root of the first term and y is the square root of the second term.

Example: $x^2 - 4$

Both x^2 and 4 are perfect squares, and they are connected by a subtraction sign, which is why the expression is called the *difference* of two squares. To factor the expression, take the square root of the first term and the square root of the second term. Write it like this: $(x + 2)(x - 2)$.

Tip

The *sum* of two squares cannot be factored. Example: $x^2 + 4$ is prime. It cannot be factored.

Here are two more examples:

Example: $y^2 - 9$

$= (y + 3)(y - 3)$

Example: $16a^2 - 25b^2$

$= (4a + 5b)(4a - 5b)$

Practice Problems

Factor these expressions using the greatest common factor method.

1. $5x + 25$	**2.** $100a + 300$
3. $15a^2b^2 + 15ab^2$	**4.** $22xy + 11x$
5. $5x + 9$	**6.** $16x^2 + 20x$
7. $x^2y + 3x$	**8.** $8x^3 - 2x^2 + 4x$

Factor these expressions using the difference of two squares method.

9. $16r^2 - 121$	**10.** $y^2 - 64$
11. $x^2y^2 - 49$	**12.** $25x^2 - 4y^2$
13. $b^2 - 100$	**14.** $x^4 + 1$
15. $16a^2 - 25b^2$	