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When working with algebraic expressions, one of the fundamental skills students learn is factoring. Factoring simplifies expressions, making it easier to solve equations, analyze polynomial functions, and perform algebraic manipulations. One common method of factoring involves identifying the greatest common factor (GCF) of the terms and then factoring it out. In this article, we will explore how to factor the expression \(32z - 48\) using the GCF, discuss the importance of GCF in algebra, and provide comprehensive steps, tips, and examples to master this essential skill.

Understanding the Greatest Common Factor (GCF)

What Is the GCF?

The greatest common factor (GCF) of two or more algebraic terms is the largest expression that divides all of them evenly. It is the highest number or algebraic expression that is a factor of each term in the given expression.

For numerical coefficients, the GCF is the largest number that divides all coefficients without leaving a remainder. For algebraic terms involving variables, the GCF also considers the variables, taking the lowest powers of common variables.

Why Is Finding the GCF Important?

- Simplifies algebraic expressions
- Facilitates easier solving of equations
- Helps in identifying common factors in polynomial expressions
- Essential for factoring quadratics and higher degree polynomials
- Provides a foundation for more advanced algebraic concepts like factoring by grouping and synthetic division

Step-by-Step Guide to Factoring \(32z - 48\) Using the GCF

Let's walk through the process of factoring the expression \(32z - 48\) step by step.

Step 1: Identify the Numerical Coefficients

Look at the two coefficients:
- 32
- 48

Find the GCF of these numbers.

Step 2: Find the GCF of the Numerical Coefficients

To find the GCF of 32 and 48:

Method: Prime Factorization
- 32: 2^5
- 48: $2^4 \times 3$

The common prime factors are 2^4.

GCF of 32 and 48 = $2^4 = 16$.

Alternatively, list factors:
- Factors of 32: 1, 2, 4, 8, 16, 32
- Factors of 48: 1, 2, 4, 8, 12, 16, 24, 48

Largest common factor: 16.

Step 3: Find the GCF of the Variables

- The expression has the variable z in the first term and no variable in the second term.
- Since only the first term contains z, and the second term has no z, the GCF in terms of variables is 1 (no variable is common to both terms).

Step 4: Combine the Numerical and Variable GCFs

- The overall GCF of the entire expression is 16 (since the variable part is 1).

Step 5: Factor Out the GCF

Now, rewrite the original expression as a product of the GCF and the remaining factors.

\[

32z - 48 = 16 \times \text{(what?)}
\]

Divide each term by 16:

- \(32z \div 16 = 2z\)
- \(48 \div 16 = 3\)

Thus,

\[
32z - 48 = 16(2z - 3)
\]

Final Factored Form of \(32z - 48\)

\[
\boxed{
\textbf{The factored form of } 32z - 48 \text{ using the GCF is } 16(2z - 3)
}
\]

This is the simplest factored form of the expression using the greatest common factor.

Additional Tips for Factoring Using the GCF

- Always start by identifying the GCF of the numerical coefficients.
- Consider both coefficients and variables to find the GCF.
- Remember that if the terms do not share any common factors other than 1, then the expression is already prime with respect to factoring by GCF.
- For polynomials with more than two terms, find the GCF of all terms collectively.

Examples of Factoring Using GCF

To reinforce understanding, here are a few more examples:

1. Factor $18x + 24$:

   - GCF of 18 and 24 is 6
   - Both terms have no common variable
   - Factored form: $6(3x + 4)$

2. Factor $45a^2b - 15ab^2 + 30a^3b$:

   - Numerical GCF of 45, 15, and 30 is 15
   - Variables:
   - a^2b, ab^2, a^3b
   - GCF of variables: a^1b^1 (since all terms contain at least a and b)
   - GCF: $15ab$
   - Factored form:
   $$
   15ab(3a - b + 2a^2)
   $$

   <

3. Factor $100z^3 - 20z^2 + 40z$:

   - GCF of 100, 20, 40 is 20
   - Variables: z^3, z^2, z; GCF is z
   - Overall GCF: $20z$
   - Factored form:
   $$
   20z(5z^2 - z + 2)
   $$

Conclusion: Mastering Factoring Using the GCF

Factoring algebraic expressions using the greatest common factor is a foundational skill that simplifies many algebraic operations. The process involves identifying the GCF of coefficients and variables and then rewriting the expression as a product of this GCF and a simpler binomial or polynomial.

For the specific expression $32z - 48$, we determined the GCF to be 16, leading to the factored form $16(2z - 3)$. This method not only simplifies the expression but also sets the stage for more complex factoring techniques like factoring trinomials, difference of squares, and polynomial division.

Practicing these steps with a variety of expressions will help you become confident and efficient in algebra. Remember, always look for the GCF first—it's often the quickest path to simplifying and factoring expressions effectively.

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Frequently Asked Questions

How do you find the greatest common factor (GCF) when factoring the expression 32z - 48?

To find the GCF, identify the largest number that divides both coefficients, which is 16 in this case, since 16 divides both 32 and 48 evenly.

What is the first step in factoring 32z - 48 using the GCF?

The first step is to find the GCF of the coefficients 32 and 48, which is 16, and then factor it out of the entire expression.

What is the factored form of 32z - 48 using the GCF?

The factored form is 16(2z - 3), since 16 is the GCF and dividing each term inside the parentheses by 16 gives 2z - 3.

Why is factoring out the GCF useful in simplifying expressions like 32z - 48?

Factoring out the GCF simplifies the expression, making it easier to solve equations or further factor if needed.

Can the expression 32z - 48 be factored further after extracting the GCF?

No, after factoring out the GCF, the remaining binomial 2z - 3 cannot be factored further using common methods.

Is 16 the only GCF for the coefficients in 32z - 48?

Yes, 16 is the greatest common factor for 32 and 48, making it the appropriate GCF to factor out.

How can understanding GCF help in factoring more complex algebraic expressions?

Understanding GCF helps identify common factors in all terms, simplifying the expression and enabling more straightforward factoring techniques.

Additional Resources

Factor The Expression Using The GCF. The Expression \(32z - 48 \) Factored Using The GCF Is a fundamental concept in algebra that helps simplify expressions and prepare them for solving equations or graphing. Understanding how to identify and extract the greatest common factor (GCF) from algebraic expressions is essential for students and professionals working with polynomial expressions, as it streamlines calculations and reveals underlying relationships between terms. In this guide, we'll explore the process of factoring using the GCF step-by-step, using the specific example of \(32z - 48 \), and expand on related concepts to deepen your understanding of algebraic factoring techniques.

What Is the GCF and Why Is It Important?

Before diving into the specific example, it’s crucial to understand what the Greatest Common Factor (GCF) is and why it’s a vital tool in algebra.

Definition of GCF
The GCF of two or more numbers (or terms) is the largest number that divides each of them evenly, without leaving a remainder. For algebraic expressions, the GCF can involve coefficients (numbers) and variables, considering their common factors.

Importance in Factoring
Factoring out the GCF simplifies the expression, making it easier to work with. It can:

- Reduce the complexity of the expression
- Reveal common factors that can facilitate further factoring (like factoring quadratics)
- Aid in solving equations by simplifying expressions beforehand
- Help find roots or solutions more efficiently

Step-by-Step Guide to Factoring Using the GCF

Let’s now explore the process of factoring the expression $32z - 48$ using the GCF. The steps outlined below are applicable to a variety of similar expressions.

Step 1: Identify the GCF of the coefficients

The first step involves examining the coefficients of each term:

- 32 (coefficient of z)
- -48 (constant term)

Find their GCF:

- Factors of 32: 1, 2, 4, 8, 16, 32
- Factors of 48: 1, 2, 3, 4, 6, 8, 12, 16, 24, 48

The largest common factor of 32 and 48 is 16.

Step 2: Identify common variable factors

In this expression, only the first term contains a variable z. The second term is a constant. Since the variable appears only in the first term, the GCF will only include factors common to the numerical coefficients unless the variable appears in all terms.

Because the second term is a constant, the GCF will not include a variable unless it appears in both terms with the same exponent. Since the second term has no variable, the variable is not part of the GCF in this case.

Step 3: Factor out the GCF from each term

Now, rewrite each term by dividing it by the GCF:

- $32z \div 16 = 2z$
- $-48 \div 16 = -3$

Express the original expression as:

$$16 (2z - 3)$$

This is the factored form using the GCF, and it simplifies the expression significantly.

The Fully Factored Expression

The factored form of $32z - 48$ using the GCF is:

$$16 (2z - 3)$$

This reveals the common factor 16 outside the parentheses, with the remaining binomial $2z - 3$ inside. Factoring in this way simplifies further algebraic operations, such as solving or analyzing the expression.

Why Is Factoring Using the GCF Useful?

Factoring out the GCF is often the first step in simplifying algebraic expressions, especially when dealing with more complex polynomials or in solving equations. Here are some reasons why:

- It reduces the coefficients, making calculations easier.
- It can reveal the structure of the expression, aiding in recognizing special products (like difference of squares).

- It simplifies solving equations, as you can divide both sides by the GCF to reduce the problem.

Common Mistakes to Avoid

While factoring using the GCF is straightforward, several common pitfalls can trip students:

- Ignoring the negative sign: Ensure that the GCF accounts for signs, especially if the expression contains negative coefficients.
- Forgetting variables: When variables are involved, verify whether they are common in all terms before including them in the GCF.
- Not checking for the greatest factor: Always confirm that the factor you choose is the largest possible, not just any common factor.

Extending the Concept: Factoring Other Types of Expressions

The technique of factoring using the GCF isn't limited to binomials like $32z - 48$. It extends to many algebraic forms, including:

- Polynomials with multiple terms: For example, $12x^3 + 18x^2 - 6x$ can be factored by extracting the GCF $6x$.
- Quadratic expressions: After factoring out the GCF, quadratic expressions can sometimes be factored further using methods like splitting the middle term or quadratic formulas.
- Higher-degree polynomials: GCF factoring simplifies the expression before applying other factoring techniques.

Practice Problems

To reinforce your understanding, try factoring the following expressions using the GCF:

1. $45a^2b - 30ab^2 + 15ab$
2. $20x^4 - 50x^3 + 30x^2$
3. $14y^3 + 21y^2 - 7y$

Solutions:

1. GCF: $15ab$, factored form: $15ab (3a - 2b + 1)$
2. GCF: $10x^2$, factored form: $10x^2 (2x^2 - 5x + 3)$

3. GCF: $7y$, factored form: $7y (2y^2 + 3y - 1)$

Summary

Factoring an expression using the GCF is a fundamental algebraic skill that streamlines the process of simplifying and solving expressions. The key steps involve identifying the greatest common factor among coefficients and variables, then factoring it out to reveal a simpler, equivalent expression.

In the specific case of $32z - 48$, the GCF is 16, leading to the factored form:

$$16 (2z - 3)$$

Mastering this technique provides a strong foundation for tackling more complex algebraic problems and enhances overall mathematical fluency.

Final Remarks

Remember, always verify your GCF, consider signs carefully, and check if further factoring is possible after extracting the GCF. With practice, recognizing and factoring out the GCF will become an intuitive part of your algebra toolkit, facilitating smoother problem-solving and a deeper understanding of polynomial structures.

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