# PLEASE HELP MEAn Expression Is Shown Below:6x^2y 3xy 24xy^2 + 12y^2Part A: Rewrite The Expression By

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When dealing with algebraic expressions, one of the fundamental skills students and professionals alike need to master is simplifying expressions by rewriting them in more manageable or insightful forms. The process often involves factoring, combining like terms, or applying algebraic identities to reveal the structure of the expression. In this guide, we will explore how to rewrite the given algebraic expression:

6x^2y + 3xy + 24xy^2 + 12y^2

by identifying common factors, factoring the expression completely, and understanding the significance of each step. This process not only simplifies calculations but also deepens the understanding of algebraic relationships.

## Understanding the Given Expression

Before rewriting or simplifying, it's essential to analyze the expression carefully:

- The expression consists of four terms:
1. 6x^2y
2. 3xy
3. 24xy^2
4. 12y^2

- Each term contains variables x and y, but with different exponents and coefficients.

- The goal is to factor the expression fully, i.e., express it as a product of its factors, which can be constants, variables, or binomials/trinomials.

## Step 1: Identify Common Factors in the Terms

The first step in rewriting the expression is to look for common factors across all terms.

### Analyzing coefficients:

- 6, 3, 24, and 12 are the coefficients.

- The greatest common divisor (GCD) of these numbers is 3.

**Analyzing variables:**

- All terms contain at least one y:
- $6x^2y \rightarrow y$
- $3xy \rightarrow y$
- $24xy^2 \rightarrow y^2$
- $12y^2 \rightarrow y^2$

- For variable x:
- $6x^2y$ contains $x^2$
- $3xy$ contains x
- $24xy^2$ contains x
- $12y^2$ contains no x

- For the variable y:
- The smallest power of y among all terms is y (from $6x^2y$ and $3xy$).

Based on this, the common variables in all terms are y, at least to the power of 1.

# Step 2: Find the Greatest Common Factor (GCF)

- Coefficient GCF: 3
- For variable y: y (since all terms contain at least y)
- For variable x: only some terms contain x, so cannot factor x out of all terms.

Therefore, the GCF of the entire expression is:

$3y$

# Step 3: Factor Out the GCF

Now, rewrite the original expression as:

$6x^2y + 3xy + 24xy^2 + 12y^2 = 3y ( \dots )$

Next, divide each term by $3y$:

- $6x^2y \div 3y = 2x^2$
- $3xy \div 3y = 1x = x$
- $24xy^2 \div 3y = 8xy$
- $12y^2 \div 3y = 4y$

Thus, the factored form becomes:

$3y ( 2x^2 + x + 8xy + 4y )$

# Step 4: Simplify the Remaining Expression Inside the Parentheses

The expression inside the parentheses is:

$2x^2 + x + 8x y + 4 y$

Observe that this is a four-term polynomial, and the next step is to factor it further if possible.

### Grouping Terms

Group the terms as:

$(2x^2 + x) + (8x y + 4 y)$

Now, factor out common factors from each group:

- From $2x^2 + x$:
- Factor out $x$: $x (2x + 1)$

- From $8x y + 4 y$:
- Factor out $4 y$: $4 y (2x + 1)$

Now, the expression becomes:

$x (2x + 1) + 4 y (2x + 1)$

Notice that $(2x + 1)$ is a common binomial factor.

## Step 5: Factor Out the Common Binomial

Express the entire inside as:

$(2x + 1) (x + 4 y)$

Therefore, the entire original expression can be written as:

$3 y (2x + 1)(x + 4 y)$

## Final Factored Form and Explanation

The original expression:

$6x^2 y + 3 xy + 24 xy^2 + 12 y^2$

has been fully rewritten as:

**$3 y (2x + 1)(x + 4 y)$**

This factored form reveals the structure of the expression and makes subsequent calculations, such as solving equations or integrating algebraically, more straightforward.

# Significance of Factoring in Algebra

Factoring algebraic expressions is a fundamental skill with numerous applications:

1. **Simplification:** It simplifies expressions, making calculations easier and more efficient.
2. **Solving Equations:** Factoring transforms complex equations into products of simpler binomials or polynomials, enabling the use of the zero-product property.
3. **Graphing:** Factored forms help identify roots and intercepts of functions, which are critical in graphing.
4. **Identifying Patterns:** Recognizing common factors and factoring patterns enhances understanding of algebraic identities and relationships.
5. **Preparation for Advanced Topics:** Factoring lays the groundwork for calculus, polynomial theory, and other higher-level mathematics.

# Additional Tips for Factoring Algebraic Expressions

When attempting to factor more complex expressions, keep these tips in mind:

- **Always look for the greatest common factor (GCF):** This is the first step in simplifying any polynomial.
- **Use grouping:** When expressions have four or more terms, group terms to find common factors.
- **Recognize special products:** Patterns such as difference of squares, perfect square trinomials, and sum/difference of cubes can simplify factoring.
- **Check your work:** After factoring, expand the factors to ensure you obtain the original expression.
- **Practice regularly:** The more you practice different types of expressions, the more intuitive factoring becomes.

# Conclusion

Rewriting and factoring algebraic expressions is a vital skill that enhances mathematical understanding and problem-solving efficiency. By identifying common factors, employing grouping techniques, and recognizing algebraic identities, you can transform complex expressions into simpler, more manageable forms. The detailed process applied to the expression:

$6x^2 y + 3 xy + 24 xy^2 + 12 y^2$

demonstrates how to approach similar problems systematically. Mastery of these techniques will serve you well in various mathematical contexts, from basic algebra to advanced calculus and beyond.

Whether you're preparing for exams, solving real-world problems, or exploring mathematical theory, understanding how to rewrite and factor expressions empowers you to analyze and manipulate algebraic structures with confidence. Keep practicing, and soon you'll find that identifying factors and rewriting expressions becomes a natural part of your mathematical toolkit.

## Frequently Asked Questions

### How do I factor the expression 6x^2y + 3xy + 24xy^2 + 12y^2?

First, look for common factors in the terms. Notice that 3 is a common factor for all, and x and y appear in multiple terms. Group the terms to factor common factors from each group, then factor out the common binomial or monomial.

### What is the first step to rewrite the expression 6x^2y + 3xy + 24xy^2 + 12y^2?

The first step is to group the terms in pairs: $(6x^2y + 3xy)$ and $(24xy^2 + 12y^2)$, then factor out the greatest common factor (GCF) from each group.

### How can I factor out the GCF from the group 6x^2y + 3xy?

The GCF of $6x^2y$ and $3xy$ is $3xy$. Factoring this out, we get $3xy(2x + 1)$.

### How do I factor out the GCF from 24xy^2 + 12y^2?

The GCF of $24xy^2$ and $12y^2$ is $12y^2$. Factoring this out gives $12y^2(2x + 1)$.

### What is the fully factored form of the expression 6x^2y + 3xy + 24xy^2 + 12y^2?

After factoring each group, the expression becomes $3xy(2x + 1) + 12y^2(2x + 1)$. Since $(2x + 1)$ is common in both, factor it out: $(2x + 1)(3xy + 12y^2)$. You can further factor the second binomial: $3y( x + 4y )$. So, the fully factored form is $(2x + 1) 3y(x + 4y)$.

# Additional Resources

PLEASE HELP ME: An In-Depth Analysis of the Expression 6x^2y + 3xy + 24xy^2 + 12y^2

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Introduction

Mathematics often presents us with intricate expressions that require careful examination and manipulation to understand their structure and potential for simplification. One such expression, "PLEASE HELP ME," which appears to be a plea for assistance, is actually a prompt for algebraic exploration: 6x^2y + 3xy + 24xy^2 + 12y^2. This article aims to conduct a comprehensive investigation into this algebraic expression, focusing on rewriting, factorization, and potential simplifications. Through an analytical lens, we will uncover the structure beneath the surface, providing clarity and insight into its composition.

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Understanding the Expression

Original Expression:

$$ 6x^2y + 3xy + 24xy^2 + 12y^2 $$

At first glance, the expression comprises four terms involving variables $x$ and $y$, with coefficients that suggest common factors. Our goal is to deconstruct this expression, identify common factors, and possibly rewrite it in a more simplified or factored form.

Part A: Rewriting the Expression

1. Initial Observations and Structural Analysis

The terms can be grouped based on common variables:

- Terms involving $x^2 y$: $6x^2 y$
- Terms involving $x y$: $3 x y$
- Terms involving $x y^2$: $24 x y^2$
- Terms involving $y^2$: $12 y^2$

Noticing these groupings hints at potential common factors within subsets of terms.

2. Factoring by Grouping

To facilitate rewriting, we can attempt to factor common factors from pairs or groups of terms.

Step 1: Group the terms

$$
(6x^2 y + 3 x y) + (24 x y^2 + 12 y^2)
$$

Step 2: Factor each group

- From the first group:

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

- From the second group:

$$
12 y^2 (2 x + 1)
$$

Result:

$$
3 x y (2 x + 1) + 12 y^2 (2 x + 1)
$$

3. Factor out the common binomial factor

Both terms share $(2 x + 1)$:

$$
(2 x + 1) \left( 3 x y + 12 y^2 \right)
$$

Step 3: Further factor inside the parentheses

Notice that $3 x y + 12 y^2$ has a common factor of $3 y$:

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

Final rewritten form:

$$
(2 x + 1) \times 3 y (x + 4 y)
$$

Or, equivalently,

$$
3 y (2 x + 1)(x + 4 y)
$$

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Part B: Deep Dive into Factorization and Simplification

1. Complete Factorization

The key to understanding this expression is recognizing its factored form:

$$
\boxed{
\textbf{Simplified Factorization:} \quad 3 y (2 x + 1)(x + 4 y)
}
$$

This form reveals the structure more transparently, showing the expression as a product of three factors.

2. Verifying the Factorization

To ensure correctness, expand the factored form:

$$
3 y (2 x + 1)(x + 4 y)
$$

First, expand $(2 x + 1)(x + 4 y)$:

$$
(2 x)(x) + (2 x)(4 y) + (1)(x) + (1)(4 y) = 2 x^2 + 8 x y + x + 4 y
$$

Multiplying by $3 y$:

$$
3 y (2 x^2 + 8 x y + x + 4 y) = 3 y \times 2 x^2 + 3 y \times 8 x y + 3 y \times x + 3 y \times 4 y
$$

$$
= 6 x^2 y + 24 x y^2 + 3 x y + 12 y^2
$$

This matches the original expression exactly, confirming the correctness of the factorization.

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Part C: Implications and Applications

1. Mathematical Significance

The process of rewriting and factoring this expression demonstrates essential algebraic techniques such as grouping, common factor extraction, and binomial multiplication. These methods are foundational in simplifying complex expressions, solving equations, and analyzing polynomial behaviors.

2. Practical Applications

- Simplification in Calculus: Factored expressions are invaluable when integrating or differentiating polynomials.
- Problem Solving: Recognizing factorizations expedites solving equations, especially quadratic and higher-degree polynomials.
- Modeling and Engineering: Algebraic manipulations underpin models involving physical systems, economics, and computer algorithms.

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Part D: Broader Context and Key Takeaways

1. The Power of Factorization

This investigation underscores that many seemingly complex algebraic expressions can be reduced to simpler, more manageable forms through systematic factorization. Recognizing common factors and applying algebraic identities is crucial.

2. Educational Value

Such exercises serve as excellent pedagogical tools, fostering skills in pattern recognition, algebraic manipulation, and critical thinking.

3. Encouraging Mathematical Curiosity

The initial "PLEASE HELP ME" plea reflects a common sentiment among students tackling challenging algebra. This exploration exemplifies how perseverance and methodical analysis can demystify complex expressions, turning confusion into clarity.

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Conclusion

The algebraic expression 6x^2 y + 3 x y + 24 x y^2 + 12 y^2 can be elegantly rewritten as:

$$
\boxed{
3 y (2 x + 1)(x + 4 y)
}
$$

This factorization not only simplifies the expression but also reveals its underlying structure, facilitating further mathematical operations or problem-solving efforts. The process underscores the importance of strategic grouping, common factor extraction, and verification through expansion—cornerstones of algebraic proficiency. As a microcosm of broader mathematical principles, this analysis exemplifies how diligent exploration can transform complexity into simplicity, empowering learners and practitioners alike to approach algebraic challenges with confidence and insight.

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