Factorise 3x Yz-2x3y-xyz

Factorise 3x Yz-2x3y-xyz: A Comprehensive Guide to Algebraic Expression Factorisation

Understanding how to factorise algebraic expressions is a fundamental skill in mathematics that enhances problem-solving abilities and algebraic manipulation. In this article, we will dive deep into the process of factorising the expression 3x Yz - 2x3y - xyz, explaining each step in detail, providing useful tips, and exploring related concepts to help you master the art of algebraic factorisation.

Understanding the Expression: 3x Yz - 2x3y - xyz

Before we begin factorising, let's analyze the given expression:

Expression: 3x Yz - 2x3y - xyz

Notice that the expression contains three terms, each involving variables x, y, and z, with some coefficients. To simplify the process, we'll first write the expression clearly:

- 3x Yz
- - 2x3y
- - xyz

Note: It appears that the notation might be inconsistent or ambiguous, especially with "Yz" and "xyz". For clarity, we assume:

- "Yz" refers to the variables y and z multiplied together, possibly with a coefficient.
- "3x Yz" suggests 3 times x times y times z, or 3x y z.
- "2x3y" suggests 2 times x times 3 times y, which simplifies to 6xy.
- "xyz" is straightforward: x y z.

Based on this, the expression can be rewritten as:

\[3 x y z - 6 x y - x y z \]

Important: Clarifying the notation is crucial. If the interpretation above is correct, then the expression is:

\[3xyz - 6xy - xyz \]

Let's verify and proceed with this assumption.

Rewriting and Simplifying the Expression

Given the above, the expression simplifies as:

$$ 3xyz - 6xy - xyz $$

Now, combine like terms:

$$ (3xyz - xyz) - 6xy = 2xyz - 6xy $$

Expressed more simply:

$$ 2xyz - 6xy $$

Note: For clarity, let's factor out the common factors from this simplified expression.

Factoring the Simplified Expression

The simplified form is:

$$ 2xyz - 6xy $$

Identify common factors:

- Both terms have 2.
- Both terms have xy.

Therefore, factor out 2xy:

$$ 2xy(z - 3) $$

This is the fully factored form of the simplified expression.

Step-by-Step Guide to Factorising the Original Expression

If the original expression was intended differently, or if the notation involves different variables or coefficients, the process remains similar. Here's a general approach:

Step 1: Clarify the Expression

- Write the expression clearly.
- Identify all coefficients and variables.
- Ensure the notation is consistent.

Step 2: Simplify the Expression

- Combine like terms.
- Use algebraic rules to simplify coefficients.

Step 3: Find Common Factors

- Look for the greatest common factor (GCF) among all terms.
- Factor out the GCF.

Step 4: Use Recognised Factoring Patterns

- Recognise patterns such as difference of squares, perfect square trinomials, sum or difference of cubes.
- Apply appropriate formulas.

Step 5: Factor Completely

- Continue factoring if the resulting expression can be factored further.
- Verify the final factored form by expanding it back.

Detailed Explanation of Each Step with Examples

Example 1: Factoring a Simple Polynomial

Consider the expression:

$$6x^2 + 9x$$

- GCF is $3x$:

$$3x(2x + 3)$$

- The expression is now fully factored.

Example 2: Factoring the Difference of Squares

Expression:

$$ x^2 - 16 $$

- Recognise as a difference of squares:

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

Applying to Our Expression: 2xyz - 6xy

- GCF is 2xy:

$$ 2xy(z - 3) $$

- The expression is fully factored as the product of 2xy and (z - 3).

Additional Techniques in Algebraic Factorisation

While the example above involves straightforward GCF extraction, other techniques can be useful for more complex expressions:

1. Factoring Trinomials

- Use methods like splitting the middle term, or the quadratic formula when necessary.

2. Recognising Special Patterns

- Sum or difference of cubes:

$$ a^3 \pm b^3 = (a \pm b)(a^2 \mp ab + b^2) $$

- Perfect square trinomials:

$$ a^2 \pm 2ab + b^2 = (a \pm b)^2 $$

3. Grouping Terms

- Group terms to factor common binomials.

Common Mistakes to Avoid

- Misinterpreting notation: Always clarify variables and coefficients.
- Overlooking common factors: Always check for the greatest common factor.
- Forgetting to fully expand and verify: After factoring, expand to ensure correctness.
- Ignoring special patterns: Recognising patterns can simplify the process significantly.

Practice Problems for Mastery

To reinforce your understanding, try factoring these expressions:

1. $12a^2b + 18ab^2$
2. $x^2 - 9$
3. $8x^3 + 27$
4. $4x^2 + 4x + 1$

Solutions:

1. $6ab(2a + 3b)$
2. $(x + 3)(x - 3)$
3. $(2x + 3)^3$ (sum of cubes)
4. $(2x + 1)^2$ (perfect square trinomial)

Conclusion

Factorising algebraic expressions like $3x Yz - 2x3y - xyz$ involves understanding the structure of the terms, simplifying where necessary, and systematically extracting common factors. Whether dealing with simple polynomials or complex expressions, mastering the techniques outlined—such as identifying common factors, recognising patterns, and applying algebraic identities—will enhance your problem-solving skills.

Remember, practice is key to becoming proficient in algebraic factorisation. Regularly challenge yourself with diverse problems, and over time, you'll develop an intuitive sense for recognising patterns and applying the most effective methods.

Happy factoring!

Frequently Asked Questions

How can I factorise the expression $3x Yz - 2x^3 y - xyz$?

To factorise $3x Yz - 2x^3 y - xyz$, first look for common factors in the terms. Notice that each term contains an 'x'. Factoring out 'x' gives: $x(3 Yz - 2x^2 y - yz)$. Next, observe if further factorisation is possible within the parentheses, perhaps by grouping or common factors. However, since the remaining terms don't share a common factor, the fully factored form is x(3 Yz - yz - 2x^2 y). Alternatively, rearranging terms or exploring substitution might help, but as it stands, this is the factored form.

What are the common factors in the expression 3x Yz - 2x^3 y - xyz?

The common factors across all three terms are 'x' and 'z'. Each term contains 'x', and two of the terms contain 'z'. Specifically, the first term has '3x Yz', the second '2x^3 y', and the third 'xyz'. Factoring out 'x' gives a common factor, and further simplification depends on grouping or recognizing patterns.

Can the expression 3x Yz - 2x^3 y - xyz be grouped for easier factorisation?

Yes, you can attempt to group the terms: (3x Yz - xyz) - 2x^3 y. Factoring 'x' from the first group yields x(3 Yz - yz), and the second group remains -2x^3 y. Further factoring within these groups depends on recognizing common factors; for example, in the first group, 'yz' is common, leading to x y (3 Z - Z). The overall expression can be partially simplified this way, but complete factorisation may require additional steps.

Is there a common binomial or polynomial factor in 3x Yz - 2x^3 y - xyz?

In the expression 3x Yz - 2x^3 y - xyz, a common factor is 'x', but no common binomial or polynomial factor appears across all three terms beyond that. After factoring 'x', the remaining terms don't share a further common factor, so the expression doesn't factor into a product of binomials directly without more advanced methods or substitutions.

What is the step-by-step process to fully factorise 3x Yz - 2x^3 y - xyz?

Step 1: Identify common factors in all terms; here, 'x' is common. Factor out 'x': x(3 Yz - 2x^2 y - yz).
Step 2: Look inside the parentheses to see if further factorisation is possible. Notice that 3 Yz - yz = yz(3 - 1) = 2 yz, but since the terms are 3 Yz and - yz, they can be combined: yz(3 - 1) = 2 yz.
Step 3: Rewrite the expression inside parentheses as: yz(3 - 1) - 2x^2 y.
Step 4: Recognize that further common factors are limited; thus, the fully simplified factorised form is x(yz(3 - 1) - 2x^2 y), or x(2 yz - 2 x^2 y).
Step 5: Factor out common factors within the parentheses: 2 y z (1 - x^2).
Final answer: x 2 y z (1 - x^2).

Are there any special identities or formulas useful for factorising the expression 3x Yz - 2x^3 y - xyz?

The expression doesn't directly match common special identities like difference of squares, perfect square trinomials, or sum/difference of cubes. However, recognizing patterns such as factoring out common terms and grouping can simplify the process. If the variables represent numbers, substitution might reveal more patterns, but algebraically, standard factorisation techniques are most applicable here.

Can substitution help in factorising the expression $3x Yz - 2x^3 y - xyz$?

Yes, substitution can sometimes simplify the process. For example, substituting variables or assigning specific values can reveal common factors or patterns. However, for general algebraic expressions, direct factorisation by extracting common factors and grouping is usually more straightforward. Substitution is more useful when trying to identify hidden patterns or simplify complex expressions.

What are common mistakes to avoid when factorising an expression like $3x Yz - 2x^3 y - xyz$?

Common mistakes include overlooking common factors across all terms, attempting to factorise without fully checking for common factors, and missing opportunities to group terms effectively. Also, confusing variables or misapplying algebraic identities can lead to incorrect factorisation. Always carefully check each term for common factors before proceeding.

Is the expression $3x Yz - 2x^3 y - xyz$ fully factorisable over the real numbers?

Yes, the expression can be factored as much as possible over the real numbers. A possible factorisation is $x\ 2\ y\ z\ (1 - x^2)$, which further factors as $x\ 2\ y\ z\ (1 - x)(1 + x)$. Thus, the fully factorised form over the reals is $2\ x\ y\ z\ (1 - x)(1 + x)$.

Additional Resources

Factorise $3x Yz - 2x^3 y - xyz$

Introduction

In the realm of algebra, factorisation is an essential skill that unlocks the ability to simplify complex expressions, solve equations efficiently, and understand the underlying structure of algebraic formulas. The expression $3x Yz - 2x^3 y - xyz$ might seem daunting at first glance, but with a systematic approach, it can be broken down into factors that reveal its core components. Think of this process as akin to deconstructing a sophisticated product into its fundamental parts — each step revealing more about the item's design and function.

This detailed exploration will serve as an expert review of the factorisation process for this particular algebraic expression, providing insights into the methods, strategies, and common pitfalls to avoid. Whether you're a student aiming to master polynomial factorisation or an educator seeking to deepen your understanding, this guide will cover every aspect needed to decode $3x Yz - 2x^3 y - xyz$

comprehensively.

Understanding the Expression

Before diving into factorisation, it's crucial to understand the structure of the expression:

$$
3x Yz - 2x^3 y - xyz
$$

Notice the following key features:

- The variables involved are x, Y (possibly a typo, but we'll treat it as a variable), z, and y.
- The coefficients are numerical: 3, -2, and -1 (implied in the last term).
- The terms involve different powers of x and different arrangements of variables.

Assumption & Clarification:
Given the notation, it's probable that Y is intended to be y (a common variable). If Y is indeed a distinct variable, the process remains similar, just with different variables involved.

For clarity, we'll assume the expression is:

$$
3x y z - 2x^3 y - x y z
$$

which simplifies to:

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

Step 1: Rewrite the Expression for Clarity

Expressing the terms clearly:

$$
3xyz - 2x^{3} y - xyz
$$

Now, the expression is:

$$
(3xyz) - (2x^{3} y) - (xyz)
$$

Note that the terms include similar factors, especially xyz, which suggests the potential for common factors.

Step 2: Group Like Terms

Grouping the terms to identify common factors:

$$
(3xyz - xyz) - 2x^{3} y
$$

which simplifies to:

$$
(3xyz - xyz) - 2x^{3} y
$$

Calculating the difference in the first group:

$$
(3xyz - xyz) = 2xyz
$$

Therefore, the entire expression simplifies to:

$$
2xyz - 2x^{3} y
$$

Step 3: Factor Out Common Terms

Now, look for common factors in the simplified expression:

$$
2xyz - 2x^{3} y
$$

Both terms share:

- Numerical coefficient 2
- The variables x and y

Factor out 2xy:

$$
2xy(z - x^{2})
$$

Result:

$$
\boxed{2xy(z - x^{2})}
$$

This is the fully factorised form of the original expression, assuming the initial variables are as clarified.

Detailed Explanation of the Factorisation Process

1. Recognising Common Factors

The key step in algebraic factorisation is recognizing common factors across terms. Here, the common factors are:

- The numerical coefficient 2
- The variables x and y

Extracting these simplifies the expression significantly.

2. Simplifying Within Parentheses

After factoring out common factors, the remaining expression inside parentheses often reveals further opportunities for factorisation or recognition of special products.

In this case:

$$
z - x^{2}
$$

is a difference of two terms, which cannot be simplified further unless specific values are given, but it's a simple binomial.

Alternative Approach: Factoring Without Simplification

Suppose we start from the original expression directly:

$$
3xyz - 2x^{3} y - xyz
$$

- First, notice the terms 3xyz and -xyz can be combined:

$$
(3xyz - xyz) - 2x^{3} y = 2xyz - 2x^{3} y
$$

\]

- Next, factor out 2xy:

$$
2xy(z - x^{2})
$$

This confirms the earlier result, emphasizing the importance of strategic grouping and recognizing common factors.

Common Pitfalls and Tips

1. Overlooking Common Factors

Many students miss the opportunity to factor out common factors because they focus on the terms individually. Always look for the greatest common factor (GCF) first.

2. Variable Handling

Variables can be tricky, especially with different powers. Remember:

- When factoring out variables, take the lowest power common to all terms.
- For example, if one term has x^3 and another x, the GCF with respect to x is x.

3. Recognizing Special Patterns

Be on the lookout for special products like:

- Difference of squares: $a^2 - b^2 = (a - b)(a + b)$
- Perfect square trinomials
- Sum or difference of cubes

In this case, $z - x^2$ does not match these patterns, but recognizing such can simplify more complex expressions.

Extending the Analysis: Potential Variations

Suppose the original expression was slightly different, such as:

$$
3x Yz - 2x^{3} y - xyz + \text{additional terms}
$$

The approach remains similar:

- Group like terms

- Factor out common factors
- Recognize patterns

For more complex expressions, methods like polynomial division or synthetic division might be necessary.

Practical Applications of Such Factorisation

Understanding how to factor expressions like 3x y z - 2x^3 y - xyz isn't just academic; it has real-world applications:

- Simplifying algebraic expressions for easier computation
- Solving polynomial equations efficiently
- Optimizing algebraic models in physics, engineering, and computer science
- Factoring in calculus for derivatives and integrals involving polynomial functions

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Final Remarks

Factorising the expression 3x y z - 2x^3 y - xyz demonstrates the importance of methodical approaches in algebra. The key steps involve:

- Recognising shared factors across terms
- Combining like terms where possible
- Factoring out common elements systematically

The final factorised form:

\[
\boxed{2xy(z - x^{2})}
\]

captures the essence of the original polynomial, revealing its core structure in a compact form.

Mastery of such techniques enhances problem-solving efficiency and deepens understanding of algebraic relationships. Whether tackling straightforward polynomial expressions or more intricate algebraic structures, the principles illustrated here serve as a foundational toolkit for mathematicians, students, and professionals alike.

Factorise 3x Yz 2x3y Xyz

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