

Simplify $4(6 - 2x) - 3(3 - 4x)4x + 1515 - 20x15 - 6x$

$4(6 - 2x) - 3(3 - 4x)4x + 1515 - 20x15 - 6x$ is a complex algebraic expression that requires careful attention to detail to simplify accurately. Such expressions are common in algebra and often appear in various mathematical problems, including solving equations, evaluating expressions, and understanding algebraic relationships. To simplify this expression, we need to follow systematic steps: expand the parentheses, combine like terms, and simplify the coefficients. This process not only helps in solving the problem at hand but also reinforces fundamental algebraic skills essential for higher mathematics.

Understanding the Expression

Before diving into the simplification process, it's vital to understand each component of the given expression:

- $4(6 - 2x)$: A binomial multiplied by 4.
- $- 3(3 - 4x)4x$: A more complex term involving multiplication of binomials and variables.
- 1515 : A constant term.
- $- 20x15$: Involving a constant multiplied by a variable.
- $- 6x$: A simple linear term.

The key to simplifying such an expression is to handle each part methodically, applying algebraic rules such as distributive property, combining like terms, and simplifying constants.

Step-by-Step Simplification Process

1. Expand the Parentheses

The first step involves distributing the coefficients across the terms inside the parentheses.

- Expand $4(6 - 2x)$:
- $4 \cdot 6 = 24$
- $4 \cdot (-2x) = -8x$

$$\text{So, } 4(6 - 2x) = 24 - 8x$$

- Expand $-3(3 - 4x)4x$:

This term is slightly more complex due to the lack of clear parentheses, but assuming the expression is:

$$-3 (3 - 4x) 4x$$

We proceed step by step:

- First, expand $(3 - 4x)$:

- No further expansion needed here.

- Then, multiply $(3 - 4x)$ by $4x$:

$$- 3 \ 4x = 12x$$

$$- (-4x) \ 4x = -16x^2$$

- Now, multiply by -3 :

$$- -3 \ 12x = -36x$$

$$- -3 \ (-16x^2) = +48x^2$$

Result:

$$-3(3 - 4x)4x = -36x + 48x^2$$

- Constants:

- 1515 remains as is.

- -20×15 : Assuming this is $-20 \ 15x$, since the notation suggests multiplication of 20 with $15x$:

$$- -20 \ 15x = -300x$$

- The last term, $-6x$, is already simplified.

2. Combine All Expanded Terms

Now, rewrite the entire expression with the expanded parts:

$$24 - 8x + (-36x + 48x^2) + 1515 - 300x - 6x$$

Simplify by grouping similar terms:

- Quadratic terms: $48x^2$

- x terms: $-8x - 36x - 300x - 6x$

- Constants: $24 + 1515$

3. Combine Like Terms

- Quadratic term:
 - $48x^2$
- Linear terms:
 - $-8x - 36x - 300x - 6x$

Sum:

- $(-8x - 36x) = -44x$
- $-44x - 300x = -344x$
- $-344x - 6x = -350x$
- Constants:
 - $24 + 1515 = 1539$

Putting everything together:

$$48x^2 - 350x + 1539$$

Final Simplified Expression

After carefully expanding, distributing, and combining like terms, the simplified form of the original expression is:

$$48x^2 - 350x + 1539$$

This quadratic expression is now in a standard form, which can be used for further analysis, such as solving for x , graphing, or substitution in other equations.

Additional Tips for Simplifying Algebraic Expressions

To efficiently simplify similar algebraic expressions in the future, consider the following tips:

- **Always expand parentheses first:** Use the distributive property to eliminate parentheses.
- **Be mindful of signs:** Sign errors are common; double-check negative signs during expansion.

- **Group like terms:** After expansion, organize the expression by grouping similar terms (constants, x terms, x^2 terms, etc.).
- **Combine constants and coefficients carefully:** Arithmetic mistakes can significantly affect the final result.
- **Check your work:** Revisit each step to ensure accuracy, especially when dealing with multiple terms.

Why Simplification Matters

Simplifying algebraic expressions is fundamental in mathematics because it:

- Makes complex expressions more manageable.
- Facilitates solving equations more efficiently.
- Helps in understanding the relationships between variables.
- Prepares students for advanced topics like calculus and algebraic functions.

In real-world scenarios, such as engineering, physics, and computer science, simplifying expressions allows professionals to analyze systems, optimize solutions, and interpret data more effectively.

Practice Problems to Reinforce Skills

To strengthen your understanding of algebraic simplification, try solving these practice problems:

1. Simplify: $3(2x + 5) - 4(x - 3) + 7$
2. Expand and simplify: $(x + 4)(x - 2) + 3x$
3. Combine like terms: $5x^2 - 3x + 2x^2 + 4x - 7$

Working through these problems will enhance your ability to handle complex expressions confidently.

Conclusion

Simplifying the expression $4(6 - 2x) - 3(3 - 4x)4x + 1515 - 20x15 - 6x$ demonstrates the importance of systematic approaches in algebra. By carefully expanding, distributing, and combining like terms, we arrive at a clean,

manageable quadratic expression. Mastery of such techniques is essential for progressing in mathematics and applying algebra to real-world problems. Remember, practice and attention to detail are key to becoming proficient in algebraic simplifications.

Frequently Asked Questions

How do I simplify the expression $4(6 - 2x) - 3(3 - 4x)4x + 1515 - 20x15 - 6x$?

First, expand all parentheses: $4(6 - 2x) = 24 - 8x$; $-3(3 - 4x)4x = -3 \cdot 3 \cdot 4x + (-3) \cdot (-4x) \cdot 4x$ (which simplifies further). However, note that the expression contains some ambiguous parts like ' $3 - 4x)4x$ ' and ' $20x15$ '—assuming ' $20x15$ ' means $20x \cdot 15$. Carefully expanding and combining like terms will help simplify the entire expression.

What is the first step to simplify the given algebraic expression?

The first step is to distribute the coefficients across the parentheses: expand $4(6 - 2x)$ to get $24 - 8x$, and carefully interpret and expand the other parts, especially noting that some terms like $20x15$ are multiplication expressions, not variables.

Are there any common mistakes to avoid when simplifying this expression?

Yes, avoid misinterpreting the notation—ensure that multiplication is correctly applied, especially with terms like $3(3 - 4x)4x$ and $20x15$. Also, be cautious with signs and distributive property to prevent errors in combining like terms.

How can I handle the term ' $20x15$ ' in the expression?

Assuming ' $20x15$ ' means 20 times x times 15, multiply 20 by 15 to get 300, then multiply by x to get $300x$. This simplifies that part of the expression.

After simplifying all parts, how do I combine like terms in the expression?

Once all terms are expanded, group the constant terms and the terms with x , then add or subtract coefficients accordingly to obtain a simplified expression.

Additional Resources

Simplify $4(6 - 2x) - 3(3 - 4x)4x + 1515 - 20x15 - 6x$: An In-Depth Investigation into Algebraic Simplification

Introduction

Mathematics, especially algebra, forms the backbone of logical reasoning and problem-solving in various scientific and technological fields. Among the foundational skills in algebra is the ability to simplify complex expressions, transforming them into more manageable and understandable forms. This process not only aids in solving equations but also enhances conceptual understanding of the relationships between variables and constants.

In this article, we undertake a comprehensive analysis of the algebraic expression:

Simplify $4(6 - 2x) - 3(3 - 4x)4x + 1515 - 20x15 - 6x$

This expression, seemingly intricate, is representative of many real-world problems where multiple layers of operations are involved. Our goal is to dissect the expression step-by-step, identify potential pitfalls, and arrive at a simplified form that clarifies its structure and implications.

Context and Relevance

Before diving into the algebraic manipulations, it is important to understand the significance of expression simplification. Whether in physics, economics, engineering, or computer science, complex formulas often need to be reduced to their simplest form to interpret relationships, optimize solutions, or facilitate computational efficiency.

This specific expression, although possibly a typographical or transcriptional anomaly (given the presence of repeated and seemingly inconsistent terms like $4(6 - 2x)$ and $- 20x15$), provides a realistic scenario where an expression might contain potential ambiguities or formatting issues that need careful analysis.

Initial Examination of the Expression

The original expression is:

$4(6 - 2x) - 3(3 - 4x)4x + 1515 - 20x15 - 6x$

At first glance, it appears to combine standard algebraic operations with

potential misprints or misinterpretations, especially with terms like $-20x15$, which could imply $-20x15$ or -20×15 . Similarly, the term $-3(3-4x)4x$ raises questions about the intended grouping.

For clarity, we will interpret the expression as follows:

- The term $4(6-2x)$ is straightforward.
- The term $-3(3-4x)4x$ is assumed to mean $-3(3-4x)4x$.
- The constant 1515 remains as is.
- The term $-20x15$ is interpreted as -20×15 .
- The term $-6x$ remains as is.

This interpretation aligns with standard algebraic conventions, allowing us to proceed with systematic simplification.

Step-by-Step Algebraic Simplification

1. Expand the Parentheses

- First term: $4(6-2x)$

Expand: $4 \cdot 6 - 4 \cdot 2x$

Simplifies to: $24 - 8x$

- Second term: $-3(3-4x)4x$

First, expand $(3-4x)$ multiplied by $4x$:

$(3-4x)4x = 3 \cdot 4x - 4x \cdot 4x = 12x - 16x^2$

Now multiply by -3 :

$-3(12x - 16x^2) = -36x + 48x^2$

- Third term: 1515 (constant, remains as is)

- Fourth term: -20×15

Multiply: $-20 \cdot 15 = -300$

- Fifth term: $-6x$ (already simplified)

2. Collect Like Terms

Now, combine all the expanded terms:

$(24 - 8x) + (-36x + 48x^2) + 1515 - 300x - 6x$

Group similar types:

- Constants: $24 + 1515$
- x terms: $-8x - 36x - 300x - 6x$
- x^2 terms: $48x^2$

Calculations:

- Constants: $24 + 1515 = 1539$
- x terms: $-8x - 36x - 300x - 6x$
- Sum: $(-8 - 36 - 300 - 6)x = (-350)x$
- x^2 term: $48x^2$

Simplified Expression

After combining all components, the expression simplifies to:

$$48x^2 - 350x + 1539$$

This quadratic form is much more manageable and provides a clear view of the relationship between x and the entire expression.

Deep Dive: Analyzing the Simplified Result

1. The Quadratic Nature

The simplified expression $48x^2 - 350x + 1539$ is a quadratic function in standard form:

$$ax^2 + bx + c$$

where:

- $a = 48$
- $b = -350$
- $c = 1539$

Understanding this form allows us to analyze properties such as roots, vertex, and graph behavior.

2. Roots and Discriminant

To find the roots (values of x where the expression equals zero), apply the quadratic formula:

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Calculate the discriminant:

$$D = b^2 - 4ac = (-350)^2 - 4 \cdot 48 \cdot 1539$$

Compute:

$$(-350)^2 = 122,500$$

$$4 \cdot 48 \cdot 1539 = 4 \cdot 48 \cdot 1539$$

First, $48 \cdot 1539$:

$$48 \cdot 1500 = 72,000$$

$$48 \cdot 39 = 1,872$$

$$\text{Sum: } 72,000 + 1,872 = 73,872$$

Now, multiply by 4:

$$4 \cdot 73,872 = 295,488$$

Compute the discriminant:

$$D = 122,500 - 295,488 = -172,988$$

Since $D < 0$, the quadratic has complex roots, indicating the original expression does not cross zero for real x .

3. Vertex of the Parabola

The vertex x -coordinate:

$$x_v = -b / (2a) = 350 / (2 \cdot 48) = 350 / 96 \approx 3.6458$$

Corresponding y value:

$$y_v = 48(3.6458)^2 - 350 \cdot 3.6458 + 1539$$

Calculations:

$$(3.6458)^2 \approx 13.308$$

$$48 \cdot 13.308 \approx 638.6$$

$$-350 \cdot 3.6458 \approx -1,275.03$$

Adding all:

$$638.6 - 1,275.03 + 1,539 \approx 902.57$$

The parabola reaches its minimum at approximately $(3.65, 902.57)$.

Implications and Practical Significance

The quadratic form indicates that the original expression, when simplified, represents a parabola opening upward (since $a = 48 > 0$). The minimum value of approximately 902.57 occurs near $x \approx 3.65$.

In applied contexts, such as optimization problems, this minimum could

represent the least cost, minimal error, or optimal point depending on the scenario.

Addressing Potential Errors and Ambiguities

Throughout this analysis, assumptions were made regarding ambiguous terms like $-20x^{15}$ and $-3(3-4x)4x$. It's critical in mathematical practice to verify such expressions for clarity.

Common pitfalls include:

- Misinterpretation of implicit multiplication
- Transcription errors in complex expressions
- Overlooking the order of operations

Best practices:

- Clarify ambiguous notation before proceeding
- Use parentheses liberally to denote grouping
- Break complex expressions into manageable parts

Broader Reflections: The Importance of Precise Expression Handling

This exercise underscores how small ambiguities can lead to vastly different interpretations and results. In mathematical literature, education, and applied sciences, precision is paramount. Misreading a term can lead to incorrect conclusions or flawed models.

The process demonstrated here—careful expansion, systematic combination, and critical analysis—is essential for mathematicians, scientists, and engineers alike. It emphasizes the importance of meticulous attention to detail and methodical problem-solving.

Conclusion

Through a detailed examination of the expression $4(6-2x) - 3(3-4x)4x + 1515 - 20x^{15} - 6x$, we've transformed a seemingly complex algebraic form into a manageable quadratic expression: $48x^2 - 350x + 1539$.

This process exemplifies the core principles of algebraic simplification, including expansion, combination of like terms

Simplify 4 6 2x 3 3 4x 4x 1515 20x15 6x

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