Find The Value Of X(3x + 2)(6x - 118)

Find The Value Of X(3x + 2)(6x - 118): A Comprehensive Guide to Solving Algebraic Expressions

Understanding how to evaluate algebraic expressions is a fundamental skill in mathematics that students and learners of all ages should develop. One such expression that often appears in algebra problems is X(3x + 2)(6x - 118). This article provides an in-depth explanation of how to find the value of this expression, including the necessary steps, methods, and tips to master similar problems.

Breaking Down the Expression

Before diving into the solution, it's essential to analyze the components of the expression:

- X: A variable, which can take any real value.
- (3x + 2): A linear binomial involving the variable x.
- (6x - 118): Another linear binomial involving the same variable x.

The expression is a product of three parts: X, (3x + 2), and (6x - 118). To evaluate this expression for a specific value of X, we also need a value for x. Conversely, if the problem asks for the value of x given the entire expression's value, then additional information will be necessary.

Understanding the Context

Before attempting to find the value of the entire expression, consider these common scenarios:

1. Given a specific value of X and x: You can directly substitute the values into the expression.
2. Given the value of the entire expression: You need to find the value of x that satisfies the equation.
3. Simplify the expression algebraically: Express it in a simplified form to understand its structure better.

In this guide, we will cover each of these scenarios, focusing on how to evaluate and manipulate the expression effectively.

Scenario 1: Evaluating the Expression with Known Values of X and x

Suppose you are given specific values, for example:

- X = 4
- x = 3

Step-by-step approach:

Step 1: Substitute the known values into the expression

$$
\text{Expression} = X(3x + 2)(6x - 118)
$$

becomes

$$
= 4 \times (3 \times 3 + 2) \times (6 \times 3 - 118)
$$

Step 2: Simplify inside the parentheses

- $3 \times 3 + 2 = 9 + 2 = 11$
- $6 \times 3 - 118 = 18 - 118 = -100$

Step 3: Multiply the components

$$
= 4 \times 11 \times (-100) = 4 \times 11 \times -100
$$

Calculate:

- $4 \times 11 = 44$
- $44 \times -100 = -4400$

Final answer:

$$
\boxed{-4400}
$$

This straightforward substitution method works well when specific values are provided.

Scenario 2: Finding the Value of x Given the Entire Expression

Suppose the problem states:

> Find the value of x if the entire expression equals a certain number, say 0.

The equation becomes:

$$
x(3x + 2)(6x - 118) = 0
$$

This is a product equal to zero, which implies at least one factor must be zero.

Step 1: Set each factor equal to zero

$$
x = 0
$$
or
$$
3x + 2 = 0
$$
or
$$
6x - 118 = 0
$$

Step 2: Solve each equation

- For $x = 0$, the solution is straightforward.

- For $3x + 2 = 0$:

$$
3x = -2 \Rightarrow x = -\frac{2}{3}
$$

- For $6x - 118 = 0$:

$$
6x = 118 \Rightarrow x = \frac{118}{6} = \frac{59}{3}
$$

Solutions:

$$
x = 0, \quad x = -\frac{2}{3}, \quad x = \frac{59}{3}
$$

Scenario 3: Simplify the Expression Algebraically

Simplifying the expression can offer insights into its structure, especially when solving or analyzing its behavior.

Step 1: Expand the product $(3x + 2)(6x - 118)$

Use the distributive property (FOIL):

$$
(3x + 2)(6x - 118) = 3x \times 6x + 3x \times (-118) + 2 \times 6x + 2 \times (-118)
$$

Calculate each term:

- $3x \times 6x = 18x^2$
- $3x \times -118 = -354x$
- $2 \times 6x = 12x$
- $2 \times -118 = -236$

Combine like terms:

$$
18x^2 + (-354x + 12x) - 236 = 18x^2 - 342x - 236
$$

\]

Step 2: Rewrite the original expression

\[
X(3x + 2)(6x - 118) = X \times (18x^2 - 342x - 236)
\]

Thus, the simplified form is:

\[
X \times (18x^2 - 342x - 236)
\]

This form is helpful for further analysis, such as graphing or solving for specific values.

Using the Simplified Expression for Advanced Problems

The simplified form opens pathways to various problem-solving strategies:

- **Factorization:** Attempt to factor the quadratic \(18x^2 - 342x - 236\) if solving for roots.
- **Graphical Analysis:** Plot the quadratic to understand its behavior.
- **Calculus Applications:** Find derivatives to analyze increasing/decreasing intervals if needed.

Additional Tips for Solving Similar Expressions

To handle expressions like X(3x + 2)(6x - 118), keep these tips in mind:

1. **Always simplify step-by-step:** Expand binomials before multiplying by X for clearer calculations.

2. **Pay attention to the order of operations:** Parentheses, exponents, multiplication/division, addition/subtraction (PEMDAS).

3. **Use substitution wisely:** When given specific values, substitute early to avoid errors.

4. **Factor completely when solving equations:** Look for common factors or quadratic factorization to simplify solutions.

5. **Double-check calculations:** Small mistakes can lead to incorrect solutions, especially when dealing with negatives or fractions.

Practical Applications of the Expression

Understanding and evaluating expressions like X(3x + 2)(6x - 118) is vital in various real-world contexts:

- Physics: Calculating forces or other quantities where variables interact multiplicatively.
- Engineering: Analyzing systems where multiple variables influence an outcome.
- Economics: Modeling relationships involving multiple factors affecting profit or cost functions.

Mastering these algebraic techniques enhances problem-solving skills across disciplines.

Conclusion

In summary, to find the value of the expression X(3x + 2)(6x - 118), you should:

- Understand the components involved.
- Substitute known values to evaluate directly.
- Set the expression equal to a value and solve for x.
- Simplify the algebraic form to analyze the behavior or solve for roots.

Whether you're given specific values or need to solve for variables, the key is systematic reasoning, careful calculation, and understanding algebraic principles. Practice with various problems will deepen your mastery of such expressions, enabling you to handle increasingly complex mathematical

challenges with confidence.

Frequently Asked Questions

How do I find the value of x in the expression (3x + 2)(6x - 118)?

To find the value of x, you need an equation set equal to zero or some value. If given an equation like (3x + 2)(6x - 118) = 0, then set each factor to zero and solve for x.

What steps are involved in solving (3x + 2)(6x - 118) = 0?

First, set each factor equal to zero: 3x + 2 = 0 and 6x - 118 = 0. Then, solve each for x separately to find the possible solutions.

Can I expand (3x + 2)(6x - 118) to find the value of x?

Yes, expanding the expression gives a quadratic equation: (3x + 2)(6x - 118) = 18x^2 - 354x + 12x - 236, which simplifies to 18x^2 - 342x - 236. You can then set this equal to zero and solve for x.

What is the quadratic equation derived from (3x + 2)(6x - 118)?

Expanding gives 18x^2 - 342x - 236 = 0, which you can solve using factoring, completing the square, or quadratic formula.

How do I use the quadratic formula to find x from (3x + 2)(6x - 118) = 0?

Since setting the expression to zero results in 18x^2 - 342x - 236 = 0, identify a = 18, b = -342, c = -236. Plug these into the quadratic formula: x = [-b ± √(b² - 4ac)] / 2a.

Are there any special cases or restrictions when solving (3x + 2)(6x - 118) = 0?

The main restriction is that the solutions come from setting each factor to zero, so x values satisfy 3x + 2 = 0 or 6x - 118 = 0. No other restrictions unless additional context is provided.

What are the solutions for x when solving (3x + 2)(6x - 118) = 0?

Set each factor to zero: 3x + 2 = 0 gives x = -2/3, and 6x - 118 = 0 gives x = 118/6 = 59/3. So, the solutions are x = -2/3 and x = 59/3.

How can I verify the solutions for x in (3x + 2)(6x - 118)?

Substitute the found x values back into the original factors to ensure each zero is valid. For x = -2/3, check (3(-2/3) + 2) and (6(-2/3) - 118). Similarly for x = 59/3, check both factors.

Is it necessary to expand the expression to find x, or can I solve directly?

You can directly set each factor equal to zero and solve without expanding. Expansion is useful if you need to analyze the quadratic form or solve the corresponding quadratic equation.

Additional Resources

Find The Value Of X(3x + 2)(6x - 118)

When it comes to algebraic expressions and solving for unknown variables, the task of finding the value of an expression like X(3x + 2)(6x - 118) can seem daunting at first glance. However, by breaking down the problem systematically, it becomes an approachable and rewarding exercise in algebra. This particular expression involves a variable multiplied by two binomials, which invites us to explore techniques such as expansion, substitution, and factorization. Whether you're a student preparing for exams or someone interested in sharpening your algebraic skills, understanding how to evaluate such expressions is fundamental. In this comprehensive guide, we will analyze the expression step-by-step, explore different methods to find its value, and discuss related concepts that can enhance your mathematical toolkit.

Understanding the Expression

Before diving into solving, it’s essential to understand the structure of the expression:

Expression: X(3x + 2)(6x - 118)

At first glance, this appears to be a product involving a variable x and two binomials: (3x + 2) and (6x - 118).

Key points:
- The variable x appears both as a standalone factor and within the binomials.
- The expression is multiplicative: x times the product of the two binomials.
- To evaluate this expression for a specific value of x, we need that value; if not provided, the expression can be simplified or expressed in terms of x.

Approaches to Evaluating the Expression

Depending on the context, there are several ways to find the value of X(3x + 2)(6x - 118):

1. Substituting a Specific Value of x

If a specific value of x is provided, the process is straightforward:

- Plug x into each part.
- Perform the multiplication step-by-step.
- Obtain a numerical result.

Example: Find the value when x = 10.

Solution:

1. Calculate (3x + 2):
$3 \times 10 + 2 = 30 + 2 = 32$

2. Calculate (6x - 118):
$6 \times 10 - 118 = 60 - 118 = -58$

3. Multiply all parts:
$x \times (3x + 2) \times (6x - 118)$
$10 \times 32 \times (-58)$

4. Simplify step-by-step:

- $10 \times 32 = 320$

- $320 \times (-58) = -18560$

Result: -18560

This method is simple and effective when x is known.

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2. Simplifying the Expression in Terms of x

If the goal is to express the value algebraically in terms of x, then:

- Expand the binomials.
- Multiply through.
- Write the entire expression as a polynomial in x.

This approach is useful for understanding the behavior of the expression for any x, or for solving equations involving this expression.

Step-by-Step Expansion and Simplification

Let's delve into the algebraic expansion of X(3x + 2)(6x - 118).

Step 1: Expand the binomials

Use the distributive property (FOIL method):

$$
(3x + 2)(6x - 118) = (3x)(6x) + (3x)(-118) + 2(6x) + 2(-118)
$$

Calculate each term:

- $3x \times 6x = 18x^2$
- $3x \times -118 = -354x$
- $2 \times 6x = 12x$
- $2 \times -118 = -236$

Now, combine the terms:

$$
(3x + 2)(6x - 118) = 18x^2 - 354x + 12x - 236
$$

Simplify:

\[

```
= 18x^2 - 342x - 236
\]
```

Step 2: Multiply by x

The entire expression becomes:

$$
x \times (18x^2 - 342x - 236)
$$

Distribute x:

$$
x \times 18x^2 = 18x^3
$$
$$
x \times -342x = -342x^2
$$
$$
x \times -236 = -236x
$$

Therefore, the expanded form:

$$
\boxed{18x^3 - 342x^2 - 236x}
$$

This polynomial expression in x is the general form of the original expression.

Analyzing the Polynomial Expression

The simplified polynomial:

$$
f(x) = 18x^3 - 342x^2 - 236x
$$

can be used to evaluate the expression for any value of x or to analyze its properties.

Features of the Polynomial:

- Degree: 3 (cubic), indicating possible inflection points and complex behavior.
- Leading coefficient: 18, positive, so as x approaches positive infinity, f(x) also tends to positive infinity.
- Factoring: To find roots or zeros, factor the polynomial further.

Factoring the Polynomial

Factoring can reveal the roots of the polynomial, which are the values of x that make the entire expression zero.

Given:

$$
f(x) = 18x^3 - 342x^2 - 236x
$$

Factor out the greatest common factor (GCF):

- GCF of coefficients: 2 (since all are divisible by 2).

Check for common factors:

- 18, 342, and 236 are all divisible by 2.

Factor out 2x:

$$
f(x) = 2x (9x^2 - 171x - 118)
$$

Now, focus on quadratic:

$$
9x^2 - 171x - 118
$$

Attempt to factor this quadratic:

- Discriminant:

$$
D = (-171)^2 - 4 \times 9 \times (-118) = 29241 + 4 \times 9 \times 118
$$

\]

Calculate:

\[
4 \times 9 = 36
\]

\[
36 \times 118 = 4248
\]

Sum:

\[
D = 29241 + 4248 = 33489
\]

Since the discriminant is positive, roots are real but not rational unless perfect square. Roots are:

\[
x = \frac{171 \pm \sqrt{33489}}{2 \times 9} = \frac{171 \pm \sqrt{33489}}{18}
\]

Approximate \(\sqrt{33489} \approx 182.98\).

Roots:

\[
x \approx \frac{171 \pm 182.98}{18}
\]

Calculate both:

- \(x \approx \frac{171 + 182.98}{18} \approx \frac{353.98}{18} \approx 19.66 \)
- \(x \approx \frac{171 - 182.98}{18} \approx \frac{-11.98}{18} \approx -0.666 \)

Thus, the roots are approximately:

**\[
x \approx 0.666 \quad \text{and} \quad x \approx 19.66
\]**

The zeros of the original polynomial (and thus the original expression) are:

**\[
x = 0 \quad \text{(from the factor } 2x), \quad x \approx 0.666, \quad x \approx 19.66
\]**

Note: Exact roots involve radicals, but for practical purposes, approximate decimal roots suffice.

Applications and Contexts

Understanding how to evaluate and analyze the

expression X(3x + 2)(6x - 118) is valuable in multiple scenarios:

- Mathematical problem-solving: Simplifying complex expressions.
- Algebra practice: Developing skills in expansion, factorization, and substitution.
- Applied mathematics: Modeling real-world problems where variables interact multiplicatively.
- Educational assessments: Demonstrating understanding of polynomial behavior and root-finding.

Pros and Cons of Different Methods

Method	Pros	Cons
Substitution	Quick for specific x values	Not suitable for general form or symbolic analysis
Expansion & Simplification	Provides a general algebraic form	Can become cumbersome for larger expressions
Factoring	Reveals roots and zeros	Not always possible with complex roots; may require quadratic formula or radicals

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Conclusion

Calculating the value of X(3x + 2)(6x - 118) involves understanding its

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