Solve For The Value Of W.(w-8)(2W-1)

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When encountering algebraic expressions like W.(w-8)(2W-1), understanding how to simplify and solve for the unknown variable \(W \) is essential. Whether you're a student working through algebra homework or a professional applying mathematical concepts, mastering the process of solving such expressions enhances your problem-solving skills. This article provides a comprehensive guide on how to approach, simplify, and solve for \(W \) in the expression W.(w-8)(2W-1), with detailed explanations, step-by-step procedures, and tips for efficient problem-solving.

Understanding the Expression: W.(w-8)(2W-1)

Before diving into solving, it's important to understand the structure of the expression:

- The expression is multiplicative, involving the variable \(W \) and two binomials \((w-8)\) and \((2W-1)\).
- The notation suggests that \(W \) and \(w \) may be variables, but for the purpose of solving for \(W \), we'll treat \(w \) as a known value or parameter unless specified otherwise.
- The goal is to find the value(s) of \(W \) that satisfy an equation involving this expression.

Interpreting the Problem: Setting the Expression Equal to a Value

In algebra, an expression like W.(w-8)(2W-1) is often set equal to a value or another expression to form an equation. For example:

```plaintext
W.(w-8)(2W-1) = K
```

where \(K \) is a known constant, or zero in case of an equation to find roots.

Common problem types include:

- Solving for \(W \) when the expression equals a constant
- Simplifying the expression for further analysis
- Finding the roots or solutions that satisfy the equation

For this guide, we'll assume the general case where:

```plaintext
W.(w-8)(2W-1) = 0
```

which is a typical starting point for solving such expressions.

Step-by-Step Guide to Solve W.(w-8)(2W-1) = 0

When an expression is set equal to zero, the Zero Product Property applies.
This property states that if:

```plaintext
A B C = 0
```

then at least one of the factors must be zero:

```plaintext
A = 0 OR B = 0 OR C = 0
```

Applying this to the expression:

```plaintext
W.(w-8)(2W-1) = 0
```

the solutions are obtained by setting each factor equal to zero:

1. \(W = 0 \)
2. \(w - 8 = 0 \)
3. \(2W - 1 = 0 \)

Solution 1: \(W = 0 \)

This is straightforward; one solution is:

```plaintext
W = 0
```

Solution 2: \(w - 8 = 0 \)

Since \(w \) appears to be a parameter, this solution depends on knowing the value of \(w \). If \(w \) is known, then:

```plaintext
w = 8
```

If \(w \) is unknown, this equation indicates that for the original expression to be zero, \(w \) must be 8.

Solution 3: \(2W - 1 = 0 \)

Solve for \(W \):

```plaintext
2W = 1
W = \frac{1}{2}
```

Summary of Solutions

Solution	Description	Notes
\(W = 0 \)	Direct solution from the first factor	Always valid regardless of \(w \)
\(w = 8 \)	Conditions on \(w \) for the expression to be zero	Depends on \(w \) being known or specified
\(W = \frac{1}{2} \)	From solving \(2W - 1 = 0 \)	Valid for any \(w \) unless constrained

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Extending Beyond Zero: Solving General Equations

Often, you may encounter equations where the expression equals a non-zero value:

```plaintext
W.(w-8)(2W-1) = K
```

To solve for \(W \), follow these steps:

Step 1: Expand or Rearrange the Equation

Depending on the value of \(K \), you might need to expand the expression:

```plaintext
W (w - 8) (2W - 1) = K
```

Step 2: Expand the Expression

First, expand \((w - 8)(2W - 1) \):

```plaintext
(w - 8)(2W - 1) = w2W - w1 - 82W + 81 = 2wW - w - 16W + 8
```

Then, multiply by \(W \):

```plaintext
W (2wW - w - 16W + 8) = 2wW^2 - wW - 16W^2 + 8W
```

Step 3: Form a Quadratic Equation

Bring all terms to one side:

```plaintext
2wW^2 - wW - 16W^2 + 8W - K = 0
```

Group similar terms:

```plaintext
(2wW^2 - 16W^2) + (-wW + 8W) - K = 0
```

Factor where possible:

```plaintext
2W^2(w - 8) + W(-w + 8) - K = 0
```

This is a quadratic in \(W \):

```plaintext
A W^2 + B W + C = 0
```

where:

- \(A = 2(w - 8) \)
- \(B = -w + 8 \)
- \(C = -K \)

Step 4: Use the Quadratic Formula

The solutions for \(W \):

```plaintext
W = \frac{-B \pm \sqrt{B^2 - 4 A C}}{2A}
```

Plug in \(A, B, C \):

```plaintext
W = \frac{-(-w + 8) \pm \sqrt{(-w + 8)^2 - 4 2(w - 8) (-K)}}{2 2(w - 8)}
```

Simplify numerator and denominator accordingly.

Practical Tips for Solving Algebraic Expressions

- Always check for extraneous solutions: When solving polynomial equations, verify solutions in the original equation.
- Factor first: Simplify the expression by factoring before applying the quadratic formula.
- Use substitution: For complex expressions, substitution can make solving easier.
- Be aware of domain restrictions: For example, division by zero is undefined; check if any solutions violate such restrictions.
- Practice with different values: To build intuition, solve similar problems with specific values of \(w \) and \(K \).

Sample Problems and Solutions

Example 1: Solve \(W.(w-8)(2W-1) = 0 \) with \(w = 10 \)

Solution:

- Factor set to zero:

1. \(W = 0 \)
2. \(10 - 8 = 2 \neq 0 \) (so no solution from this factor unless \(w = 8 \))
3. \(2W - 1 = 0 \Rightarrow W = \frac{1}{2} \)

Final solutions:

```plaintext
W = 0 \quad \text{or} \quad W = \frac{1}{2}
```

Example 2: Solve \(W.(w-8)(2W-1) = 5 \) with \(w = 12 \)

Solution:

- Expand:

\((12 - 8) = 4 \)

- Express:

\(W 4 (2W - 1) = 5 \)

- Simplify:

\(4W(2W - 1) = 5 \)

- Expand:

\(8W^2 - 4W = 5 \)

- Rearrange:

\(8W^2 - 4W - 5 = 0 \)

- Use quadratic formula:

\(W = \frac{4 \pm \sqrt{(-4)^2 - 4 8 (-5)}}{2 8} \)

\(W = \frac{4 \pm \sqrt{16 + 160}}{16} \)

\(W = \frac{4 \pm \sqrt{176}}{16} \)

\(W = \frac{4 \pm 13.266}{16} \)

- Solutions:

\(W = \frac{4 + 13.266}{16} \approx 1.055 \)

\(W = \frac{4 - 13

Frequently Asked Questions

How do I solve the equation (w - 8)(2w - 1) = 0 for w?

Set each factor equal to zero: $w - 8 = 0$ or $2w - 1 = 0$. Solving these gives $w = 8$ and $w = 1/2$.

What are the solutions to the equation (w - 8)(2w - 1) = 0?

The solutions are $w = 8$ and $w = 1/2$.

How do I find the roots of the quadratic expression (w - 8)(2w - 1)?

Set each factor equal to zero: $w - 8 = 0$ (which gives $w = 8$) and $2w - 1 = 0$ (which gives $w = 1/2$).

Can I expand (w - 8)(2w - 1) before solving for w?

Yes, expanding gives $2w^2 - w - 16w + 8 = 0$, which simplifies to $2w^2 - 17w + 8 = 0$. Then, you can solve using the quadratic formula.

What is the quadratic formula to solve 2w^2 - 17w + 8 = 0?

$w = [17 \pm \sqrt{(17^2 - 428)}] / (22)$, which simplifies to $w = [17 \pm \sqrt{(289 - 64)}] / 4$.

What are the approximate solutions when solving (w - 8)(2w - 1) = 0?

The solutions are $w \approx 8$ and $w \approx 0.0588$ (from the quadratic formula).

Is (w - 8)(2w - 1) = 0 a factored quadratic equation?

Yes, it is factored form of a quadratic equation, and solving it involves setting each factor to zero.

What steps should I follow to solve (w - 8)(2w - 1) = 0?

First, set each factor equal to zero: $w - 8 = 0$ and $2w - 1 = 0$. Then, solve each for w to find the solutions.

How do I interpret the solutions w = 8 and w = 1/2 in the context of the original equation?

These are the values of w that make the original expression equal to zero, i.e., where the product (w - 8)(2w - 1) equals zero.

Can the equation (w - 8)(2w - 1) = 0 have more than two solutions?

No, since it's a quadratic (product of two factors), it can have at most two real solutions, which are w = 8 and w = 1/2.

Additional Resources

Solve For The Value Of W.(w-8)(2W-1): An In-Depth Analytical Exploration

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Introduction

Mathematics is a discipline rooted in problem-solving, logical reasoning, and the pursuit of understanding relationships between quantities. One intriguing class of problems involves solving algebraic expressions to determine the value of variables that satisfy certain conditions. Among these, the expression W · (W - 8) · (2W - 1) offers a compelling case study for algebraic manipulation and critical reasoning.

This article rigorously investigates the problem: Solve For The Value Of W · (W - 8) · (2W - 1). While seemingly straightforward, the task involves multiple layers of algebraic analysis, potential constraints, and interpretive nuances. We aim to dissect this problem thoroughly, exploring possible solution pathways, implications, and mathematical insights.

Contextualizing the Problem

Before delving into solution strategies, it's crucial to clarify what the problem entails:

- Nature of the problem: It appears to be an algebraic expression involving a variable \(W \). The phrase "solve for the value of \(W \)" suggests we are either asked to find specific numeric solutions or to analyze the expression's properties.

- Possible interpretations:

- If the problem provides an equation, such as $W \cdot (W - 8) \cdot (2W - 1) = 0$, then the solution involves finding the roots where the expression equals zero.
- Alternatively, the problem could be asking for the maximum or minimum value of the expression as a function of W.
- Or, perhaps, the problem aims to find the value of W for which the entire expression equals a specific target.

Given the phrase "Solve For The Value Of W.(w-8)(2W-1)", we interpret it as a request to find all W such that the expression is zero, i.e., the roots of the expression.

Mathematical Foundations and Approach

1. Parsing the Expression

The expression:

$$
E(W) = W \cdot (W - 8) \cdot (2W - 1)
$$

is a cubic polynomial in W. To analyze it, we can expand it, identify roots, and understand its behavior.

2. Factoring and Roots

Since the expression is already factored, the roots are straightforward to identify:

- $W = 0$
- $W - 8 = 0 \Rightarrow W = 8$
- $2W - 1 = 0 \Rightarrow W = \frac{1}{2}$

Thus, the solutions to $E(W) = 0$ are:

$$
\boxed{
W = 0, \quad W = 8, \quad W = \frac{1}{2}
}
$$

These roots are critical points where the entire expression evaluates to zero.

Deeper Analysis: Behavior, Significance, and Applications

3. Sign Analysis and Graphical Behavior

Understanding the behavior of $E(W)$ across the real number line involves examining the sign of each factor and their combined effects:

Interval	W	W	$W - 8$	$2W - 1$	Sign of $E(W)$
$(-\infty, 0)$	Negative	Negative	Negative	Negative	Negative (since 3 negatives)
$(0, \frac{1}{2})$	Positive	Negative	Negative	Negative	Positive (two negatives make positive, multiplied by positive)
$(\frac{1}{2}, 8)$	Positive	Negative	Negative	Positive	Negative (two negatives and one positive)
$(8, \infty)$	Positive	Positive	Positive	Positive	Positive

This sign analysis reveals the cubic's behavior:

- $E(W)$ is negative in $(-\infty, 0)$,
- positive in $(0, \frac{1}{2})$,
- negative in $(\frac{1}{2}, 8)$,
- positive in $(8, \infty)$.

The roots at $0, \frac{1}{2}, 8$ are where the function crosses the x-axis.

4. Critical Points and Extrema

To find local maxima and minima, differentiate $E(W)$:

$$
E(W) = W (W - 8)(2W - 1)
$$

Expanding:

$$
E(W) = W (W - 8)(2W - 1)
$$

Calculate step-by-step:

$$
(W - 8)(2W - 1) = 2W^2 - W - 16W + 8 = 2W^2 - 17W + 8
$$

Thus,

$$
E(W) = W (2W^2 - 17W + 8) = 2W^3 - 17W^2 + 8W
$$

\]

Derivative:

\[
E'(W) = 6W^2 - 34W + 8
\]

Set \(E'(W) = 0 \):

\[
6W^2 - 34W + 8 = 0
\]

Divide through by 2:

\[
3W^2 - 17W + 4 = 0
\]

Quadratic formula:

\[
W = \frac{17 \pm \sqrt{(-17)^2 - 4 \times 3 \times 4}}{2 \times 3} = \frac{17 \pm \sqrt{289 - 48}}{6} = \frac{17 \pm \sqrt{241}}{6}
\]

Since \(\sqrt{241} \approx 15.52 \), the critical points are approximately:

- \(W \approx \frac{17 + 15.52}{6} \approx \frac{32.52}{6} \approx 5.42 \)
- \(W \approx \frac{17 - 15.52}{6} \approx \frac{1.48}{6} \approx 0.25 \)

These critical points indicate where the function has local extrema.

Application: Solving for Specific Values

The initial analysis suggests that if the goal is to find values of \(W \) where the expression equals zero, the roots are as identified:

\[
W = 0, \quad W = 8, \quad W = \frac{1}{2}
\]

However, if the problem involves solving for \(W \) given a specific value of \(E(W) \), say \(E(W) = K \), then the approach involves solving the cubic:

\[
2W^3 - 17W^2 + 8W = K

\]

which may require numerical methods or factoring techniques depending on K.

Theoretical and Practical Significance

1. Algebraic Roots and Polynomial Behavior

The roots of the polynomial provide critical insight into the function's behavior, including points of intersection with the x-axis and changes in sign. Such roots are fundamental in algebra, calculus, and applied mathematics, underpinning many scientific modeling scenarios.

2. Critical Points and Optimization

Identifying critical points via derivatives allows us to understand where the function reaches local maxima or minima, which is essential in optimization problems in engineering, economics, and physics.

Limitations and Considerations

While the roots are straightforward, real-world applications often require considering constraints or additional conditions:

- If W is restricted to positive values, the roots at negative W are irrelevant.
- If $E(W)$ models a physical quantity, only positive solutions might be meaningful.
- Numerical solutions become necessary when solving for specific $E(W) \neq 0$.

Conclusion

The problem Solve For The Value Of W.(w-8)(2W-1) exemplifies the power and elegance of algebraic analysis. By recognizing the factors, identifying roots, and analyzing the polynomial's behavior, one gains comprehensive insight into the solutions and the nature of the function.

The roots at $W = 0, \frac{1}{2}, 8$ are fundamental to understanding the polynomial's zero-crossings, while derivative analysis reveals the critical points that inform us about local extrema. Whether applied in theoretical contexts or practical problem-solving, these insights are foundational in mathematical sciences.

In sum, this investigation underscores that even seemingly simple algebraic expressions can unveil rich structures and behaviors, emphasizing the importance of thorough analysis in mathematical problem-solving.

References

- Stewart, J. (2015). Calculus: Early Transcendentals. Cengage Learning.
- Lay, D. C. (2012). Linear Algebra and Its Applications. Addison-Wesley.
- Anton, H., Bivens, I., & Davis, S. (2013). Calculus: Early Transcendental. Wiley.

Note: For specific numerical solutions or more advanced analysis such as graphing or solving for particular constants, computational tools like WolframAlpha, MATLAB, or graphing calculators are recommended.

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