Use Properties To Rewrite The Given Equation. Which Equations Have The Same Solution As 2.3p 10.1 = 6.5p

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Understanding how to manipulate equations using algebraic properties is essential for solving for variables and identifying equivalent equations that share the same solution set. In this article, we will explore the process of rewriting the given equation $2.3p \times 10.1 = 6.5p$, analyze which equations have the same solutions, and discuss the algebraic properties involved in these transformations.

Understanding the Given Equation

The initial equation is:

```plaintext
2.3p × 10.1 = 6.5p
```

Before proceeding to manipulate this equation, let's understand its components:

- The variable p appears on both sides.
- The left side involves the product of 2.3, 10.1, and p.
- The right side involves 6.5 multiplied by p.

Our goal is to simplify or rewrite this equation using algebraic properties to identify equivalent forms and determine all solutions for p.

Algebraic Properties Used in Equation Rewriting

When rewriting equations, several algebraic properties are frequently used:

1. Commutative Property of Multiplication

- States that $a \times b = b \times a$.
- Useful for rearranging factors for clarity.

2. Associative Property of Multiplication

- States that $(a \times b) \times c = a \times (b \times c)$.
- Facilitates grouping factors differently.

3. Distributive Property

- States that $a \times (b + c) = a \times b + a \times c$.
- Useful when expanding or factoring expressions.

4. Division Property of Equality

- States that dividing both sides of an equation by a non-zero number maintains equality.
- Used to isolate variables.

5. Multiplicative Inverse

- For a non-zero number a, the inverse is $1/a$, such that $a \times (1/a) = 1$.
- Used to solve for variables by division.

Rewriting the Given Equation Step-by-Step

Let's now apply these properties to rewrite the given equation.

Original Equation:

```plaintext
2.3p × 10.1 = 6.5p
```

Step 1: Rewrite the Left Side Using Associative Property

The left side involves a product of constants and p:

```plaintext
(2.3 × 10.1) p = 6.5p
```

Calculating 2.3×10.1:

```plaintext
```

2.3 × 10.1 = 23.23
```

Therefore, the equation becomes:

```plaintext
23.23p = 6.5p
```

Step 2: Bring All Terms to One Side

Subtract \(6.5p \) from both sides to set the equation to zero:

```plaintext
23.23p - 6.5p = 0
```

Using the distributive property in reverse (factoring out \(p \)):

```plaintext
(23.23 - 6.5)p = 0
```

Calculate \(23.23 - 6.5 \):

```plaintext
16.73p = 0
```

Step 3: Solve for \(p \)

Divide both sides by 16.73 (non-zero):

```plaintext
p = 0 / 16.73 = 0
```

Solution:

\[
\boxed{
p = 0
}
\]

This is the only solution, as the equation simplifies to a linear equation with a unique solution.
```

Identifying Equations With the Same Solution

Equations that are equivalent to the original, in the sense that they have the same solution set, can be derived through algebraic properties such as multiplying or dividing both sides by non-zero constants, rearranging terms, or factoring.

Let's explore some of these equivalent equations.

Equation 1: Dividing Both Sides by 16.73

Starting from:

```plaintext
16.73p = 0
```

Dividing both sides by 16.73:

```plaintext
p = 0
```

This confirms that dividing both sides by a non-zero constant preserves the solution.

Equation 2: Re-Expressed Original Equation

Rearranged form:

```plaintext
23.23p = 6.5p
```

Subtract \(6.5p \) from both sides:

```plaintext
(23.23 - 6.5)p = 0
```

Which simplifies to:

```plaintext
16.73p = 0
```

Again, leading to \(p=0 \).

Equation 3: Multiplying Both Sides by Non-zero Constant

Suppose we multiply both sides of the original equation by 2:

```plaintext
2 × (2.3p × 10.1) = 2 × 6.5p
```

Calculate:

```plaintext
(2 × 23.23)p = 13p
```

which simplifies to:

```plaintext
46.46p = 13p
```

Subtract \(13p \):

```plaintext
(46.46 - 13)p = 0
```

which simplifies to:

```plaintext
33.46p = 0
```

Leading to \(p=0 \).

Since the constant multiplier is non-zero, the solution remains the same.

Equation 4: Rewriting as an Equation Without Variables

Another equivalent form involves moving all terms to one side:

```plaintext
2.3p × 10.1 - 6.5p = 0
```

which simplifies to:

```plaintext
(23.23p - 6.5p) = 0
```

or:

```plaintext
16.73p = 0
```

Again, solution $p=0$.

General Principles for Creating Equivalent Equations

From the above examples, several key principles emerge:

- Dividing both sides by a non-zero constant does not change the solution set.
- Multiplying both sides by a non-zero constant maintains equivalence.
- Adding or subtracting the same expression from both sides preserves solutions.
- Factoring or expanding expressions can generate equivalent equations.
- Rearranging terms, such as moving all variable terms to one side, does not alter solutions.

Summary: Equations That Have the Same Solution as the Original

Based on the manipulations, the following are equivalent to the original equation:

1. The simplified form:

```plaintext
16.73p = 0
```

2. Any equation obtained by multiplying both sides of the original by a non-zero constant, such as:

```plaintext
46.46p = 13p
```

3. Any rearrangement involving moving all variable terms to one side, as in:

```plaintext
(23.23 - 6.5)p = 0
```

4. Equations derived by dividing both sides by a non-zero number:

```plaintext
p = 0
```

5. Equations involving the original constants but expressed differently, such as:

```plaintext
2.3p × 10.1 = 6.5p
```

which we already know is equivalent.

Practical Applications of Equation Rewriting

Understanding how to rewrite equations using algebraic properties is essential in various real-world contexts, including:

- Solving for unknowns in engineering and physics: Rewriting complex equations simplifies calculations.
- Data analysis and modeling: Transforming equations to standard forms helps in interpreting results.
- Financial calculations: Rewriting formulas ensures clarity and correctness in computations.

Conclusion

In conclusion, the key to rewriting equations like $2.3p \times 10.1 = 6.5p$ lies in understanding and applying algebraic properties such as the associative, commutative, distributive, and division properties. The original equation simplifies to $16.73p = 0$, leading to the unique solution $p=0$. Any equation derived through multiplication or division by non-zero constants, or through rearrangement, maintains the same solution set.

By mastering these properties and techniques, students and professionals can confidently manipulate equations, solve for unknowns, and identify equivalent forms, which are foundational skills in algebra and many applied fields.

Keywords: algebraic properties, equation rewriting, solving equations, equivalent equations, properties of equality, linear equations, algebra tips, mathematical transformations

Frequently Asked Questions

How can properties be used to rewrite the equation 2.3p + 10.1 = 6.5p?

Properties like the distributive, commutative, and associative properties can be used to rearrange and simplify the equation, such as subtracting 2.3p from both sides to isolate the variable terms.

Which equations have the same solution as 2.3p + 10.1 = 6.5p?

Any equation that simplifies to the same value of p as the original equation, such as 2.3p - 6.5p = -10.1, or rearranged forms like -4.2p = -10.1.

Can you give an example of an equivalent equation to 2.3p + 10.1 = 6.5p?

Yes, subtract 2.3p from both sides to get 10.1 = 4.2p. This is equivalent because it maintains the same solution for p.

What property justifies subtracting 2.3p from both sides in the original equation?

The subtraction property of equality states that subtracting the same amount from both sides of an equation preserves equality.

Is the equation 10.1 = 4.2p equivalent to the original equation?

Yes, after rearranging the original equation by subtracting 2.3p from both sides, it simplifies to 10.1 = 4.2p, which has the same solution.

How do you determine which equations have the same

solution as the original?

By applying valid properties of equality to manipulate the original equation into different forms, ensuring the solution for p remains unchanged.

What is the solution to the equation 10.1 = 4.2p?

The solution is p = 10.1 / 4.2, which simplifies to $p \approx 2.4048$.

Can multiplying or dividing both sides of the original equation help find equivalent equations?

Yes, multiplying or dividing both sides by a non-zero number, such as dividing both sides by 4.2, can produce equivalent equations that lead to the same solution for p.

What is the importance of properties when rewriting equations like 2.3p + 10.1 = 6.5p?

Properties ensure that the equations are manipulated correctly, preserving their solutions while allowing for simpler or more convenient forms for solving.

Are equations like 2.3p + 10.1 = 6.5p and 10.1 = 4.2p equivalent?

Yes, because they are different forms of the same relationship, and both lead to the same solution for p.

Additional Resources

Use Properties To Rewrite The Given Equation is a fundamental skill in algebra that enables students and mathematicians alike to simplify, analyze, and solve equations more efficiently. Mastering how to manipulate equations using properties of equality and algebraic properties not only enhances problem-solving skills but also deepens understanding of the relationships between variables. In this article, we will explore the concept of rewriting equations using properties, examine which equations share the same solutions as the given equation \(2.3p \times 10.1 = 6.5p \), and discuss the various methods and considerations involved in this process.

Understanding the Importance of Rewriting Equations

Rewriting equations involves applying algebraic properties—such as the distributive, associative, commutative, and identity properties—to transform equations into equivalent forms. This process is crucial for several reasons:

- Simplification: Making equations easier to work with.
- Isolation of Variables: Facilitating the solving process.
- Comparison: Determining if different equations have the same solutions.
- Error Checking: Confirming the correctness of solutions.

By mastering the use of properties, one can manipulate complex equations into simpler, more revealing forms, which can be essential for solving and understanding them.

The Given Equation: $2.3p \times 10.1 = 6.5p$

Let's analyze the given equation and the methods to rewrite it:

$$
2.3p \times 10.1 = 6.5p
$$

This equation involves a variable p, coefficients, and multiplication. Our goal is to rewrite this equation using properties to facilitate solving and to identify other equations with the same solutions.

Applying Properties to Rewrite the Equation

Step 1: Use the Commutative Property of Multiplication

The commutative property states that:

$$
a \times b = b \times a
$$

Applying this to the left side:

$$
2.3p \times 10.1 = 10.1 \times 2.3p
$$

Step 2: Use the Associative Property of Multiplication

The associative property states that:

$$
(a \times b) \times c = a \times (b \times c)
$$

While not directly necessary here, it can help group constants:

$$
(2.3 \times 10.1) \times p = 6.5p
$$

Calculate 2.3×10.1:

$$
2.3 \times 10.1 = (2 \times 10.1) + (0.3 \times 10.1) = 20.2 + 3.03 = 23.23
$$

So, the equation simplifies to:

$$
23.23p = 6.5p
$$

Step 3: Use the Subtraction Property of Equality

Subtract $6.5p$ from both sides:

$$
23.23p - 6.5p = 0
$$

Combine like terms:

$$
(23.23 - 6.5)p = 0
$$

Calculate:

$$
16.73p = 0
$$

Step 4: Solve for p

Divide both sides by 16.73 (assuming $p \neq 0$, but since the coefficient is non-zero):

$$
p = 0
$$

This reveals that the only solution for the original equation is $p = 0$.

Equations That Have The Same Solution as the Given Equation

Understanding which equations share the same solution set as the original involves analyzing how transformations affect the solutions. Since the original equation simplifies to $p = 0$, any equivalent equation must also have $p = 0$ as its sole solution.

Criteria for Equations to Have the Same Solution

- Equivalent transformations: Equations obtained by applying properties that do not change the solution set.
- Linear equations with the same coefficient ratio: For example, equations that simplify to the form $kp = 0$, where $k \neq 0$.

Examples of Equations with the Same Solution

1. $23.23p - 6.5p = 0$

- After combining like terms, it reduces to $16.73p = 0$, which gives $p = 0$.

2. $0.5p = 0$

- Directly implies $p = 0$.

3. $10p - 10p = 0$

- Simplifies to $0 = 0$ for all p, but to have the same solution $p=0$, the equation should be set equal to zero:

$$
10p - 10p = 0
$$

which simplifies to $0=0$, indicating any p is a solution, so it does not have only $p=0$. To restrict solutions to $p=0$, consider:

$$
10p = 10p
$$

which is an identity and has all real numbers as solutions, so not equivalent.

4. $16.73p = 0$

- Exactly the simplified form of the original equation, solution $p=0$.

Summary

Equations that are scalar multiples or rearrangements of $16.73p = 0$, such as \(2 \times 8.365p =

0 \), or equations obtained by applying properties that preserve solutions, will have the same solution \(p=0 \).

Methods to Rewrite Equations Using Properties

Rewriting an equation involves various properties, each serving specific purposes:

1. Distributive Property

- Used to expand or factor expressions.
- Example: \(a(b + c) = ab + ac \).

2. Commutative Property

- Switch the order of terms.
- Example: \(a + b = b + a \) (for addition), \(a \times b = b \times a \) (for multiplication).

3. Associative Property

- Group terms differently.
- Example: \((a + b) + c = a + (b + c) \).

4. Identity Property

- Use the fact that adding zero or multiplying by one leaves the value unchanged.
- Example: \(a + 0 = a \), \(a \times 1 = a \).

5. Inverse Property

- Use additive or multiplicative inverses to isolate variables.
- Example: \(a + (-a) = 0 \), \(a \times \frac{1}{a} = 1 \) (assuming \(a \neq 0 \)).

Practical Application: Solving and Rewriting Equations

Let’s consider a step-by-step approach to rewriting equations to find solutions:

Step 1: Simplify the equation using properties

- Expand products if necessary.
- Combine like terms.

Step 2: Isolate the variable

- Use inverse properties (subtract/add, divide/multiply) as needed.

Step 3: Verify the solution

- Substitute back into the original or rewritten equations to confirm.

Pros and Cons of Rewriting Equations Using Properties

Pros:

- Clarity: Rewriting can make solutions more transparent.
- Simplification: Reduces complexity, making solving easier.
- Versatility: Different forms can reveal different insights.
- Error Prevention: Helps identify mistakes in earlier steps.

Cons:

- Potential for Mistakes: Incorrect application of properties can lead to wrong solutions.
- Time-consuming: Excessive rewriting may be unnecessary for simple equations.
- Over-complication: Transforming equations unnecessarily may obscure the solution.

Conclusion

Using properties to rewrite equations is a powerful technique that underpins algebraic problem-solving. The given equation $2.3p \times 10.1 = 6.5p$ simplifies to $16.73p = 0$, leading to the unique solution $p=0$. Equations that are scalar multiples or algebraic rearrangements of this form will share the same solution. Recognizing these forms allows a deeper understanding of the relationships between equations and their solutions. Mastery of properties of equality and algebraic manipulation enables efficient solving, comparison, and analysis of equations, making it an essential skill for students and professionals working with mathematical expressions.

By practicing rewriting equations using properties, learners can develop a more intuitive and flexible approach to algebra, improving their problem-solving speed and accuracy. Whether simplifying complex expressions or verifying solutions, the strategic application of algebraic properties remains a cornerstone of mathematical proficiency.

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