# **Lesson 8: Replacing Numbers with Letters**

# Classwork

## **Opening Exercise**

| 4 | + | 0 | = | 4             |
|---|---|---|---|---------------|
| 4 | × | 1 | = | 4             |
| 4 | ÷ | 1 | = | 4             |
| 4 | × | 0 | = | 0             |
| 1 | ÷ | 4 | = | $\frac{1}{4}$ |

How many of these statements are true?

How many of those statements would be true if the number 4 was replaced with the number 7 in each of the number sentences?

Would the number sentences be true if we were to replace the number 4 with any other number?

What if we replaced the number 4 with the number 0? Would each of the number sentences be true?

What if we replace the number 4 with a letter g? Please write all 4 expressions below, replacing each 4 with a g.



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Are these all true (except for g = 0) when dividing?

Example 1: Additive Identity Property of Zero

$$g + 0 = g$$

Remember a letter in a mathematical expression represents a number. Can we replace g with any number?

Choose a value for g, and replace g with that number in the equation. What do you observe?

Repeat this process several times, each time choosing a different number for g.

Will all values of g result in a true number sentence?

Write the mathematical language for this property below.



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#### **Example 2: Multiplicative Identity Property of One**

### $g\times 1=g$

Remember a letter in a mathematical expression represents a number. Can we replace g with any number?

Choose a value for g, and replace g with that number in the equation. What do you observe?

Will all values of *g* result in a true number sentence? Experiment with different values before making your claim.

Write the mathematical language for this property below.

**Example 3: Commutative Property of Addition and Multiplication** 

3 + 4 = 4 + 3 $3 \times 4 = 4 \times 3$ 

Replace the 3's in these number sentences with the letter a.

Choose a value for a, and replace a with that number in each of the equations. What do you observe?



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Will all values of *a* result in a true number sentence? Experiment with different values before making your claim.

Now write the equations again, this time replacing the number 4 with a variable, b.

Will all values of *a* and *b* result in true number sentences for the first two equations? Experiment with different values before making your claim.

Write the mathematical language for this property below.

# Example 4

$$3 + 3 + 3 + 3 = 4 \times 3$$
$$3 \div 4 = \frac{3}{4}$$

Replace the 3's in these number sentences with the letter a.



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Choose a value for *a* and replace *a* with that number in each of the equations. What do you observe?

Will all values of *a* result in a true number sentence? Experiment with different values before making your claim.

Now write the equations again, this time replacing the number 4 with a variable, b.

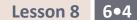
Will all values of *a* and *b* result in true number sentences for the equations? Experiment with different values before making your claim.



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## **Problem Set**

- 1. State the commutative property of addition using the variables *a* and *b*.
- 2. State the commutative property of multiplication using the variables *a* and *b*.
- 3. State the additive property of zero using the variable *b*.
- 4. State the multiplicative identity property of one using the variable *b*.
- 5. Demonstrate the property listed in the first column by filling in the third column of the table.

| Commutative Property of Addition        | 25 + c =       |  |
|---|----------------|--|
| Commutative Property of Multiplication  | $l \times w =$ |  |
| Additive Property of Zero               | h + 0 =        |  |
| Multiplicative Identity Property of One | $v \times 1 =$ |  |

6. Why is there no commutative property for subtraction or division? Show examples.



