Lesson 8: Replacing Numbers with Letters

Student Outcomes

- Students understand that a letter in an expression or an equation can represent a number. When that number is replaced with a letter, an expression or an equation is stated.
- Students discover the commutative properties of addition and multiplication, the additive identity property of zero, and the multiplicative identity property of one. They determine that $g \div 1 = g$, $g \div g = 1$, *and* $1 \div g = \frac{1}{g}$.

Classwork

Opening Exercise

$4 + 0 = 4$
$4 \times 1 = 4$
$4 \div 1 = 4$
$4 \times 0 = 0$
$1 \div 4 = \frac{1}{4}$

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?

Feb 10-6:40 AM

Opening Exercise

$4 + 0 = 4$
$4 \times 1 = 4$
$4 \div 1 = 4$
$4 \times 0 = 0$
$1 \div 4 = \frac{1}{4}$

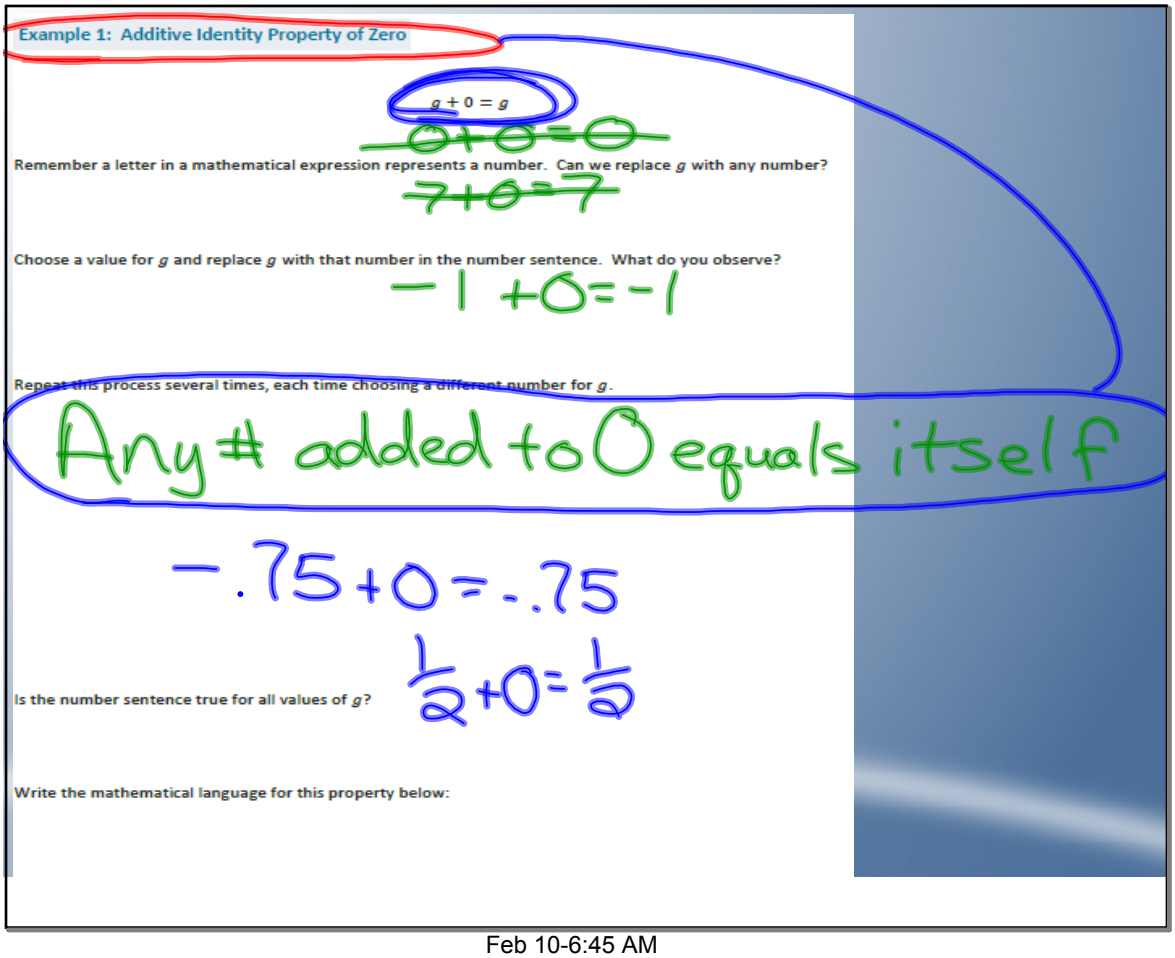
Would the number sentences be true if we were to replace the number 4 with any other number?

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

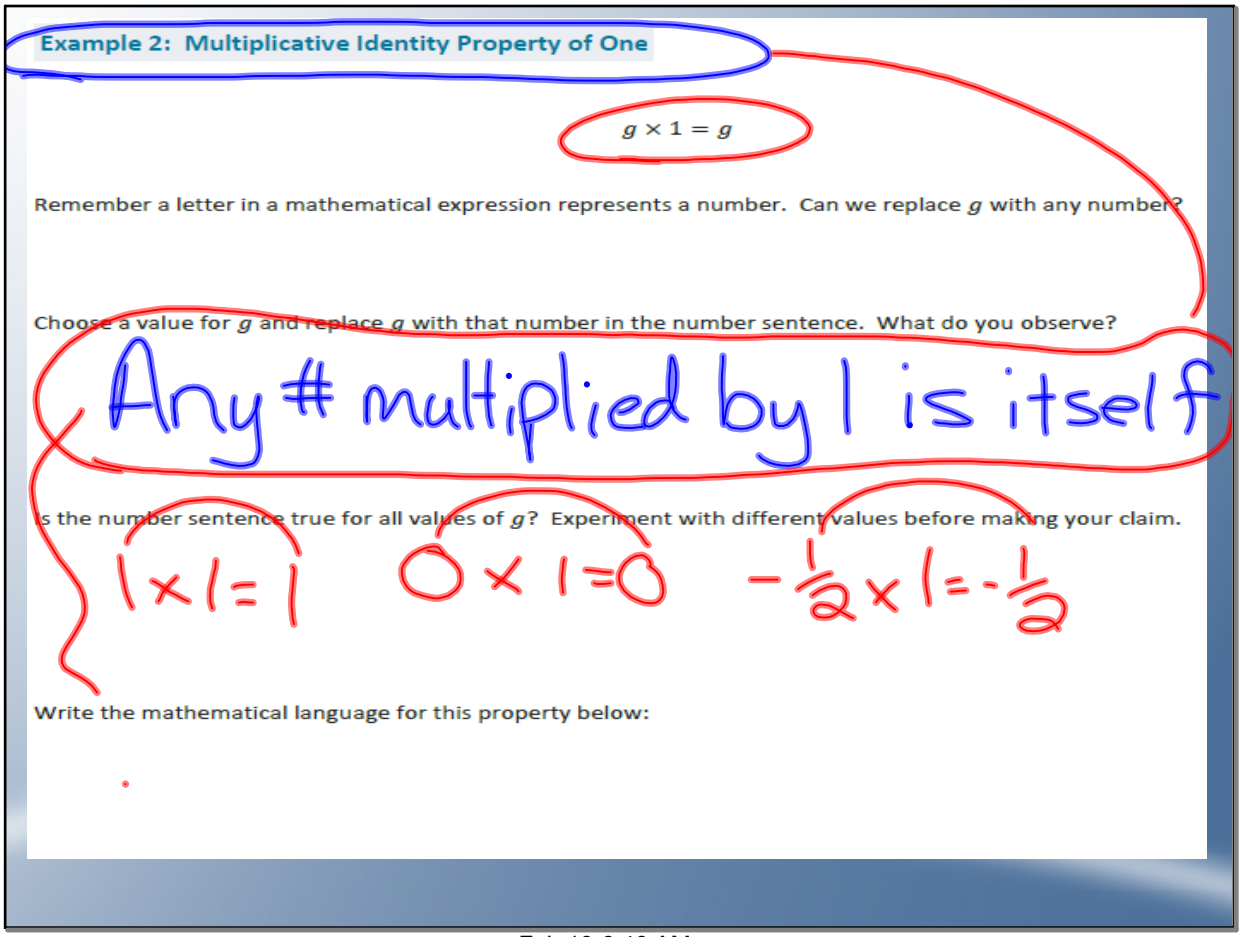
What if we replace the number 4 with a letter g? Please write all 4 expressions below, replacing each 4 with a g.

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

Feb 10-6:43 AM



Feb 10-6:45 AM



Feb 10-6:46 AM

Example 3: Commutative Property of Addition and Multiplication

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

Co = Change Order

TAT = Turn Around Town

Replace the 3 in these equations with the letter a.

$a + 4 = 4 + a$

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

In addition & multiplication, the order does not matter, the answer is the same.

Are the number sentences true for all values of a? Experiment with different values before making your claim.

Feb 10-6:48 AM

Example 3: Commutative Property of Addition and Multiplication

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

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

~~Comm. of Subtraction & Div.~~

$5 - 4 = 4 - 5$ ✓ 1 ✗ -1

$-2 - 2 = 2 - (-2)$

$2 - 2 = 2 - 2$ ✓ 0

~~$20 \div 5 = 5 \div 20$~~ ✗ 4

Are the first two number sentences true for all values of a and b? Experiment with different values before making your claim.

Write the mathematical language for this property below:

Feb 10-6:49 AM

Closing Activities

- Tell your partner which of these properties of numbers is the easiest for you to remember?
- Now tell your partner which of these properties of numbers is the hardest for you to remember?
- Although these properties might seem simple, we apply them in many different ways in mathematics. If you have a good grasp on them, you will recognize them and use them in many applications.
- With a partner, create two different division problems that supports the following: $g \times 1 = g$, and be ready to explain your reasoning.

Feb 12-5:51 AM

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.

Feb 10-6:51 AM

Lesson 8: Replacing Numbers with Letters

Exit Ticket

1. State the commutative property of addition, and provide an example using two different numbers.

2. State the commutative property of multiplication, and provide an example using two different numbers.

3. State the additive property of zero, and provide an example using any other number.

4. State the multiplicative identity property of one, and provide an example using any other number.

Feb 10-6:52 AM