

## Lesson 5: Using the Identity and Inverse to Write Equivalent Expressions

### Classwork

#### Opening Exercise

- a. In the morning, Harrison checked the temperature outside to find that it was  $-12^{\circ}\text{F}$ . Later in the afternoon, the temperature rose  $12^{\circ}\text{F}$ . Write an expression representing the temperature change. What was the afternoon temperature?
  
  
  
  
  
  
  
  
  
  
- b. Rewrite subtraction as adding the inverse for the following problems and find the sum.
  - i.  $2 - 2$
  
  
  
  
  
  
  
  
  
  
  - ii.  $-4 - (-4)$
  
  
  
  
  
  
  
  
  
  
  - iii. The difference of 5 and 5
  
  
  
  
  
  
  
  
  
  
  - iv.  $g - g$

- c. What pattern do you notice in part (a) and (b)?
- d. Add or subtract.
- $16 + 0$
  - $0 - 7$
  - $-4 + 0$
  - $0 + d$
- v. What pattern do you notice in parts (i) through (iv)?
- e. Your younger sibling runs up to you and excitedly exclaims, "I'm thinking of a number. If I add it to the number 2 ten times, that is,  $2 + \text{my number} + \text{my number} + \text{my number}$ , and so on, then the answer is 2. What is my number?" You almost immediately answer, "zero," but are you sure? Can you find a different number (other than zero) that has the same property? If not, can you justify that your answer is the only correct answer?

**Example 1**

Write the sum, and then write an equivalent expression by collecting like terms and removing parentheses.

a.  $2x$  and  $-2x + 3$

b.  $2x - 7$  and the opposite of  $2x$

c. The opposite of  $(5x - 1)$  and  $5x$

**Exercise 1**

With a partner, take turns alternating roles as writer and speaker. The speaker verbalizes how to rewrite the sum and properties that justify each step as the writer writes what is being spoken without any input. At the end of each problem, discuss in pairs the resulting equivalent expressions.

Write the sum, and then write an equivalent expression by collecting like terms and removing parentheses whenever possible.

a.  $-4$  and  $4b + 4$

b.  $3x$  and  $1 - 3x$

- c. The opposite of  $4x$  and  $-5 + 4x$
- d. The opposite of  $-10t$  and  $t - 10t$
- e. The opposite of  $(-7 - 4v)$  and  $-4v$

**Example 2**

- $\left(\frac{3}{4}\right) \times \left(\frac{4}{3}\right) =$
- $4 \times \frac{1}{4} =$
- $\frac{1}{9} \times 9 =$
- $\left(-\frac{1}{3}\right) \times -3 =$
- $\left(-\frac{6}{5}\right) \times \left(-\frac{5}{6}\right) =$

Write the product, and then write the expression in standard form by removing parentheses and combining like terms. Justify each step.

- a. The multiplicative inverse of  $\frac{1}{5}$  and  $\left(2x - \frac{1}{5}\right)$
- b. The multiplicative inverse of 2 and  $(2x + 4)$

- c. The multiplicative inverse of  $\left(\frac{1}{3x+5}\right)$  and  $\frac{1}{3}$

### Exercise 2

Write the product, and then write the expression in standard form by removing parentheses and combining like terms. Justify each step.

- a. The reciprocal of 3 and  $-6y - 3x$
- b. The multiplicative inverse of 4 and  $4h - 20$
- c. The multiplicative inverse of  $-\frac{1}{6}$  and  $2 - \frac{1}{6}j$

## Problem Set

1. Fill in the missing parts.

- a. The sum of  $6c - 5$  and the opposite of  $6c$

$$(6c - 5) + (-6c)$$

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Rewrite subtraction as addition

$$6c + (-6c) + (-5)$$

\_\_\_\_\_

$$0 + (-5)$$

\_\_\_\_\_

\_\_\_\_\_

Additive identity property of zero

- b. The product of  $-2c + 14$  and the multiplicative inverse of  $-2$

$$(-2c + 14)\left(-\frac{1}{2}\right)$$

$$(-2c)\left(-\frac{1}{2}\right) + (14)\left(-\frac{1}{2}\right)$$

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Multiplicative inverse, multiplication

$$1c - 7$$

Adding the additive inverse is the same as subtraction

$$c - 7$$

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2. Write the sum, and then rewrite the expression in standard form by removing parentheses and collecting like terms.

- 6 and  $p - 6$
- $10w + 3$  and  $-3$
- $-x - 11$  and the opposite of  $-11$
- The opposite of  $4x$  and  $3 + 4x$
- $2g$  and the opposite of  $(1 - 2g)$

3. Write the product, and then rewrite the expression in standard form by removing parentheses and collecting like terms.

- $7h - 1$  and the multiplicative inverse of 7
- The multiplicative inverse of  $-5$  and  $10v - 5$
- $9 - b$  and the multiplicative inverse of 9
- The multiplicative inverse of  $\frac{1}{4}$  and  $5t - \frac{1}{4}$
- The multiplicative inverse of  $-\frac{1}{10x}$  and  $\frac{1}{10x} - \frac{1}{10}$

4. Write the expressions in standard form.

a.  $\frac{1}{4}(4x + 8)$

b.  $\frac{1}{6}(r - 6)$

c.  $\frac{4}{5}(x + 1)$

d.  $\frac{1}{8}(2x + 4)$

e.  $\frac{3}{4}(5x - 1)$

f.  $\frac{1}{5}(10x - 5) - 3$