Name _____ Date _____

California Standards

Algebra 1.1

Students use properties of numbers to demonstrate whether assertions are true or false.

Use Properties of Numbers

Example 1

Analyze a Mathematical Claim

Mary claims that $2(3x - 1) - 6x + 3 = 1$. Determine whether Mary's claim is *true* or *false*. *Justify* your answer.

Solution

Simplify the left side of the equation $2(3x - 1) - 6x + 3 = 1$

$2(3x - 1) - 6x + 3 = 6x - 2 - 6x + 3$		**Distributive property**
$= 6x - 6x - 2 + 3$		**Commutative property**
$= (6x - 6x) + (-2 + 3)$		**Associate property**
$= 0 + (-2 + 3)$		**Inverse property of addition**
$= 0 + 1$		**Add −2 and 3.**
$= 1$		**Identity property of addition**

Answer Mary's claim is true, $2(3x - 1) - 6x + 3 = 1$.

Example 2

Use the Closure Property

Is the set of negative integers *closed* under multiplication? Explain.

Solution

STEP 1 Assume that the set of negative integers is closed under multiplication and find a counterexample.

STEP 2 Multiplying a negative integer by another negative integer gives a positive integer.

Example: $-2 \cdot -4 = 8$

STEP 3 Because 8 is not a negative number, the set of negative integers is not closed under multiplication.

Answer No, the set of negative numbers is *not* closed under multiplication.

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Exercises

1. Which step is incorrect?

Step 1: $3[-4x + \frac{x}{3}(3 - 7y)] =$

$3(-4x) + 3\left(\frac{x}{3}\right)(3 - 7y)$

Step 2: $3(-4x) + 3\left(\frac{x}{3}\right)(3 - 7y) =$

$-12x + x(3 - 7y)$

Step 3: $-12x + x(3 - 7y) = -12x + 3x - 7y$

Step 4: $-12x + 3x - 7y = -9x - 7y$

(A) Step 3

(B) Step 1

(C) Step 2

(D) Step 4

2. The steps Jessie took to simplify this expression are shown below.

$$\left(\frac{1}{3x}\right)(4x - 9)$$

Step 1: $\left(\frac{1}{3x}\right)(4x - 9) = 4x\left(\frac{1}{3x}\right) - 9\left(\frac{1}{3x}\right)$

Step 2: $4x\left(\frac{1}{3x}\right) - 9\left(\frac{1}{3x}\right) = \frac{4}{3}\left(x \cdot \frac{1}{x}\right) - \left(\frac{1}{9}\right)(3x)$

Step 3: $\frac{4}{3}\left(x \cdot \frac{1}{x}\right) - \left(\frac{1}{9}\right)(3x) = \frac{4}{3}(1) - \left(\frac{1}{3}\right)x$

Step 4: $\frac{4}{3}(1) - \left(\frac{1}{3}\right)x = \frac{4}{3} - \frac{1}{3}x$

In which step does an error occur?

(A) Step 2

(B) Step 4

(C) Step 3

(D) Step 1

3. Which set is *closed* under multiplication?

(A) set of *all* integers

(B) set of *odd negative* integers

(C) set of *all negative* integers

(D) set of *even negative* integers

4. Which statement is true about the set below?

$S = \{\ldots, -6, -3, 0, 3, 6, \ldots\}$

(A) The set S is not closed under multiplication.

(B) The set S is closed under addition and multiplication.

(C) The set S is not closed under addition.

(D) The set S is closed under addition, but not under multiplication.

5. Zoe told Angelina that the set

$$\{\ldots, \tfrac{1}{27}, \tfrac{1}{9}, \tfrac{1}{3}, 1, 3, 9, \ldots\}$$

is closed. Under which operation or operations is the set *not* closed?

(A) Addition

(B) Addition and multiplication

(C) Multiplication

(D) None of the above.

6. Which of the following is incorrect?

(A) $(2 + 3)6 = 12 + 18$

(B) $(8 - 5x) + 3 = 8 + (-5x + 3)$

(C) $-6(9 + 8x) = -54 + 48x$

(D) $-7 - x = -x - 7$

7. Which set is closed under addition, but not multiplication?

(A) Negative integers

(B) Rational numbers

(C) Positive whole numbers

(D) Positive rational numbers