

## Lesson 3 - Properties of Operations

### Example 1

Name the property shown by the statement  $u + v = v + u$ .

The order in which the variables are being added changed. This is the Commutative Property of Addition.

### Example 2

State whether the following conjecture is *true* or *false*. If *false*, provide a counterexample.

*Subtraction of integers is commutative.*

Write two subtraction expressions using the Commutative Property.

$$17 - 9 \stackrel{?}{=} 9 - 17 \quad \text{State the conjecture.}$$

$$8 \neq -8 \quad \text{Subtract.}$$

We found a counterexample. That is,  $17 - 9 \neq 9 - 17$ . So, subtraction is *not* commutative. The conjecture is false.

### Example 3

Simplify the expression. Justify each step.

$$9 + (3x + 4)$$

$$9 + (3x + 4) = 9 + (4 + 3x) \quad \text{Commutative Property of Addition}$$

$$= (9 + 4) + 3x \quad \text{Associative Property of Addition}$$

$$= 13 + 3x \quad \text{Simplify.}$$

### Exercises

Name the property shown by each statement.

1.  $7 \cdot 1 = 7$

**Multiplicative Identity**

2.  $4 + (3y + 2) = (4 + 3y) + 2$

**Associative Property of Addition**

State whether the following conjectures are *true* or *false*. If *false*, provide a counterexample.

3. The product of two even numbers is odd. **false;  $4 \cdot 6 = 24$**

4. The difference of two odd numbers is even. **true**

5. Simplify  $4 + (5x + 2)$ . Justify each step.

$$4 + (5x + 2) = 4 + (2 + 5x)$$

$$= (4 + 2) + 5x$$

$$= 6 + 5x$$

**Commutative Property of Addition**

**Associative Property of Addition**

**Simplify**

# Lesson 3 Homework Practice

## Properties of Operations

Name the property shown by each statement.

1.  $1 \cdot (a + 3) = a + 3$

**Multiplicative Identity**

2.  $2p + (3q + 2) = (2p + 3q) + 2$

**Associative Property of Addition**

3.  $(ab)c = c(ab)$

**Commutative Property of Multiplication**

4.  $2t \cdot 0 = 0$

**Multiplicative Property of Zero**

5.  $m(nr) = (mn)r$

**Associative Property of Multiplication**

6.  $0 + 2s = 2s$

**Additive Identity**

State whether the following conjectures are *true* or *false*. If *false*, provide a counterexample.

7. The product of an odd number and an even number is always odd. **false;  $2 \cdot 3 = 6$**

8. The sum of two whole numbers is always larger than either whole number.  
**false;  $2 + 0 = 2$**

Simplify each expression. Justify each step.

9.  $2d(3)$

$2d(3) = 2(d \cdot 3) = 2(3d)$  **Associative Property of Multiplication**

$= (2 \cdot 3)d$  **Commutative Property of Multiplication**

$= 6d$  **Simplify.**

10.  $2y + (4 + 5y)$

$2 + (4 + 5y) = (2 + 4) + 5y$  **Associative Property of Addition**

$= 6 + 5y$  **Simplify.**

11. **FAXES** Marcellus sent four faxes to Gem. The first fax took 14 seconds to send, the second fax 19 seconds, the third 16 seconds, and the fourth 11 seconds. Use mental math to find out how many seconds it took to fax all four documents to Gem. Explain your reasoning. **60 s; Sample answer:  $14 + 16 = 30$ ,  $19 + 11 = 30$ ,  $30 + 30 = 60$**

12. **SNOW** The first four snowfalls of the year in Shawnee's hometown measured 1.6 inches, 2.2 inches, 1.8 inches, and 1.4 inches. Use mental math to find the total amount of snow that fell. Explain your reasoning. **7 in.; Sample answer:  $1.6 + 1.4 = 3$ ,  $2.2 + 1.8 = 4$ ,  $3 + 4 = 7$**