

## Indicator 20 Class Notes by Mrs. Joshi

### Properties and Equivalent Expressions

(Alabama Standard: 16, 17--I can identify and generate equivalent expressions using properties and combining like terms.)

#### 1.3 Lesson



**Key Vocabulary**  
equivalent expressions, p. 16

Expressions with the same value, like  $12 + 7$  and  $7 + 12$ , are **equivalent expressions**. The commutative and associative properties can be used to write equivalent expressions.

#### Key Ideas

##### Commutative Properties

**Words** Changing the order of addends or factors does not change the sum or product.

**Numbers**  $5 + 8 = 8 + 5$   
 $5 \cdot 8 = 8 \cdot 5$

**Algebra**  $a + b = b + a$   
 $a \cdot b = b \cdot a$

##### Associative Properties

**Words** Changing the grouping of addends or factors does not change the sum or product.

**Numbers**  $(7 + 4) + 2 = 7 + (4 + 2)$   
 $(7 \cdot 4) \cdot 2 = 7 \cdot (4 \cdot 2)$

**Algebra**  $(a + b) + c = a + (b + c)$   
 $(a \cdot b) \cdot c = a \cdot (b \cdot c)$

#### EXAMPLE 1 Using Properties to Simplify Expressions

- a. Simplify the expression  $7 + (12 + x)$ .

$$\begin{aligned} 7 + (12 + x) &= (7 + 12) + x && \text{Associative Property of Addition} \\ &= 19 + x && \text{Add 7 and 12.} \end{aligned}$$

- b. Simplify the expression  $(6.1 + x) + 8.4$ .

$$\begin{aligned} (6.1 + x) + 8.4 &= (x + 6.1) + 8.4 && \text{Commutative Property of Addition} \\ &= x + (6.1 + 8.4) && \text{Associative Property of Addition} \\ &= x + 14.5 && \text{Add 6.1 and 8.4.} \end{aligned}$$

- c. Simplify the expression  $5(11y)$ .

$$\begin{aligned} 5(11y) &= (5 \cdot 11)y && \text{Associative Property of Multiplication} \\ &= 55y && \text{Multiply 5 and 11.} \end{aligned}$$

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### Key Ideas

#### Addition Property of Zero

**Words** The sum of any number and 0 is that number.

**Numbers**  $7 + 0 = 7$

**Algebra**  $a + 0 = a$

#### Multiplication Properties of Zero and One

**Words** The product of any number and 0 is 0.

The product of any number and 1 is that number.

**Numbers**  $9 \times 0 = 0$

**Algebra**  $a \cdot 0 = 0$

$4 \times 1 = 4$

$a \cdot 1 = a$

### EXAMPLE 2 Using Properties to Simplify Expressions

- a. Simplify the expression  $9 \cdot 0 \cdot p$ .

$$9 \cdot 0 \cdot p = (9 \cdot 0) \cdot p$$

Associative Property of Multiplication

$$= 0 \cdot p = 0$$

Multiplication Property of Zero

- b. Simplify the expression  $4.5 \cdot r \cdot 1$ .

$$4.5 \cdot r \cdot 1 = 4.5 \cdot (r \cdot 1)$$

Associative Property of Multiplication

$$= 4.5 \cdot r$$

Multiplication Property of One

$$= 4.5r$$

### EXAMPLE 3 Real-Life Application

#### Common Error

You **and** six friends are on the team, so use the expression  $7x$ , not  $6x$ , to represent the cost of the T-shirts.

You and six friends play on a basketball team. A sponsor paid \$100 for the league fee,  $x$  dollars for each player's T-shirt, and \$68.25 for trophies. Write an expression for the total amount paid by the sponsor.

Add the entry fee, the cost of the T-shirts, and the cost of the trophies.

$$100 + 7x + 68.25 = 7x + 100 + 68.25$$

Commutative Property of Addition

$$= 7x + 168.25$$

Add 100 and 68.25.

∴ An expression for the total amount is  $7x + 168.25$ .

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### 1.4 Lesson



### Key Idea

#### Distributive Property

**Words** To multiply a sum or difference by a number, multiply each number in the sum or difference by the number outside the parentheses. Then evaluate.

**Numbers**

$$\begin{array}{l} 3(7 + 2) = 3 \times 7 + 3 \times 2 \\ \quad \quad \quad \uparrow \quad \uparrow \\ 3(7 - 2) = 3 \times 7 - 3 \times 2 \\ \quad \quad \quad \uparrow \quad \uparrow \end{array}$$

**Algebra**

$$\begin{array}{l} a(b + c) = ab + ac \\ \quad \quad \quad \uparrow \quad \uparrow \\ a(b - c) = ab - ac \\ \quad \quad \quad \uparrow \quad \uparrow \end{array}$$

### EXAMPLE 1 Using Mental Math

Use the Distributive Property and mental math to find  $8 \times 53$ .

$$\begin{array}{ll} 8 \times 53 = 8(50 + 3) & \text{Write 53 as } 50 + 3. \\ = 8(50) + 8(3) & \text{Distributive Property} \\ = 400 + 24 & \text{Multiply.} \\ = 424 & \text{Add.} \end{array}$$

### EXAMPLE 2 Simplifying Algebraic Expressions

Use the Distributive Property to simplify the expression.

a.  $4(n + 5)$

$$\begin{array}{ll} 4(n + 5) = 4(n) + 4(5) & \text{Distributive Property} \\ = 4n + 20 & \text{Multiply.} \end{array}$$

b.  $12(y - 3)$

$$\begin{array}{ll} 12(y - 3) = 12(y) - 12(3) & \text{Distributive Property} \\ = 12y - 36 & \text{Multiply.} \end{array}$$

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### EXAMPLE 3 Standardized Test Practice

Which expression is equivalent to  $9(6 + x + 2)$ ?

- (A)  $9x + 8$       (B)  $9x + 54$       (C)  $9x + 56$       (D)  $9x + 72$

$$\begin{aligned} 9(6 + x + 2) &= 9(6) + 9(x) + 9(2) && \text{Distributive Property} \\ &= 54 + 9x + 18 && \text{Multiply.} \\ &= 9x + 54 + 18 && \text{Commutative Property of Addition} \\ &= 9x + 72 && \text{Add 54 and 18.} \end{aligned}$$

❖ The correct answer is (D).

### EXAMPLE 4 Real-Life Application

José is  $x$  years old. His brother, Felipe, is 2 years older than José. Their aunt, Maria, is three times as old as Felipe. Write and simplify an expression that represents Maria's age in years.

Name	Description	Expression
José	He is $x$ years old.	$x$
Felipe	He is 2 years <i>older</i> than José. So, <i>add 2</i> to $x$ .	$x + 2$
Maria	She is three <i>times</i> as old as Felipe. So, <i>multiply 3</i> and $(x + 2)$ .	$3(x + 2)$

$$\begin{aligned} 3(x + 2) &= 3(x) + 3(2) && \text{Distributive Property} \\ &= 3x + 6 && \text{Multiply.} \end{aligned}$$

❖ Maria's age in years is represented by the expression  $3x + 6$ .