

1-4

**Essential Understanding** Relationships that are always true for real numbers are called *properties*, which are rules used to rewrite and compare expressions.

Two algebraic expressions are  if they have the same value for all values of the variable(s). The following properties show expressions that are equivalent for all real numbers.



**Properties Properties of Real Numbers**

Let  $a$ ,  $b$ , and  $c$  be any real numbers.

**Properties of Addition and Multiplication**

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

**Addition**

**Algebra**

**Example**

**Multiplication**



**Properties of Addition and Multiplication**

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

**Addition**

**Multiplication**





**Properties Properties of Real Numbers**

Let  $a$  be any real number.

**Properties of Addition and Multiplication**

The sum of any real number and 0 is the original number. The product of any real number and 1 is the original number.

**Addition**

**Multiplication**

**Algebra**

**Example**



**Property of Multiplication**

The product of  $a$  and 0 is 0.

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**Multiplication Property of**

The product of  $-1$  and  $a$  is  $-a$ .

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Match each property name to its example



Example

Property Name

$$3 + (4 + 5) = (3 + 4) + 5$$

$$3 + 7 = 7 + 3$$

$$33(14) = 14(33)$$

$$(9 \cdot 5) \cdot 7 = 9 \cdot (5 \cdot 7)$$

$$-\frac{2}{3} \cdot -\frac{3}{2} = 1$$

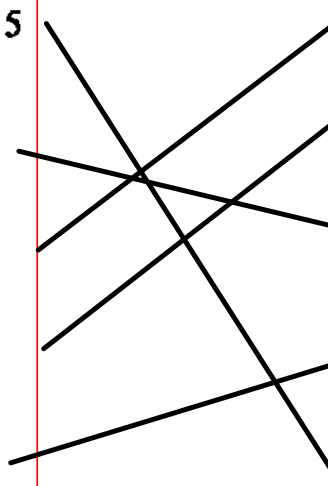
Commutative, Multiplication

Associative, Multiplication

Commutative, Addition

Inverse, Multiplication

Associative, Addition





Match each property name to its example



**Example**

**Property Name**

$$25 + 0 = 25$$

$$-18(-1) = 18$$

$$3 + (-3) = 0$$

$$-23 \cdot 1 = -23$$

$$54,321 \cdot 0 = 0$$

$$5(3 - 9) = 5(3) - 5(9)$$

Distributive

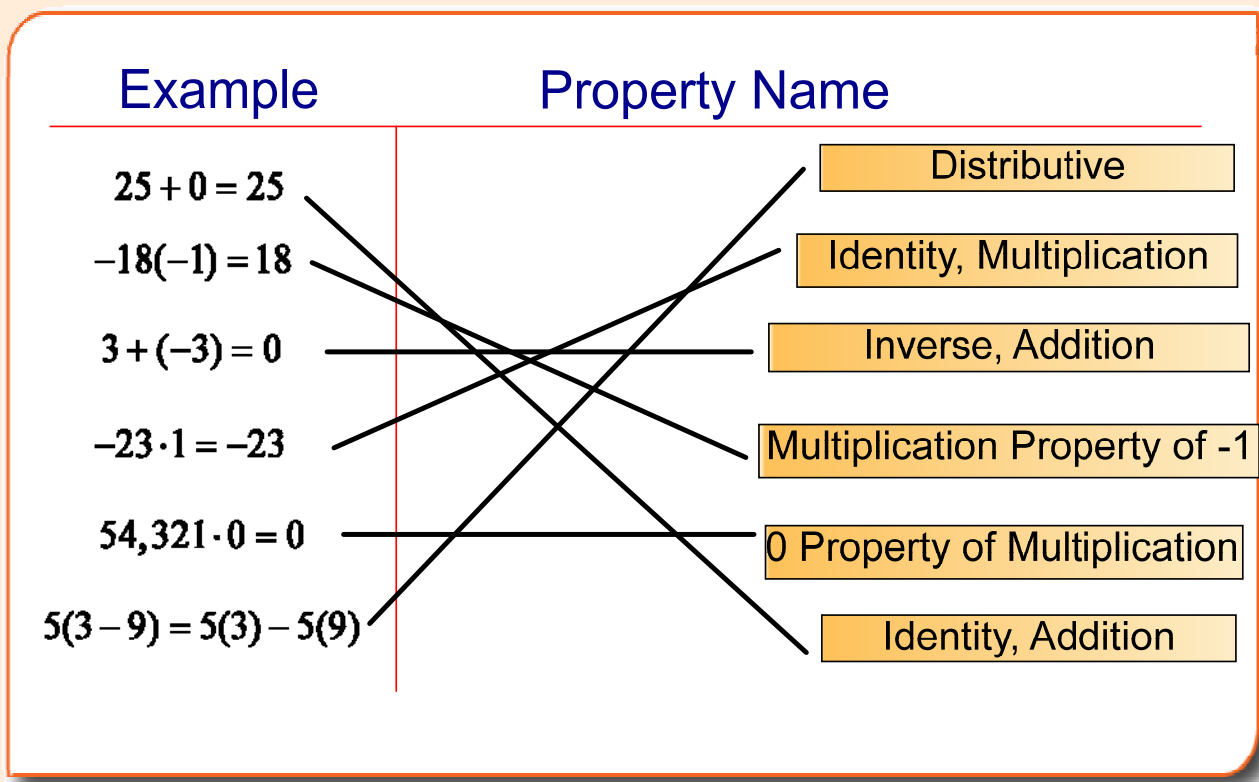
Identity, Multiplication

Inverse, Addition

Multiplication Property of -1

0 Property of Multiplication

Identity, Addition

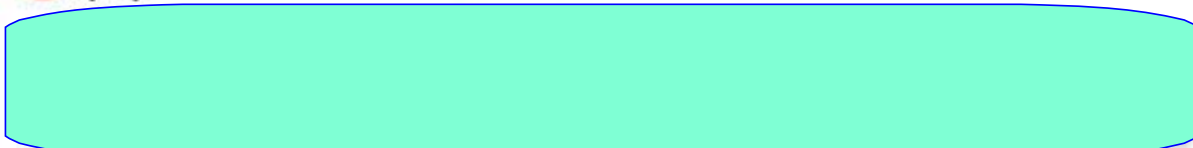






**Problem 3** Writing Equivalent Expressions

Simplify each expression.


**A**  $5(3n)$





$$5(3n) = (5 \cdot 3)n$$


$$= 15n$$


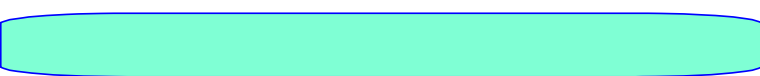
**B**  $(4 + 7b) + 8$


$$(4 + 7b) + 8 = (7b + 4) + 8$$



$$\rightarrow 7b + (4 + 8)$$


$$= 7b + 12$$


**C**  $\frac{6xy}{y}$

$$\frac{6xy}{y} = \frac{6x \cdot y}{1 \cdot y}$$


$$= \frac{6x}{1} \cdot \frac{y}{y}$$


$$= 6x \cdot 1$$


$$= 6x$$
