

# Number Properties

**Goal:** Use properties to evaluate expressions.

## Commutative Properties

### Addition

**Words** You can add numbers in a sum in any order.

**Numbers**  $4 + (-9) = \boxed{-9} + \boxed{4}$

**Algebra**  $a + b = b + a$

### Multiplication

You can multiply factors in a product in any order.

$3(-7) = \boxed{-7} \boxed{3}$

$ab = ba$

## EXAMPLE 1 Using a Commutative Property

**Babysitting** You have a summer babysitting job. You baby-sit 5 days a week. You work 9 hours each day earning \$4 per hour. What is your weekly pay?

### Solution

You can use a verbal model to find your weekly pay.

$$\boxed{\text{Weekly pay}} = \boxed{\text{Hourly rate}} \cdot \boxed{\text{Hours per day}} \cdot \boxed{\text{Number of days}}$$

$$= 4 \cdot \boxed{9} \cdot \boxed{5}$$

Substitute known values.

$$= 4 \cdot \boxed{5} \cdot \boxed{9}$$

Commutative property of multiplication

$$= \boxed{20} \cdot \boxed{9}$$

Multiply.

$$= \boxed{180}$$

Multiply.

The unit for the result is  $\boxed{\text{dollars}}$ .  $\frac{\text{dollars}}{\text{hour}} \cdot \frac{\text{hours}}{\text{day}} \cdot \text{days} = \boxed{\text{dollars}}$

**Answer:** Your weekly pay is  $\boxed{\$180}$ .

**EXAMPLE 2** Using a Commutative Property

When deciding what numbers to add or multiply first, look for pairs whose sum or product ends in zero, because multiples of 10 are easier to work with.

$$\begin{aligned}
 -63 + 38 - 17 &= -63 + 38 + (-17) \\
 &= -63 + (-17) + 38 \\
 &= -80 + 38 \\
 &= -42
 \end{aligned}$$

Change subtraction to addition.

Commutative property of addition

Add.

Add.

**Guided Practice** Use a commutative property to evaluate the expression.

1. $5 \cdot (-7) \cdot 4$	2. $56 + (-115) - (-64)$	3. $91 - 32 - 71$
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**Associative Properties****Addition**

**Words** Changing the grouping of numbers will not change their sum.

**Numbers**  $(1 + 3) + 6 = 1 + (3 + 6)$

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

**Multiplication**

Changing the grouping of factors will not change their product.

$(8 \cdot 2) \cdot 4 = 8 \cdot (2 \cdot 4)$

$(ab)c = a(bc)$

**EXAMPLE 3** Using an Associative Property

$$\begin{aligned}
 -13 + (-8 + 30) &= [-13 + (-8)] + 30 \\
 &= -21 + 30 \\
 &= 9
 \end{aligned}$$

Associative property of addition

Add  $-13$  and  $-8$ .

Add  $-21$  and  $30$ .

### EXAMPLE 4 Using an Associative Property

Commutate means change locations. You can use the commutative properties to change the order of numbers. Associate means group together. You can use the associative properties to group numbers differently.

$$\begin{aligned} 6 \cdot (9 \cdot 5) &= 6 \cdot (5 \cdot 9) \\ &= (6 \cdot 5) \cdot 9 \\ &= 30 \cdot 9 \\ &= 270 \end{aligned}$$

Commutative prop. of multiplication

Associative prop. of multiplication

Multiply inside grouping symbols.

Multiply.

**Guided Practice** Use a commutative and/or associative property to evaluate the expression.

4. $15 + (-46 + 25)$	5. $37 + (-82 - 37)$	6. $-5(9 \cdot 40)$
7. $-12(5 \cdot 3)$	8. $29 + (34 - 29)$	9. $2(9 \cdot 15)$

### Homework