

# Properties

---

<b>Reporting Category</b>	Patterns, Functions, and Algebra
<b>Topic</b>	Identifying and applying properties
<b>Primary SOL</b>	7.16 The student will apply the following properties of operations with real numbers: a) the commutative and associative properties for addition and multiplication; b) the distributive property; c) the additive and multiplicative identity properties; d) the additive and multiplicative inverse properties; and e) the multiplicative property of zero.
<b>Related SOL</b>	7.13, 7.14

## Materials

- Ten envelopes
- Mental Math activity sheet (attached)
- Envelope Activity and Recording Sheet (attached)

## Vocabulary

*expression, variable, equation, order of operations, commutative and associative properties for addition and multiplication, distributive property, additive and multiplicative identity properties, additive and multiplicative inverse properties, multiplicative property of zero (earlier grades)*

*inequality (7.15)*

*one-step equation, inverse operations, two-step equation (7.14)*

*variable expression, numerical expression, verbal expression, verbal sentence, algebraic expression, algebraic equation (7.13)*

## Student/Teacher Actions (what students and teachers should be doing to facilitate learning)

Prior to the activity, number 10 envelopes and inside each place the following numbers:

Envelope 1: 4, 7, 9 (this will show commutative property of addition)

Envelope 2: 3, 6, 8 (this will show associative property of addition)

Envelope 3: 2, 4, 7 (this will show additive identity property)

Envelope 4: 3, 4, 5 (this will show commutative property of multiplication)

Envelope 5: 2, 3, 6 (this will show associative property of multiplication)

Envelope 6: 1, 6, 9 (this will show the multiplicative identity property)

Envelope 7: 2, 4, 7 (this will show the distributive property)

Envelope 8: 2, 8, -5 (this will show the additive inverse property)

Envelope 9:  $\frac{5}{6}$ ,  $\frac{2}{3}$ ,  $\frac{7}{4}$  (this will show the multiplicative inverse property)

Envelope 10: 3, 8, -5 (this will show the multiplicative property of zero)

1. Distribute the Mental Math activity to students, and direct them to complete it as quickly as they can, without calculators. Make note of which students do this the fastest, and observe what strategies are being used. Have students share their strategies, and ask how they knew to use them. This discussion will help you know what prior knowledge students possess.
2. Have students work in small groups to complete the Envelope Activity and Recording Sheet. In this activity, students should explore the properties of addition and multiplication in small groups and summarize the properties on their own. Review the envelopes, and discuss as a class giving students the formal names of the properties as needed.

### Assessment

- **Questions**
  - How do the properties of operations with real numbers assist us in mathematics?
  - Do the properties we have discussed work with subtraction? Division? Prove your reasoning.
- **Journal/Writing Prompts**
  - Explain how it is easy to find the solution for  $n$  in  $\frac{1}{7} \times n = \frac{1}{7}$ . Name the property.
  - Identify the property you think is most useful, and explain why.
- **Other**
  - Have students create property matching cards. (One card has the property name; a second card has a numerical or symbolic example of the property; and the third card summarizes what the property means in student words.)
  - Have students represent the properties with a poster, poem, story, skit, or song.

### Extensions and Connections (for all students)

- Have students apply the properties as they are solving equations.

### Strategies for Differentiation

- Give students word clues to help them remember the property names, for example:
  - *Commutative* sounds like *commute*. Your commute to work is the same as your commute home; as long as you follow the same route, the number of miles stays the same (order doesn't matter).
  - *Associative* sounds like *associate*. You can change the group of friends you associate with in school, but you still all belong to the same school.
  - *Identity*—your identity doesn't change.
  - *Distributive*—when you distribute something, you pass it out. You pass out what is on the outside of the parenthesis to what is on the inside of the parenthesis.
  - *Inverse*—doing the opposite thing.
- Put each envelope activity on one page, and provide an example inside each envelope.
- Have students create property sorting cards.
- Pass out numbers and mathematical symbols, and have students model the properties.

# Mental Math

Name \_\_\_\_\_ Date \_\_\_\_\_

Complete the following using mental math. Be ready to explain how you got your answers.

$$14 + 5 + 16 + 25$$

$$235648 + 0$$

$$8907564 \cdot 1$$

$$45 + 37 + 65 + 53$$

$$25 \cdot 9 \cdot 4$$

$$1523 \cdot 0$$

$$50 \cdot 8 \cdot 2$$

$$1523 \cdot 0$$

$$5 ( 3 + 7 )$$

$$\frac{3}{4} \cdot \frac{4}{3}$$

# Envelope Activity and Recording Sheet

Name \_\_\_\_\_ Date \_\_\_\_\_

## Envelope #1

1. Pick two numbers from the envelope, and add them. Write down the exact sequence in which you added them and the sum. \_\_\_\_\_
2. Change the order of the two numbers, and write down their sum.  
\_\_\_\_\_
3. Choose two numbers of your own, and repeat steps 1 and 2.  
\_\_\_\_\_
4. When you add numbers together, does the order in which you add them matter?  
\_\_\_\_\_

## Envelope #2

1. Write down the three numbers in the envelope. Put parentheses around two, and add them first. Then, add the third number. Write down the exact sequence, placement of the parentheses, and the sum. \_\_\_\_\_
2. Keep the three numbers in the exact same sequence, but change the placement of the parentheses. Find the sum. Write this down.  
\_\_\_\_\_
3. Choose three numbers of your own, and repeat steps 1 and 2.  
\_\_\_\_\_
4. Does it matter how you group numbers with parentheses when adding?  
\_\_\_\_\_

## Envelope #3

1. Pick a number from the envelope, and add zero to it.  
\_\_\_\_\_
2. Repeat this process with another number in the envelope.  
\_\_\_\_\_
3. Choose a number of your own, and add zero to it.  
\_\_\_\_\_
4. What happens when you add zero to a number?  
\_\_\_\_\_

**Envelope #4**

1. Pick two numbers and multiply them. Write down the exact sequence in which they were multiplied and their product.

---

2. Change the order of the two numbers, and write down their product.

---

3. Choose two numbers of your own, and repeat steps 1 and 2.

---

4. When you multiply numbers together, does the order in which you multiply them matter?

---

**Envelope #5**

1. Write down the three numbers in the envelope. Put parentheses around two, and multiply them first. Then, multiply the third number. Write down the exact sequence, placement of the parentheses, and the product.

---

2. Keep the three numbers in the exact same sequence, but change the placement of the parentheses. Record the product.

---

3. Choose three numbers of your own, and repeat steps 1 and 2.

---

4. Does it matter how you group numbers with parentheses when multiplying?

---

**Envelope #6**

1. Pick a number from the envelope, and multiply it by one. Record the product.

---

2. Repeat this process with another number in the envelope.

---

3. Choose a number of your own, and multiply it by one.

---

4. What happens when you multiply a number by one?

---

**Envelope #7**

1. Place the three numbers in the envelope in this expression: \_\_\_\_\_ ( \_\_\_\_\_ + \_\_\_\_\_ ). Add the two numbers in the parentheses. Then, multiply that sum by the outside number. Record your answer. \_\_\_\_\_

2. Take these same three numbers in the exact same order, and multiply the first number by the second number and record it. \_\_\_\_\_ Then, multiply the first by the third and record it. \_\_\_\_\_ Add the two numbers you recorded. \_\_\_\_\_ What do you notice? \_\_\_\_\_
3. Use three different numbers, and repeat steps 1 and 2.  
\_\_\_\_\_
4. What do you think is happening?  
\_\_\_\_\_

**Envelope #8**

1. Choose a number from the envelope, and add it to its opposite. Record the result.  
\_\_\_\_\_
2. Choose another number from the envelope, and repeat step 1. Record the result.  
\_\_\_\_\_
3. What sum do you get when you add a number and its opposite?  
\_\_\_\_\_

**Envelope #9**

1. Choose a fraction from the envelope, and multiply it by its reciprocal. Record the result.  
\_\_\_\_\_
2. Choose another fraction from the envelope, and repeat step 1. Record the result.  
\_\_\_\_\_
3. What product do you get when you multiply a fraction and its reciprocal?  
\_\_\_\_\_

**Envelope #10**

1. Choose a number from the envelope, and multiply it by zero. Record the result.  
\_\_\_\_\_
2. Choose another number from the envelope, and repeat step 1. Record the result.  
\_\_\_\_\_
3. What happens when you multiply a number by zero?  
\_\_\_\_\_