# It's All the Same: Objectives



## Students will be able to:

Apply the properties of operations to generate equivalent expressions.

**Why the calculator is helpful:**

The calculator allows students to explore different expressions while using variables commonly used in algebra. Students will grow more comfortable with using variables and manipulating algebraic expressions through the calculator.

## ENGAGE

Access students’ knowledge by asking the following questions:

* What do you know about variables?
* What have you learned about the following mathematical properties? Commutative, Associative, Distributive, Identity, Zero Product
* What is confusing about these properties?

## EXPLORE

Explore students’ understanding and/or inquiry by asking:

* How could we prove two expressions are equal?
* How can we use a calculator to prove that these mathematical properties are true?

## EXPLAIN

Have students explain their thoughts/ideas to the following questions:

* Explain how the Commutative and Associative properties are similar and different. Describe the Distributive Property and discuss how it can be used to make it easier to multiply mentally.

## EXTEND

Extend student understanding by asking the following questions:

* How can you apply the Distributive Property to a “real-world” situation?
* How can you apply the Associative Property to a “real-world” situation?

# It's All the Same: Getting Started



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## Getting Started:

Jamaal and Taheya were studying the following rectangle.

𝑥

2𝑥 + 3

The teacher asked them to find the perimeter of the rectangle. Jamaal was very con- fused because of the variables used for the length and the width. He really wanted numbers instead of expressions. Taheya told him that the expressions represented numbers and all he had to do was to add the dimensions together. Taheya told her teacher that the perimeter of the rectangle was 𝑥 + 2𝑥 + 3 + 𝑥 + 2𝑥 + 3. The teacher told Taheya that the answer was correct but asked her if she could simplify it. Taheya looked confused and didn’t know how to simplify the expression.

1. Help Taheya by simplifying the expression 𝑥 + 2𝑥 + 3 + 𝑥 + 2𝑥 + 3. Write your answer on the line provided.
2. How could you show Taheya that your expression is equivalent to hers? Use your calculator to justify your reasoning. Show your work.
3. What is the area of the rectangle if 𝑥 = 4?

# It's All the Same: Problems

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1. Mrs. Stewart loves to bake cookies for her class. One day she brought cookies for her class. She decided to distribute two cookies per student. There were 27 students in her class. Then, she decided to share the cookies with the class next door. There were 14 students in that class and each student received two cookies. Write an expression to show how many cookies Mrs. Stewart distributed to all of the students. Explain your reasoning.
2. State which expressions are equivalent and justify your reasoning. (Hint: You may want to substitute values for the variables to prove whether or not they are equivalent.)
   1. 3𝑥 – 9
   2. 3(𝑥 – 3)
   3. (9 𝑥 – 27)
   4. [4(3𝑥 -9)]/4
   5. 6𝑥 – 12
3. Explain which statement(s) proves the Commutative Property to be true. Justify your reasoning.
   1. 𝑥 + y = y + 𝑥
   2. 𝑥 – y = y – 𝑥
   3. 𝑥y = y𝑥
   4. 𝑥/y = y/𝑥
4. Explain which statement(s) proves the Associative Property to be true. Justify your reasoning.

a. 𝑥 + (y + z) = (𝑥 + y) + z b. 𝑥 – (y – z) = 𝑥 – (y – z)

1. 𝑥(yz) = (𝑥y)z
2. 𝑥/yz = 𝑥y/z
3. Examine the following rectangles.

2𝑥

𝑥

4𝑥

2𝑥

Do these rectangles have the same perimeter? Explain your reasoning.

Do these rectangles have the same area? Explain your reasoning.

1. Prove that 𝑥 + 𝑥 + 𝑥 = 3𝑥. Explain your reasoning.
2. Prove that 𝑥(𝑥)(𝑥) ≠ 3𝑥. Explain your reasoning.
3. Use the Distributive Property to find an equivalent expression for 48𝑥 + 18y. Explain your reasoning.
4. Use the Distributive Property to find an equivalent expression for 7(2𝑥 – 3y). Explain your reasoning.