



Lesson 1: The Relationship of Addition and Subtraction

Student Outcomes

- Students build and clarify the relationship of addition and subtraction by evaluating identities such as $w - x + x = w$ and $w + x - x = w$.

Lesson Notes

Teachers need to create square pieces of paper in order for students to build tape diagrams. Each pair of students will need 10 squares to complete the activities. If the teacher has square tiles, these can be used in place of paper squares.

The template for the squares and other shapes used in the lesson are provided at the end of the lesson. Teachers will need to cut out the shapes.

Classwork

Fluency Exercise (5 minutes): Multiplication of Decimals

RWBE: Refer to the Rapid White Board Exchanges sections in the Module Overview for directions to administer an RWBE.

Opening Exercise (5 minutes)

Opening Exercise

a. Draw a tape diagram to represent the following expression: $5 + 4$.

b. Write an expression for each tape diagram.

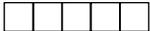
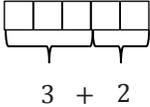
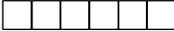
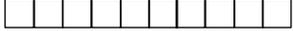
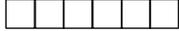
i.

ii.

Discuss the answers with the class. If students struggled with the Opening Exercise, provide more examples before moving into the discussion.

Discussion (15 minutes)

Provide each pair of students with a collection of 10 squares so they can use these squares to create tape diagrams throughout the lesson.

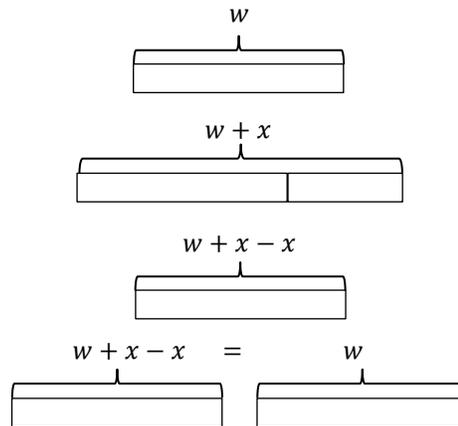
- If each of the squares represents 1 unit, represent the number 3 using the squares provided.
 - 
- Add two more squares to your tape diagram.
 - 
- Write an expression to represent how we created a tape diagram with five squares.
 - 
- Remove two squares from the tape diagram.
 - 
- Alter our original expression $3 + 2$ to create an expression that represents what we did with the tape diagram.
 - $3 + 2 - 2$
- Evaluate the expression.
 - 3
- Let's start a new diagram. This time, create a tape diagram with six squares.
 - 
- Use your squares to demonstrate the expression $6 + 4$.
 - 
- Remove four squares from the tape diagram.
 - 
- Alter the expression $6 + 4$ to create an expression to represent the tape diagram.
 - $6 + 4 - 4$
- How many squares are left on your desk?
 - 6
- Evaluate the expression.
 - 6
- How many squares did we start with?
 - 6
- What effect did adding four squares then subtracting the four squares have on the number of squares?
 - *Adding and then subtracting the same number of squares resulted in the same number that we started with.*
- What if I asked you to add 215 squares to the six squares we started with, and then subtract 215 squares? Do you need to actually add and remove these squares to know what the result will be? Why is that?
 - *We do not actually need to do the addition and subtraction because we now know that it will result in the same amount of squares that we started with; when you add and then subtract the same number, the results will be the original number.*

- What do you notice about the expressions we created with the tape diagrams?
 - *Possible answer: When we add one number and then subtract the same number, we get our original number.*
- Write an equation, using variables, to represent what we just demonstrated with tape diagrams. Remember that a variable is a letter that represents a number. Use the shapes provided to create tape diagrams to demonstrate this equation.

Provide students time to work with their partners to write an equation.

MP.2

- *Possible answer: $w + x - x = w$. Emphasize that both w 's represent the same number, and the same rule applies to the x 's.*
- Why is the equation $w + x - x = w$ called an identity?
 - *Possible answer: The equation is called an identity because the variables can be replaced with any numbers, and after completing the operations, I returned to the original value.*



Exercises (12 minutes)

Students will use their knowledge gained in the discussion to create another equation using identities. Allow students to continue to work with their partners and 10 squares.

MP.7

Exercises

1. Predict what will happen when a tape diagram has a large number of squares, some squares are removed, and then the same amount of squares are added back on.

Possible answer: When some squares are removed from a tape diagram, and then the same amount of squares are added back on, the tape diagram will end up with the same amount of squares that it started with.

2. Build a tape diagram with 10 squares.

- a. Remove six squares. Write an expression to represent the tape diagram.

$10 - 6$

- b. Add six squares onto the tape diagram. Alter the original expression to represent the current tape diagram.

$10 - 6 + 6$

Scaffolding:
The exercise could be completed as a class if students are struggling with the concept.



- c. Evaluate the expression.

10

3. Write an equation, using variables, to represent the identities we demonstrated with tape diagrams.

Possible answer: $w - x + x = w$

4. Using your knowledge of identities, fill in each of the blanks.

a. $4 + 5 - \underline{\quad} = 4$

5

b. $25 - \underline{\quad} + 10 = 25$

10

c. $\underline{\quad} + 16 - 16 = 45$

45

d. $56 - 20 + 20 = \underline{\quad}$

56

5. Using your knowledge of identities, fill in each of the blanks.

a. $a + b - \underline{\quad} = a$

b

b. $c - d + d = \underline{\quad}$

c

c. $e + \underline{\quad} - f = e$

f

d. $\underline{\quad} - h + h = g$

g

Closing (3 minutes)

- In every problem we did today, why did the final value of the expression equal the initial expression?
 - *The overall change to the expression was 0.*
- Initially, we added an amount and then subtracted the same amount. Later in the lesson, we subtracted an amount and then added the same amount. Did this alter the outcome?
 - *This did not alter the outcome; in both cases, we still ended with our initial value.*



- Why were we able to evaluate the final expression even when we did not know the amount we were adding and subtracting?
 - *If we add and subtract the same value, it is similar to adding 0 to an expression because the two numbers are opposites, which have a sum of 0.*

Exit Ticket (5 minutes)



Name _____

Date _____

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Exit Ticket

1. Draw tape diagrams to represent each of the following number sentences.

a. $3 + 5 - 5 = 3$

b. $8 - 2 + 2 = 8$

2. Fill in each blank.

a. $65 + \underline{\quad} - 15 = 65$

b. $\underline{\quad} + g - g = k$

c. $a + b - \underline{\quad} = a$

d. $367 - 93 + 93 = \underline{\quad}$

Multiplication of Decimals

Progression of Exercises

1. $0.5 \times 0.5 =$

0.25

2. $0.6 \times 0.6 =$

0.36

3. $0.7 \times 0.7 =$

0.49

4. $0.5 \times 0.6 =$

0.3

5. $1.5 \times 1.5 =$

2.25

6. $2.5 \times 2.5 =$

6.25

7. $0.25 \times 0.25 =$

0.0625

8. $0.1 \times 0.1 =$

0.01

9. $0.1 \times 123.4 =$

12.34

10. $0.01 \times 123.4 =$

1.234

$$w + x$$

$$w$$

$$x$$

$$w$$

$$x$$

$$w + x$$

$$w$$

$$x$$

$$w$$

$$x$$