Expressions, Expressions, and More Expressions

Strand: Patterns, Functions, and Algebra

Topic: Simplify algebraic expressions in one variable

Primary 2023 SOL: 8.PFA.1

           b) Simplify and generate equivalent algebraic expressions in one variable by applying the order of operations and properties of real numbers. Expressions may need to be expanded (using the distributive property) or require combining like terms to simplify. Expressions will include only linear and numeric terms. Coefficients and numeric terms may be rational.

Related 2023 SOL: 8.PFA.4

Materials

- Algebra Tiles or similar concrete manipulative
- Real Life Items Cards (attached)
- Term Cards (attached)
- Simplifying Algebraic Expressions Exploration Sheet (attached)
- Assessment Questions sheet (attached)
- Tape
- Colored Pencils (optional)

Vocabulary

equivalent algebraic expression, coefficient, constant, distributive property, like terms, simplify, term, variable

Student/Teacher Actions: What should students be doing? What should teachers be doing?

1. Prepare the **Real Life Item Cards** by printing them on card stock, if available, and cutting them out before class.
2. Prepare the **Term Cards** by printing on card stock, if available, and cutting them out before class.
3. Distribute the **Real Life Item Cards** so each student gets one card.
4. Have students get into random groups of three and combine their cards and figure out a way to express their cards.
5. Combine groups of three into groups of six and have students discuss their expressions and create one expression for all their cards.
6. Have the groups of six tape their cards to a piece of paper and write their expressions in large writing.

7. Discuss all the expressions that have been created and work toward creating expressions with variables used to represent the items with coefficients that indicate how many of that item are shown in all the pictures.

8. Combine all the pictures to create one expression. Discuss how students just combined like terms. Tell students that they will now look at another manipulative that allows students to combine like terms.

9. Ask students if there are different expressions that would still represent what they have on their cards.

10. Create equivalent expressions with the cards.

11. Distribute the **Term Cards.**

12. Ask students how their **Term Card** relates to the fruit and vegetable cards they just used.

13. Have students use their algebra tiles or similar concrete manipulative to show the expression on their card.

14. Ask students if they see anyone around them who might be able to combine with theirs or are exactly like theirs. As students find those exactly like theirs, ask if there is another way they could have written the expression on their card (e.g., three students have -2x-2, it could also be written as 3(-2x-2)?) Discuss how the distributive property can be demonstrated.

15. As students find cards with expressions that they might be able to combine, draw representations on the board to show the like terms. Show how the like terms can be written as equivalent expressions (e.g., -4x+1 and -6x+2 can be represented as -10x+3 or -12x+2x+3 or -10x+5-2 or any other number of ways).

16. Discuss that there are an infinite number of equivalent expressions. Discuss that all equivalent expressions may not be simplified. Be certain to make the distinction between simplified expressions and equivalent expressions.

17. Place students in groups of three to complete the **Simplifying Algebraic Expressions Exploration Sheet** and distribute the sheet or show the problems for all students to see. Have students complete their representations on their own paper or individual white boards.

18. Students can draw any representation they like to complete the **Simplifying Algebraic Expressions Exploration Sheet,** provided they supply a key. Students may wish to use colored pencils for this.

Assessment

- **Questions**
    - What properties do you apply while simplifying expressions?
    - What differentiates an expression from an equation?
    - What is the difference between simplifying an expression and solving an equation?
    - What does the number in front of parentheses mean mathematically?
    - How do zero pairs help make equivalent expressions?

- o Ask students to complete the **Assessment Questions** sheet.
- **Journal/writing prompts**
  - o Explain what it means to combine like terms. Provide examples with your explanation.
  - o Explain the distributive property. Provide an example with representations.
  - o Explain what it means to generate equivalent expressions.
  - o Explain how simplifying an expression and generating equivalent expressions are similar and different.
  - o Create an expression for your partner to simplify. Identify the properties your partner used to simplify your expression.
- **Other Assessments**
  - o Practice simplifying the expressions given throughout the activity, as a class, on dry-erase boards or on an electronic device. Have students simplify and share.
  - o Have groups share the expression they found the most difficult to simplify and explain why to the class.
  - o Allow students to keep the concrete manipulatives as long as necessary, even as they draw representations.
  - o Encourage students to continue drawing representations until they are comfortable moving to the abstract.

Extensions and Connections (for all students)
- Have students apply the concept of simplifying expressions with equations.
- Review the properties of real numbers and identify which properties are often applied when simplifying algebraic expressions.

Strategies for Differentiation
- Allow students to work independently or in smaller pairs.
- Create additional sorting cards with varied levels of difficulty.
- Challenge your students who master the concept quickly to apply the distributive property and the concept of combining like terms to create and solve multistep equations.
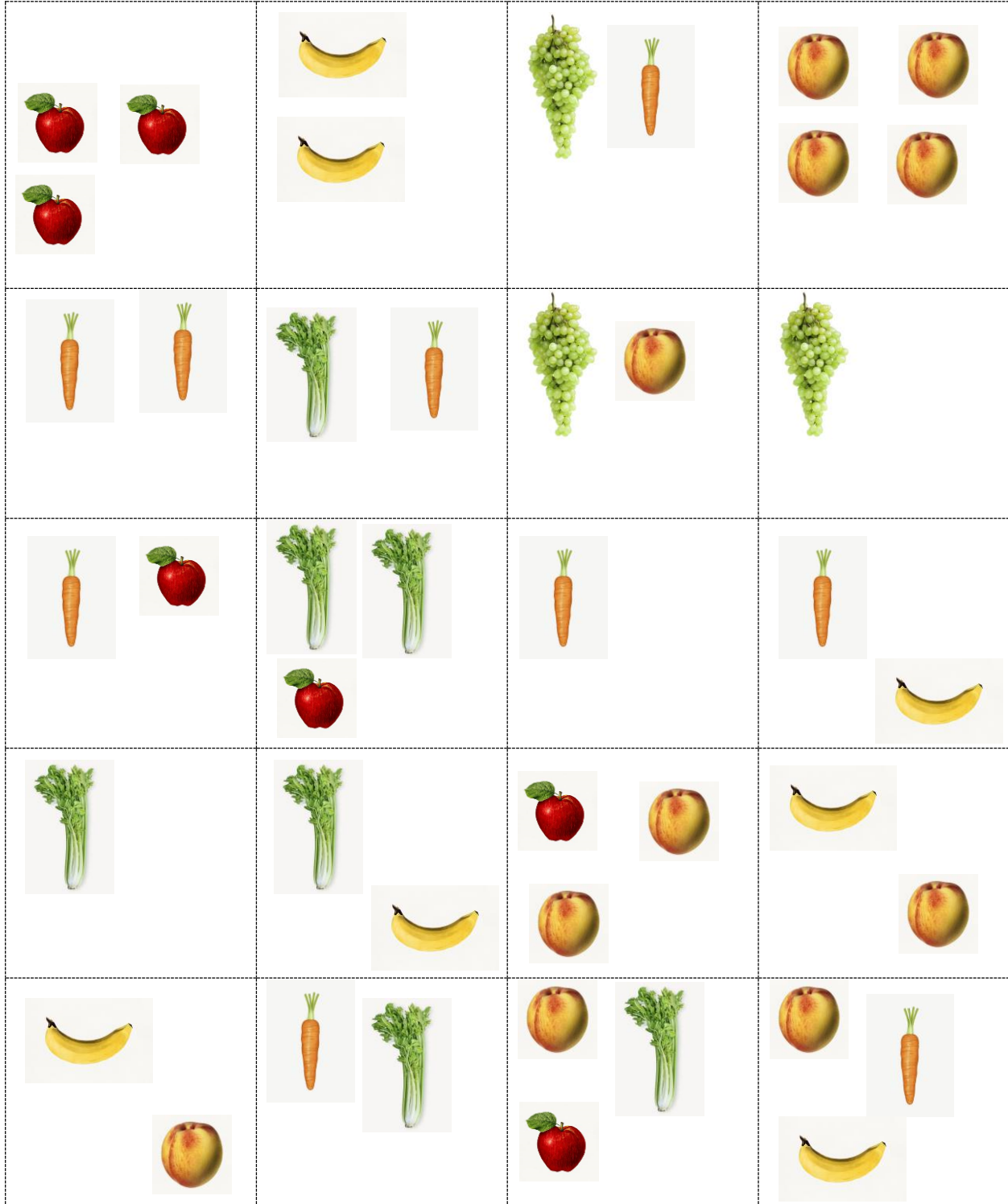
Note: The following pages are intended for classroom use for students as a visual aid to learning.
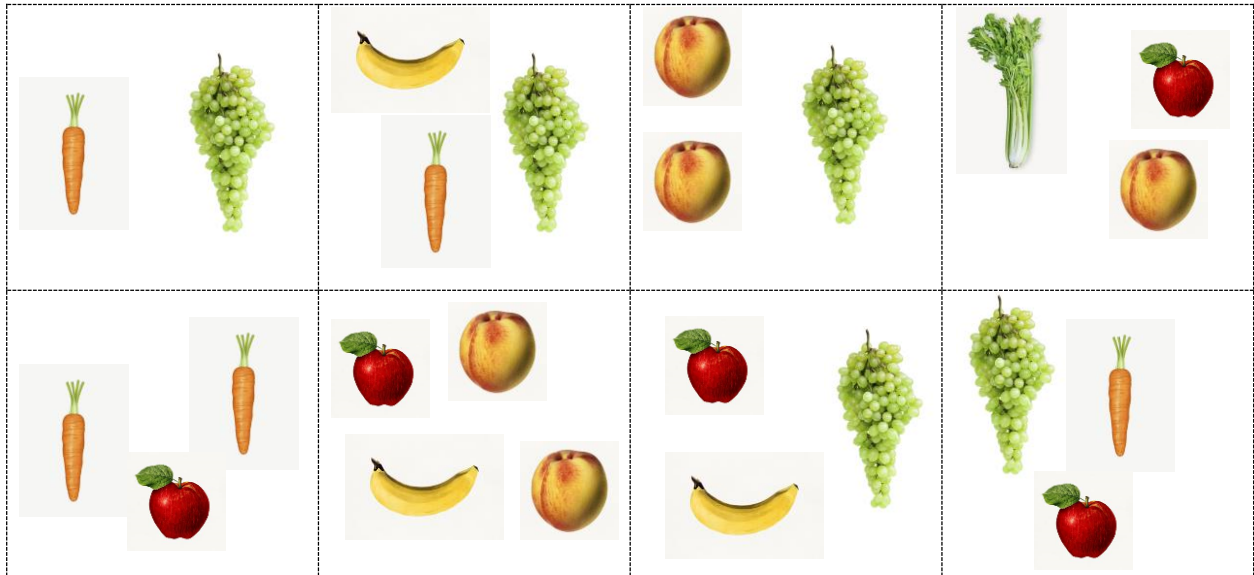
Real Life Items Cards

All pictures come from this creative commons approved site:
https://www.rawpixel.com/search/apple?page=1&sort=curated&topic_group=_topics

Print on card stock, cut out, and distribute one card per student.

Term Cards

Print on card stock, cut out, and distribute one card to each student.

|			
$-4x + 1$	$2x - 1$	$-3x + 4$	$-x$
$-2y - 2$	y	$2y - 3$	$-y + 1$
$5x - 1$	$-6x + 2$	$-2x$	$x + 1$
$3y - 1$	$-y + 1$	$2y - 3$	$2y - 3$
$-4x + 1$	$2x - 1$	$2x - 1$	$-2y - 2$
$-2y - 2$	$-2y - 2$	3	-1

Simplifying Algebraic Expressions Exploration

Name _____ **Date** _____

1. Draw a representation of each term in the expression. Don't forget to provide a key.
2. Draw a representation of the expression with the like terms combined.
3. Draw a representation of an equivalent expression to the one you found in Step 2.
4. Write the simplified expression in algebraic terms.

Sample expression: $-7y + 4 + 5y - 5 - 2y + 2$

Draw a representation of all the terms:
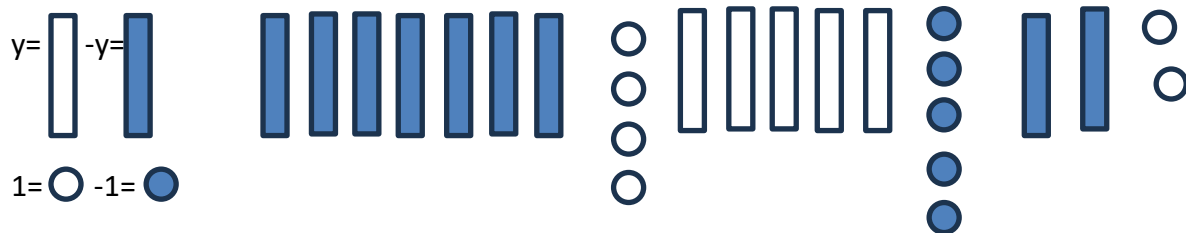
Draw a representation of the expression with the like terms combined:

Draw a representation of an equivalent expression:

Write the simplified expression in algebraic terms:

-4y + 1

1. Expression: $-6q + 8q - 5 + 2q + 2 - 4q$

Draw a representation of all the terms:

Draw a representation of the expression with the like terms combined:

Draw a representation of an equivalent expression:

Write the simplified expression in algebraic terms:

2. Expression: $-4x - 2y + 4 + 3y - 3 - 4y$

Draw a representation of all the terms:

Draw a representation of the expression with the like terms combined:

Draw a representation of an equivalent expression:

Write the simplified expression in algebraic terms:

3. Expression: $5m + 4 - m - 9m - 5m - 3$

Draw a representation of all the terms:

Draw a representation of the expression with the like terms combined:

Draw a representation of an equivalent expression:

Write the simplified expression in algebraic terms:

4. Expression: $-2(3b + 1)$

Draw a representation of all the terms:

Draw a representation of the expression with the like terms combined:

Draw a representation of an equivalent expression:

Write the simplified expression in algebraic terms:

5. Expression: $33(2m + 1) - 3m + 4$

Draw a representation of all the terms:

Draw a representation of the expression with the like terms combined:

Draw a representation of an equivalent expression:

Write the simplified expression in algebraic terms:

Assessment Questions

Name _____ **Date** _____

Simplify the expressions given below.

$-3x + 2w + 5w - 4x - 3 + 9x$	$6s + 2s - 16 - 19s + 18 + 15s$	$22x - 16x + \dfrac{1}{4} - 10x - \dfrac{5}{8} + 10x$

Apply the properties of real numbers to simplify the expressions given below.

$8(-3 + 4w) + 10w - 2$	$10a + 4 + 5(2a - 6a)$	$-\dfrac{1}{2} + (4m + 2) + 8m - 12$

Review the terms in the box below.

16y	−8x	2y		−3y	
					12x
−2x	5		5x		
		−8		14	
y	12	−x		x	9

How many different terms are shown? _____

List the constants shown in the box above: _____

Sum the constants. _____

List the *x* terms shown in the box above. _____

Sum the *x* terms. _____

List the *y* terms shown. _____

Record the simplified algebraic expression based on the terms shown.

_____