SAVVAS

Grade 6

# Let's Investigate Take and Teach

enVision+ MATHEMATICS

Real-World Math. Real-World Ready.

Let's Investigate

Lesson 3-7

# Understand Equivalent Expressions

## FOCUS

**Mathematics Objectives**

- Model and identify equivalent algebraic expressions.
- Use substitution to prove expressions are equivalent.

**Language Objective** Explain, orally and in writing, whether two expressions are equivalent, and justify the conclusion by using substitution.

**Essential Understanding** Two algebraic expressions are equivalent if they always have the same value when the same number is substituted for the variable in each expression.

## COHERENCE

**Previously in this topic, students:**

- wrote and evaluated algebraic expressions.

**In this lesson, students:**

- extend their work by understanding equivalent algebraic expressions.

**Later in this topic, students will:**

- generate and simplify equivalent algebraic expressions.

**Cross-Cluster Connection** Problems and activities involving identifying equivalent expressions build a strong foundation for using properties of operations to generate equivalent expressions later in this topic.

## RIGOR

**Conceptual Understanding** Students develop an understanding of how to identify equivalent expressions via modeling and substitution.

**Application** Understanding equivalent expressions builds the foundation for generating and simplifying them in later lessons.

## Vocabulary

none

## Materials

- algebra tiles

## Student Resources

Family Engagement

**Intervention System (IS)**

**K15** Writing Expressions

## Teacher Resources

enVision on the Go

**Exit Ticket**

Support for using the Exit Ticket is available online.

# Step 1 Investigate

30–35 min

Investigate  Scout Observational Assessment

## Understand Equivalent Expressions

Let's Investigate

Lesson 3-7

**I can ...** investigate what it means for two expressions to be equivalent.

Methods for harvesting vegetables can influence the growth and production of crops. Techniques include harvesting in the early morning, using the correct hand tools for cutting, and handling and cleaning the vegetables.

### Healthy Harvesting

**A garden begins with three beds of plants. Two beds starts with 10 plants and 2 plants are added weekly. Bed 3 starts with 2 plants and 4 plants are added weekly.**

**A.** Use the algebra tiles to write three expressions representing the plants in each bed after $x$ weeks. Explain what each term represents.

**B.** Compare two different ways to represent the total plants in beds 1 and 2 and explain why they are equivalent.

Each representation models the total number of plants after $x$ weeks in each bed.

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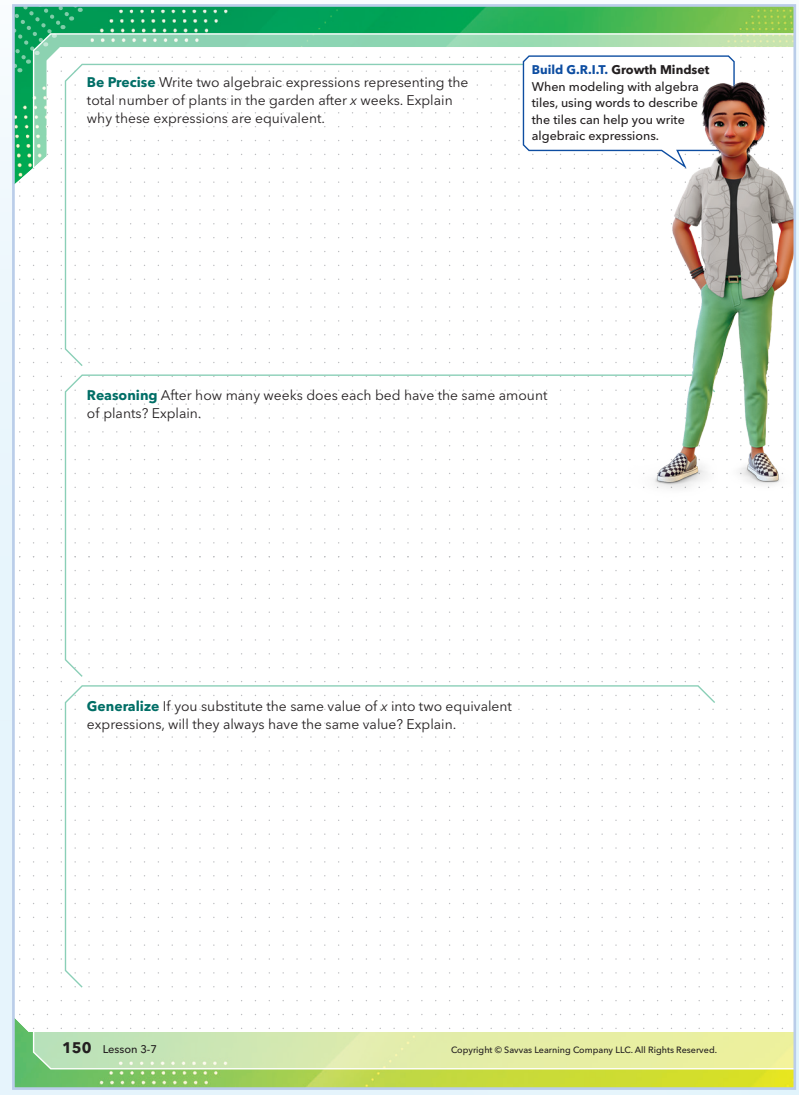

**Be Precise** Write two algebraic expressions representing the total number of plants in the garden after $x$ weeks. Explain why these expressions are equivalent.

**Build G.R.I.T. Growth Mindset** When modeling with algebra tiles, using words to describe the tiles can help you write algebraic expressions.

**Reasoning** After how many weeks does each bed have the same amount of plants? Explain.

**Generalize** If you substitute the same value of $x$ into two equivalent expressions, will they always have the same value? Explain.



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## MTP Anticipate

**Anticipate students' solution strategies.** Think of various ways students will write expressions to represent the plant beds. See the next page for sample student work.

## Introduce the Investigation

**Elevate Student Voice: Engage Students in the Context**

- Why are community gardens important?
- What vegetables would you plant in a garden?
- What are some ways to avoid overcrowding in a garden?

**Use the Slow Reveal Slides** Reveal part of the information. Ask: What do you notice? What do you wonder?

## Check for Understanding

### MLR3 Clarify, Critique, Correct

Draw two $x$-tiles and four unit tiles on the board. Read the following statement to the class: "Ana writes the expression $4x + 2$ to represent the algebra tiles."

Have partners compare Ana's expression to the algebra tiles and discuss. Ask:

- Are there any reasoning errors? Is anything unclear?

Ask a volunteer to correct Ana's statement and explain her error.

# Step 1 Investigate *continued*

## Sample Student Work

### Student 1 Work

- **correctly writes expressions to represent the plant beds**

A. Plant bed 1: $10 + 2x$
Plant bed 2: $10 + 2x$
Plant bed 3: $2 + 4x$
In $10 + 2x$, the 10 represents the number of plants the bed had initially. The 2 represents the number of plants added each week. The x represents the number of weeks.
In $2 + 4x$, 2 represents the initial number of plants and 4 represents the number added each week.

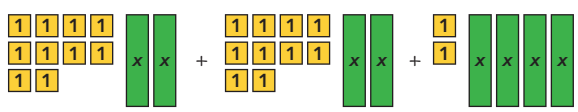
B. Another way to represent the plants in beds 1 and 2 is: $1 + 1 + 1 + 1 + 1 + 1 + 1 + 1 + 1 + 1 + x + x$
The two expressions are equivalent because they each have the same number of x-tiles and unit tiles.

Ask: If you substituted the same number for *x* in both expressions you wrote for plant beds 1 and 2, would the values of the expressions be the same? [Yes; If the expressions are equivalent, their values will be the same.]

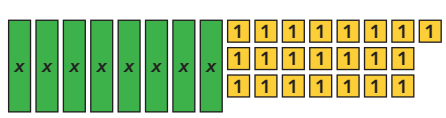
### Student 2 Work

- **correctly writes two expressions representing the total number of plants in the garden after *x* weeks**

I used algebra tiles to write two equivalent algebraic expressions.



$10 + 2x + 10 + 2x + 2 + 4x$



$8x + 22$

Ask: How can algebra tiles help you write equivalent expressions? [Use the original sets of tiles and rearrange them to help write another expression. They are equivalent because you use the same tiles to create both.]

### Student 3 Work

- **correctly uses substitution to evaluate the expressions and find when the beds will have the same number of plants.**

To find how many weeks it will be until all three beds have the same number of plants, I can substitute values for x to see when the expressions are equal.

| Week | Plant Bed 1<br>$10 + 2x$ | Plant Bed 2<br>$10 + 2x$ | Plant Bed 3<br>$2 + 4x$ |
|---|---|---|---|
| 1 | $10 + 2(1) = 12$ | $10 + 2(1) = 12$ | $2 + 4(1) = 6$ |
| 2 | $10 + 2(2) = 14$ | $10 + 2(2) = 14$ | $2 + 4(2) = 10$ |
| 3 | $10 + 2(3) = 16$ | $10 + 2(3) = 16$ | $2 + 4(3) = 14$ |
| 4 | $10 + 2(4) = 18$ | $10 + 2(4) = 18$ | $2 + 4(4) = 18$ |

All three beds will have the same number of plants in week 4.

Ask: How did you approach this problem? [I made a table to organize the expressions. I substituted the number of weeks into each expression and saw that they all had the same value in week 4. Plant beds 1 and 2 will always be equal.]

### Student 4 Work

- **incorrectly writes expressions to represent the plant beds**

Plant bed 1: $2 + 10x$
Plant bed 2: $2 + 10x$
Plant bed 3: $4 + 2x$

I add the expressions:
$2 + 10x + 2 + 10x + 4 + 2x = 8 + 22x$

Ask: How could you check your work by finding how many plants are in each bed to start? [Substitute 0 for *x* in each expression and evaluate.]

## MTP Monitor

**Monitor Students at Work** Ask questions to assess and advance students' thinking.

### Assessing Questions

**Questions for Students to Understand Their Thinking**

- What is the problem asking you to do?
- What do the algebra tiles represent?
- Are the expressions that represent plant beds 1 and 2 the same or different?

**Questions for You as You Observe**

- Which groups rearrange the algebra tiles to find equivalent expressions?
- Which groups correctly write expressions for all three plant beds?

### Advancing Questions

**Questions for Students Who Need Help**

- How can you use algebra tiles to help you write equivalent expressions?
- What do the *x*-tiles represent?
- What do the unit tiles represent?

**Questions to Help Students Think More Deeply**

- After week 4, will all three beds ever have the same number of plants again?

## MTP Select and Sequence

**Select and Sequence Students' Solutions** for presentations with the goal of building understanding of key math concepts.

- **Start** with a correct solution that shows an expression for plant bed 3 and equivalent expressions for plant beds 1 and 2 (Student 1 Work).
- **Then** show a correct solution strategy for using algebra tiles to find equivalent expressions (Student 2 Work).
- **Finally,** show a correct solution strategy that uses substitution to determine what value of *x* will result in all expressions having equal value (Student 3 Work).

## MTP Discuss Student Solutions

After allowing students to finish the questions for the lesson, return to an all-class discussion.

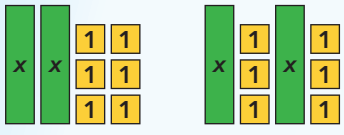
- How can you tell if two expressions are equivalent using algebra tiles? [If two expressions modeled with algebra tiles have the same number of *x*-tiles and unit tiles, they are equal.]
- How can you use substitution to tell if two expressions are equivalent? [Substitute the same number for *x* in each expression and see if their values are the same.]

Do we have enough information to identify equivalent expressions? Students are likely to say yes. If they do, prompt further by asking:

- How do you know you have enough information?
- How can you determine if three expressions are equivalent? [Substitute the same number for *x* in all three to see if their values are the same.]

## MLL Multilingual Learners SPEAKING

**Emerging** Review *Healthy Harvesting*.



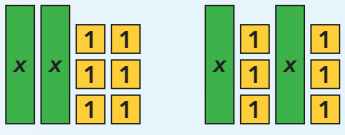

Provide these sentence stems for students to verbally respond to a partner.

Model 1: There are _____ *x*-tiles and _____ unit tiles. [2, 6]

Model 2: There are _____ *x*-tiles and _____ unit tiles. [2, 6]

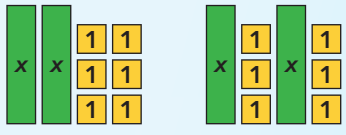
Do the models represent equivalent expressions? _____ [Yes]

**Expanding** Review *Healthy Harvesting*.




Have students write two expressions to represent each model and explain their answer to a partner.

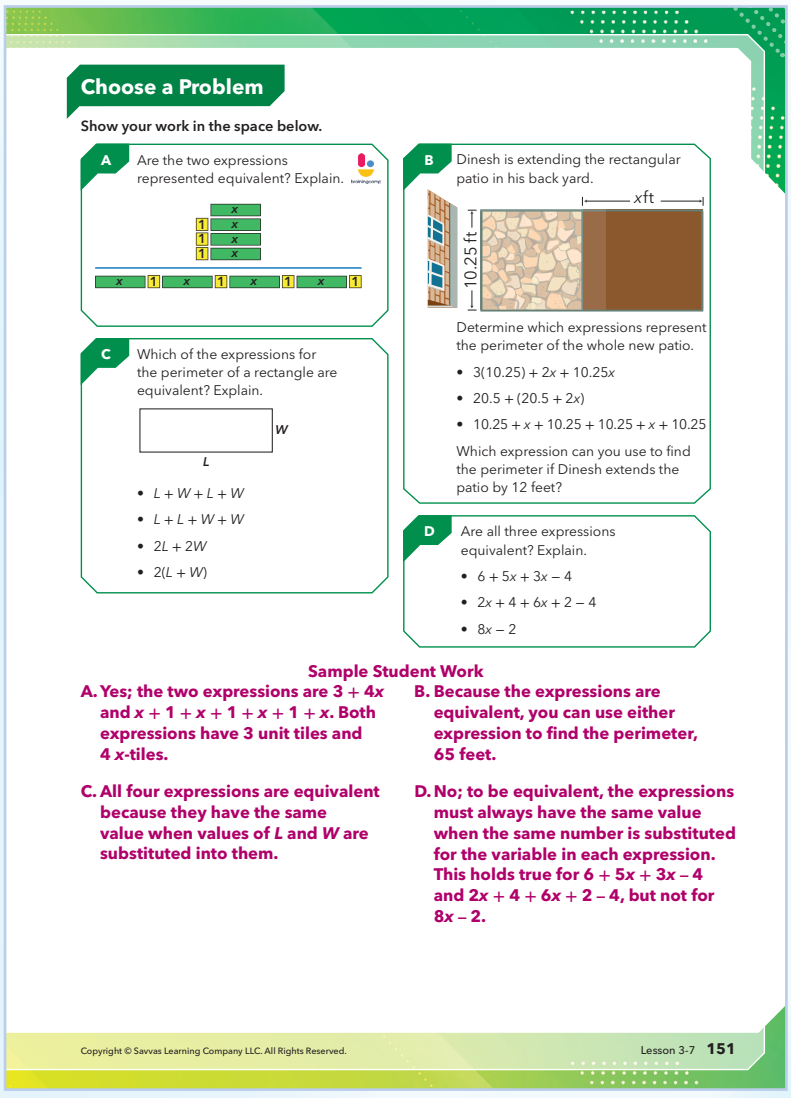
**Bridging** Review *Healthy Harvesting*.




Have students write an expression for each model, use substitution to check for equivalence, and describe their process in full sentences to a partner.

# Step 2 Connect

25–30 min



## Choose a Problem

Show your work in the space below.

**A** Are the two expressions represented equivalent? Explain.

**B** Dinesh is extending the rectangular patio in his back yard.

Determine which expressions represent the perimeter of the whole new patio.

- $3(10.25) + 2x + 10.25x$
- $20.5 + (20.5 + 2x)$
- $10.25 + x + 10.25 + 10.25 + x + 10.25$

Which expression can you use to find the perimeter if Dinesh extends the patio by 12 feet?

**C** Which of the expressions for the perimeter of a rectangle are equivalent? Explain.

- $L + W + L + W$
- $L + L + W + W$
- $2L + 2W$
- $2(L + W)$

**D** Are all three expressions equivalent? Explain.

- $6 + 5x + 3x - 4$
- $2x + 4 + 6x + 2 - 4$
- $8x - 2$

**Sample Student Work**

**A. Yes; the two expressions are $3 + 4x$ and $x + 1 + x + 1 + x + 1 + x$. Both expressions have 3 unit tiles and 4 $x$-tiles.**

**B. Because the expressions are equivalent, you can use either expression to find the perimeter, 65 feet.**

**C. All four expressions are equivalent because they have the same value when values of $L$ and $W$ are substituted into them.**

**D. No; to be equivalent, the expressions must always have the same value when the same number is substituted for the variable in each expression. This holds true for $6 + 5x + 3x - 4$ and $2x + 4 + 6x + 2 - 4$, but not for $8x - 2$.**

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### Engage Students Through Choice

Allow students to select a problem to solve individually.

**Problem A** supports students who are still developing their understanding of equivalent expressions.

**Problem B** shows a real-world connection with geometry and perimeter.

**Problem C** compares four expressions for perimeter and asks why they are equivalent.

**Problem D** focuses on whether or not three expressions are equivalent.

**Early finishers** may choose more than one problem.

## MTP Choose a Problem

### Discuss Solution Strategies

Group students based on the chosen problem to discuss their solution strategies. Consider having groups record their solutions on a vertical surface. Do a gallery walk so they can discuss different problems and solution strategies.

**Problem A**

- How many $x$-tiles and unit tiles does each model have?

**Problem B**

- What is the new length of the patio after extending the patio $x$ feet?

**Problem C**

Prompt students to substitute 3 for $W$ and 6 for $L$ to help determine if all four expressions are equivalent.

**Problem D**

Allow students to use algebra tiles as a model to represent the expressions and show equivalency.

### Present and Analyze

Prioritize discussion about the various ways to check for equivalence. If needed to promote discussion, ask questions such as:

**Problem A**

- How do the models connect to algebraic expressions? [The number of $x$-tiles shows the coefficient that will be multiplied by $x$ and the number of unit tiles shows the constant in the expression.]

**Problem B**

- What do the 20.5, 10.25, and $x$ represent in the given expressions? [The 20.5 represents two existing sides of the patio, the 10.25 represents one side of the patio, and the $x$ represents the number of feet the patio will be extended by.]

**Problem C**

- How can you tell which expressions are equivalent? [I can substitute numbers for $L$ and $W$ and check which expressions have the same value.]

**Problem D**

- How can you use substitution to check if the expressions are equivalent? [I can substitute the same number for $x$ in all four expressions to see which expressions have the same value.]

## Connect

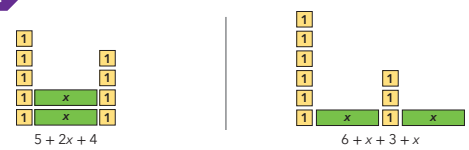
1. **Make Sense and Persevere** How was the strategy you used in *Choose a Problem* the same as your strategy in *Healthy Harvesting*? How were your strategies different?
   **Sample answers: In all of the problems you determine if two algebraic expressions are equivalent.**
   **A. You see if the expressions represented by algebra tiles are equivalent.**
   **B. When finding the perimeter of a rectangular patio, you choose which algebraic expression can be used.**
   **C. You analyze four different expressions for perimeter of a rectangle and determine if they are equivalent.**
   **D. You analyze three given algebraic expressions and tell why they are not all equivalent.**

2. **Reasoning** How does understanding the perimeter of a rectangle help you determine whether a given algebraic expression is useful?
   **Sample answer: Knowing that the perimeter of a rectangle is adding the lengths of the sides can help you understand whether the terms in the algebraic expression represent this sum.**

3. **Use Structure** How do you know if two algebraic expressions are equivalent?
   **Sample answer: Both expressions must always have the same value when the same number is substituted for the variable in each expression.**

4. **Generalize** How do algebra tiles help you determine whether or not expressions are equivalent?
   **Sample answer: You can write expressions from the given algebra tiles and then determine if the expressions always have the same value when the same number is substituted for the variable in each expression.**

**Key Concept**




$5 + 2x + 4$ $\qquad$ $6 + x + 3 + x$

The algebraic expressions are equivalent because they always have the same value when the same number is substituted for the variable in each expression.

**Talk About Ideas**

How can you recognize when two algebraic expressions are equivalent?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## MTP Connect

**Connect Solution Strategies** Use your students' work or the sample student work to facilitate responses phrased in students' own words. Encourage students to use the vocabulary *equivalent expressions*.

**Item 1** Comparing and contrasting different solutions builds understanding of problems that involve equivalent expressions. Have students focus on they ways they utilized algebra tiles and substitution.

**Item 2** Real-world connections allow for a deeper understanding. Ask students if they can relate the perimeters of other shapes to algebraic expressions.

**Item 3** Algebra tiles also provide another method of determining whether two expressions are equivalent. The models of each expression must have the same number of *x*-tiles and unit tiles.

**Item 4** Modeling expressions with algebra tiles provides a deeper understanding of the many ways a single expression can be presented.

## MTP Key Concept

- What is the value of each expression if you substitute 5 for $x$? [19]
- Can you rearrange the algebra tiles in another way to show a new equivalent expression? [Yes; $2x + 9$]

## MTP Talk About Ideas

Have students engage in a think-pair-share to discuss the different strategies they could use to determine whether two expressions are equivalent. Use the models in the Key Concept as an example. Ask: Why do you know the models represent equivalent expressions? Listen for discussions about using algebra tiles or substitution.

# Step 3 Practice and Problem Solving

15–20 min

Interactive Practice  Adaptive Practice

You may opt to have students complete automatically scored practice items online.

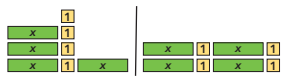
Name _____

Lesson Help

## Practice and Problem Solving

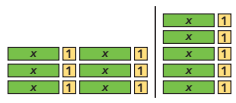
In 5–8, determine whether the two expressions represented by the algebra tiles are equivalent. Explain.

**5.**



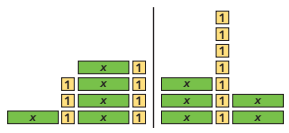
**Yes; Sample answer: The two expressions represented by the algebra tiles are $3x + 4 + x$ and $2x + 2 + 2x + 2$.**

**6.**



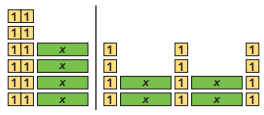
**No; Sample answer: The two expressions represented by the algebra tiles are $3x + 3 + 3x + 3$ and $5x + 5$.**

**7.**



**Yes; Sample answer: The two expressions represented by the algebra tiles are $x + 3 + 4x + 4$ and $3x + 7 + 2x$.**

**8.**



**Yes; Sample answer: The two expressions represented by the algebra tiles are $12 + 4x$ and $4 + 2x + 4 + 2x + 4$.**

**Reasoning** In 9–12, identify which expressions are equivalent. Justify your reasoning.

**9.** **a.** $4 + 3x + 7x - 1$
**b.** $4x + 2 + 6x + 2 - 1$
**c.** $10x - 3$

**a and b; To be equivalent, the expressions must always have the same value when the same number is substituted for the variable in each expression. This holds true for a and b, but not c.**

**10.** **a.** $4x - 2 + 3x$
**b.** $4x + 5 + 3x - 2$
**c.** $7x + 4 + 1 - 2$

**b and c; To be equivalent, the expressions must always have the same value when the same number is substituted for the variable in each expression. This holds true for b and c, but not a.**

**11.** **a.** $6 + x + 2x - 3$
**b.** $2x + 6 + x + 5 - 4$
**c.** $3x + 7$

**b and c; To be equivalent, the expressions must always have the same value when the same number is substituted for the variable in each expression. This holds true for b and c, but not a.**

**12.** **a.** $8 + 9x + 2x - 5$
**b.** $5x + 5 - 3 + 6x + 1$
**c.** $4x + 4 - 3 + 7x + 2$

**a, b, and c; To be equivalent, the expressions must always have the same value when the same number is substituted for the variable in each expression. This holds true for all three expressions.**

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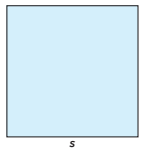
**13.** Which of the expressions for the perimeter of a square are equivalent? Explain.
- $s + s + s + s$
- $2s + 2s$
- $4s$




**All three expressions for the perimeter are equivalent since they will always have the same value when the same number is substituted for the variable in each expression.**

**14.** **Higher Order Thinking** You are given the expressions $x^3$ and $x^4$. Since both have the same value for 0 and 1, are they equivalent expressions?

**No; Sample answer: Both expressions must have the same value when any number is substituted for the variable $x$ in each expression. For $x = 2$, the expressions are not equivalent, so the value of the expressions is not the same for any value of $x$.**

**15.** A group of students want to extend the length of their community garden.

If they want to place fencing around the entire garden, they need to find the perimeter. The expressions $15.75 + x + 15.75 + 15.75 + x + 15.75$ and $31.5 + (31.5 + 2x)$ represent the perimeter of the garden. Which expression can they use to find the perimeter if the garden is extended by 8 feet? What is the new perimeter?

**76 feet; Because the expressions are equivalent, either can be used: $15.75 + 8 + 15.75 + 15.75 + 8 + 15.75 = 79$ and $31.5 + (31.5 + 2 \times 8) = 79$.**

### Assessment Practice

**16.** **Reasoning** Are the two algebraic expressions equivalent? Explain.

$9x + 5 + x + 4$  $4x + 9 + 5x - 1 + x + 1$

**Sample answer: The two expressions are equivalent because they have the same value when any value of $x$ is substituted into them.**

**17.** Select all the expressions that are equivalent to $11x + 7 + 3x - 5$.

- [x] $11x + 2 + 3x$
- [ ] $10x + 7 + 4x$
- [x] $6x + 4x + 8 + 2x - 6 + 2x$
- [ ] $7x + 4x + 7 - 5 + 3$
- [x] $14x + 2$



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## Practice and Problem Solving

### Error Intervention

**Items 5–8** Students may attempt to group the $x$-tiles and unit tiles while writing the expressions and forget to include parts of the model in the expression. Tell them to write the $x$-tiles and unit tiles as they appear in the model to make sure all parts are represented.

### Multilingual Learners

**Items 9–12** Multilingual learners may need additional prompting when attempting to justify their reasoning.

- What strategies can you use to tell if these expressions are equivalent? [Substitute the same number for $x$ in all the expressions and see if they have the same value.]

### Engage Through Student Choice

Go online for an assignment strategy.

### Item Analysis: Practice and Problem Solving

| Items | DOK |
|---|---|
| 5–8, 17 | 1 |
| 9–13, 16 | 2 |
| 14, 15 | 3 |

# Step 4 Assess and Differentiate

15–30 min

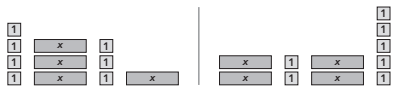
## Additional Practice

Name _____

### 3-7 Additional Practice

Lesson Help

**1.** Determine whether the modeled algebraic expressions are equivalent.



$4 + 3x + 3 + x$ $\qquad$ $2x + 2 + 2x + 5$

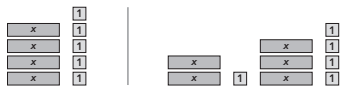
The algebraic expressions **are** equivalent.

**For 2–5, determine whether the two expressions represented by the algebra tiles are equivalent. Explain.**

**2.**

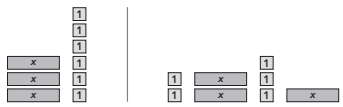
**Sample answer: Yes; the two expressions represented by the algebra tiles are $4 + 5x + 2$ and $3x + 3 + 2x + 3$.**

**3.**



**Sample answer: No; the two expressions represented by the algebra tiles are $4x + 5$ and $2x + 1 + 3x + 4$.**

**4.**



**Sample answer: No; the two expressions represented by the algebra tiles are $3x + 6$ and $2 + 2x + 3 + x$.**

**5.**

**Sample answer: Yes; the two expressions represented by the algebra tiles are $1 + 3x + 3 + 3x$ and $2 + 4x + 2 + 2x$.**



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**For 6–9, identify which algebraic expressions are equivalent. Justify your reasoning.**

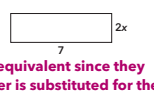
**6.** **a.** $4x + 9$
**b.** $2 + 2x + 7 + 3x$
**c.** $x + x + 9 + 2x$
**a and c; Sample answer: To be equivalent, the expressions must always have the same value when the same number is substituted for the variable in each expression. This holds true for $4x + 9$ and $x + x + 9 + 2x$, but not $2 + 2x + 7 + 3x$.**

**7.** **a.** $3 + 2x + 4$
**b.** $3x + 7 - x$
**c.** $2 + x + x + 5 + x$
**b and c; Sample answer: To be equivalent, the expressions must always have the same value when the same number is substituted for the variable in each expression. This holds true for $3x + 7 - x$ and $2 + x + x + 5 + x$, but not $3 + 2x + 4$.**

**8.** **a.** $9 + 5x$
**b.** $5x + 8 - 2$
**c.** $3x + 7 + 2x + 1$
**None; Sample answer: To be equivalent, the expressions must always have the same value when the same number is substituted for the variable in each expression. This is not true for any of the algebraic expressions.**

**9.** **a.** $1 + 7x - x + 7$
**b.** $2x + 2x + 8 + 2x$
**c.** $8x + 8 - 2x$
**a, b, and c; Sample answer: To be equivalent, the expressions must always have the same value when the same number is substituted for the variable in each expression. This holds true for all the algebraic expressions**

**10.** **Critique Reasoning** Anthony writes the algebraic expression $2x + 7 + 2x + 7$ to represent the perimeter of this rectangle. Ella says that the perimeter is $4x + 14$. Who is correct? Explain.




**Both are correct; Sample answer: The expressions are equivalent since they will always have the same value when the same number is substituted for the variable in each expression.**

**11.** **Higher Order Thinking** What is the simplest expression that is equivalent to the algebraic expression $3x + 9 - 4x - 8 + x - 1$? Explain.
**0; Sample answer: The same number of $x$ terms and unit terms are being added as are being subtracted, so there are 0 $x$ terms and 0 units.**

**Assessment Practice**

**12.** Select all the algebraic expressions that are equivalent to $5 + 6x + x - 4 + x$.

- [x] $x + 1 + 7x$
- [ ] $5x + 3x - 1$
- [ ] $8x + 1 - x$
- [x] $-2x + 2 + 10x - 1$
- [x] $3 - x + 9x - 2$
- [ ] $x + x + 1 + 7x$



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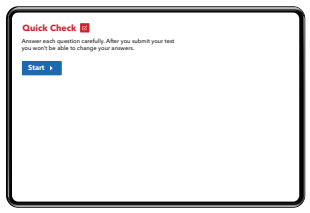
**Item Analysis: Additional Practice**

| Items | DOK |
|---|---|
| 1, 12 | 1 |
| 2–5 | 2 |
| 6–11 | 3 |

## MTP Quick Check

Formative Assessment

The Quick Check is available in the Assessment Sourcebook. The online Quick Check is automatically scored and appropriate remediation, practice, or enrichment will be assigned based on student performance.




## Differentiation Library

The **Differentiation Library** at the beginning of this topic shows the differentiation options available, each of which can be appropriate for all students. However, based on the **Quick Check** results, you may prescribe:

**0–3 points:** Reteach to Build Understanding and Additional Vocabulary Support Activities

**4–5 points:** Enrichment Activity

In addition, **Multilingual Learners** may benefit from the Build Mathematical Literacy Activity.

## Video Tutorials

Students can access instructional tutorials online.

How Do You Evaluate an Algebraic Expression with One Variable?

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# Understand Equivalent Expressions

Let's Investigate

**Lesson 3-7**

**I can ...** investigate what it means for two expressions to be equivalent.

Methods for harvesting vegetables can influence the growth and production of crops. Techniques include harvesting in the early morning, using the correct hand tools for cutting, and handling and cleaning the vegetables.

## Healthy Harvesting

**A garden begins with three beds of plants. Two beds starts with 10 plants and 2 plants are added weekly. Bed 3 starts with 2 plants and 4 plants are added weekly.**

Each representation models the total number of plants after $x$ weeks in each bed.




**A.** Use the algebra tiles to write three expressions representing the plants in each bed after $x$ weeks. Explain what each term represents.

**B.** Compare two different ways to represent the total plants in beds 1 and 2 and explain why they are equivalent.

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**Be Precise** Write two algebraic expressions representing the total number of plants in the garden after $x$ weeks. Explain why these expressions are equivalent.

**Build G.R.I.T. Growth Mindset** When modeling with algebra tiles, using words to describe the tiles can help you write algebraic expressions.

**Reasoning** After how many weeks does each bed have the same amount of plants? Explain.

**Generalize** If you substitute the same value of $x$ into two equivalent expressions, will they always have the same value? Explain.


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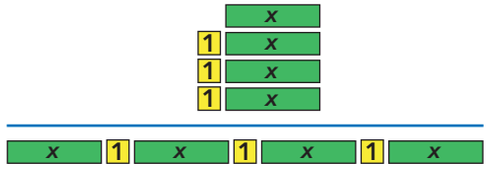
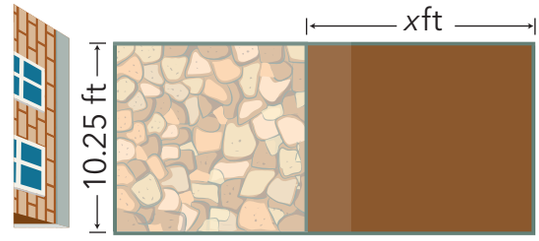
## Choose a Problem

**Show your work.**

**A** Are the two expressions represented equivalent? Explain.




**B** Dinesh is extending the rectangular patio in his back yard.

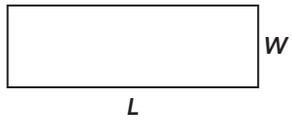



Determine which expressions represent the perimeter of the whole new patio.

- $3(10.25) + 2x + 10.25x$
- $20.5 + (20.5 + 2x)$
- $10.25 + x + 10.25 + 10.25 + x + 10.25$

Which expression can you use to find the perimeter if Dinesh extends the patio by 12 feet?

**C** Which of the expressions for the perimeter of a rectangle are equivalent? Explain.




- $L + W + L + W$
- $L + L + W + W$
- $2L + 2W$
- $2(L + W)$

**D** Are all three expressions equivalent? Explain.

- $6 + 5x + 3x - 4$
- $2x + 4 + 6x + 2 - 4$
- $8x - 2$

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## Connect

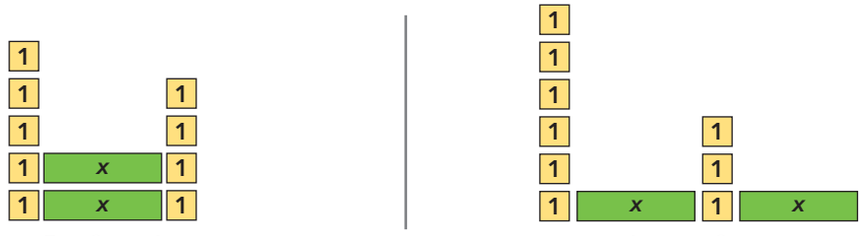
1. **Make Sense and Persevere** How was the strategy you used in *Choose a Problem* the same as your strategy in *Healthy Harvesting*? How were your strategies different?

2. **Reasoning** How does understanding the perimeter of a rectangle help you determine whether a given algebraic expression is useful?

3. **Use Structure** How do you know if two algebraic expressions are equivalent?

4. **Generalize** How do algebra tiles help you determine whether or not expressions are equivalent?

## Key Concept




$5 + 2x + 4$ $\qquad$ $6 + x + 3 + x$

The algebraic expressions are equivalent because they always have the same value when the same number is substituted for the variable in each expression.

## Talk About Ideas

How can you recognize when two algebraic expressions are equivalent?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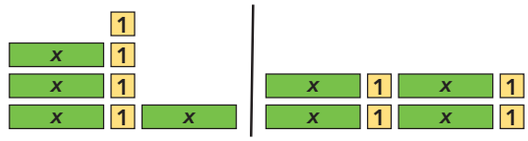
Name _____

Lesson Help

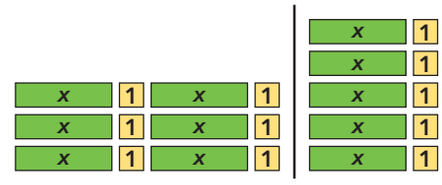
## Practice and Problem Solving

**In 5–8, determine whether the two expressions represented by the algebra tiles are equivalent. Explain.**

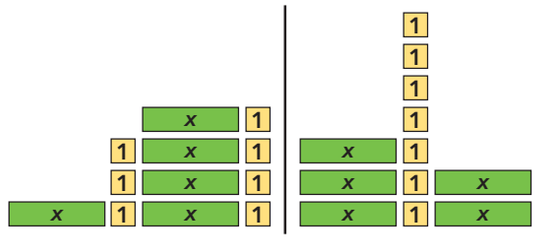
**5.**



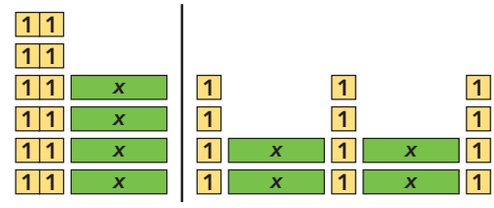
**6.**



**7.**



**8.**



**Reasoning** **In 9–12, identify which expressions are equivalent. Justify your reasoning.**

**9.** **a.** $4 + 3x + 7x - 1$

**b.** $4x + 2 + 6x + 2 - 1$

**c.** $10x - 3$

**10.** **a.** $4x - 2 + 3x$

**b.** $4x + 5 + 3x - 2$

**c.** $7x + 4 + 1 - 2$

**11.** **a.** $6 + x + 2x - 3$

**b.** $2x + 6 + x + 5 - 4$

**c.** $3x + 7$

**12.** **a.** $8 + 9x + 2x - 5$

**b.** $5x + 5 - 3 + 6x + 1$

**c.** $4x + 4 - 3 + 7x + 2$

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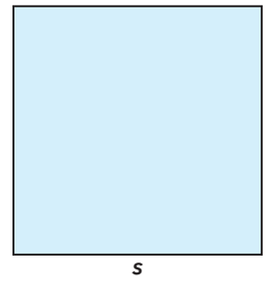
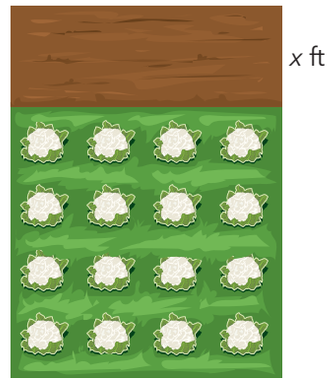
**13.** Which of the expressions for the perimeter of a square are equivalent? Explain.

- $s + s + s + s$
- $2s + 2s$
- $4s$




**14.** **Higher Order Thinking** You are given the expressions $x^3$ and $x^4$. Since both have the same value for 0 and 1, are they equivalent expressions?

**15.** A group of students wants to extend the length of their community garden.




If they want to place fencing around the entire garden, they need to find the perimeter. The expressions $15.75 + x + 15.75 + 15.75 + x + 15.75$ and $31.5 + (31.5 + 2x)$ represent the perimeter of the garden. Which expression can they use to find the perimeter if the garden is extended by 8 feet? What is the new perimeter?

## Assessment Practice

**16.** **Reasoning** Are the two algebraic expressions equivalent? Explain.

$9x + 5 + x + 4$ $\qquad$ $4x + 9 + 5x - 1 + x + 1$

**17.** Select all the expressions that are equivalent to $11x + 7 + 3x - 5$.

- ☐ $11x + 2 + 3x$
- ☐ $10x + 7 + 4x$
- ☐ $6x + 4x + 8 + 2x - 6 + 2x$
- ☐ $7x + 4x + 7 - 5 + 3$
- ☐ $14x + 2$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