Ready® Classroom

Grade 7 | Volume 1

Mathematics

Sampler

Ready® Classroom Mathematics

Grade 7 Student Worktext Sampler

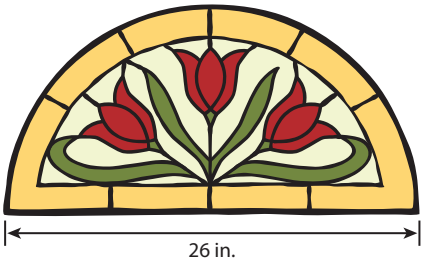
In this sampler, you will see *Ready Classroom Mathematics* Student Worktext pages for the Beginning and End of Unit 4 and two complete lessons.

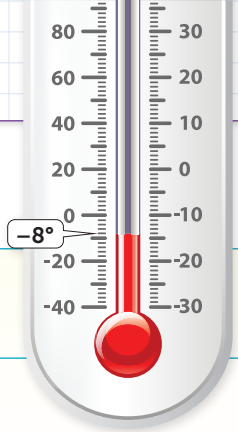
Contents

UNIT 1

Proportional Relationships

Ratios, Rates, and Circles





UNIT

2

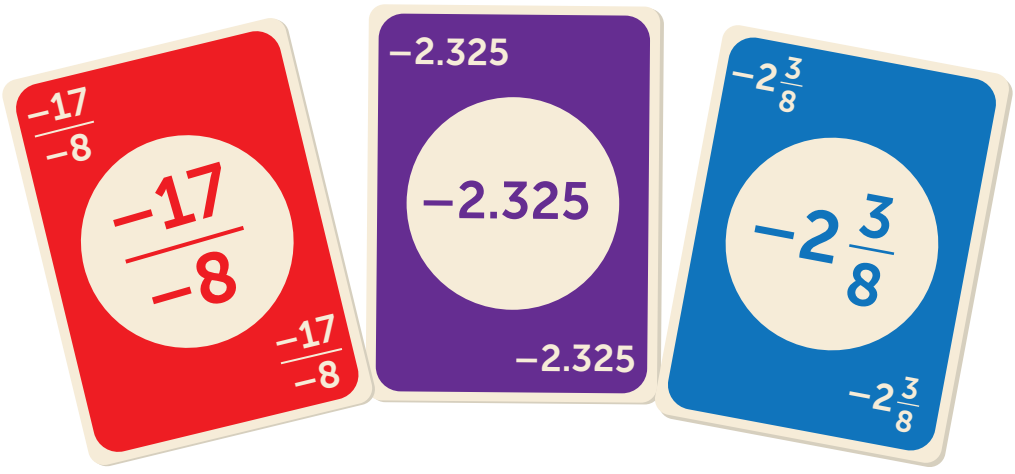
Numbers and Operations

Add and Subtract Rational Numbers

UNIT 3

Numbers and Operations

Multiply and Divide Rational Numbers



UNIT

4

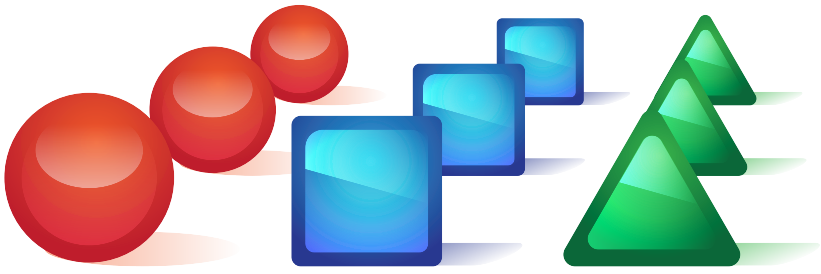
Algebraic Thinking

Expressions, Equations, and Inequalities

UNIT 5

Proportional Reasoning

Percents and Statistical Samples

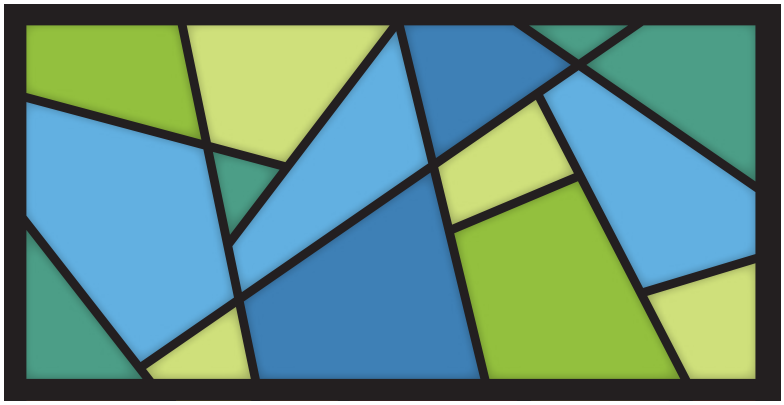


UNIT

6

Geometry

Solids, Triangles, and Angles

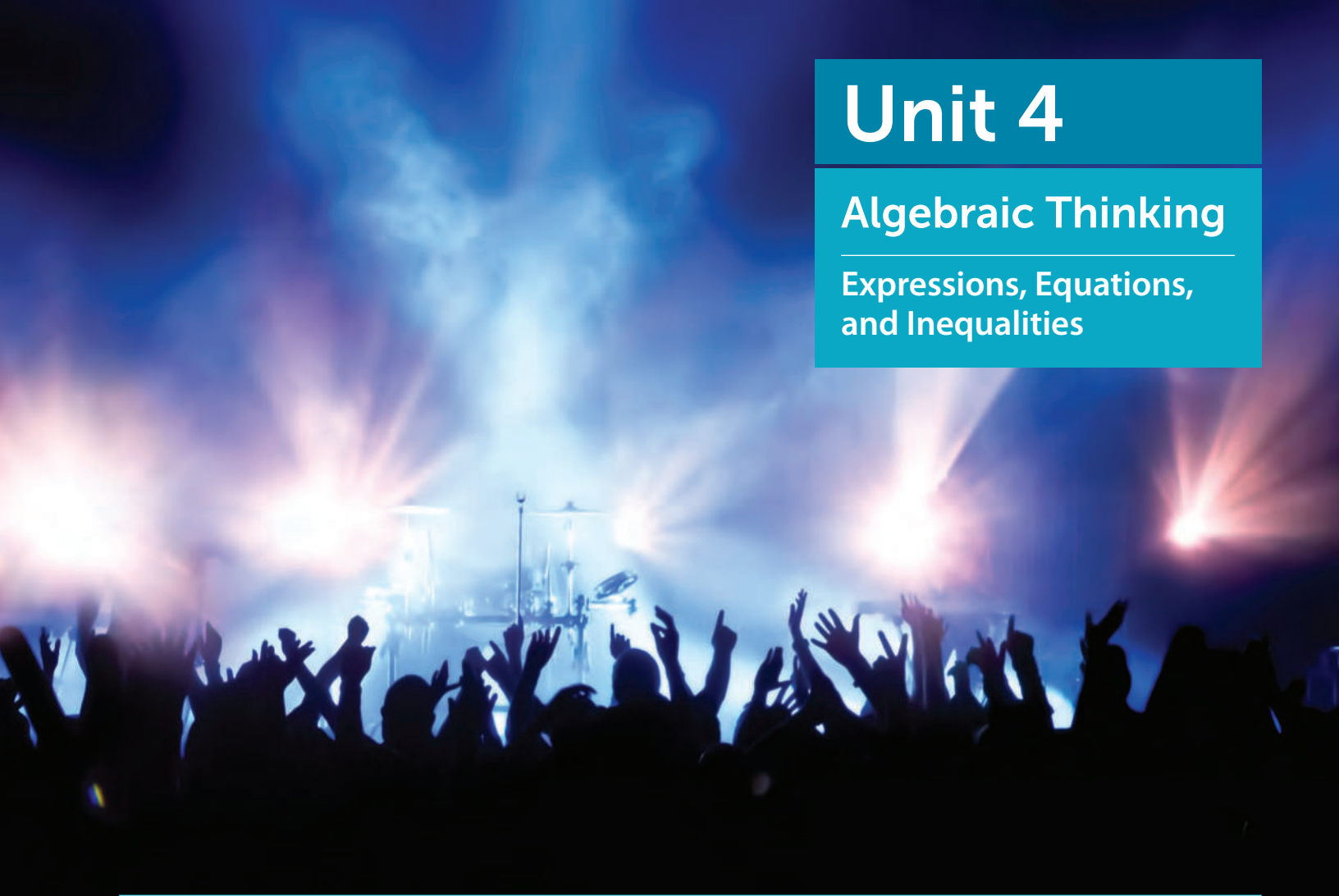


UNIT 7

Probability

Theoretical Probability, Experimental Probability, and Compound Events

Beginning of Unit 4



Unit 4

Algebraic Thinking

Expressions, Equations, and Inequalities

Self Check | **Before starting this unit, check off the skills you know below. As you complete each lesson, see how many more skills you can check off!**

I can . . .	Before	After
Find equivalent expressions.	☐	☐
Rewrite linear equations in different forms.	☐	☐
Solve multi-step equations.	☐	☐
Solve problems using equations.	☐	☐
Solve inequalities.	☐	☐
Solve problems using inequalities.	☐	☐
Graph the solution set of an inequality.	☐	☐
Actively participate in discussions by asking questions and rephrasing or building on classmates' ideas.	☐	☐

➤ **Think about what you know about calculating with rational numbers. Look at each set of expressions and circle the expression that is not equivalent to the others.**

$-3(2x + 8)$ $-3 \cdot 2x + (-3 \cdot 8)$ $-6x - 8$ $-2(3x + 12)$	$-\frac{1}{3}y - 2y + 15x - 3y$ $-10\frac{1}{3}y$ $-5\frac{1}{3}y + 15x$ $-2\frac{1}{3}y + 15x - 3y$
$8 \cdot 3^2 + 5w$ $24^2 + 5w$ $8 \cdot 9 + 5w$ $72 + 5w$	

Meet with a partner and compare answers. Discuss how you arrived at your answers. Then, in the last box, make your own set of four expressions and circle the one that is not equivalent to the others.

Lesson 17

Understand Multi-Step Equations

LESSON 17

Understand Multi-Step Equations

Dear Family,

This week your student is exploring multi-step equations.

You can use a variable to represent an unknown quantity and write an equation with the variable to represent a situation. Then you can use reasoning to find the value of the unknown quantity. You can use a hanger diagram to reason about the value of an unknown quantity.

Your student will be reasoning about situations like the one below.

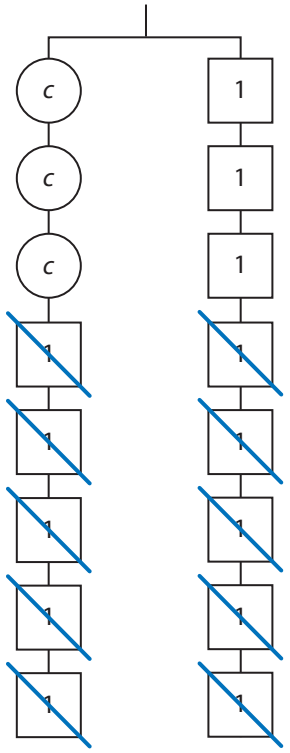
> For a party, Mr. Díaz buys 3 packs of confetti and a banner. He spends a total of \$8. He knows that the banner cost \$5, but does not remember the cost, c, of each pack of confetti. How can you represent this situation? How can you reason about the cost of each pack of confetti?

➤ **ONE WAY** is to use a hanger diagram.

The hanger diagram models this situation. The bar at the top is not tilted, showing the sides are balanced, or equal.

One way to reason about the cost, c, of each pack of confetti, is to cross off the same number of 1s from each side.

Now there are three c's on the left side and three 1s on the right side. That means each c is equal to 1.



➤ **ANOTHER WAY** is to use an equation.

The equation $3c + 5 = 8$ models this situation.

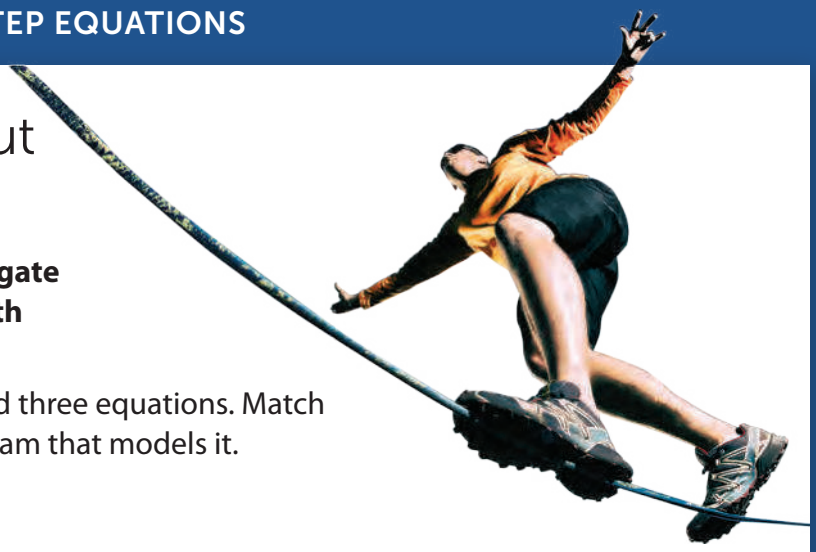
One way to reason about the cost, c, of each pack of confetti is to first think about the value of $3c$. This means thinking about what plus 5 equals 8. Since 3 plus 5 equals 8, that means $3c$ equals 3.

You can then use the value of $3c$ to reason about the value of c. If 3 times c equals 3, then c equals 1.

Using either representation, you can reason that the cost of each pack of confetti is \$1.

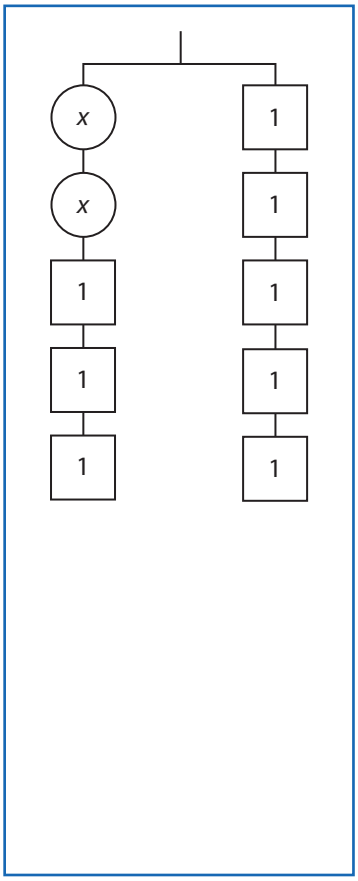
▶ Use the next page to start a conversation about multi-step equations.

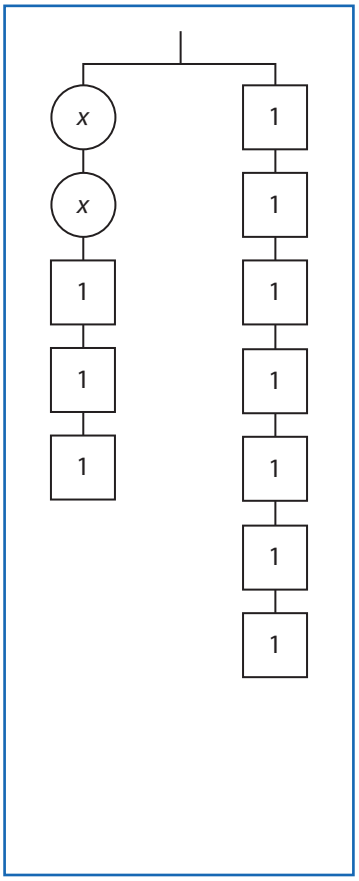
Activity Thinking About Multi-Step Equations

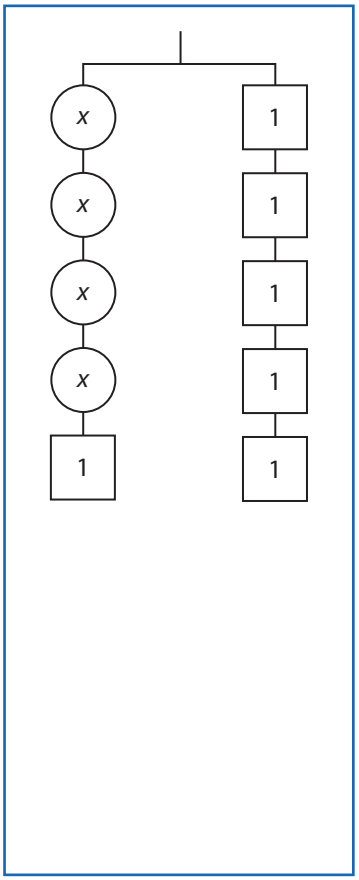


➤ **Do this activity together to investigate modeling multi-step equations with hanger diagrams.**

Below are three hanger diagrams and three equations. Match each equation with the hanger diagram that models it.







$2x + 3 = 7$

$4x + 1 = 5$

$2x + 3 = 5$

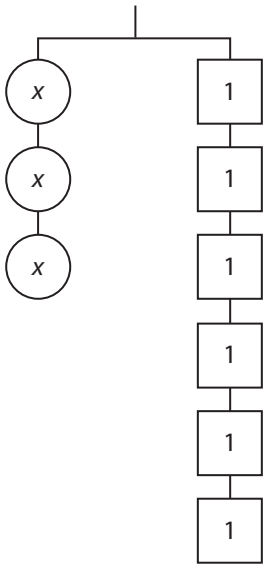
? How can you match the hanger diagram with the equation that it models?

UNDERSTAND: How can you reason about equations to find the value of the unknown?

Explore Reasoning About Multi-Step Equations

Model It

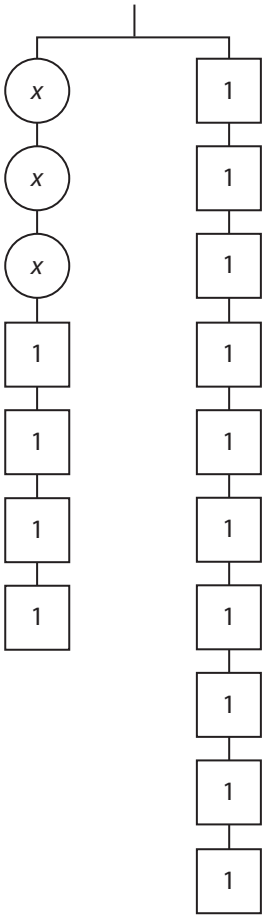
➤ **Complete the problems about using hanger diagrams to reason about the value of an unknown in an equation.**



1 **a.** When the top bar in a hanger diagram is level, it means the hanger diagram is balanced. That means the value of what is on one side is equal to the value of what is on the other side. The hanger diagram at the right models the equation $3x = 6$. How can you use the diagram to find the value of x?

b. What does the hanger diagram show is the value of x?

2 The hanger diagram at the right models the equation $3x + 4 = 10$. You can use this diagram to find the value of x.



a. If you add or remove the same amount from both sides of the hanger diagram, it will stay balanced. What can you remove from both sides of the hanger so only variables are on the left side? Cross off what you can remove.

b. Fill in the blank to show the equation the hanger diagram now models.

$3x =$ _____

c. How can you use this hanger diagram to find the value of x?

d. What does the diagram show is the value of x?

DISCUSS IT

Ask: What does it mean if the bar in a hanger diagram is not level?

Share: When I cross off the 1s . . .

Learning Target SMP 2, SMP 3, SMP 7

Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities.

Model It

➤ **Complete the problems about using reasoning to solve equations.**

3 Instead of using a diagram, another way to solve an equation is to reason about its terms. Think about the equation $4w + 8 = 32$.

a. You can think of $4w$ as the unknown quantity. How could you find the value of $4w$? What is the value of $4w$?

b. How could you use the value of $4w$ to find the value of w? What is the value of w?

c. How can you check that the value of w is correct?

DISCUSS IT

Ask: How is $4w + 8 = 32$ similar to $w + 8 = 32$?

Share: Once I know the value of $4w$, then I can . . .

4 Think about the equation $4w - 8 = 32$.

a. The value of $4w$ is 40. How do you know this is true?

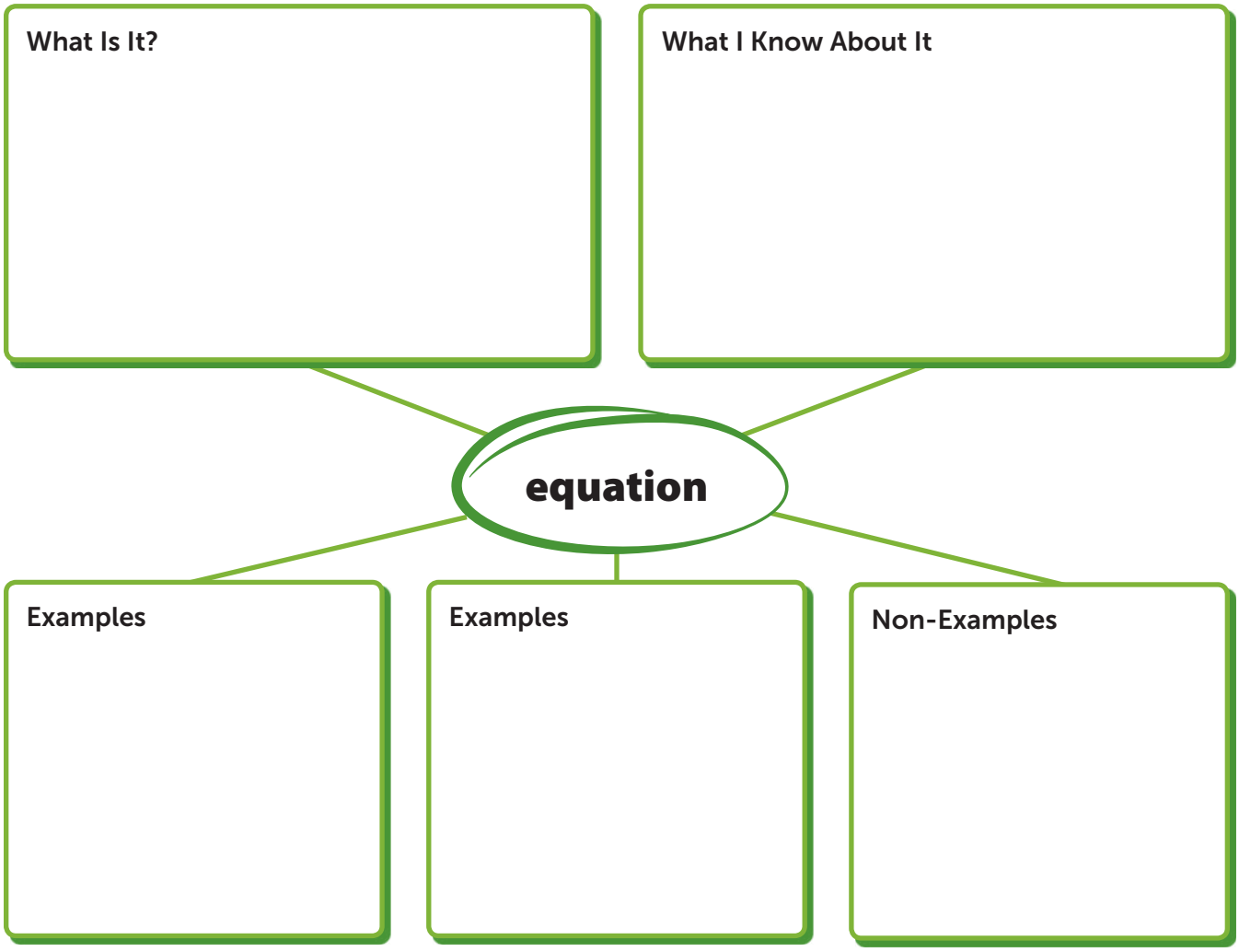
b. The value of w is 10. How do you know this is true?

5 **Reflect** How is reasoning about the value of y the same in $5y + 10 = 25$ and $5y - 10 = 25$? How is it different?

 Name:

Prepare for Multi-Step Equations

1 Think about what you know about an equation. Fill in each box. Use words, numbers, and pictures. Show as many ideas as you can.

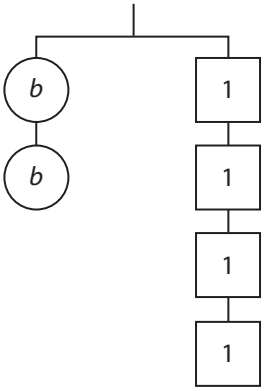


2 Circle the equations. Justify your answer.

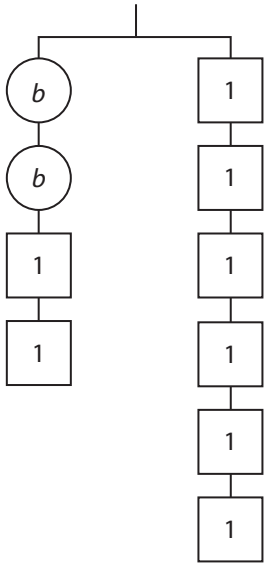
$x + 2$ $x + 2 = 4$ $x < 2$ $4 = x$ $5 + 7 = 12$

➤ **Complete problems 3–5.**

3 The hanger diagram models the equation $2b = 4$. Use the diagram to find the value of b. Show your reasoning.



4 The hanger diagram models $2b + 2 = 6$. You can use this diagram to find the value of b.



a. What can you remove from both sides of the hanger diagram so only variables are on the left side? Cross off what you can remove.

b. Fill in the blank to show the equation the hanger diagram now models.

$2b =$ _____

c. How can you use the diagram to find the value of b?

d. What does the diagram show is the value of b?

5 Think about the equation $3y - 9 = 24$.

a. The value of $3y$ is 33. How do you know this is true?

b. The value of y is 11. How do you know this is true?

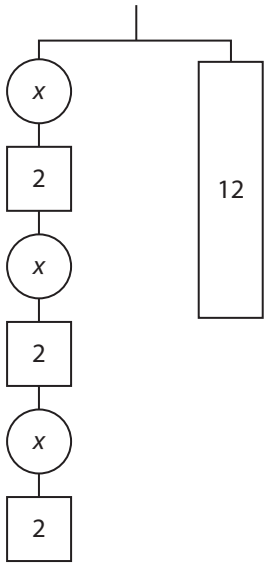
UNDERSTAND: How can you reason about equations to find the value of the unknown?

Develop Understanding of Reasoning About Multi-Step Equations

Model It: Hanger Diagrams

➤ **Try these two problems involving using a hanger diagram to find an unknown value.**

1 The hanger diagram models the equation $3(x + 2) = 12$.

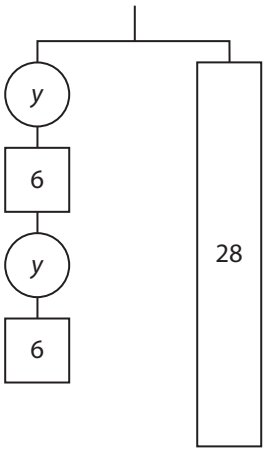


a. How many groups of $x + 2$ are in the diagram and the equation? Explain your reasoning. Circle each group of $x + 2$ in the diagram.

b. How can you figure out the value of each group of $x + 2$?

c. How can you figure out the value of x?

2 Look at the hanger diagram.



a. How many groups of $y + 6$ are there?

b. Fill in the blank to show the equation the hanger diagram models.

_____ $(y + 6) = 28$

c. How can you figure out the value of each group of $y + 6$?

d. How can you figure out the value of y?

DISCUSS IT

Ask: Why is it helpful to think of each side of the hanger diagram as having the same number of groups?

Share: Noticing groups of the same size helps me because . . .

Model It: Equations

➤ **Try this problem about using reasoning to solve equations.**

3 **a.** Complete the equation to model *3 times the sum of k and 8 is 36*.

_____ (_____ + _____) = _____

b. You can think of $k + 8$ as the unknown quantity. How could you find the value of $k + 8$? What is the value of $k + 8$?

c. How could you use the value of $k + 8$ to find the value of k? What is the value of k?

d. How can you check that the value of k is correct?

DISCUSS IT

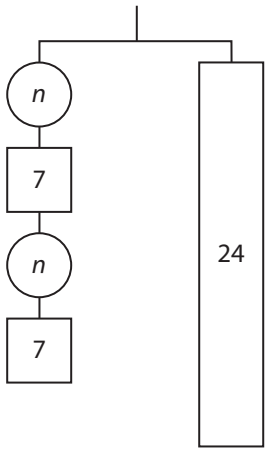
Ask: How does finding the value of $k + 8$ help you reason about the value of k?

Share: Once I know the value of $k + 8$, then I can . . .

CONNECT IT

➤ **Complete the problems below.**

4 The hanger diagram models the equation $2(n + 7) = 24$. What could be the first step in using the diagram to find the value of n? What could be the first step reasoning about the equation to find the value of n? How are these steps the same or different?



5 Explain how to find the value of y in the equation $6(y + 4) = 12$.

 Name:

Practice Reasoning About Multi-Step Equations

➤ **Study how the Example shows how to use reasoning to find the value of an unknown in an equation. Then solve problems 1–6.**

Example

The product of 4 and (3 + *x*) is equal to 36. What is the value of *x*?

The equation $4(3 + x) = 36$ models this statement.

Think: 4 times what number is 36?

Since $4 \cdot 9$ equals 36, that means $(3 + x)$ equals 9.

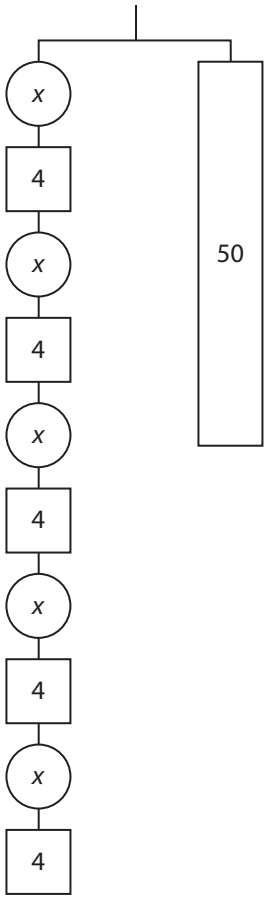
Since $3 + x = 9$, and $3 + 6 = 9$, that means x equals 6.

1. The sum of twice a number, n, and 14 is 30. Write an equation that models this statement. Then explain how you might use reasoning to find the value of n.

2. Is the value of $(y + 6)$ greater in $4(y + 6) = 48$ or $12(y + 6) = 48$? How do you know?

3. Ana wants to place 11 plants on 3 shelves. Each shelf holds the same number of plants. There are 2 plants that do not fit. Model this situation with an equation and a hanger diagram, where p is the number of plants that fit on each shelf.

4 Write an equation that hanger diagram models. How can you use the hanger diagram to find the value of x?



5 Write an equation to model the statement *the product of -8 and $(y + 3)$ is 32*. How you can use the equation to reason about the value of y?

6 Jiro buys 2 rocks that each cost the same amount, r, and a magnifying glass that costs \$5. The total cost is \$9. Model this situation with an equation and a hanger diagram.

UNDERSTAND: How can you reason about equations to find the value of the unknown?

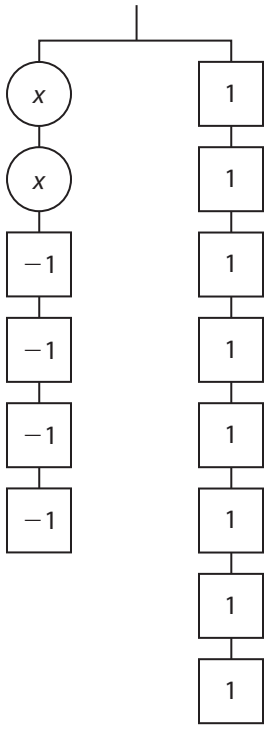
Refine Ideas About Multi-Step Equations

Apply It

➤ **Complete problems 1–5.**

1 **Examine** Hiroko is trying to find the value of d in $10d + 490 = 2{,}500$. He starts by correctly rewriting the equation as $10(d + 49) = 10(250)$. How could this help Hiroko figure out the value of d?

2 **Critique** Gavin says the hanger diagram shows that $2x - 4 = 8$ is the same as $2x = 4$. Jabari says the hanger diagram shows that $2x = 12$ is the same as $2x - 4 = 8$. Who is correct? Explain.



3 **Explain** To reason about the value of y in $\frac{1}{2}(2y + 4) = 14$, Lamont and Serafina each rewrite the equation. Lamont rewrites the equation as $2y + 4 = 28$. Serafina rewrites the equation as $y + 2 = 14$. Explain each person's strategy.

4 Consider the following equations:

$w + 4 = 25$

$3x + 4 = 25$

$7y + 4 = 25$

PART A What must be true about the values of w, $3x$, and $7y$?

PART B Which variable will have a greater value, w or y? Explain.

PART C Order w, x, and y from least to greatest. Explain.

5 **Math Journal** How can you reason about the equation $8b + 3 = 35$ to find the value of b?

End of Lesson Checklist

☐ **INTERACTIVE GLOSSARY** Write a new entry for *reasoning*. Tell what you look for in an equation when you use reasoning to find an unknown value.

Lesson 18

Write and Solve Multi-Step Equations

LESSON 18

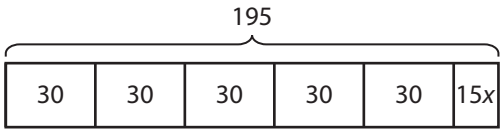
Dear Family,

This week your student is learning about writing and solving multi-step equations using algebraic approaches.

One way to solve word problems is by writing and solving an equation that represents the situation. A bar model may help you make sense of a problem. Then you can use it to write an equation to represent the situation.

A group of 5 friends go to a concert. Each friend buys a ticket that costs $30 and some buy a T-shirt that costs $15. In total the friends spend $195. How many T-shirts, x, did the friends buy?

Bar Model



Equation

$15x + 150 = 195$

There are often multiple ways to approach solving an equation. Your student will be solving problems like the one below.

A family buys 2 adult tickets and 4 child tickets to a high school basketball game. The family spends a total of $28 on tickets. The adult tickets cost $7 each. What is the cost, x, of each child ticket?

ONE WAY to start finding the value of x is to subtract 14 from both sides of the equation.

$$4x + 14 = 28$$
$$4x + 14 - 14 = 28 - 14$$
$$4x = 14$$
$$\frac{4x}{4} = \frac{14}{4}$$
$$x = 3.5$$

ANOTHER WAY to start is to divide both sides by 4.

$$4x + 14 = 28$$
$$\frac{4x + 14}{4} = \frac{28}{4}$$
$$x + 3.5 = 7$$
$$x + 3.5 - 3.5 = 7 - 3.5$$
$$x = 3.5$$

Using either method, $x = 3.5$. The cost of each child ticket is $3.50.

Use the next page to start a conversation about equations.

Activity Thinking About Multi-Step Equations

➤ **Do this activity together to investigate using an equation to make sense to a situation.**

Have you ever taken a taxi to get somewhere? Many taxi companies charge per mile you travel plus a fee to start the trip! That means how much the ride costs is based on more than just how far you travel.

You can use an equation to think about the relationship between miles traveled and the cost of the taxi ride.

Cost of Taxi ($)	=	Cost per Mile ($)	×	Number of Miles	+	Taxi Fee($)

You can use this equation to figure out much a taxi ride will cost if you know how many miles long the trip is. You can also use this equation to figure out how many miles you can travel for a certain amount.

? What are other situations where a total depends on more than one thing?

Explore Solving Multi-Step Equations

Previously, you learned how to reason about equations to find unknown values. In this lesson, you will learn about solving equations algebraically.

➤ **Use what you know to try to solve the problem below.**

Adela, Rachel, and Santo take pictures at a Purim celebration.

- Adela takes 7 more pictures than Rachel.
- Santo takes 4 times as many pictures as Adela.
- Santo takes 48 pictures.

How many pictures does Rachel take?

TRY IT

Math Toolkit algebra tiles, grid paper, number lines, sticky notes

DISCUSS IT

Ask: What did you do first to find the number of pictures Rachel takes? Why?

Share: I started by . . . because . . .

Learning Targets SMP 1, SMP 2, SMP 3, SMP 4, SMP 5, SMP 6, SMP 7

Use variables to represent quantities and construct simple equations to solve problems.

- Solve word problems leading to equations of the form $px + q = r$ and $p(x + q) = r$, where p, q, and r are specific rational numbers. Solve equations of these forms fluently. Compare an algebraic solution to an arithmetic solution, identifying the sequence of the operations used in each approach.

CONNECT IT

1 **Look Back** How many pictures do Adela and Rachel each take? How do you know?

2 **Look Ahead** One way to find the number of photos Adela and Rachel each take is to reason about the quantities arithmetically. Another way is to solve an equation algebraically. Look at two ways you could find the unknown in the statement *the product of 6 and a number, n, plus 4 is 22*.

Arithmetic Approach		Algebraic Approach	
Think: What number is 4 less than 22?			$6n + 4 = 22$
Step 1:	$22 - 4 = 18$	**Step 1:**	$6n + 4 - 4 = 22 - 4$
Think: What number times 6 is 18?			$6n = 18$
Step 2:	$18 \div 6 = 3$	**Step 2:**	$6n \div 6 = 18 \div 6$
	The number is 3.		$n = 3$

a. How is Step 1 in the arithmetic approach like Step 1 in the algebraic approach?

b. How is Step 2 in the arithmetic approach like Step 2 in the algebraic approach?

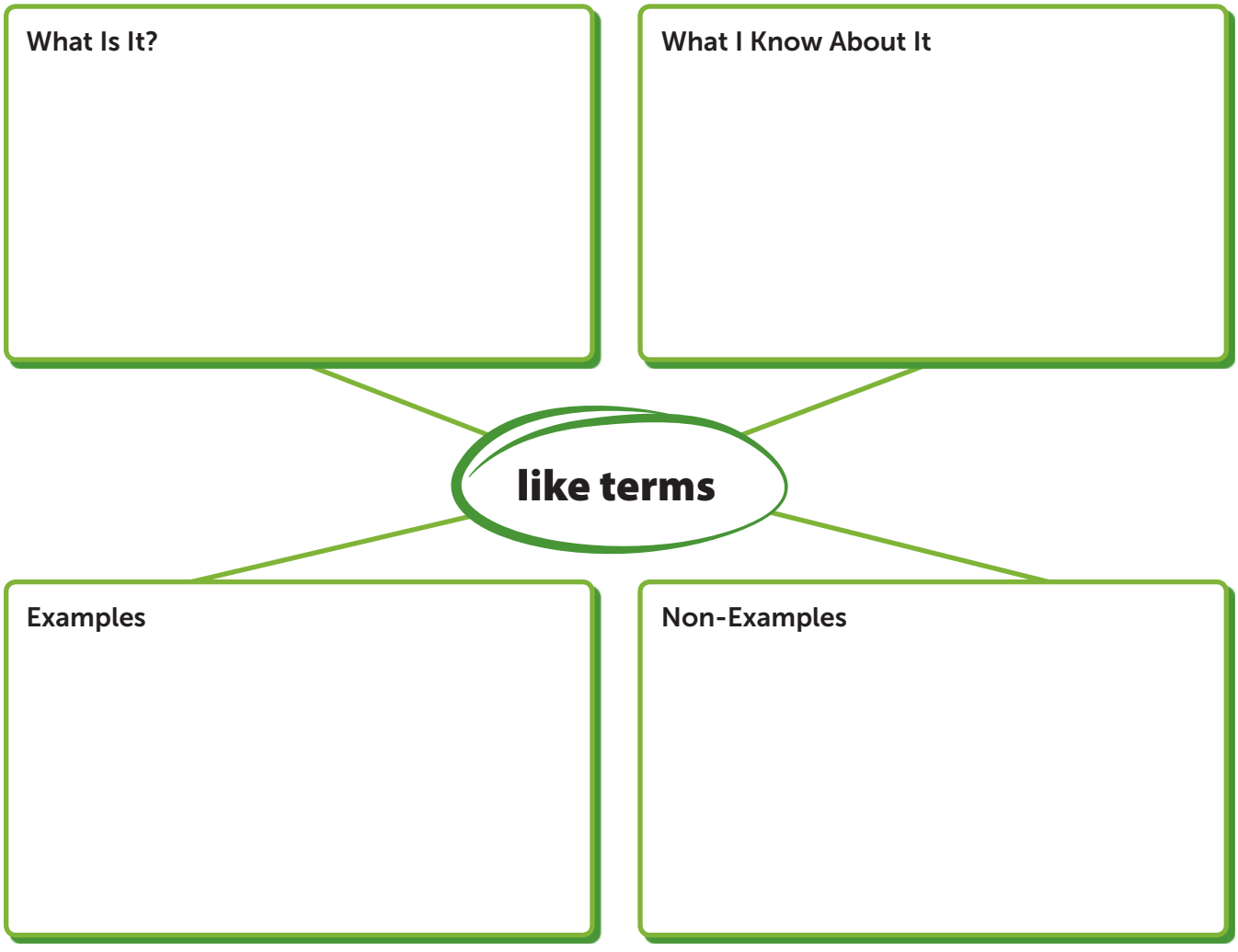
c. Why do both approaches lead to the same solution?

3 **Reflect** How is the algebraic approach similar to the arithmetic approach? How is it different?

 Name:

Prepare for Writing and Solving Multi-Step Equations

1 Think about what you know about the like terms in an expression. Fill in each box. Use words, numbers, and pictures. Show as many ideas as you can.

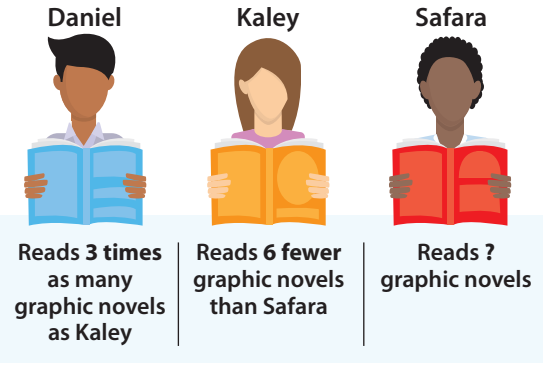


2 Rosa says $4x$ and $-6x$ are like terms, so they can be combined. Tiffany says $5a$ and $5b$ are like terms, so they can be combined. Is Rosa correct? Is Tiffany correct? Why or why not?

3 Kaley, Safara, and Daniel keep track of how many graphic novels they read over the summer.

- Kaley reads 6 graphic novels fewer than Safara.
- Daniel reads 3 times as many as Kaley.
- Daniel reads 30 graphic novels.

a. How many graphic novels does Safara read? Show your work.



SOLUTION _____

b. Check your answer to problem 3a. Show your work.

Develop Writing and Solving Equations With Two or More Addends

➤ **Read and try to solve the problem below.**

Noah is designing a set for a school theater production. He has 150 cardboard bricks. He needs to use some of the bricks to make a chimney and 4 times as many bricks to make an arch. He also saves 15 bricks in case some get crushed. How many cardboard bricks can he use to make the arch?

TRY IT

Math Toolkit algebra tiles, grid paper, number lines, sticky notes

DISCUSS IT

Ask: How would you explain what the problem is asking in your own words?

Share: The problem is asking . . .

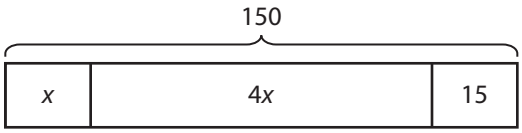
➤ **Explore different ways to find an unknown value in an equation that has two or more addends.**

Noah is designing a set for a school theater production. He has 150 cardboard bricks. He needs to use some of the bricks to make a chimney and 4 times as many bricks to make an arch. He also saves 15 bricks in case some get crushed. How many cardboard bricks can he use to make the arch?

Model It

You can draw a bar model to make sense of the problem.

Let x represent the number of bricks in the chimney.



Use the model to write an equation.

$$x + 4x + 15 = 150$$

$$5x + 15 = 150$$

Model It

You can start solving the equation by isolating the x-term.

$$5x + 15 = 150$$

$$5x + 15 - 15 = 150 - 15$$

$$5x = 135$$

Model It

You can start solving the equation by dividing both sides by the same value.

$$5x + 15 = 150$$

$$\frac{(5x + 15)}{5} = \frac{150}{5}$$

$$x + 3 = 30$$

CONNECT IT

➤ **Use the problem from the previous page to help you understand how to solve an equation that has two or more addends.**

1. How many bricks can Noah use to make the arch?

2. Look at the first **Model It**. How does the bar model represent the situation?

3. Look at the second **Model It**. Why do you subtract 15 from both sides? What do you need to do next to find the value of x?

4. Look at the third **Model It**. Why do you divide all of the terms by 5?

5. Look at the second and third **Model Its**. How are the strategies for solving $5x + 15 = 150$ similar? How are they different?

6. Describe two ways you could solve the equation $2x + 12 = 8$.

7. **Reflect** Think about all the models and strategies you have discussed today. Describe how one of them helped you better understand how to solve the **Try It** problem.

Apply It

➤ **Use what you learned to solve these problems.**

8 Solve $-21 = -\frac{1}{4}y + 6$. Show your work.

SOLUTION _____

9 A rectangular garden sits next to a house. There is fencing on three sides of the garden and the fourth side is the house. There is a total of 21.5 meters of fencing around the garden. The length of the garden along the house is 9 meters. Which equation can be used to find the width, *w*, of the garden in meters?

A $2w + 9 = 21.5$

B $2w + 18 = 21.5$

C $2w - 21.5 = 9$

D $2w + 21.5 = 9$

10 The total cost of a sketchpad and 6 pencils is $22.53. The sketchpad costs $9.99. Each pencil costs the same amount. How much does each pencil cost? Show your work.

SOLUTION _____

 Name:

Practice Writing and Solving Equations With Two or More Addends

➤ **Study the Example showing how to solve a problem using an equation. Then solve problems 1–5.**

Example

Chloe is making a mural. She spends 6 hours designing it. She paints it during 3 sessions. Each session is the same number of hours long. In all, Chloe spends 24 hours making the mural. How many hours long, *h*, is each painting session?

You can represent the situation with an equation.

$$3h + 6 = 24$$

$$\frac{3h + 6}{3} = \frac{24}{3}$$

$$h + 2 = 8$$

$$h + 2 - 2 = 8 - 2$$

$$h = 6$$

Each painting session is 6 hours long.

1 Demarco has a piece of fabric 6 yd long. He uses a piece 3 yd long. He cuts the rest into strips that are each $\frac{3}{4}$ yd long. How many $\frac{3}{4}$ yd long strips are there? Show your work.

SOLUTION _____

2 Solve $-7 = 12x - 16$. Show your work.

SOLUTION _____

3 Liam makes soap sculptures of sea turtles. Each sculpture weighs $\frac{3}{8}$ pound. He ships them in a wooden box that weighs 2 pounds. The total weight of the box filled with the t sea turtles is 5 pounds. How many sea turtles are in the box? Show your work.

SOLUTION _____

4 Solve $-0.4k - 6 = 1.2$. Show your work.

SOLUTION _____

5 Claudia buys 12 postcards, 12 stamps, and 1 pen. The postcards cost twice as much as the stamps. The pen costs $1.50. The total cost is $14.10. How much does each postcard cost? Show your work.

SOLUTION _____

Develop Writing and Solving Equations with Grouping Symbols

➤ **Read and try to solve the problem below.**

Hugo is traveling in Toronto, Canada. His weather app shows the temperature is 25°C. Hugo writes the equation $25 = \frac{5}{9}(F - 32)$ to find the temperature in degrees Fahrenheit, F. What is the temperature in degrees Fahrenheit?

TRY IT

Math Toolkit grid paper, number lines, sticky notes

DISCUSS IT

Ask: Why did you choose that strategy to find the temperature in degrees Fahrenheit?

Share: I knew . . . so I . . .

➤ **Explore different ways to find an unknown value in an equation with grouping symbols.**

Hugo is traveling in Toronto, Canada. His weather app shows the temperature is 25°C. Hugo writes the equation $25 = \frac{5}{9}(F - 32)$ to find the temperature in degrees Fahrenheit, F. What is the temperature in degrees Fahrenheit?

Model It

You can use the distributive property to expand.

$$25 = \frac{5}{9}(F - 32)$$

$$25 = \frac{5}{9}(F) - \frac{5}{9}(32)$$

$$25 = \frac{5}{9}F - \frac{160}{9}$$

$$25 + \frac{160}{9} = \frac{5}{9}F - \frac{160}{9} + \frac{160}{9}$$

$$\frac{385}{9} = \frac{5}{9}F$$

Model It

You can divide each side by the coefficient $\frac{5}{9}$.

$$25 = \frac{5}{9}(F - 32)$$

$$25 \div \frac{5}{9} = \frac{5}{9}(F - 32) \div \frac{5}{9}$$

$$25 \cdot \frac{9}{5} = \frac{5}{9}(F - 32) \cdot \frac{9}{5}$$

$$45 = F - 32$$

CONNECT IT

➤ **Use the problem from the previous page to help you understand how to solve an equation with grouping symbols.**

1. What is 25°C in degrees Fahrenheit?

2. Look at the first **Model It**. Describe the steps shown for solving the equation. What do you still need to do to find the value of F?

3. Look at the second **Model It**. Describe the steps shown for solving the equation. What do you still need to do to find the value of F?

4. Look at the **Model Its**. What was one advantage of distributing first? What was one advantage of dividing first?

5. Consider the equation $12 = b(2.5x + 15)$. What values of b might make you want to start solving the equation by distributing b? What values of b might make you want to start solving the equation by dividing by b?

6. **Reflect** Think about all the models and strategies you have discussed today. Describe how one of them helped you better understand how to write and solve an equation that includes grouping symbols.

Apply It

Use what you learned to solve these problems.

7 Carolina fosters 5 puppies. For each puppy she buys a crate that costs c dollars and a leash that costs $20. She spends $475 total. Which equations model the situation? Select all that apply.

A $5c + 20c = 475$

B $5(c + 20) = 475$

C $5c + 100 = 475$

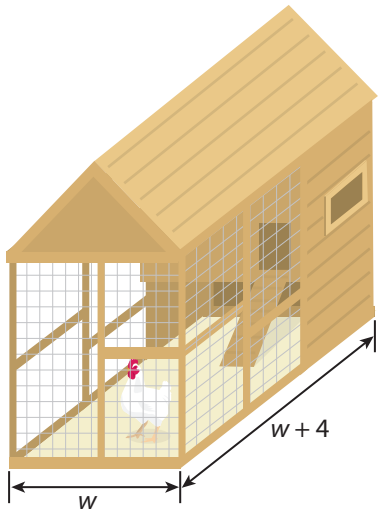
D $5c + 20 = 475$

E $c + 20 = 475$

8 Solve $-8 = \frac{k - 4}{-6}$. Show your work.

SOLUTION

9 The perimeter of a rectangular chicken coop is 30 feet. The width is w feet and the length is $w + 4$ feet. What are the length and width of the coop? Show your work.



SOLUTION

Name:

Practice Writing and Solving Equations with Grouping Symbols

➤ **Study the Example showing how to use an equation with grouping symbols to solve a problem. Then solve problems 1–5.**

Example

Lillie and her family donate money to charity at the end of each year. Lillie's brother donates $3 more than Lillie. Her parents donate 4.5 times as much as Lillie's brother. Lillie's parents donate $45. How much does Lillie donate?

You can represent the situation with an equation.

d = Lillie's donation in dollars

$$4.5(d + 3) = 45$$

$$\frac{4.5(d + 3)}{4.5} = \frac{45}{4.5}$$

$$d + 3 = 10$$

$$d + 3 - 3 = 10 - 3$$

$$d = 7$$

Lillie donates $7.

1 Look at $4.5(d + 3) = 45$ from the Example.

a. What does $(d + 3)$ represent?

b. Why is $(d + 3)$ multiplied by 4.5?

c. How much does Lillie's brother donate?

2 Malik joins a gym. He gets $2 per month off the regular monthly rate for 3 months. Malik pays $49.50 for 3 months. What is the gym's regular monthly rate, r?
Show your work.

SOLUTION _____

3 Luis is shopping for gifts. Mugs are on sale for $4 off the regular price, p. Luis buys 6 mugs. He pays a total of $54. What is the regular price of a mug? Show your work.

SOLUTION _____

4 Solve $\frac{3}{4}(5x - 3) + 8 = 17$. Show your work.

SOLUTION _____

5 Solve $-72 = 8(y - 3)$. Show your work.

SOLUTION _____

Refine Writing and Solving Multi-Step Equations

➤ **Complete the Example below. Then solve problems 1–8.**

Example

Solve $-0.25x + 7.5 = 15$.

Look at how you could show your work using multiplication.

$$-0.25x + 7.5 = 15$$
$$100(-0.25x + 7.5) = (100)15$$
$$-25x + 750 = 1{,}500$$
$$-25x + 750 - 750 = 1{,}500 - 750$$
$$-25x = 750$$

SOLUTION _____

CONSIDER THIS . . .
You can multiply both sides by a power of 10 to eliminate the decimals.

PAIR/SHARE
What is another way you could solve this problem?

Apply It

1 Solve $0 = -1.8y + 0.72$. Show your work.

CONSIDER THIS . . .
You can think of $0 = -1.8y + 0.72$ as having two addends.

SOLUTION _____

PAIR/SHARE
How can you check your answer?

2 Solve $\frac{2(n + 17)}{8} = \frac{3}{8}$. Show your work.

CONSIDER THIS . . .
There is more than one way to think about this problem.

PAIR/SHARE
How did you choose your first step?

SOLUTION

3 Three siblings are born on the same date in consecutive years. The sum of their ages is 42. What is the age of the oldest sibling?

A 13

B 14

C 15

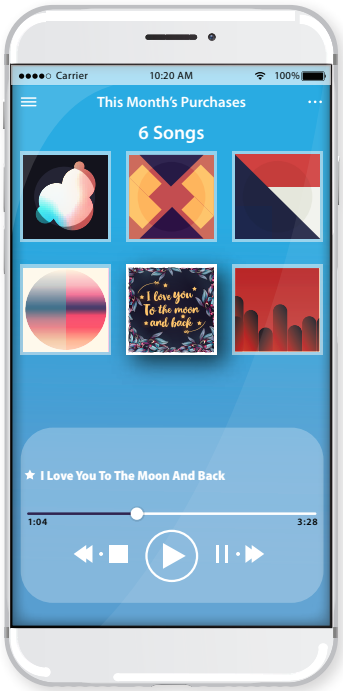
D 16

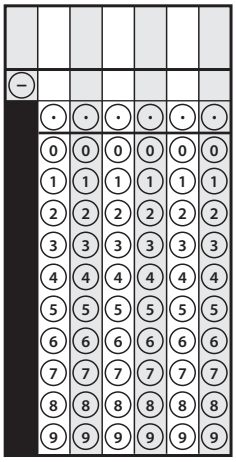
Victoria chose A as the correct answer. How might she have gotten that answer?

CONSIDER THIS . . .
Consecutive integers follow each other, like 4, 5, 6. If the first integer is x, the next is $x + 1$, then $x + 2$, and so on.

PAIR/SHARE
How would the answer change if there were four siblings?

4 Leon pays $12.50 per month for a music subscription service. One month he also buys 6 songs from the service. Each song costs the same. His bill for that month is $17.84. In dollars, how much does he pay for each song?





5 One side of an isosceles triangle is $2x + 1$ ft long. The other two sides are both $3x - 1$ ft long. The perimeter of the triangle is 55 ft. What is the length of each side? Show your work.

SOLUTION

6 Khalid is solving the equation $8.5 - 1.2y = 6.7$. He gets to $1.8 = 1.2y$. Explain what he might have done to get to this equation.

7 Mora preparing her pack for a hike. Her empty pack weighs $\frac{15}{16}$ pound. She adds some water bottles that each weigh $1\frac{1}{8}$ pound. Now Mora's pack weighs $6\frac{9}{16}$ pounds. How many bottles, b, does Mora add to her pack? Show your work.

SOLUTION

8 Solve $\frac{1}{2} + \frac{1}{3}w = \frac{1}{6}$. Show your work.

SOLUTION

9 **Math Journal** Damita says the equations $0.8x - 0.8 = 1.6$ and $\frac{4}{5}(x - 1) = 1\frac{3}{5}$ are the same. How can she show this, without solving the equations?

End of Lesson Checklist

- ☐ **INTERACTIVE GLOSSARY** Write a new entry for *represent*. Write at least one synonym for *represent*.
- ☐ **SELF CHECK** Go back to the Unit 4 Opener and see what you can check off.

End of Unit 4

Math IN Action

SMP 1 Make sense of problems and persevere in solving them.

Study an Example Problem and Solution

➤ **Read this problem involving linear expressions and rational numbers. Then look at one student's solution to this problem on the following pages.**

Booking a Show

Jorge and Liam play in a band called J Plus L. The band needs to decide on a venue for their next show. Read this email from their agent about the band's options, and help them respond to their agent.

Delete Archive Reply Reply All Forward

To: Jorge, Liam
Subject: Show for August 4th

Hey guys,

Here are the options for where we can book your next show. I think you would sell between 200 and 300 tickets at any of these venues.

CONCERT Live Music

Venue	Ticket Price	Share of Ticket Sales
Moonmint Music Hall	$22	20%
Legacy Park	$24	40%
Galaxy Theater	$28	30%

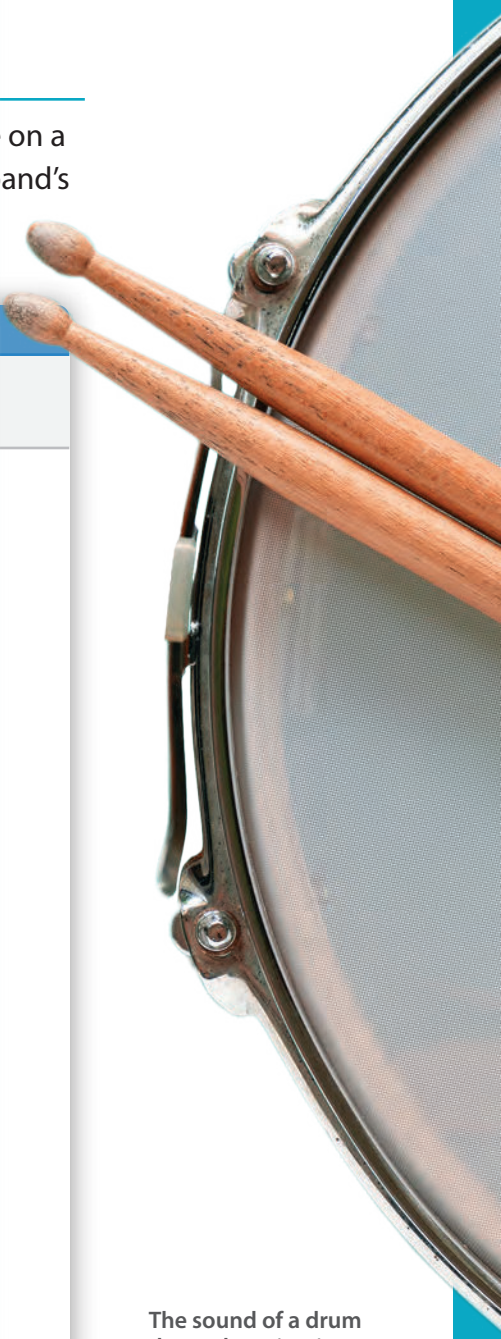
Section AA
Row 3
Seat 17

Remember that each venue takes a percent of the ticket sales, my fee is $\frac{1}{10}$ of the ticket sales, and $\frac{3}{20}$ of the ticket sales go to your manager. You keep the rest.

WHAT I NEED FROM THE BAND:

- Pick a venue.
- Write an expression that shows how much the band will make from the sale of t tickets. The expression should make it easy for me to see the price for a ticket and the amount that the venue, your manager, and I will make for every ticket sold.
- Write an equivalent expression that makes it easy for me to see how much the band will make for every ticket sold.
- Estimate how much the band will make in ticket sales from the show.

Thanks!



The sound of a drum depends on its size, shape, materials, and the striking technique of the drummer.

One Student's Solution

Problem-Solving Checklist

- [ ] Tell what is known.
- [ ] Tell what the problem is asking.
- [ ] Show all your work.
- [ ] Show that the solution works.

NOTICE THAT . . .
Each term of the expression provides information about the situation.

NOTICE THAT . . .
20% is the same as $\frac{20}{100}$, which means 20 hundredths, or 0.20.

First, I have to choose one of the venues for the band.

I will pick Moonmint Music Hall because it takes the smallest percent of the band's ticket sales.

The ticket price at Moonmint Music Hall is $22, and this venue takes 20% of the ticket sales.

Next, I will think about how I can write an expression for the amount the band will make from the sale of *t* tickets at a Moonmint show.

I know that the band has to pay part of the ticket sales to the venue, part to their agent, and part to their manager.

I can subtract each part from the total ticket sales to find the amount the band gets to keep.

total ticket sales − **part to venue** − **part to agent** − **part to manager**

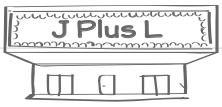
Now, I will use the given information to write the expression.

total ticket sales	price per ticket times number of tickets, *t*	$22t$
part to venue	20% of ticket sales	$0.20(22t)$
part to agent	$\frac{1}{10}$ of ticket sales	$\frac{1}{10}(22t)$
part to manager	$\frac{3}{20}$ of ticket sales	$\frac{3}{20}(22t)$

Here is my expression:

Ticket Sales

$22t$ −



Venue

$0.20(22t)$ −

Agent

$\frac{1}{10}(22t)$ −

Manager

$\frac{3}{20}(22t)$

Then, I will rewrite the expression to make it easy to see the price for a ticket and how much the venue, agent, and manager each make for every ticket sold.

I can rewrite each term as the product of a number and t.

total ticket sales − **part to venue** − **part to agent** − **part to manager**

$22t$	−	$0.20(22t)$	−	$\frac{1}{10}(22t)$	−	$\frac{3}{20}(22t)$
$22t$	−	$4.40t$	−	$0.1(22t)$	−	$0.15(22t)$
$22t$	−	**$4.40t$**	−	**$2.20t$**	−	**$3.30t$**

The new expression shows that the price of a ticket is **$22** and that, for every ticket sold, the venue receives **$4.40**, the agent receives **$2.20**, and the manager receives **$3.30**.

NOTICE THAT . . .
Because the expression represents an amount of money, it makes sense to rewrite the fractions as decimals.

Next, I will write another expression to make it easy to see how much the band makes for every ticket sold.

I can rewrite the previous expression as the product of a number and t.

$22t - 4.40t - 2.20t - 3.30t$

$12.10t$

For each ticket sold, the band members will make $12.10.

NOTICE THAT . . .
All terms from the previous expression are like terms, so they can be combined.

Finally, I will use my expressions to estimate how much the band will make in ticket sales from a show at Moonmint Music Hall.

I will use 250 tickets, since 250 is between 200 and 300 tickets.

$22t - 4.40t - 2.20t - 3.30t$	$12.10t$
$22(250) - 4.40(250) - 2.20(250) - 3.30(250)$	$12.10(250)$
$5{,}500 - 1{,}100 - 550 - 825$	$3{,}025$
$3{,}025$	

Both expressions have a value of 3,025. This helps to show that my calculations are correct and that the expressions I wrote are equivalent.

So, the band will make about $3,025 in ticket sales.

Try Another Approach

There are many ways to solve problems. Think about how you might solve the Booking a Show problem in a different way.

Booking a Show

Jorge and Liam play in a band called J Plus L. The band needs to decide on a venue for their next show. Read this email from their agent about the band's options, and help them respond to their agent.

Problem-Solving Checklist

- ☐ Tell what is known.
- ☐ Tell what the problem is asking.
- ☐ Show all your work.
- ☐ Show that the solution works.

Delete Archive Reply Reply All Forward

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Remember that each venue takes a percent of the ticket sales, my fee is $\frac{1}{10}$ of the ticket sales, and $\frac{3}{20}$ of the ticket sales go to your manager. You keep the rest.

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- Write an equivalent expression that makes it easy for me to see how much the band will make for every ticket sold.
- Estimate how much the band will make in ticket sales from the show.

Thanks!

Plan It

➤ **Answer these questions to help you start thinking about a plan.**

a. Which venue will you pick? What value will you use for the number of tickets the band will sell at the show?

b. How will you rewrite a percent or fraction as a decimal?

Solve It

➤ **Find a different solution for the Booking a Show problem. Show all your work on a separate sheet of paper. You may want to use the Problem-Solving Tips to get started.**

PROBLEM-SOLVING TIPS

Math Toolkit sticky notes

Key Terms

expression	variable	like terms
equivalent expression	coefficient	estimate

Questions

- How will you keep track of what each part of the expression represents?
- How can you check that the expressions you wrote are equivalent?

Reflect

Use Mathematical Practices As you work through the problem, discuss these questions with a partner.

- **Use Structure** What does each form of the expression tell you about the band's expenses?
- **Reason Mathematically** How do you know that the amount the agent and manager make in ticket sales will always be less than the amount the band makes?

Discuss Models and Strategies

Read the problem. Write a solution on a separate sheet of paper. Remember, there can be lots of ways to solve a problem.

Renting a Tour Van

Jorge and Liam want to rent a van for their band to use on a tour around Texas. Read through their notes, and help them finalize their plans.

Problem-Solving Checklist

- ☐ Tell what is known.
- ☐ Tell what the problem is asking.
- ☐ Show all your work.
- ☐ Show that the solution works.

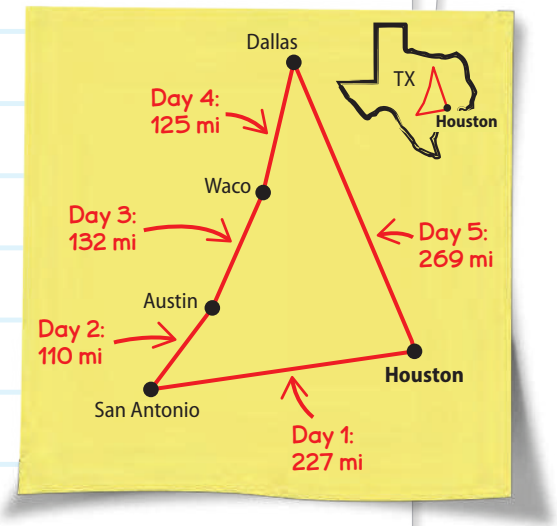
J Plus L Texas Tour!

Rental Company Info:

Company	Daily Rate	Fee for Extra Miles	Van Gas Mileage
Sapling	$191.80	$0.25 for each mile over 500	24 miles per gallon
Raven Rentals	$171.72	$0.30 for each mile over 750	15 miles per gallon
Bridge King	$206.22	$0.35 for each mile over 1,000	19 miles per gallon

Other Info:

- The tour starts and ends in Houston. Each distance includes how far we will drive to reach each city and other stops we will make.
- Right now, gas in Texas ranges from $2.39 to $2.63 per gallon.
- Our budget for renting the van, including gas, is $1,100.



WHAT WE NEED TO DO:

- Choose a rental company.
- Determine how many miles we can drive without going over budget for a 5-day tour.
- Figure out if we can afford to keep Dallas as the last show on our tour or if we should end the tour a day early. If our last show is in Waco, we will drive about 215 miles back to Houston on Day 4.

Plan It and Solve It

➤ **Find a solution to the Renting a Tour Van problem.**

Write a detailed plan and support your answer. Be sure to include:

- the rental company you choose.
- the greatest number of miles the band can afford to drive on a 5-day tour.
- a statement about whether or not the band can afford to keep Dallas as the last show on the tour.

PROBLEM-SOLVING TIPS

Math Toolkit number lines, sticky notes

Key Terms

expression	inequality	inverse operations
distributive property	term	expand
like terms	solution	

Questions

- What gas price will you use to make sure the band will not go over budget?
- How can you write an expression that represents the fee the band will pay for extra miles if they drive a total of *m* miles?
- If the band drives *m* miles, how many gallons of gas will they need? How can you write an expression to represent the cost for this number of gallons?

Reflect

Use Mathematical Practices As you work through the problem, discuss these questions with a partner.

- **Make Sense of Problems** What costs or fees contribute to the total amount the band will pay for the van during the tour?
- **Use a Model** How could an inequality help you solve this problem?

Persevere On Your Own

Read the problem. Write a solution on a separate sheet of paper.

Choosing Merch(andise)

Jorge and Liam's band plans to set up a merchandise table at each show to sell items to fans. The flyer shows the items the band may sell.

The band's total budget for merchandise is $1,350. They want to order 100 T-shirts, 1,000 stickers, and one more item. Select one more item for the band to order, and determine how many of that item the band can afford.

Problem-Solving Checklist

- ☐ Tell what is known.
- ☐ Tell what the problem is asking.
- ☐ Show all your work.
- ☐ Show that the solution works.

Item	Design Fee	Cost per Item	Minimum Number of Items per Order	Quantity
T-shirt	N/A	$6.99	25	100
Sticker	N/A	$0.35	100	1,000
Button	$107	$0.30	100	
Guitar pick	$64	$0.37	100	
Hat	$149	$6.54	25	
Poster	$354	$0.20	25	
Tote bag	$72	$3.74	5	

Solve It

➤ **Find a solution to the Choosing Merch(andise) problem.**

- Determine whether the band's order will qualify to pay only 95% of the purchase price.
- Write and solve an inequality that shows how much of the band's merchandise budget will be left after they buy the T-shirts and stickers.
- Choose another merchandise item, and determine how many of that item the band can buy with the remaining money in their budget.

Reflect

Use Mathematical Practices After you complete the problem, choose one of these questions to discuss with a partner.

- **Be Precise** How did the context of this problem help you decide how to round your answers?
- **Critique Reasoning** Which merchandise item did your partner choose? Do you agree that the band could buy as many of that item as your partner says? Could they buy more? Explain.

In this unit you learned to . . .

Skill	Lesson(s)
Find equivalent expressions.	**15**
Rewrite linear equations in different forms.	**15, 16**
Solve multi-step equations.	**17, 18**
Solve problems using equations.	**18**
Solve inequalities.	**19**
Solve problems using inequalities.	**19**
Graph the solution set of an inequality.	**19**
Actively participate in discussions by asking questions and rephrasing or building on classmates' ideas.	**15–19**

Think about what you have learned.

➤ **Use words, numbers, and drawings.**

1. Three examples of what I learned are . . .

2. The hardest thing I learned to do is _____ because . . .

3. A question I still have is . . .

Vocabulary Review

➤ **Review the unit vocabulary. Put a check mark by items you can use in speaking and writing. Look up the meaning of any terms you do not know.**

Math Vocabulary		Academic Vocabulary
☐ equation	☐ inequality	☐ combine
☐ equivalent expressions	☐ like terms	☐ consider
☐ expression	☐ rational number	☐ interpret
☐ factor (verb)		☐ modify

➤ **Use the unit vocabulary to answer the questions.**

1. Give an example of an equation and an inequality. Then use at least two math or academic vocabulary terms to explain how equations and inequalities are the same and different. Underline each term you use.

2. Explain each step of solving the inequality. Use at least two math or academic vocabulary terms. Underline each term you use.

$75(2x + 9) \leq 30x - 165$

$150x + 675 \leq 30x - 165$ _____

$150x - 30x + 675 \leq -165$ _____

$120x + 675 \leq -165$ _____

$120x \leq -840$ _____

$x \leq -7$ _____

Use what you have learned to complete these problems.

1 A square's side length is represented by $2x - 1.8$. Its perimeter is 24 inches. Which equations represent the perimeter? Choose all the correct answers.

A $4(2x - 1.8) = 24$

B $8x - 7.2 = 24$

C $2(2x - 1.8) = 24$

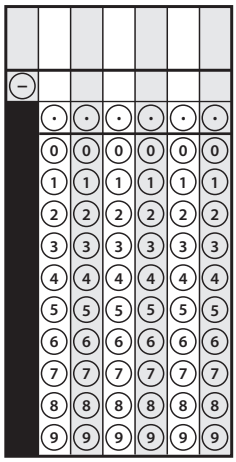
D $2(2x - 1.8) + 2(2x - 1.8) = 24$

E $8x - 1.8 = 24$

2 Aaliyah teaches an exercise class. The class has 25 regular participants. Each participant uses 4 weights. Aaliyah writes the expression $4(25 - n)$ to represent the number of weights needed if n regular participants do not come to class. The gym manager represents the number of weights needed with the expression $100 - 4n$. What information does each expression tell you? Explain your reasoning.

SOLUTION _____

3 Solve $\frac{1}{4}(x - 16) = \frac{3}{4}$. Record your answer on the grid. Then fill in the bubbles.



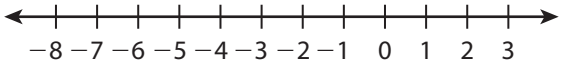
4 Monica works at a fitness center. She sells 15 fitness class passes that each cost the same amount and one exercise mat that costs $18. The total amount of money she collects is $93. How much does each fitness class pass cost? Show your work.

SOLUTION _____

5 Which expression is equivalent to $-5(2g + 6) - 4g$?

A $10g - 30$ **B** $-10g - 34$ **C** $-14g + 6$ **D** $-14g - 30$

6 Graph $\frac{b}{-2} - 4 < -1$ on the number line below. Show your work.



SOLUTION

7 Daniel and Amber each solved the inequality $-4(1.5 + 2n) \geq -24$. Their work is shown below. Why are both strategies correct? Explain your reasoning.

Daniel

$$-4(1.5 + 2n) \geq -24$$
$$-6 - 8n \geq -24$$
$$-6 - 8n + 6 \geq -24 + 6$$
$$-8n \geq -18$$
$$\frac{-8n}{-8} \leq -\frac{18}{-8}$$
$$n \leq 2.25$$

Amber

$$-4(1.5 + 2n) \geq -24$$
$$\frac{-4(1.5 + 2n)}{-4} \leq \frac{-24}{-4}$$
$$1.5 + 2n \leq 6$$
$$1.5 + 2n - 1.5 \leq 6 - 1.5$$
$$2n \leq 4.5$$
$$\frac{2n}{2} \leq \frac{4.5}{2}$$
$$n \leq 2.25$$

SOLUTION

Performance Task

➤ **Answer the questions and show all your work on separate paper.**

Backyard Paradise has hired you as their lead designer. Your first client wants a rectangular pool that is 20 feet by 40 feet. She would also like to install a fence around the pool that meets the following requirements:

- The fence must have a minimum perimeter of 300 feet.
- The distance from the pool to the fence must be the same on all sides of the pool.
- The maximum budget for the fence is $8,000.

The costs for different types of fencing are shown in the table.

Fence Type	Price (per foot)
Chain link	$14
Vinyl	$25
Wood	$22
Metal	$30

Describe two different fence options for the client. Include the type of fence, dimensions of the fence, and the total price. Prove that either option will satisfy all the requirements.

Checklist

Did you . . .

- ☐ Describe two fence options?
- ☐ Meet all the requirements?
- ☐ Include the types of fences, dimensions, and prices?

Reflect

Use Mathematical Practices After you complete the task, choose one of the following questions to answer.

- **Persevere** How would you compare using algebraic thinking to using guess-and-check approaches to create your design and plan a solution?
- **Use Reasoning** How did you visualize the fence and its dimensions?

Sampler

Curriculum Associates