Chapter 4

Name_____

Chapter 4 Equations and Inequalities

Dear Family,

Gardeners are familiar with uncertainty. Will there be enough sun? Will there be enough rain? Did I use too much fertilizer? Planning a garden can be a challenge, whether in a small container or over several acres.

You might work with your student to plan and create a small potted garden. Make sure you plant more seeds than you need—some will not germinate and some will produce weak plants. Make sure the plants get enough sun but not too much heat. Have your student write an *inequality* to represent each of these situations.

As your garden grows, ask your student to keep track of the growing conditions. Track your garden's basic needs and have your student write an inequality to represent these situations:

- How tall are the plants likely to get?
- Research how much water the plants need. Check the soil's moisture content every day—plants need water to survive. However, too much water can be just as bad as too little.
- Make sure the recommended amount of sunshine is available. The seed packet will usually tell you the minimum amount required.
- In a potted garden, your plants will probably need some fertilizer to stay healthy. Keep an eye out for signs of overfeeding, however.

Not all problems in mathematics involve a single answer. Many problems have answers that fall into a range. Your plants need at least enough fertilizer to grow, but you must limit the amount of fertilizer to what the plant can safely use. You must make sure the water stays in the right range.

It's hard to beat the satisfaction of growing a successful garden—and the fruits of your labor are beautiful to behold!

Equations and Inequalities (continued)

Lesson	Learning Target	Success Criteria
4.1 Solving Equations Using Addition or Subtraction	Write and solve equations using addition or subtraction.	• I can apply the Addition and Subtraction Properties of Equality to produce equivalent equations. • I can solve equations using addition or subtraction. • I can apply equations involving addition or subtraction to solve real-life problems.
4.2 Solving Equations Using Multiplication or Division	Write and solve equations using multiplication or division.	• I can apply the Multiplication and Division Properties of Equality to produce equivalent equations. • I can solve equations using multiplication or division. • I can apply equations involving multiplication or division to solve real-life problems.
4.3 Solving Two-Step Equations	Write and solve two-step equations.	• I can apply properties of equality to produce equivalent equations. • I can solve two-step equations using the basic operations. • I can apply two-step equations to solve real-life problems.
4.4 Writing and Graphing Inequalities	Write inequalities and represent solutions of inequalities on number lines.	• I can write word sentences as inequalities. • I can determine whether a value is a solution of an inequality. • I can graph the solutions of inequalities.
4.5 Solving Inequalities Using Addition or Subtraction	Write and solve inequalities using addition or subtraction.	• I can apply the Addition and Subtraction Properties of Inequality to produce equivalent inequalities. • I can solve inequalities using addition or subtraction. • I can apply inequalities involving addition or subtraction to solve real-life problems.
4.6 Solving Inequalities Using Multiplication or Division	Write and solve inequalities using multiplication or division.	• I can apply the Multiplication and Division Properties of Inequality to produce equivalent inequalities. • I can solve inequalities using multiplication or division. • I can apply inequalities involving multiplication or division to solve real-life problems.
4.7 Solving Two-Step Inequalities	Write and solve two-step inequalities.	• I can apply properties of inequality to produce equivalent inequalities. • I can solve two-step inequalities using the basic operations. • I can apply two-step inequalities to solve real-life problems.

Nombre _____

Capítulo 4 Ecuaciones y desigualdades

Querida familia:

Los jardineros están familiarizados con la incertidumbre. ¿Habrá suficiente sol? ¿Habrá suficiente lluvia? ¿Usé demasiado fertilizante? Planificar un jardín puede ser un reto, bien sea solo en una pequeña maceta o sobre varias hectáreas.

Usted podría trabajar con su estudiante en planificar plantar una pequeña área de jardín. Asegúrese de plantar más semillas de las que crea necesitar—algunas no germinan y otras podrían producir plantas débiles. Esté pendiente que las plantas reciban suficiente luz solar pero no mucho calor. Haga que su estudiante escribe una desigualdad para representar cada una de estas situaciones.

A medida que su jardín crezca, pídale a su estudiante hacerle seguimiento a las condiciones de crecimiento. Verifique las condiciones básicas de su jardin y haga que su estudiante escribe una desigualdad para representar estas situaciones:

- ¿A cuál altura es probable que crezcan las plantas?
- Investigue cuánta agua necesitan las plantas. Verifique el contenido de humedad del suelo cada día—las plantas necesitan agua para sobrevivir. Sin embargo, demasiada agua puede ser tan prejudicial como muy poca.
- Asegúrese que las plantas reciben la cantidad recomendada de luz solar. El empaque de las semillas usualmente indica la cantidad mínima requerida.
- En un jardín de macetas, sus plantas probablemente necesitarán más fertilizantes para estar sanas. Sin embargo, esté atento a signos por usar de más.

No todos los problemas en matemáticas tienen una sola respuesta. Muchos problemas tienen respuestas que están dentro de un rango. Sus plantas necesitan por lo menos suficiente fertilizante para crecer, pero se debe limitar la cantidad de fertilizante que es seguro usar para la planta. Se debe asegurar que el agua esté en el rango correcto.

Es difícil que algo supere la satisfacción de cultivar con éxito un jardín —¡y al final disfrutará contemplar el fruto de su trabajo!

Capítulo 4 Ecuaciones y desigualdades (continuación)

Lección	Obejtivo de aprendizaje	Criterios de éxito
4.1 Resolver ecuaciones usando suma o resta	Escribir y resolver ecuaciones usando suma o resta.	• Sé aplicar propiedades de igualdad de suma y resta para producir ecuaciones equivalentes. • Sé resolver ecuaciones usando suma o resta. • Sé aplicar ecuaciones con sumas y restas para resolver problemas de la vida real.
4.2 Resolver ecuaciones usando multiplicación o división	Escribir y resolver ecuaciones usando multiplicación o división.	• Sé aplicar propiedades de igualdad de multiplicación y división para producir ecuaciones equivalentes. • Sé resolver ecuaciones usando multiplicación o división. • Sé aplicar ecuaciones con multiplicación o división para resolver problemas de la vida real.
4.3 Resolver ecuaciones de dos pasos	Escribir y resolver ecuaciones de dos pasos.	• Sé aplicar propiedades de igualdad para producir ecuaciones equivalentes. • Sé resolver ecuaciones de dos pasos usando operaciones básicas. • Sé aplicar ecuaciones de dos pasos para resolver problemas de la vida real.
4.4 Escribir y graficar desigualdades	Escribir desigualdades y representar soluciones de desigualdades en líneas numéricas.	• Sé escribir un enunciado como una desigualdad. • Sé determinar si un valor es una solución a una desigualdad. • Sé graficar soluciones de una desigualdad.
4.5 Resolver desigualdades usando suma o resta	Escribir y resolver desigualdades usando suma o resta.	• Sé aplicar propiedades de desigualdad de suma y resta para producir desigualdades equivalentes. • Sé resolver desigualdades usando suma o resta. • Sé aplicar desigualdades con sumas o restas para resolver problemas de la vida real.
4.6 Resolver desigualdades usando multiplicación o división	Escribir y resolver desigualdades usando multilpicación o división.	• Sé aplicar propiedades de desigualdad de multilpicación y división para producir desigualdades equivalentes. • Sé resolver desigualdades usando multilpicación o división. • Sé aplicar desigualdades con multilpicación o división para resolver problemas de la vida real.
4.7 Resolver desigualdades de dos pasos	Escribir y resolver desigualdades de dos pasos.	• Sé aplicar propiedades de desigualdad para producir desigualdades equivalentes. • Sé resolver desigualdades de dos pasos usando operaciones básicas. • Sé aplicar desigualdades de dos pasos para resolver problemas de la vida real.

Lesson 4.1 Cumulative Practice

For use before Lesson 4.1

Find the product. Write your answer as a decimal.

1. $-8.9(-3.1) =$ _____

2. $-7.4 \times 4.2 =$ _____

Lesson 4.1 Vocabulary Practice

For use before Lesson 4.1

1. Write what you know about this phrase.

Review: equivalent expressions

Lesson 4.1 Prerequisite Skills Practice

For use before Lesson 4.1

Add.

1. $65 + (-23)$

Subtract.

2. $-15 - 24$

Name _____ Date _____

Lesson 4.1 Extra Practice

Solve the equation. Check your solution.

1. $x + 3 = 10$

2. $b - 6 = -14$

3. $5 = n + 9$

4. $y - 2.1 = 7.5$

5. $-6.4 = x + 4.3$

6. $k - \frac{1}{3} = \frac{5}{6}$

7. $10.5 + p = -8.32$

8. $3\frac{3}{4} = r + \frac{1}{8}$

9. $m + 1.06 = 5$

10. $-\frac{7}{12} = 1\frac{5}{6} + d$

11. $t - \frac{2}{7} = \frac{1}{2}$

12. $-10.2 + c = -8.14$

Write the word sentence as an equation. Then solve the equation.

13. 5 more than a number y is -2.

14. The sum of 8 and a number h is 12.

15. -13 is 4 less than a number n.

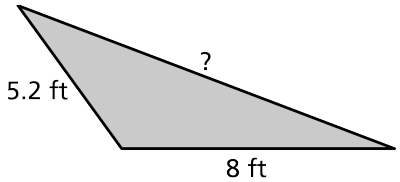
16. You earn \$9 per hour babysitting. This is \$2 more than what you earned per hour last year. What did you earn per hour last year?

17. Your mother asked you to turn the oven down to 325°F. This is 75°F less than it was. What was the original temperature?

18. The difference between the heights of your chair and your desk is $-10\frac{1}{4}$ inches. The height of your desk is $29\frac{3}{4}$ inches. What is the height of your chair?

19. Your Two-Day-Pass to a theme park is \$76.50. This is \$31.41 less than your uncle's Two-Day Pass. What is the price of your uncle's pass?

20. The perimeter of the triangle is 25 feet. What is the length of the unknown side?



21. Find the value of $3x + 2$ when $7 + x = 5$.

Name _____ Date _____

Lesson 4.1 Reteach

Two equations are **equivalent equations** when they have the same solutions.

Key Ideas

Addition Property of Equality

Words Adding the same number to each side of an equation produces an equivalent equation.

Algebra If $a = b$, then $a + c = b + c$.

Subtraction Property of Equality

Words Subtracting the same number from each side of an equation produces an equivalent equation.

Algebra If $a = b$, then $a - c = b - c$.

You can check your solution by substituting the value of the variable in the original equation. If the equation is true, then your solution is correct.

EXAMPLE Solving Equations

a. Solve $a - 16 = 24$.

$a - 16 = 24$ Write the equation.

$+ 16 \quad + 16$ Addition Property of Equality

$a = 40$ Simplify.

Check

$a - 16 = 24$

$40 - 16 \stackrel{?}{=} 24$

$24 = 24$ ✔

▶ The solution is $a = 40$.

b. Solve $d + \frac{1}{4} = \frac{3}{4}$.

$d + \frac{1}{4} = \frac{3}{4}$ Write the equation.

$-\frac{1}{4} \quad -\frac{1}{4}$ Subtraction Property of Equality

$d = \frac{1}{2}$ Simplify.

Check

$d + \frac{1}{4} = \frac{3}{4}$

$\frac{1}{2} + \frac{1}{4} \stackrel{?}{=} \frac{3}{4}$

$\frac{3}{4} = \frac{3}{4}$ ✔

▶ The solution is $d = \frac{1}{2}$.

Name _____ Date _____

Lesson 4.1 Reteach (continued)

EXAMPLE Writing an Equation

A movie ticket costs p dollars. A box of popcorn costs $5.50. The total cost for a ticket and a box of popcorn is $14. Which equation can be used to find p?

a. $p - 5.50 = 14$

b. $5.50 = p + 14$

c. $p + 5.50 = 14$

d. $p - 14 = 5.50$

Write an equation by rewriting the given information.

Words: The cost for a ticket and a box of popcorn is $14.

Equation: $p + 5.50 = 14$

▶ The equation is $p + 5.50 = 14$. The correct answer is c.

Solve the equation. Check your solution.

1. $x - 3 = 14$

2. $f + 6 = 9$

3. $t + 1 = -8$

4. $y + 10 = 45$

5. $g - 12 = -36$

6. $3.5 = m + 1.2$

7. $q - 11.4 = 6.2$

8. $b + \frac{2}{3} = 4\frac{1}{3}$

9. $w - 2\frac{4}{5} = 5\frac{1}{5}$

10. $27 = n + 7$

11. $15.8 = z - 4.1$

12. $6.7 + j = 19.9$

Write the word sentence as an equation. Then solve the equation.

13. 25 is 9 more than a number x.

14. The difference of a number p and 7 is 13.

15. 45 less than a number m is -78.

16. A number y minus 8 is 23.

17. The sum of a number r and 10 is -2.

Name _____ Date _____

Lesson 4.1 Enrichment and Extension

You Be the Teacher

In Exercises 1 and 2, use the student solutions below.

Courtney
$\|x\| = 7$
$x = 7$

Karen
$\|x\| = 7$
$x = 7$ or $x = -7$

1. Did both students get a correct solution?
2. Is one student's answer more complete? If so, which one? Explain.
3. A student asks you how to solve $|x + 8| = 12$. Describe your explanation and any math steps you would show.
4. Describe Mario's solution. Did he get the correct answers? Explain.

Mario

$|x - 5| = 9$

$x - 5 = 9$ or $x - 5 = -9$

$x = 14$ or $x = -4$

5. Kelly looks at Mario's solutions and does not understand why -4 is a solution. She thought absolute value could not be negative. Explain Kelly's error.
6. Pat says he can solve the equation $|x| + 7 = 2$. He says the solutions are $x = 5$ and $x = -5$. What mistake did Pat make? Explain.
7. A student asks you if every absolute value equation has two solutions. How would you respond? Explain.
8. Give an example of an absolute value equation with (a) one solution, (b) two solutions, and (c) no solutions.

Name _____ Date _____

4.1 Puzzle Time

What Did The Digital Clock Say To Its Mother?

Circle the letter of each correct answer in the boxes below. The circled letters will spell out the answer to the riddle.

Solve the equation.

1. $x + 8 = 21$

2. $3 = a - 12$

3. $y - 7 = -4$

4. $g + 11 = -13$

5. $z - 1.75 = 3.82$

6. $4.9 = h - 2.6$

7. $8.7 + b = 14.5$

8. $-10.3 = w - 5.8$

9. $\frac{3}{5} = c + \frac{1}{4}$

10. $r + 3\frac{1}{2} = -4\frac{2}{3}$

11. $5\frac{3}{4} = d - 2\frac{1}{8}$

12. $-7\frac{1}{3} = p - \frac{4}{9}$

13. The second book in your favorite series has 9 more chapters than the first book in the series. The second book has 38 chapters. How many chapters does the first book have?

14. Emily has a Springer Spaniel that weighs 48.5 pounds. She also has a Cocker Spaniel that weighs 24.8 pounds less than the Springer Spaniel. How many pounds does the Cocker Spaniel weigh?

L	M	O	O	I	K	E	T	M	S	O	R	D	M	A	E
23.7	4.7	3	$-\mathbf{8\frac{1}{6}}$	$\mathbf{2\frac{3}{7}}$	5.8	$-\mathbf{5\frac{2}{5}}$	7.2	13	−42	−4.5	$\mathbf{1\frac{1}{9}}$	−8.9	$-\mathbf{6\frac{8}{9}}$	12	8
H	**N**	**E**	**R**	**O**	**S**	**H**	**T**	**U**	**A**	**N**	**Y**	**D**	**M**	**E**	**S**
52	7.5	$4\frac{3}{8}$	$12\frac{1}{3}$	−24	$-1\frac{2}{5}$	29	−3.9	17	5.57	$\frac{7}{20}$	$-\frac{1}{6}$	15	33	65.5	$7\frac{7}{8}$

Lesson 4.2 Cumulative Practice

For use before Lesson 4.2

Find the difference. Write your answer as a decimal.

1. $-5.1 - 2.8 =$ _____

2. $-4.3 - (-9.91) =$ _____

Lesson 4.2 Vocabulary Practice

For use before Lesson 4.2

1. Write what you know about this word.

Review: reciprocals

Lesson 4.2 Prerequisite Skills Practice

For use before Lesson 4.2

Multiply or divide.

1. $(-21)(8)$

2. $\frac{-96}{3}$

Name _____ Date _____

Lesson 4.2 Extra Practice

Solve the equation. Check your solution.

1. $4b = 24$

2. $-7n = 35$

3. $\frac{y}{-3} = 33$

4. $\frac{p}{5} = -32$

5. $-3t = -4.2$

6. $1.5q = -8.4$

7. $\frac{1}{5}d = -3$

8. $14 = 3y$

9. $\frac{g}{2.1} = -6.8$

10. $-\frac{3}{5}a = 2$

11. $\frac{k}{-9} = -\frac{1}{3}$

12. $\frac{5}{8}j = -10$

In Exercises 13 and 14, write the word sentence as an equation. Then solve the equation.

13. A number multiplied by $\frac{1}{2}$ is $-\frac{5}{12}$.

14. The quotient of a number and 0.2 is −2.6.

15. You earn $7.50 per hour at a fast food restaurant. You earned $123.75 last week. How many hours did you work last week?

16. Your family took a road trip on Saturday. You were in the car for 4.5 hours and averaged 70 miles per hour. How many miles did you travel?

17. The area of a rectangle is $\frac{1}{2}$ square inch. The length of the rectangle is $\frac{3}{8}$ inch. What is the width of the rectangle?

18. You are in a room with other students and are asked to get in groups of 3. When finished, there are 21 groups of 3. How many students are in the room?

19. The perimeter of a square is 26.46 inches. What is the side length of the square?

20. Write a multiplication equation that has a solution of $\frac{2}{7}$.

21. Write a division equation that has a solution of −20.

Name _____ Date _____

Lesson 4.2 Reteach

Key Ideas

Multiplication Property of Equality

Words Multiplying each side of an equation by the same number produces an equivalent equation.

Algebra If $a = b$, then $a \cdot c = b \cdot c$.

Division Property of Equality

Words Dividing each side of an equation by the same number produces an equivalent equation.

Algebra If $a = b$, then $a \div c = b \div c$, $c \neq 0$.

You can check your solution by substituting the value of the variable in the original equation. If the equation is true, then your solution is correct.

EXAMPLE Solving Equations

a. Solve $\frac{b}{4} = -5$.

$\frac{b}{4} = -5$	Write the equation.
$4 \cdot \frac{b}{4} = 4 \cdot -5$	Multiplication Property of Equality to undo the division.
$b = -20$	Simplify.

Check

$\frac{b}{4} = -5$

$\frac{-20}{4} \stackrel{?}{=} -5$

$-5 = -5$ ✔

▶ The solution is $b = -20$.

b. Solve $24 = -6k$.

$24 = -6k$	Write the equation.
$\frac{24}{-6} = \frac{-6k}{-6}$	Division Property of Equality to undo the multiplication.
$-4 = k$	Simplify.

Check

$24 = -6k$

$24 \stackrel{?}{=} -6(-4)$

$24 = 24$ ✔

▶ The solution is $k = -4$.

Name _____ Date _____

Lesson 4.2 Reteach (continued)

EXAMPLE Solving Equations Using Reciprocals

a. Solve $-\frac{3}{4}y = -9$.

Multiply each side by $-\frac{4}{3}$, the reciprocal of $-\frac{3}{4}$.

$-\frac{3}{4}y = -9$	Write the equation.
$-\frac{4}{3} \cdot \left(-\frac{3}{4}y\right) = -\frac{4}{3} \cdot (-9)$	Multiplication Property of Equality
$y = 12$	Simplify.

▶ The solution is $y = 12$.

b. Solve $-15 = \frac{5}{2}d$.

Multiply each side by $\frac{2}{5}$, the reciprocal of $\frac{5}{2}$.

$-15 = \frac{5}{2}d$	Write the equation.
$\frac{2}{5} \cdot -15 = \frac{2}{5} \cdot \frac{5}{2}d$	Multiplication Property of Equality
$-6 = d$	Simplify.

▶ The solution is $d = -6$.

Solve the equation. Check your solution.

1. $15t = 60$

2. $-7p = -28$

3. $\frac{q}{4} = -2.4$

4. $\frac{d}{6} = -3$

5. $3j = -36$

6. $\frac{1}{8}m = 6$

7. $9.6 = 1.2y$

8. $\frac{n}{-7} = -1$

9. $18 = -\frac{6}{7}h$

10. $-\frac{3}{4}x = \frac{21}{8}x$

11. $-\frac{1}{2}z = \frac{5}{12}$

12. $\frac{3}{10} = \frac{9}{40}g$

Name _____ Date _____

Lesson 4.2 Enrichment and Extension

Equations with No Solution

For some equations, there is no value that could be substituted for the variable to make the equation true. In this case, the equation has no solution.

Example: Solve $4|x| = -12$.

$4|x| = -12$ Write the equation.

$|x| = -3$ Divide both sides by 4.

Because absolute value is always nonnegative, no number has an absolute value of −3 So, this equation has *no solution.*

Without solving the equation, tell whether it has *one solution, two solutions,* or *no solution*. If the equation has one solution, tell whether the solution is *positive* or *negative*. Explain your reasoning.

1. $-5x = -16$ **2.** $\frac{n}{-5} = -12$ **3.** $\frac{g}{7} = -8$ **4.** $-12t = 100$

5. $-8|v| = -16$ **6.** $\frac{|k|}{-9} = 6$ **7.** $\left|\frac{x}{-5}\right| = -15$ **8.** $|-6p| = 42$

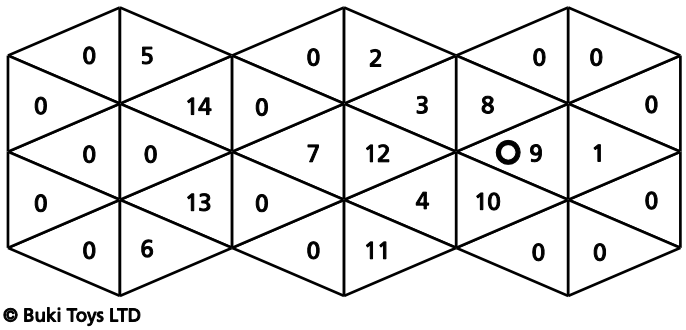
9. $|2.7u| = 10.8$ **10.** $\left|1\frac{1}{2}b\right| = -13\frac{4}{5}$ **11.** $3h = |8|$ **12.** $|-9|y = -12$

13. $\frac{|b|}{-3} = -7$ **14.** $\left|\frac{a}{-9}\right| = -2.5$

For each exercise number, use your answers and the key below to color the cell. Do not color the cells that have a zero in them.

One Positive Solution = Orange **One Negative Solution = Blue**

Two Solutions = Green **No Solution = Green**



Name _____ Date _____

4.2 Puzzle Time

Did You Hear About...

A	B	C	D	E	F
G	H	I	J	K	L
M					

Complete each exercise. Find the answer in the answer column. Write the word under the answer in the box containing the exercise letter.

−12 PLANET	
−60 MOON	
−14 GOOD	
4 THE	
−1.7 EARTH	
−56 REALLY	
9 ATMOSPHERE	
$-13\frac{1}{2}$ THAT	
$\frac{3}{11}$ ORBIT	

Solve the equation.

A. $6x = 24$

B. $-7a = 35$

C. $-3g = -33$

D. $\frac{c}{4} = -8$

E. $\frac{z}{-12} = 5$

F. $\frac{2}{3}h = -9$

G. $-\frac{4}{5} = 2b$

H. $32 = -\frac{4}{7}y$

I. $-1.8m = 25.2$

J. $\frac{p}{3.7} = 5.1$

K. $20.3 = -2.9c$

L. $-12.6w = -16.38$

M. Tyler has $11.25. How many ride tickets can he buy for himself and his friends if the ride tickets cost $1.25 each?

8.3 EAT
11 ON
−5 RESTAURANT
−7 BUT
−32 THE
1.3 NO
18.87 FOOD
$-1\frac{3}{5}$ BAD
$-\frac{2}{5}$ HAS

Lesson 4.3 Cumulative Practice

For use before Lesson 4.3

Find the sum.

1. $\left(\frac{1}{3}x - 2\right) + \left(\frac{1}{2}x - 2\right) =$ _____

2. $\left(\frac{2}{3}x - 6\right) + \left(\frac{1}{6}x - 12\right) =$ _____

Lesson 4.3 Vocabulary Practice

For use before Lesson 4.3

1. Write what you know about this phrase.

Review: simplest form

Lesson 4.3 Prerequisite Skills Practice

For use before Lesson 4.3

Solve the equation. Check your solution.

1. $-9x = -108$

2. $x - 3 = -12$

Name _____ Date _____

Lesson 4.3 Extra Practice

Solve the equation. Check your solution.

1. $3k - 2 = 10$

2. $5p + 2 = -10$

3. $-4x + 3 = -11$

4. $12 = 2d + 3.2$

5. $-1 - 5h = 14$

6. $1.25r - 7 = 2.5$

7. $-4k + 3.6 = 7.8$

8. $6 + 2n = 3$

9. $4y - 16.3 = 53.1$

10. $\frac{1}{2}b + \frac{9}{4} = \frac{7}{4}$

11. $\frac{5}{6} + 3j = -\frac{2}{3}$

12. $-\frac{9}{10}p - 3 = \frac{3}{5}$

13. $7c - 2c = 45$

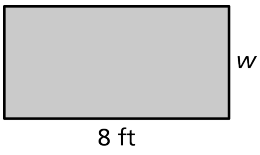
14. $3(k - 5) = -16$

15. $-2(m + 1) = 10$

16. It costs \$4 to enter the fair. Each ride costs \$2.50. You have \$21.50. How many rides can you go on?

17. The cable company charges a monthly fee of \$45. Each movie rental is \$1.99. You owe \$68.88. How many movies did you rent?

18. The perimeter of the rectangle is 24 feet. What is the width of the rectangle?



19. The senior class has 412 students. They are assigned to different homerooms. There are 28 students in the smallest homeroom and the remaining 12 homerooms have the same number of students. How many students are in each of the remaining 12 homerooms?

20. You purchased paint for the rooms in your house. You have 1.5 cans of paint left. You painted 4 rooms and each room required 2 cans of paint. You spilled $\frac{1}{2}$ of a can of paint. How many cans of paint did you purchase?

a. Solve the problem by working backwards.

b. Solve the equation $\frac{x-2}{4} = 2$. How does the answer compare to part (a)?

Name _____ Date _____

Lesson 4.3 Reteach

EXAMPLE Solving a Two-Step Equation

Solve $-2x + 6 = 14$

$-2x + 6 = 14$ Write the equation.

$\underline{-6 \quad -6}$ Use the Subtraction Property of Equality to undo addition.

$-2x = 8$ Simplify.

$\frac{-2x}{-2} = \frac{8}{-2}$ Use the Division Property of Equality to undo multiplication.

$x = -4$ Simplify.

▶ The solution is $x = -4$.

Check

$-2x + 6 = 14$

$-2(-4) + 6 \stackrel{?}{=} 14$

$8 + 6 \stackrel{?}{=} 14$

$14 = 14$ ✔

EXAMPLE Solving a Two-Step Equation

Solve $\frac{x}{6} - \frac{1}{3} = \frac{5}{3}$.

$\frac{x}{6} - \frac{1}{3} = \frac{5}{3}$ Write the equation.

$\underline{+\frac{1}{3} \quad +\frac{1}{3}}$ Use the Addition Property of Equality to undo subtraction.

$\frac{x}{6} = 2$ Simplify.

$6 \cdot \frac{x}{6} = 6 \cdot 2$ Use the Multiplication Property of Equality to undo division.

$x = 12$ Simplify.

▶ The solution is $x = 12$.

Check

$\frac{x}{6} - \frac{1}{3} = \frac{5}{3}$

$\frac{12}{6} - \frac{1}{3} \stackrel{?}{=} \frac{5}{3}$

$2 - \frac{1}{3} \stackrel{?}{=} \frac{5}{3}$

$\frac{5}{3} = \frac{5}{3}$ ✔

Name _____ Date _____

Lesson 4.3 Reteach (continued)

If an equation has like terms on the same side of the equal sign, combine like terms before using properties of equality.

EXAMPLE Combining Like Terms Before Solving

a. Solve $2x - 9x = 28$.

$2x - 9x = 28$ Write the equation.

$-7x = 28$ Combine like terms.

$\frac{-7x}{-7} = \frac{28}{-7}$ Use the Division Property of Equality to undo multiplication.

$x = -4$ Simplify.

▶ The solution is $x = -4$.

Check

$2x - 9x = 28$

$2(-4) - 9(-4) \stackrel{?}{=} 28$

$-8 + 36 \stackrel{?}{=} 28$

$28 = 28$ ✔

b. Solve $-8 = \frac{3}{4}h - \frac{1}{2}h$.

$-8 = \frac{3}{4}h - \frac{1}{2}h$ Write the equation.

$-8 = \frac{1}{4}h$ Combine like terms.

$4 \cdot (-8) = 4 \cdot \frac{1}{4}h$ Multiply each side by 4, the reciprocal of $\frac{1}{4}$.

$-32 = h$ Simplify.

▶ The solution is $h = -32$.

Check

$-8 = \frac{3}{4}h - \frac{1}{2}h$

$-8 \stackrel{?}{=} \frac{3}{4}(-32) - \frac{1}{2}(-32)$

$-8 \stackrel{?}{=} -24 + 16$

$-8 = -8$ ✔

Solve the equation. Check your solution.

1. $3k - 8 = 7$

2. $8b + 9 = -15$

3. $8 = 3x - 13$

4. $6p + 22 = 4$

5. $84 = 51 + 11c$

6. $\frac{n}{2} + 9 = 15$

7. $\frac{-z}{5} - 6 = 1$

8. $\frac{t}{4} + 2 = -10$

9. $\frac{2}{3} + 6a = -\frac{16}{3}$

10. $-4j - 5j = 27$

11. $7 - 4w + 10 = 1$

12. $-12 = 13x - 9x$

13. $\frac{x}{4} + 3 = 8$

14. $24 = 10 + 7a$

15. $30 = 5 - 5a$

Name _____ Date _____

Lesson 4.3 Enrichment and Extension

Solving Equations with Fractions

1. If you multiply each term by this number, the equation $\frac{3x}{2} - \frac{4}{5} = 5\frac{1}{5}$ will contain no fractions. What number could this be?
2. Are there other numbers you can multiply by to rewrite the equation in Exercise 1 without fractions? Explain.
3. What number do you think is best to use as the multiplier? Explain.
4. Why can you multiply each term and not change the solution of the equation?
5. Describe to someone how to rewrite an equation with fractions so that there are no fractions left in it.
6. Solve each equation by rewriting it without fractions first.

   a. $\frac{x}{8} - 5 = \frac{3}{4}$

   b. $\frac{x}{4} - \frac{1}{2} = 3\frac{1}{4}$

   c. $2\frac{1}{3} - \frac{x}{4} = \frac{5}{6}$

   d. $-\frac{2}{7} + \frac{x}{2} = \frac{9}{14}$

   e. $6\frac{7}{9} = \frac{2}{3} - 5x$

   f. $\frac{x+10}{6} = \frac{2}{3}$

Name _____ Date _____

4.3 Puzzle Time

What Did One Bowling Ball Say To The Other Bowling Ball?

Write the letter of each answer in the box containing the exercise number.

Solve the equation.

1. $2c - 5 = 9$

2. $3m + 7 = -8$

3. $-7x - 3 = 12$

4. $15 = 4a + 3$

5. $5y - 6 = -20$

6. $9f + 3.6 = 10.8$

7. $-4p - 5.7 = 11.1$

8. $-20.3 = 6w + 3.1$

9. $2 + 5.3k = 18.43$

10. $7.8b - 2.14 = -42.7$

11. $\frac{1}{4}z - \frac{2}{7} = \frac{5}{7}$

12. $3 - \frac{r}{8} = -\frac{9}{2}$

13. $-\frac{1}{3} + 5e = -\frac{3}{4}$

14. $14d - 2d = -84$

15. $-5g - 13g = 54$

16. $-3(t - 8) = 32$

17. Kayla's age is 3 less than twice her brother's age. Kayla is 13 years old. How old is her brother?

18. Mario spent $23.85 at the bookstore on one book and some magazines. The book cost $12.60 and the magazines cost $2.25 each. How many magazines did Mario buy?

19. Ethan planted a tree that is 37.5 inches tall. If the tree grows 3 inches each year, how long will it take for the tree to reach a height of 54 inches?

Answers

T. -5.2	**N.** 3
S. 5	**M.** 8
E. $-2\frac{4}{5}$	**O.** 3.1
L. $-2\frac{1}{7}$	**T.** 7
N. -7	**O.** $-\frac{1}{12}$
M. -5	**I.** 4
P. $-2\frac{2}{3}$	**A.** 0.8
O. -3.9	**D.** -3
L. 60	**R.** 5.5
O. -4.2	

15	7	4	10		18	1	13	16		17	5		11	2		8	14		6		19	9	12	3

Lesson 4.4 Cumulative Practice

For use before Lesson 4.4

1. Simplify $\frac{1}{5}(15x + 20) + 9x$.

$\frac{1}{5}(15x + 20) + 9x =$ _____

2. Simplify $\frac{3}{5}(10x - 25) + 7x$.

$\frac{3}{5}(10x - 25) + 7x =$ _____

Lesson 4.4 Vocabulary Practice

For use before Lesson 4.4

1. Write what you know about this word.

Review: inequality

Lesson 4.4 Prerequisite Skills Practice

For use before Lesson 4.4

Plot and label each number on the same number line.

1. 8

2. -2

Name _____ Date _____

Lesson 4.4 Extra Practice

Write the word sentence as an inequality.

1. A number x is at most 3.
2. A number y added to 2 is greater than 7.
3. A number c multiplied by 3 is less than -12.
4. A number m minus 1.5 is no less than 2.
5. Your friend writes the word sentence as an inequality. Is your friend correct? Explain your reasoning.

> Three times a number z is more than 18.
> $3z < 18$

Tell whether the given value is a solution of the inequality.

6. $t - 3 \geq 2$; $t = 10$
7. $6w < -2$; $w = 1$
8. $p + 1.6 \leq 4$; $p = 5$
9. $\frac{1}{2}d > -3$; $d = 0$

Graph the inequality on a number line.

10. $k > 1$
11. $n \leq -2.5$
12. In order to try out for one of the parts in a play at the local theater, you must be at most 12 years old. Write an inequality that represents this situation.

Tell whether the given value is a solution of the inequality.

13. $3h - 7 < h$; $h = 2$
14. $q + 8 \geq \frac{q}{4}$; $q = -12$
15. Consider the inequalities $-2x < 10$ and $-6 < -2x$.
    a. Is $x = 0$ a solution to both inequalities?
    b. Is $x = 4$ a solution to both inequalities?
    c. Find another value of x that is a solution to both inequalities.
16. The maximum area that is available for a rectangular garden is 80 square feet.
    a. Write an inequality that represents the possible dimensions for the garden.
    b. Find three different sets of allowable dimensions for the garden. Find the area of each garden.

Name _____ Date _____

Lesson 4.4 Reteach

An **inequality** is a mathematical sentence that compares expressions. It contains the symbols $<$, $>$, $\leq$, or $\geq$. To write a word sentence as an inequality, look for phrases that will help you decide which symbol to use and where to place the inequality symbol.

Inequality Symbols				
Symbol	$<$	$>$	$\leq$	$\geq$
Key Phrases	• is less than • is fewer than	• is greater than • is more than	• is less than or equal to • is at most • is no more than	• is greater than or equal to • is at least • is no less than

EXAMPLE Writing an Inequality

A number *d* plus 4 is greater than or equal to −9. Write this word sentence as an inequality.

$$\underbrace{\text{A number } d \text{ plus } 4}_{d+4} \ \underbrace{\text{is greater than or equal to}}_{\geq} \ \underbrace{-9}_{-9}$$

▶ An inequality is $d + 4 \geq -9$.

A **solution of an inequality** is a value that makes an inequality true. An inequality can have more than one solution. The set of all solutions of an inequality is called the **solution set.**

To tell whether a value is a solution of an inequality, substitute the value for the variable in the inequality and simplify. If the simplified inequality is true, then the value is a solution of the inequality.

Name _____ Date _____

Lesson 4.4 Reteach (continued)

EXAMPLE Checking Solutions

a. Tell whether −3 is a solution of $a - 6 \geq 8$.

$a - 6 \geq 8$ Write the inequality.

$-3 - 6 \stackrel{?}{\geq} 8$ Substitute –3 for a.

$-9 \not\geq 8$ Simplify. ✗

▶ So, −3 is *not* a solution of the inequality.

b. Tell whether –3 is a solution of $4c < 12$.

$4c < 12$ Write the inequality.

$4(-3) \stackrel{?}{<} 12$ Substitute –3 for c.

$-12 < 12$ Simplify. ✓

▶ So, −3 is a solution of the inequality.

Write the word sentence as an inequality.

1. A number b added to 10 is no more than −2.

2. A number k multiplied by 6 is greater than 11.

3. A number m divided by 4 is at least 5.

4. A number c subtracted from 8 is greater than or equal to 16.

5. $\frac{3}{5}$ is at most 3 times a number d.

Tell whether the given value is a solution of the inequality.

6. $\frac{x}{2} \leq -6$; $x = -15$

7. $5n > 9$; $n = 1$

8. $z + 12 \geq 32$; $z = 20$

9. $y - 1 < 8$; $y = 12$

10. $a + 1 \geq -4$; $a = -7$

11. $5d < 45$; $d = 6$

Name _____ Date _____

Lesson 4.4 Enrichment and Extension

Compound Inequalities

Little League is a commercially sponsored baseball league for boys and girls.

A *compound inequality* is a special type of inequality that places both an upper and lower boundary on a variable. Write a compound inequality that describes the Little League rule.

Example: The maximum number of innings in a Little League game is 6. Each player must play at least 2 innings. Write a compound inequality that represents the number of innings a player plays.

Let n represent the number of innings a player plays. Because 2 is the minimum number of innings and 6 is the maximum number of innings, the compound inequality that represents the number of innings a player plays is $2 \leq n \leq 6$.

1. To be eligible to play Little League, a player must be at least 9 years old and at most 12 years old. Let a represent the player's age.

   a. Write an inequality that represents the minimum age a player must be to participate in Little League.

   b. Write an inequality that represents the maximum age a player can be to participate in Little League.

   c. Use the inequalities from parts (a) and (b) to write a compound inequality that represents the age restrictions of Little League players.

2. For health and safety reasons, the number of pitches p a player can make per game is limited based on his or her age. A 12-year-old may pitch a maximum of 85 pitches in a game day.

   a. Write an inequality that represents the minimum number of pitches a player could make during a game.

   b. Write an inequality that represents the maximum number of pitches a player could make during a game.

   c. Use the inequalities from parts (a) and (b) to write a compound inequality that represents the number of pitches that a player can throw per game.

3. A Little League game lasts for at least 3.5 innings and at most 6 innings. Write a compound inequality that represents the number of innings n that a Little League game lasts.

Name _____ Date _____

4.4 Puzzle Time

What Do You Call A Bull That's Sleeping?

Write the letter of each answer in the box containing the exercise number.

Write the word sentence as an inequality.

1. A number x is greater than 25.8.
2. Twice a number x is at most $-\frac{3}{5}$.
3. A number x minus 9.3 is more than 4.6.
4. A number x added to 11.7 is less than 14.

Tell whether the given value is a solution of the inequality.

5. $x - 3.6 \leq 2.8; x = 6.7$
6. $\frac{5}{6}x > -10; x = -6$

Match each inequality with its graph.

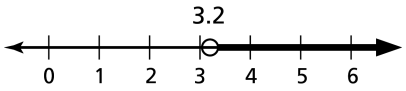
7. $x \leq -7$
8. $x > 3.2$
9. $x < 3\frac{1}{4}$
10. $x \geq -11$

Answers

U. $11.7 + x < 14$

L. $x > 25.8$

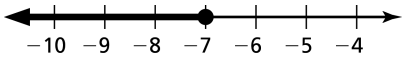
A.



D. yes

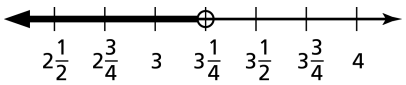
E. $2x \leq -\frac{3}{5}$

R.



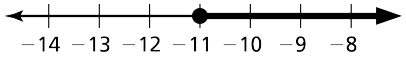
L. $x - 9.3 > 4.6$

Z.



B. no

O.



8		5	4	1	3	6	10	9	2	7

Lesson 4.5 Cumulative Practice

For use before Lesson 4.5

1. Solve $\frac{x}{16} + \frac{3}{4} = -\frac{3}{4}$.

The solution is $x =$ _____.

2. Solve $\frac{x}{9} - \frac{5}{3} = \frac{5}{3}$.

The solution is $x =$ _____.

Lesson 4.5 Vocabulary Practice

For use before Lesson 4.5

1. Write what you know about this phrase.

Review: graph of an inequality

Lesson 4.5 Prerequisite Skills Practice

For use before Lesson 4.5

Graph the inequality on a number line.

1. $x \leq 13$

2. $x > 6$

Name _____ Date _____

Lesson 4.5 Extra Practice

Solve the inequality. Graph the solution.

1. $p - 4 < 2$

2. $s + 1 \geq -5$

3. $k - 14 \leq -10$

4. $2 < n + \frac{3}{2}$

5. $z - \frac{2}{3} \geq \frac{1}{3}$

6. $-\frac{1}{2} > -\frac{1}{6} + t$

7. $d - 2.4 \leq -5.1$

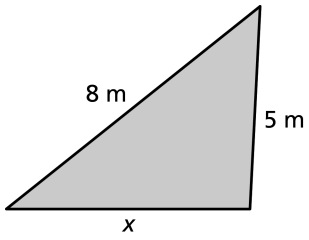
8. $-4.5 + q > 2.5$

9. To stay within your budget, the area of the house and the garage combined is at most 3000 square feet. The area of the garage is 528 square feet. Write and solve an inequality that represents the area of the house.

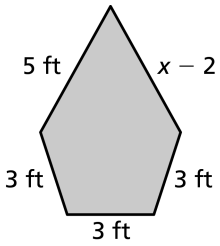
10. You have \$137.26 in a bank account. The bank requires you to have at least \$50 in your account or else you are charged a fee. Write and solve an inequality that represents the amount you can write your next check for without being charged a fee.

Find the possible values of *x*.

11. The perimeter is less than 20 meters.



12. The perimeter is at least 18 feet.



13. You need at least 5000 points to earn a gift card from your bank. You currently have 2700 points.

a. Write and solve an inequality that represents the number of points you need to earn a gift card.

b. You deposit money in your savings account and earn an additional 400 points. How does this change the inequality?

Name _____ Date _____

Lesson 4.5 Reteach

You can solve inequalities in the same way you solve equations. Use inverse operations to get the variable by itself.

Key Ideas

Addition Property of Inequality

Words When you add the same number to each side of an inequality, the inequality remains true.

Numbers

$$\begin{array}{r} -4 < 3 \\ \underline{+2 \quad +2} \\ -2 < 5 \end{array}$$

Algebra If $a < b$, then $a + c < b + c$.

If $a > b$, then $a + c > b + c$.

Subtraction Property of Inequality

Words When you subtract the same number from each side of an inequality, the inequality remains true.

Numbers

$$\begin{array}{r} -2 < 2 \\ \underline{-3 \quad -3} \\ -5 < -1 \end{array}$$

Algebra If $a < b$, then $a - c < b - c$.

If $a > b$, then $a - c > b - c$.

These properties are also true for $\leq$ and $\geq$

EXAMPLE Solving an Inequality Using Addition

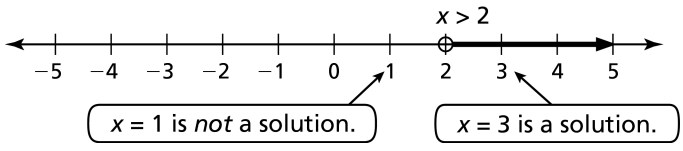
Solve $x - 6 > -4$. Graph the solution.

$x - 6 > -4$ Write the inequality.

$+6 \quad +6$ Use the Addition Property of Inequality to undo subtraction.

$x > 2$ Simplify.

▶ The solution is $x > 2$.



Check

$x = 3$: $3 - 6 \stackrel{?}{>} -4$

$-3 > -4$ ✔

$x = 1$: $1 - 6 \stackrel{?}{>} -4$

$-5 \not> -4$ ✗

Name _____ Date _____

Lesson 4.5 Reteach (continued)

EXAMPLE Solving an Inequality Using Subtraction

Solve $10 \geq x + 12$. Graph the solution.

$10 \geq x + 12$ Write the inequality.

$-12 \quad -12$ Use the Subtraction Property of Inequality to undo addition.

$-2 \geq x$ Simplify.

▶ The solution is $x \leq -2$.

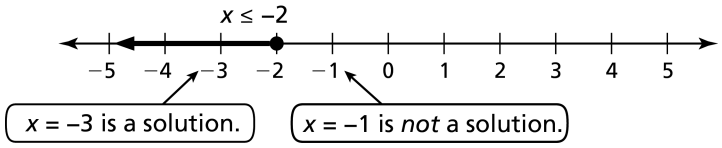
Check

$x = \not{=} 3$: $10 \geq \not{=} 3 + 12$

$10 \not\geq 15$ ✗

$x = \not{=} 1$: $10 \geq \not{=} 1 + 12$

$10 \not\geq 13$ ✗



Solve the inequality. Graph the solution.

1. $-11 \leq y - 15$

2. $w - 1.2 < 2.8$

3. $m - 13 > -18$

4. $-7 \leq d - 4$

5. $n - 1 \geq -6$

6. $p - 9 < -6$

7. $y + 5 \leq 8$

8. $a + 16 > 14$

9. $5 \geq z + 5$

10. $18 \leq 20 + g$

11. $45 + t > 30$

12. $k + 2 \geq 3$

13. $t + 3 \leq 10$

14. $n - 4 < -12$

15. $j - 3.1 < 1.7$

Name _____ Date _____

Lesson 4.5 Enrichment and Extension

Airplanes

The cabin (interior) of an airplane is partitioned into 3 distinct sections, or classes. The cost of a seat in each of the classes is different and the amenities in each class vary.

Seats	Width of Seat	Pitch of Seat
First class	51 cm	p cm
Business class	x cm	140 cm
Economy class	43 cm	81 cm

1. The width of a seat in business class is the average of the widths of the seats in first class and economy class. Find the width of a seat in business class.

2. The cabin has a minimum width requirement so that each passenger on the plane has comfortable accommodations.

   a. The width of four business class seats and an aisle y must be at least 304.75 centimeters. Write an inequality that represents this situation.

   b. What is the width of the aisle?

   c. An airplane row contains 8 business class seats and 2 aisles. What is the minimum width w of the cabin?

3. The pitch of an airplane seat refers to the distance between the backs of two consecutive seats.

   a. Thirty-eight less than the pitch p between first class seats is at least as big as 2 times the pitch between economy class seats. Write an inequality that models the pitch between seats in first class.

   b. What is the pitch between seats in first class?

4. Which class contains the greatest number of seats? the least number of seats? Explain your reasoning.

Name _____ Date _____

4.5 Puzzle Time

Did You Hear About The...

A	B	C	D	E	F
G	H	I	J	K	L
M	N				

Complete each exercise. Find the answer in the answer column. Write the word under the answer in the box containing the exercise letter.

Solve the inequality.

A. $x + 5 \geq 20$

B. $x - 4 > 6$

C. $6 \leq 9 + x$

D. $3 + x \leq -2$

E. $-17 \leq x - 8$

F. $x - 1 < 2$

G. $x - 10 \leq -16$

H. $x + \frac{1}{3} \geq 3$

I. $\frac{3}{5} \geq x + \frac{1}{5}$

J. $-4.4 < x - 7.2$

K. $\frac{11}{4} > x + \frac{9}{4}$

L. $-\frac{5}{12} \geq x - \frac{13}{12}$

M. $x + 0.4 < -0.8$

O. To play on the football team, a seventh grader must weigh no more than 110 pounds. Your neighbor is in seventh grade and weighs 94 pounds. Write and solve an inequality that represents how much weight your neighbor can gain and still meet the requirement.

$x \geq -3$ GAME	$x \geq 2\frac{2}{3}$ THE
$x \leq \frac{2}{3}$ IN	$x > 10$ BASEBALL
$x \leq -6$ AND	$x < \frac{1}{2}$ ENDED
$x \leq 16$ TIE	$x \geq 1.1$ WHICH
$x \geq 15$ THE	$x > 1$ MITT
$x < -5$ CATCHER	$x \geq -9$ THE
$x < 3$ COLLARS	$x \leq 2$ SOCKS
$x > 2.8$ THAT	$x < -1.2$ A
$x \leq \frac{2}{5}$ SHIRTS	$x \leq -5$ BETWEEN

Lesson 4.6 Cumulative Practice

For use before Lesson 4.6

Find the sum. Write your answer in simplest form as a fraction or mixed number.

1. $-\frac{1}{6}+\frac{7}{3}=$ _____

2. $-\frac{2}{3}+\left(-\frac{5}{3}\right)=$ _____

Lesson 4.6 Vocabulary Practice

For use before Lesson 4.6

1. Write what you know about this phrase.

Review: solution of an inequality

Lesson 4.6 Prerequisite Skills Practice

For use before Lesson 4.6

Complete the statement with < or >.

1. -7 ___?___ -5

2. 2 ___?___ -2

Name _____ Date _____

Lesson 4.6 Extra Practice

Solve the inequality. Graph the solution.

1. $8x > 8$

2. $\frac{r}{5} \leq 2$

3. $-32 > 1.6h$

4. $\frac{u}{8} \geq 2.1$

5. $1.5j < -6.6$

6. $-\frac{3}{2} < 3x$

7. $-2p \geq 10$

8. $-2 > \frac{v}{-3}$

9. $\frac{g}{-3.2} > 4$

10. $-\frac{y}{3} \leq 1.4$

11. $-12 > -9h$

12. $\frac{a}{-3.5} \leq -1.7$

Write the word sentence as an inequality. Then solve the inequality.

13. Five times a number is not less than 15.

14. The quotient of a number and 4 is less than −1.

15. An SUV averages 16.5 miles per gallon. The maximum average number of miles that can be driven on a full tank of gas is 363 miles. Write and solve an inequality that represents the number of gallons in a tank.

16. You are creating a decorative rope that is at least 20 feet long.

a. To create the rope you are using beads that are 6 inches long. Write and solve an inequality that represents the number of beads that you can use.

b. You do not have enough 6-inch beads to make the rope, so you will use 10-inch beads instead. Write and solve an inequality that represents the number of 10-inch beads that you can use.

Name _____ Date _____

Lesson 4.6 Reteach

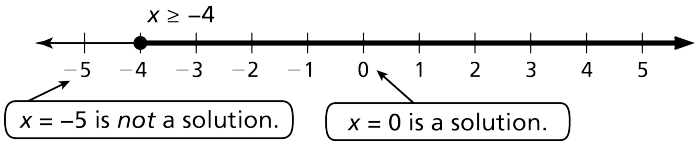
Multiplication and Division Properties of Inequality (Case 1)
When you multiply or divide each side of an inequality by the same *positive* number, the inequality remains true.
These properties are also true for $\leq$ and $\geq$.

EXAMPLE Solving an Inequality Using Multiplication

Solve $\frac{x}{2} \geq -2$. Graph the solution.

$\frac{x}{2} \geq -2$	Write the inequality.
$2 \cdot \frac{x}{2} \geq 2 \cdot (-2)$	Use the Multiplication Property of Inequality to undo division.
$x \geq -4$	Simplify.

▶ The solution is $x \geq -4$.



Check:

$x = -5$: $\frac{-5}{2} \stackrel{?}{\geq} -2$

$-2 < -2$ ✗

$x = 0$: $\frac{0}{2} \stackrel{?}{\geq} -2$

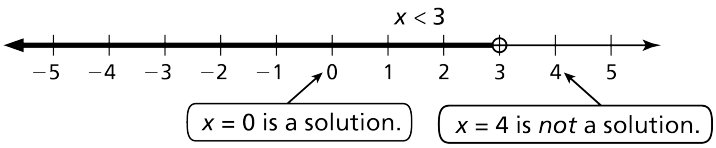
$0 \geq 2$ ✔

EXAMPLE Solving an Inequality Using Division

Solve $3x < 9$. Graph the solution.

$3x < 9$	Write the inequality.
$\frac{3x}{3} < \frac{9}{3}$	Use the Division Property of Inequality to undo subtraction.
$x < 3$	Simplify.

▶ The solution is $x < 3$.



Check:

$x = 0$: $3(0) \stackrel{?}{<} 9$

$0 < 9$ ✔

$x = 4$: $3(4) \stackrel{?}{<} 9$

$12 < 9$ ✗

Name _____ Date _____

Lesson 4.6 Reteach (continued)

Multiplication and Division Properties of Inequality (Case 2)

When you multiply or divide each side of an inequality by the same *negative* number, the direction of the inequality symbol must be reversed for the inequality to remains true.

These properties are also true for $\leq$ and $\geq$.

EXAMPLE Solving an Inequality Using Multiplication

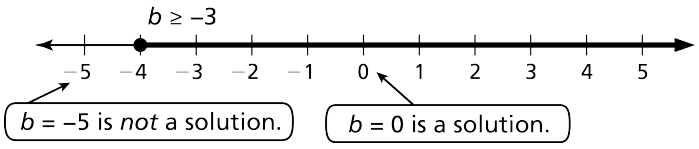
Solve $-\frac{2}{3}b \leq 2$. Graph the solution.

$-\frac{2}{3}b \leq 2$ Write the inequality.

$-\frac{3}{2} \cdot \left(-\frac{2}{3}\right)b \geq -\frac{3}{2} \cdot 2$ Use the Multiplication Property of Inequality. Reverse the inequality symbol.

$b \geq -3$ Simplify.

▶ The solution is $b \geq -3$.



Check

$b = -5$: $-\frac{2}{3} \cdot (-5) \leq 2$

$3\frac{1}{3} \leq 2$ ✗

$b = 0$: $-\frac{2}{3} \cdot 0 \leq 2$

$0 \leq 2$ ✔

Solve the inequality. Graph the solution.

1. $\frac{3}{2}y \leq 6$

2. $-0.5 > \frac{p}{10}$

3. $\frac{x}{4} < 3$

4. $-7g \geq 21$

5. $24 > -6h$

6. $-\frac{12}{9}j > -4$

7. $-3.5 < 0.7p$

8. $-\frac{3}{2}c \geq -3$

9. $\frac{w}{4} \leq 1$

10. $8z > -24$

11. $40 > -8r$

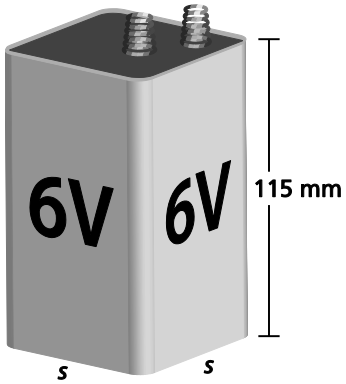
12. $5q < 0$

Name _____ Date _____

Lesson 4.6 Enrichment and Extension

Margin of Error

A 6-volt lantern battery has the given dimensions. Any company that manufactures the batteries must make sure their product meets the specifications. The batteries are made using machines. No machine is perfect and so there will always be a slight variation of the size of the batteries.



$V = 534{,}892.6 \text{ mm}^3$

The allowable difference between the required dimensions of the battery and its actual dimensions is called the *margin of error*.

1. What is the ideal side length of the base of a 6-volt lantern battery?
2. The side length of the base of the battery has a margin of error of 0.002 millimeter. Write an inequality that models the margin of error e of the base's side length.
3. A margin of error in the side length will produce a margin of error in the volume of the battery.
   a. What is the smallest side length allowed by the margin of error? What is the volume of a battery with this side length? Round your answer to the nearest thousandth.
   b. What is the greatest side length allowed by the margin of error? What is the volume of a battery with this side length? Round your answer to the nearest thousandth.
   c. Write an inequality that models the range of acceptable side lengths s of a battery.
   d. Write an inequality that models the range of acceptable volumes V of a battery.
4. The side length of a battery is the value you calculated in Exercise 1 and the height is 115.002 millimeters.
   a. Find the volume of the battery. Round your answer to the nearest thousandth.
   b. Which margin of error has a greater impact on the volume, the side length or the height? Why? Explain your reasoning.

Name _____ Date _____

4.6 Puzzle Time

What Do You Do When Your Smoke Alarm Goes Off?

Write the letter of each answer in the box containing the exercise number.

Solve the inequality.

1. $4x < 24$

2. $\frac{x}{6} \geq -3$

3. $-2.3x > 23$

4. $-15 \geq \frac{x}{3}$

5. $\frac{x}{4} > -4.1$

6. $9 \leq -1.5x$

7. $-6x > -\frac{1}{4}$

8. $4.2x \geq -12.6$

9. Three times a number x is at least -18.

10. The quotient of x and a number -7 is less than 8.

Answers

N. $x < -10$

U. $x \leq -6$

R. $x < \frac{1}{24}$

A. $x > -16.4$

I. $x \geq -6$

T. $x < 6$

F. $x \geq -3$

E. $x > -56$

T. $x \leq -45$

R. $x \geq -18$

7	6	3		5	8	1	10	2		9	4

Lesson 4.7 Cumulative Practice

For use before Lesson 4.7

Find the difference.

1. $\left(\frac{1}{2}x - 1\right) - \left(\frac{1}{4}x - 11\right) =$ _____

2. $\left(\frac{3}{5}x - 8\right) - \left(\frac{1}{5}x - 6\right) =$ _____

Lesson 4.7 Vocabulary Practice

For use before Lesson 4.7

1. Write what you know about this phrase.

Review: solution set

Lesson 4.7 Prerequisite Skills Practice

For use before Lesson 4.7

Solve the inequality.

1. $x + 9 < 12$

2. $x - 3 \geq 1$

Name _____ Date _____

Lesson 4.7 Extra Practice

Solve the inequality. Graph the solution.

1. $3m - 7 < 2$

2. $-13 \leq -5r + 2$

3. $2k + \frac{1}{3} > 1$

4. $4.3 - 1.5c \leq 10$

5. $2(b - 4) > -6$

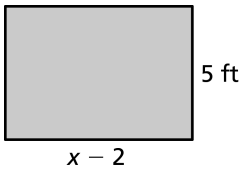
6. $-8(p + 3) \leq 16$

7. $15 \geq \frac{5}{3}(d - 6)$

8. $3.4 < 0.4(a + 12)$

9. You are renting a moving truck for a day. There is a daily fee of \$20 and a charge of \$0.75 per mile. Your budget allows a maximum total cost of \$65. Write and solve an inequality that represents the number of miles you can drive the truck.

10. Write and solve an inequality that represents the values of x for which the area of the rectangle will be at least 35 square feet.



Solve the inequality. Graph the solution.

11. $3x - 7x + 2 < 10 - 12$

12. $14w - 8w - 5.4 \geq 7.3 - 10$

13. Your weekly base salary is \$150. You earn \$20 for each cell phone that you sell.

a. What is the minimum amount you can earn in a week?

b. Write and solve an inequality that represents the number of cell phones you must sell to make at least \$630 a week.

c. Write and solve an inequality that represents the number of cell phones you must sell to make at least \$750 a week.

d. The company policy is that as a part-time employee, the maximum you can earn each week is \$950. Write and solve an inequality that represents the number of cell phones you can sell each week.

Name _____ Date _____

Lesson 4.7 Reteach

You can solve two-step inequalities in the same way you solve two-step equations.

EXAMPLE Solving Two-Step Inequalities

a. Solve $2x - 3 \leq 5$. Graph the solution.

$2x - 3 \leq 5$	Write the inequality.
$\underline{+3 \quad +3}$	Use the Addition Property of Inequality to undo the subtraction.
$2x \leq 8$	Simplify.
$\frac{2x}{2} \leq \frac{8}{2}$	Use the Division Property of Inequality to undo the multiplication.
$x \leq 4$	Simplify.

Check

$x = 0$: $2 \cdot 0 - 3 \stackrel{?}{\leq} 5$

$0 - 3 \stackrel{?}{\leq} 5$

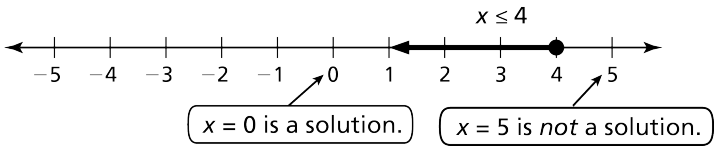
$-3 \leq 5$ ✔

$x = 5$: $2 \cdot 5 - 3 \stackrel{?}{\leq} 5$

$10 - 3 \stackrel{?}{\leq} 5$

$7 \not\leq 5$ ✗

▶ The solution is $x \leq 4$.



b. Solve $\frac{c}{2} + 3 > 4$. Graph the solution.

$\frac{c}{2} + 3 > 4$	Write the inequality.
$\underline{-3 \quad -3}$	Use the Subtraction Property of Inequality to undo the addition.
$\frac{c}{2} > 1$	Simplify.
$2 \cdot \frac{c}{2} > 2 \cdot 1$	Use the Multiplication Property of Inequality to undo the division.
$c > 2$	Simplify.

Check

$x = 0$: $\frac{0}{2} + 3 \stackrel{?}{>} 4$

$0 + 3 \stackrel{?}{>} 4$

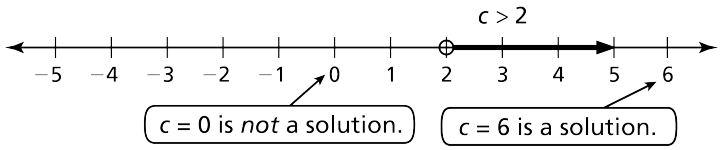
$3 \not> 4$ ✗

$x = 6$: $\frac{6}{2} + 3 \stackrel{?}{>} 4$

$3 + 3 \stackrel{?}{>} 4$

$6 > 4$ ✔

▶ The solution is $c > 2$.



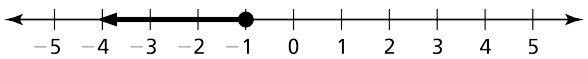
Name _____ Date _____

Lesson 4.7 Reteach (continued)

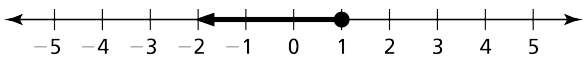
EXAMPLE Graphing an Inequality

Which graph represents the solution of $-4(y + 2) \leq -12$?

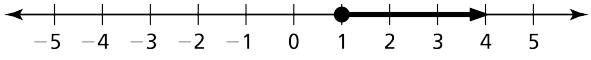
a.



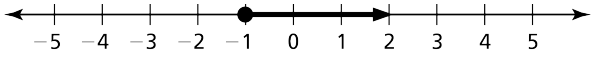
b.



c.



d.



$-4(y + 2) \leq -12$	Write the inequality.
$-4y - 8 \leq -12$	Distributive Property
$\underline{+8} \quad \underline{+8}$ (Step 1: Undo the subtraction.)	Addition Property of Inequality
$-4y \leq -4$	Simplify.
$\frac{-4y}{-4} \geq \frac{-4}{-4}$ (Step 2: Undo the multiplication.)	Use the Division Property of Inequality. Reverse the inequality symbol.
$y \geq 1$	Simplify.

▶ The correct answer is c.

Solve the inequality. Graph the solution.

1. $6y - 8 < 10$

2. $9 - 2f \leq 19$

3. $\frac{k}{-3} + 16 < 17$

4. $3p - 7 < 8$

5. $-1 \leq \frac{a}{-2} + 1$

6. $\frac{j}{5} - 4 > -4$

7. $10 \leq -8q - 6$

8. $2(m - 1) \geq 6$

9. $3(t + 2) \leq 9$

10. $\frac{x}{4} + 4 < 12$

11. $6n + 3 < 18$

12. $2(d - 3) > 4$

Name _____ Date _____

Lesson 4.7 Enrichment and Extension

Solving Multi-Step Inequalities

Solve the inequality. Graph the solution.

1. $4(x + 1) < -6$

2. $2(x - 3) \geq 10$

3. $\frac{1}{2}(x + 28) \leq 11$

4. $\frac{x+5}{6} > 2$

5. $\frac{2x-1}{4} \geq 1$

6. $\frac{3x+2.3}{5} \leq 7$

7. $8.5 < \frac{4+10+x}{2}$

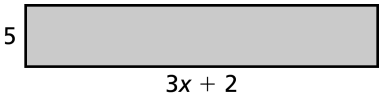
8. $-5(2x + 6) \geq 40$

9. $3(7 - 10x) < 21$

10. You get scores of 85 and 91 on two history tests. Write and solve an inequality to find the scores you can get on your next history test to have an average of at least 90.

11. You and a group of friends wait $\frac{1}{2}$ hour to ride an amusement park ride. You go on the ride a second time and wait $\frac{1}{3}$ hour. You want to go on a third time. Write and solve an inequality to find how many minutes you can wait for your average waiting time to be at most $\frac{1}{3}$ hour. (*Hint:* Convert the waiting times to minutes.)

12. Write and solve an inequality to find the possible values of x so that the rectangle has an area of more than 130 square units.



Name _____ Date _____

4.7 Puzzle Time

What Did Ernie Say When Bert Asked Him If He Wanted Ice Cream?

Write the letter of each answer in the box containing the exercise number.

Solve the inequality.

1. $8x - 11 < 13$

2. $3x - 5 \geq 16$

3. $2 - \frac{x}{4} \geq 4$

4. $\frac{6}{7} > -2x - \frac{8}{7}$

5. $4.6 > 1.2 + 1.7x$

6. $8(x - 4) \geq 40$

7. $-30 \leq -\frac{3}{4}(x + 4)$

8. $-6.8 \geq 0.8(x + 1)$

Answers

R. $x < 2$

T. $x \leq 36$

E. $x \geq 7$

S. $x \leq -9.5$

B. $x > -1$

U. $x < 3$

R. $x \leq -8$

E. $x \geq 9$

8	1	3	6		4	2	5	7