One-Step Equations With Integers

Solve each equation.

1) $v - 10 = -9$

2) $v - 10 = -3$

3) $x - 3 = 4$

4) $\dfrac{x}{5} = 2$

5) $22 = -11k$

6) $-13m = -377$

7) $b - 7 = -1$

8) $-8 = p - 13$

9) $-40 = -5p$

10) $418 = -22a$

11) $\dfrac{a}{29} = 5$

12) $-2 = \dfrac{m}{16}$

13) $x - 11 = 16$

14) $-10 = x - 21$

Infinite Algebra 1

One-Step Equations

Solve each equation.

1) $26 = 8 + v$

2) $3 + p = 8$

3) $15 + b = 23$

4) $-15 + n = -9$

5) $m + 4 = -12$

6) $x - 7 = 13$

7) $m - 9 = -13$

8) $p - 6 = -5$

9) $v - 15 = -27$

10) $n + 16 = 9$

11) $-104 = 8x$

12) $14b = -56$

13) $-6 = \dfrac{b}{18}$

14) $10n = 40$

15) $\dfrac{v}{8} = 2$

16) $16 = \dfrac{k}{11}$

17) $-15x = 0$

18) $-17x = -204$

19) $21 = -7n$

20) $\dfrac{m}{4} = -13$

21) $-126 = 14k$

22) $-143 = -11x$

23) $-16 + x = -15$

24) $-5 = \dfrac{a}{18}$

25) $-17 = x - 15$

26) $n - 8 = -10$

27) $\dfrac{v}{7} = 8$

28) $a + 11 = 20$

29) $-7 + m = 8$

30) $18 + m = 8$

1-6 Study Guide and Intervention

Algebra: Variables and Expressions

- A **variable** is a symbol, usually a letter, used to represent a number.
- Multiplication in algebra can be shown as $4n$ or $4 \times n$.
- **Algebraic expressions** are combinations of variables, numbers, and at least one operation.

EXAMPLE 1 Evaluate $35 + x$ if $x = 6$.

$$35 + x = 35 + 6 \qquad \text{Replace } x \text{ with 6.}$$
$$= 41 \qquad \text{Add 35 and 6.}$$

EXAMPLE 2 Evaluate $y + x$ if $x = 21$ and $y = 35$.

$$y + x = 35 + 21 \qquad \text{Replace } x \text{ with 21 and } y \text{ with 35.}$$
$$= 56 \qquad \text{Add 35 and 21.}$$

EXAMPLE 3 Evaluate $4n + 3$ if $n = 2$.

$$4n + 3 = 4 \times 2 + 3 \qquad \text{Replace } n \text{ with 2.}$$
$$8 + 3 \qquad \text{Find the product of 4 and 2.}$$
$$11 \qquad \text{Add 8 and 3.}$$

EXAMPLE 4 Evaluate $4n - 2$ if $n = 5$.

$$4n - 2 = 4 \times 5 - 2 \qquad \text{Replace } n \text{ with 5.}$$
$$20 - 2 \qquad \text{Find the product of 4 and 5.}$$
$$18 \qquad \text{Subtract 2 from 20.}$$

EXERCISES

Evaluate each expression if $y = 4$.

1. $3 + y$
2. $y + 8$
3. $4 \times y$

4. $9y$
5. $15y$
6. $300y$

7. y^2
8. $y^2 + 18$
9. $y^2 + 3 \times 7$

Evaluate each expression if $m = 3$ and $k = 10$.

10. $16 + m$
11. $4k$
12. $m \times k$

13. $m + k$
14. $7m + k$
15. $6k + m$

16. $3k - 4m$
17. $2mk$
18. $5k - 6m$

19. $20m \div k$
20. $m^3 + 2k^2$
21. $k^2 \div (2 + m)$

1-6 Practice: Word Problems

Algebra: Variables and Expressions

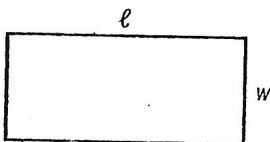**TRAVEL** For Exercises 1 and 2, use the table that shows the distance between cities in Arizona.

Arizona Mileage Chart

	Flagstaff	Phoenix	Tucson	Nogales
Phoenix	136 miles		117 miles	181 miles
Tucson	253 miles	117 miles		64 miles
Nogales	317 miles	181 miles	64 miles	

1. To find the speed of a car, use the expression $d \div t$ where d represents the distance and t represents time. Find the speed of a car that travels from Phoenix to Flagstaff in 2 hours.

2. To find the time it will take for a bicyclist to travel from Nogales to Tucson, use the expression d/s where d represents distance and s represents speed. Find the time if the bicyclist travels at a speed of 16 miles per hour.

3. **PERIMETER** The perimeter of a rectangle can be found using the formula $2\ell + 2w$, where ℓ represents the length and w represents the width. Find the perimeter if $\ell = 6$ units and $w = 3$ units.

4. **PERIMETER** Another formula for perimeter is $2(\ell + w)$. Find the perimeter of the rectangle in Exercise 3 using this formula. How do the answers compare? Explain how you used order of operations using this formula.

5. **SHOPPING** Write an expression using a variable that shows how much 3 pairs of jeans will cost if you do not know the price of the jeans. Assume each pair costs the same amount.

6. **SHOPPING** Write an expression using variables to show how much 3 plain T-shirts and 2 printed T-shirts will cost, assuming that the prices of plain and printed T-shirts are not the same.

Complete the table.

Algebraic Expressions	Variables	Numbers	Operations
1. $5d + 2c$	?	?	?
2. $5w - 4y + 2s$	?	?	?
3. $xy \div 4 + 3m - 6$	?	?	?

Evaluate each expression if $a = 3$ and $b = 4$.

4. $10 + b$

5. $2a + 8$

6. $4b - 5a$

7. $a \times b$

8. $7a \times 9b$

9. $8a - 9$

10. $b \times 22$

11. $a^2 + 1$

12. $18 \div 2a$

13. $a^2 \times b^2$

14. $ab \div 3$

15. $15a - 4b$

16. $ab + 7 \times 11$

17. $36 \div 6a$

18. $7a + 8b \times 2$

Evaluate each expression if $x = 7$, $y = 15$, and $z = 8$.

19. $x + y + z$

20. $x + 2z$

21. $xz + 3y$

22. $4x - 3z$

23. $z^2 \div 4$

24. $6z - 5z$

25. $9y \div (2x + 1)$

26. $15y + x^2$

27. $y^2 + 4 \times 6$

28. $y^2 - 2x^2$

29. $x^2 + 30 - 18$

30. $13y - zx \div 4$

31. $xz - 2y + 8$

32. $z^2 + 5y - 20$

33. $3y \times 40x - 1,000$

9-5

Study Guide and Intervention

Solving Two-Step Equations

Equations that have two different operations are called **two-step equations.** You can work backward using the reverse of the order of operations to solve a two-step equation.

EXAMPLE 1 Solve $2x + 4 = 10$ using models.

Model the equation.

$2x + 4 = 10$

Remove 4 counters from each side to get the variable by itself.

$2x + 4 - 4 = 10 - 4$

Divide the 6 counters equally into 2 groups. There are 3 in each group.

$2x = 6$
$x = 3$

EXAMPLE 2 Solve $-3z - 4 = 8$. Check your solution.

$$
\begin{aligned}
-3z - 4 &= 8 && \text{Write the equation.}\\
+4 &= +4 && \text{Add 4 to each side.}\\
-3z &= 12 && \text{Simplify.}\\
\frac{-3z}{-3} &= \frac{12}{-3} && \text{Divide each side by } -3.\\
z &= -4 && \text{Simplify.}
\end{aligned}
$$

The solution is -4.

Check
$$
\begin{aligned}
-3z - 4 &= 8 && \text{Write the original equation.}\\
-3(-4) - 4 &\stackrel{?}{=} 8 && \text{Replace } z \text{ with } -4.\\
12 - 4 &\stackrel{?}{=} 8 && \text{Multiply.}\\
8 &= 8 \checkmark && \text{Simplify.}
\end{aligned}
$$

EXERCISES

Solve each equation. Use models if necessary.

1. $4m + 5 = 9$

2. $3n + 4 = -2$

3. $3 = 2s - 5$

4. $5 = -7 + 4b$

5. $6a - 5 = 7$

6. $-13 + 3c = 8$

7. One more than four times a number is thirteen. What is the number?

8. Three is seven less than two times a number. What is the number?

9-5

Practice: Word Problems

Solving Two-Step Equations

1. **FIRE TRUCKS** Fire Station A has one more than twice as many fire trucks as Fire Station B. If Fire Station A has three fire trucks, write and solve an equation to find how many fire trucks Fire Station B has.

2. **TOY CARS** Tanisha has 7 less than 4 times as many toy cars as Fernando. If Tanisha has 9 cars, write and solve an equation to find how many toy cars Fernando has.

3. **ADDRESS** Danielle and Erin live on the same street. Danielle lives at number 13. If Danielle's house number is 5 less than 3 times Erin's house number, write and solve an equation to find Erin's house number.

4. **BIRTHDAY CAKE** Mrs. Zeng is slicing her son's birthday cake. To make sure everyone will have enough, she slices the cake so that the number of slices is 6 more than twice the number of people at the party. If she slices the cake into 20 slices, write and solve an equation to find how many people are at the party.

5. **DINOSAURS** The largest complete dinosaur we know of was a Brachiosaurus. It reached a length of 23 meters. Its length was one less than twice its height. Write and solve an equation to find the height of the Brachiosaurus.

6. **BABY-SITTING** Last week, Enrique earned $30.00 baby-sitting. Enrique earned $5.00 less than 7 times what Rhea earned. Write and solve an equation to find how much money Rhea earned baby-sitting last week.

7. **ELECTION** Raj received 8 more than 3 times as many votes as Vinny in a school election. Raj received 44 votes. Write and solve an equation to find how many votes Vinny received.

8. **JACK-O-LANTERN** It took Suki 127 minutes from start to finish to carve her pumpkin. Carving the pumpkin took her 13 fewer minutes than 10 times as long as it took her to pick the pumpkin out at the pumpkin patch. Write and solve an equation to find how long it took Suki to pick out her pumpkin.

9-5 Practice: Skills

Solving Two-Step Equations

Solve each equation. Use models if necessary.

1. $2a + 4 = 6$

2. $3b + 4 = 10$

3. $7 = 4c - 5$

4. $3x - 3 = -6$

5. $4y - 2 = -14$

6. $3 = 2g + 5$

7. $1 = 2f - 7$

8. $2 = 3h + 8$

9. $5z + 1 = 16$

10. $7m - 5 = 9$

11. $1 = 8n - 7$

12. $-11 = 9s + 7$

13. $4t + 7 = -5$

14. $4v + 10 = -6$

15. $6 = 2x - 10$

16. $3w + 5 = -7$

17. $2r - 5 = 3$

18. $5 = 2z - 9$

19. Fourteen less than four times a number is six. What is the number?

20. Two is four more than twice a number. What is the number?

21. Nine less than three times a number is zero. What is the number?

22. Two is seventeen more than three times what number?

Algebra Vocabulary

Name: _____ **Date:** _____

Read the following paragraph. Pay special attention to the algebra terms printed in bold.

> I was thinking about our algebra class today and how we used a balance scale to represent an **equation,** which is like a mathematical sentence stating that two expressions are equal. The first equation we worked with was $2x + 1 = 7$. This equation contains three terms; $2x$, 1, and 7. A **term** is a number, variable, product, or quotient in an expression of sums and/or differences. The teacher reminded us that the x was a symbol used to represent an unspecified member of a set. It is also called a **variable**. The equation also contained a **coefficient** — the numerical factor in the term. Our equation had one coefficient in the term $2x$, and it was 2.

In the chart below, write a definition for each algebra vocabulary word and then write an example in the appropriate column.

Algebra Vocabulary	Definition	Example
Equation		
Term		
Variable		
Coefficient		

Algebra Vocabulary

Name: _____ **Date:** _____

Read the following paragraph. Pay special attention to the algebra terms printed in bold.

I was thinking about our algebra class today and how we used a balance scale to represent an **equation,** which is like a mathematical sentence stating that two expressions are equal. The first equation we worked with was $2x + 1 = 7$. This equation contains three terms; $2x$, 1, and 7. A **term** is a number, variable, product, or quotient in an expression of sums and/or differences. The teacher reminded us that the x was a symbol used to represent an unspecified member of a set. It is also called a **variable**. The equation also contained a **coefficient** — the numerical factor in the term. Our equation had one coefficient in the term $2x$, and it was 2.

In the chart below, write a definition for each algebra vocabulary word and then write an example in the appropriate column.

Algebra Vocabulary	Definition	Example
Equation		
Term		
Variable		
Coefficient		

9-3 Practice: Skills

Solving Subtraction Equations

Solve each equation. Use models if necessary. Check your solution.

1. $a - 1 = 7$

2. $b - 2 = 1$

3. $3 = c - 1$

4. $x - 3 = -1$

5. $-3 = y - 4$

6. $2 = k - 4$

7. $m - 5 = -6$

8. $n - 6 = -9$

9. $-10 = s - 8$

10. $t - 9 = -1$

11. $v - 9 = -5$

12. $-6 = v - 7$

13. $3 = g - 6$

14. $-3 = h - 8$

15. $-5 = z - 7$

16. $z - 3 = 7$

17. $5 = f - 1$

18. $-1 = d - 2$

19. $e - 9 = -6$

20. $1 = t - 8$

21. $i - 5 = 4$

22. $g - 4 = 1$

23. $-3 = x - 2$

24. $y - 4 = -7$

25. If $r - 7 = -7$, what is the value of r?

26. Find the value of b if $b - 2 = 5$.

9-3

Practice: Word Problems
Solving Subtraction Equations

1. BIRDS A house cat, Sophie, scared away 5 birds when she arrived on the porch. If 3 birds remain, write and solve an equation to find how many birds were on the porch before Sophie arrived.

2. APPLES David brought apples to school one day. After giving one to each of his 5 closest friends, David had 6 apples left. Write and solve an equation to find how many apples David brought to school.

3. BASKETBALL The basketball team is practicing after school. Four students have to leave early. If 12 basketball players remain, write and solve an equation to find how many students are on the basketball team.

4. MARBLES Virginia's mother gave her marbles for her birthday. Virginia lost 13 of them. If she has 24 marbles left, write and solve an equation to find how many her mother gave her.

5. MONEY Claudio went for a walk. While he was walking, $1.35 fell out of his pocket. When he returned home, he counted his money and had $2.55 left. Write and solve an equation to find how much money was in Claudio's pocket when he started his walk.

6. HANG GLIDING Aida was hang gliding. After losing 35 feet in altitude, she was gliding at 125 feet. Write and solve an equation to find her height when she started hang gliding.

7. SHARKS The average great hammerhead shark is 11.5 feet long. The average great hammerhead shark is 13.5 feet shorter than the average whale shark. Write and solve an equation to find the length of the average whale shark.

8. JOKES At a party, Tex told 17 fewer knock-knock jokes than he did riddles. If he told 23 knock-knock jokes, write and solve an equation to find how many riddles Tex told at the party.
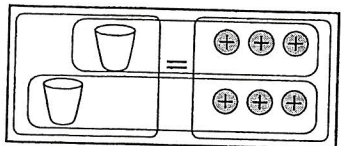
Lesson 9-3

9-4

Study Guide and Intervention

Solving Multiplication Equations

In a multiplication equation, the number by which a variable is multiplied is called the **coefficient**. In the multiplication equation, $2x = 8$, the coefficient is 2.

EXAMPLE 1 Solve $2x = 6$ using models.
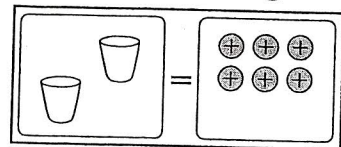
Model the equation.

$2x = 6$

Divide the 6 counters equally into 2 groups. There are 3 in each group.

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

$$x = 3$$

Check $2x = 6$ Write the original equation.

$2(3) \overset{?}{=} 6$ Replace x with 3.

$6 = 6$ This sentence is true. ✓

The solution is 3.

EXAMPLE 2 Solve $-4b = 12$.

$-4b = 12$ Write the equation.

$\dfrac{-4b}{-4} = \dfrac{12}{-4}$ Divide each side by -4 to get a single positive variable by itself.

$1b = -3$ Simplify.

$b = -3$

Check $-4b = 12$ Write the original equation.

$-4(-3) \overset{?}{=} 12$ Replace b with -3.

$12 = 12$ This sentence is true. ✓

The solution is -3.

EXERCISES

Solve each equation. Use models if necessary. Check your solution.

1. $5a = 25$

2. $7c = 49$

3. $24 = 6d$

4. $2x = -8$

5. $18 = -9y$

6. $-8g = -16$

7. $18 = -3z$

8. $-4w = -36$

9. $56 = 7v$

10. $24 = -8f$

11. $3u = -27$

12. $-42 = 6t$

9-4

Practice: Word Problems

Solving Multiplication Equations

1. BAND SOLO Kai's solo in the next school band performance is 4 times as long as Dena's solo. Kai's solo is 12 minutes long. Write and solve an equation to find the length of Dena's solo.	**2. CATS** Steve's tabby cat eats 5 times as often as his black cat. The tabby cat ate 10 times yesterday. Write and solve an equation to find how many times the black cat ate.
3. FOOTBALL In last night's football game, the home team earned 3 times as many points as the visiting team. They won the game with 21 points. Write and solve an equation to find how many points the visiting team had.	**4. MONEY** Paz has 3 times as much money in her wallet as in her pocket. There is $18 in her wallet. Write and solve an equation to find how much money is in her pocket.
5. MORNINGS It takes Jun 3 times as long as it takes Kendra to get ready in the morning. It takes Jun 45 minutes to get ready. Write and solve an equation to find how long it takes Kendra.	**6. FISH** In his home aquarium, Enli has 12 times as many guppies as he has goldfish. Enli just counted 72 guppies. Write and solve an equation to find how many goldfish he has.
7. MUSIC Ray's favorite song is 2 times longer than Meli's favorite song. Write and solve an equation to find the length of Meli's favorite song if Ray's lasts 6 minutes.	**8. TRAILS** The forest trail to Round Lake is 3 times longer than the rocky trail to Round Lake. The forest trail is 15 miles long. Write and solve an equation to find the length of the rocky trail.

1-6 Practice: Word Problems

Algebra: Variables and Expressions

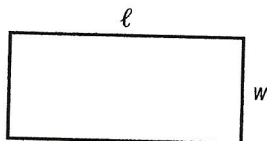**TRAVEL** For Exercises 1 and 2, use the table that shows the distance between cities in Arizona.

Arizona Mileage Chart

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1. To find the speed of a car, use the expression $d \div t$ where d represents the distance and t represents time. Find the speed of a car that travels from Phoenix to Flagstaff in 2 hours.

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3. **PERIMETER** The perimeter of a rectangle can be found using the formula $2\ell + 2w$, where ℓ represents the length and w represents the width. Find the perimeter if $\ell = 6$ units and $w = 3$ units.

4. **PERIMETER** Another formula for perimeter is $2(\ell + w)$. Find the perimeter of the rectangle in Exercise 3 using this formula. How do the answers compare? Explain how you used order of operations using this formula.

5. **SHOPPING** Write an expression using a variable that shows how much 3 pairs of jeans will cost if you do not know the price of the jeans. Assume each pair costs the same amount.

6. **SHOPPING** Write an expression using variables to show how much 3 plain T-shirts and 2 printed T-shirts will cost, assuming that the prices of plain and printed T-shirts are not the same.

1-6 Study Guide and Intervention

Algebra: Variables and Expressions

- A **variable** is a symbol, usually a letter, used to represent a number.
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$$35 + x = 35 + 6 \qquad \text{Replace } x \text{ with 6.}$$
$$= 41 \qquad \text{Add 35 and 6.}$$

EXAMPLE 2 Evaluate $y + x$ if $x = 21$ and $y = 35$.

$$y + x = 35 + 21 \qquad \text{Replace } x \text{ with 21 and } y \text{ with 35.}$$
$$= 56 \qquad \text{Add 35 and 21.}$$

EXAMPLE 3 Evaluate $4n + 3$ if $n = 2$.

$$4n + 3 = 4 \times 2 + 3 \qquad \text{Replace } n \text{ with 2.}$$
$$8 + 3 \qquad \text{Find the product of 4 and 2.}$$
$$11 \qquad \text{Add 8 and 3.}$$

EXAMPLE 4 Evaluate $4n - 2$ if $n = 5$.

$$4n - 2 = 4 \times 5 - 2 \qquad \text{Replace } n \text{ with 5.}$$
$$20 - 2 \qquad \text{Find the product of 4 and 5.}$$
$$18 \qquad \text{Subtract 2 from 20.}$$

EXERCISES

Evaluate each expression if $y = 4$.

1. $3 + y$

2. $y + 8$

3. $4 \times y$

4. $9y$

5. $15y$

6. $300y$

7. y^2

8. $y^2 + 18$

9. $y^2 + 3 \times 7$

Evaluate each expression if $m = 3$ and $k = 10$.

10. $16 + m$

11. $4k$

12. $m \times k$

13. $m + k$

14. $7m + k$

15. $6k + m$

16. $3k - 4m$

17. $2mk$

18. $5k - 6m$

19. $20m \div k$

20. $m^3 + 2k^2$

21. $k^2 \div (2 + m)$

Toby's Quiz

Name _____

Toby completed the following quiz, and it needs to be checked. Write a *C* next to each item that he got correct. Write a ✓ next to any that he got incorrect, and then write Toby a hint about what he should have done differently.

Name ___Toby___

1.
$$x + 4 = 8$$
$$x + 4 - 4 = 8 - 4$$
$$x = 4$$

6.
$$x = 5 - 2$$
$$x = 3$$

2.
$$x - 5 = 12$$
$$x - 5 - 5 = 12 - 5$$
$$x = 7$$

7.
$$x + 5 = 17$$
$$x + 5 - 5 = 17 - 5$$
$$x = 12$$

3.
$$7 + x = 13$$
$$7 - 7 + x = 13 - 7$$
$$x = 6$$

8.
$$x + 18 = 20$$
$$x + 18 + 18 = 20 + 18$$
$$x = 38$$

4.
$$x - 8 = 5$$
$$x - 8 + 8 = 5 + 8$$
$$x = 13$$

9.
$$x + 33 = 49$$
$$x + 33 - 33 = 49 - 33$$
$$x = 16$$

5.
$$4 + 5 = x$$
$$9 = x$$

10.
$$x + 34 = 64$$
$$x + 34 - 34 = 64 - 34$$
$$x = 30$$

Solve and check

Jessica's Quiz

Jessica completed the following quiz, and it needs to be checked. Write a *C* next to each item that she got correct. Write a √ next to any that she got incorrect, and then write a hint about what she should have done differently.

Name Jessica

1.
$$4y = 20$$
$$4y \div 4 = 20 \div 4$$
$$y = 5$$

2.
$$5y = 45$$
$$5y \div 5 = 45 \div 5$$
$$y = 9$$

3.
$$y \div 6 = 24$$
$$y \div 6 \div 6 = 24 \div 6$$
$$y = 4$$

4.
$$7y = 7$$
$$7y \div 7 = 7 \div 7$$
$$y = 1$$

5.
$$y \div 3 = 18$$
$$y \div 3(3) = 18(3)$$
$$y = 54$$

6.
$$y \div 5 = 2$$
$$y \div 5(5) = 2(5)$$
$$y = 10$$

7.
$$7y = 35$$
$$7(7)y = 35(7)$$
$$y = 245$$

8.
$$12y = 48$$
$$12y \div 12 = 48 \div 12$$
$$y = 4$$

9.
$$y \div 8 = 4$$
$$y \div 8(8) = 4(8)$$
$$y = 32$$

10.
$$y \div 4 = 28$$
$$y \div 4 \div 4 = 28 \div 4$$
$$y = 7$$

Solve one-step equations using multiplication or division

Solve It with Addition and Subtraction II

Name _____

Solve each of the following equations. Show all your work.

Add the same value to each side.	Or subtract the same value from each side.
$x - 6 = 3$	$x + 2 = 7$
$x - 6 + 6 = 3 + 6$	$x + 2 - 2 = 7 - 2$
$x = 9$	$x = 5$

1. $x + 5 = 9$, $x =$ _____

2. $x + 3 = 8$, $x =$ _____

3. $x + 8 = 12$, $x =$ _____

4. $x - 9 = 15$, $x =$ _____

5. $x - 15 = 15$, $x =$ _____

6. $x - 36 = 39$, $x =$ _____

Solve It with Multiplication and Division II

Solve each of the following equations. Show all your work.

Multiply both sides by the same number.	Or divide both sides by the same number.
$y \div 2 = 3$	$2y = 8$
$y \div 2 \times 2 = 3 \times 2$	$2y \div 2 = 8 \div 2$
$y = 6$	$y = 4$

1. $6y = 24$

2. $3y = 18$

3. $9y = 54$

8. $y \div 1 = 7$

9. $y \div 8 = 6$

10. $y \div 4 = 0$

15. $4y = 32$

16. $y \div 5 = 20$

17. $2y = 14$

LESSON 2-4 Reading Strategies
Focus on Vocabulary

You can see the word **equal** in **equation**. In math, an equation indicates that two quantities are equal, or the same. The = **sign** in an equation separates one quantity from the other. The value on each side of the = sign is the same.

Look at the equations below. Notice how the value on each side of the = sign is the same for each equation:

$$5 + 7 = 8 + 4 \qquad 19 - 7 = 12 \qquad 42 = 3 \bullet 14$$

If an equation contains a variable, and the variable is replaced by a value that keeps the equation equal, that value is called a **solution** of the equation.

Examples:
$y \div 4 = 15$

$80 \div 4 \neq 15$

"80 divided by 4 is not equal to 15."

$y \div 4 = 15$

$60 \div 4 = 15$

"60 divided by 4 is equal to 15."

Which are equations? Write the correct sign, = or ≠.

1. $7 + 23$ ☐ $9 + 21$ _____

2. $35 + 15$ ☐ 45 _____

3. $28 - 7$ ☐ $15 + 6$ _____

Replace the given value for the variable. Is it a solution?

4. $d + 28 = 45$ for $d = 17$ _____

5. $84 \div s = 28$ for $s = 3$ _____

6. $17 = 56 - t$ for $t = 40$ _____

7. $86 = 4w$ for $w = 24$ _____

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LESSON **Reteach**
2-4 *Equations and Their Solutions*

An equation is a mathematical sentence that says that two quantities are equal.

Some equations contain variables. A solution for an equation is a value for a variable that makes the statement true.

You can write related facts using addition and subtraction.
$7 + 6 = 13$ $13 - 6 = 7$

You can write related facts using multiplication and division.
$3 \cdot 4 = 12$ $12 \div 4 = 3$

You can use related facts to find solutions for equations. If the related fact matches the value for the variable, then that value is a solution.

A. $x + 5 = 9$, when $x = 3$
   Think: $9 - 5 = x$
      $x = 4$
      $3 \neq 4$
   So $x = 3$ is not a solution of $x + 5 = 9$.

B. $x - 7 = 5$, when $x = 12$
   Think: $5 + 7 = x$
      $x = 12$
      $12 = 12$
   So $x = 12$ is a solution of $x - 7 = 5$.

C. $2x = 14$, when $x = 9$
   Think: $14 \div 2 = x$
      $x = 7$
      $9 \neq 7$
   So $x = 9$ is not a solution for $2x = 14$.

D. $x \div 5 = 3$, when $x = 15$
   Think: $3 \cdot 5 = x$
      $x = 15$
      $15 = 15$
   So $x = 15$ is a solution for $x \div 5 = 3$.

Use related facts to determine whether the given value is a solution for each equation.

1. $x + 6 = 14$, when $x = 8$

2. $s \div 4 = 5$, when $s = 24$

3. $g - 3 = 7$, when $g = 11$

_____   _____   _____

4. $3a = 18$, when $a = 6$

5. $26 = y - 9$, when $y = 35$

6. $b \cdot 5 = 20$, when $b = 3$

_____   _____   _____

7. $15 = v \div 3$, when $v = 45$

8. $11 = p + 6$, when $p = 5$

9. $6k = 78$, when $k = 12$

_____   _____   _____
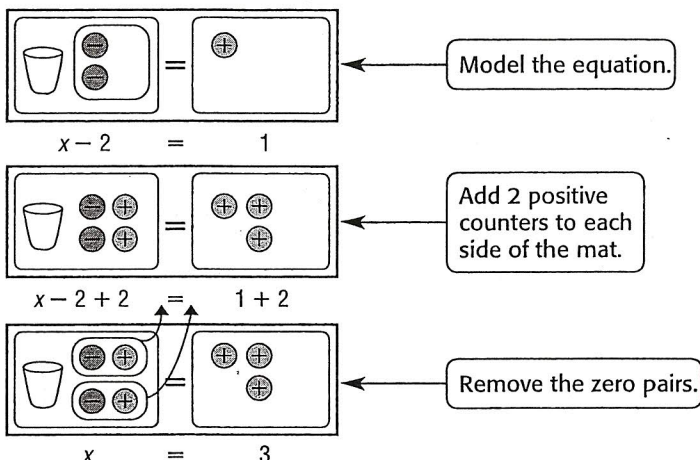
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9-3 Study Guide and Intervention

Solving Subtraction Equations

Addition Property of Equality If you add the same number to each side of an equation, the two sides remain equal.

$$
\begin{aligned}
5 &= 5 \\
+3 &= +3 \\
\hline
8 &= 8
\end{aligned}
$$

EXAMPLE 1 Solve $x - 2 = 1$ using models.

The solution is 3.

EXAMPLE 2 Solve $b - 3 = -5$.

$$
\begin{aligned}
b - 3 &= -2 &&\text{Write the equation.} \\
+3 &= +3 &&\text{Add 3 from each side to undo the addition of 3 on the left.} \\
\hline
b + 0 &= -2 &&\text{Simplify.} \\
b &= -2
\end{aligned}
$$

Check
$$
\begin{aligned}
b - 3 &= -5 &&\text{Write the original equation.} \\
-2 - 3 &\stackrel{?}{=} -5 &&\text{Replace } b \text{ with } -2. \\
-5 &= -5 \checkmark &&\text{This sentence is true.}
\end{aligned}
$$

EXERCISES

Solve each equation. Use models if necessary. Check your solution.

1. $a - 2 = 3$

2. $b - 1 = 7$

3. $c - 4 = 4$

4. $-2 = x - 4$

5. $z - 6 = -3$

6. $g - 3 = -4$

7. $-9 + w = 1$

8. $v - 8 = 5$

9. $-7 = y - 5$

10. $u - 3 = -4$

11. $-2 = t - 9$

12. $f - 6 = -3$

Lesson 9-3

9-3

Practice: Word Problems
Solving Subtraction Equations

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1. BIRDS A house cat, Sophie, scared away 5 birds when she arrived on the porch. If 3 birds remain, write and solve an equation to find how many birds were on the porch before Sophie arrived.

2. APPLES David brought apples to school one day. After giving one to each of his 5 closest friends, David had 6 apples left. Write and solve an equation to find how many apples David brought to school.

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3. BASKETBALL The basketball team is practicing after school. Four students have to leave early. If 12 basketball players remain, write and solve an equation to find how many students are on the basketball team.

4. MARBLES Virginia's mother gave her marbles for her birthday. Virginia lost 13 of them. If she has 24 marbles left, write and solve an equation to find how many her mother gave her.

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5. MONEY Claudio went for a walk. While he was walking, $1.35 fell out of his pocket. When he returned home, he counted his money and had $2.55 left. Write and solve an equation to find how much money was in Claudio's pocket when he started his walk.

6. HANG GLIDING Aida was hang gliding. After losing 35 feet in altitude, she was gliding at 125 feet. Write and solve an equation to find her height when she started hang gliding.

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7. SHARKS The average great hammerhead shark is 11.5 feet long. The average great hammerhead shark is 13.5 feet shorter than the average whale shark. Write and solve an equation to find the length of the average whale shark.

8. JOKES At a party, Tex told 17 fewer knock-knock jokes than he did riddles. If he told 23 knock-knock jokes, write and solve an equation to find how many riddles Tex told at the party.

Lesson 9-3

Balance Scale Mat

Name: _____ **Date:** _____
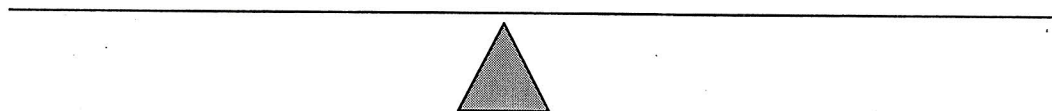
1-7 Practice: Skills

Algebra: Solving Equations

Solve each equation mentally.

1. $9 - m = 8$

2. $4 + k = 11$

3. $23 - x = 10$

4. $31 - h = 21$

5. $18 = 20 - b$

6. $16 + z = 25$

7. $y - 25 = 3$

8. $7 + f = 15$

9. $20 + r = 25$

10. $18 - v = 9$

11. $26 - d = 19$

12. $49 - c = 41$

13. $45 + r = 59$

14. $64 + n = 70$

15. $175 = w + 75$

True or False?

16. If $31 + h = 50$, then $h = 29$.

17. If $48 = 40 + k$, then $k = 8$.

18. If $17 - x = 9$, then $x = 7$.

19. If $98 - g = 87$, then $g = 11$.

20. If $p - 8 = 45$, then $p = 51$.

Identify the solution of each equation from the list given.

21. $s + 12 = 17$; 5, 6, 7

22. $59 - x = 42$; 15, 16, 17

23. $24 - k = 3$; 21, 22, 23

24. $h - 15 = 31$; 44, 45, 46

25. $69 = 50 + s$; 17, 18, 19

26. $34 - b = 13$; 20, 21, 22

27. $66 - d = 44$; 21, 22, 23

28. $h + 39 = 56$; 15, 16, 17

29. $54 + f = 70$; 16, 17, 18

30. $47 = 72 - b$; 25, 26, 27

31. $28 + v = 92$; 64, 65, 66

32. $56 + c = 109$; 52, 53, 54

1-7 Study Guide and Intervention

Algebra: Solving Equations

An **equation** is a sentence that contains an **equals sign**, =. Some equations contain variables. When you replace a variable with a value that results in a true sentence, you **solve** the equation. The value for the variable is the **solution** of the equation.

EXAMPLE 1 Solve $m + 12 = 15$ mentally.

$m + 12 = 15$ Think: What number plus 12 equals 15?
$3 + 12 = 15$ You know that $12 + 3 = 15$.
$m = 3$ The solution is 3.

EXAMPLE 2 Solve $14 - p = 6$ using guess and check.

Guess the value of p, then check it out.

Try 7.
$14 - p \overset{?}{=} 6$
$14 - 7 \neq 6$
no

Try 6.
$14 - p \overset{?}{=} 6$
$14 - 6 \neq 8$
no

Try 8.
$14 - p \overset{?}{=} 6$
$14 - 8 = 6$
yes

The solution is 8 because replacing p with 8 results in a true sentence.

EXERCISES

Identify the solution of each equation from the list given.

1. $k - 4 = 13$; 16, 17, 18

2. $31 + x = 42$; 9, 10, 11

3. $45 = 24 + k$; 21, 22, 23

4. $m - 12 = 15$; 27, 28, 29

5. $88 = 41 + s$; 46, 47, 48

6. $34 - b = 17$; 16, 17, 18

7. $69 - j = 44$; 25, 26, 27

8. $h + 19 = 56$; 36, 37, 38

Solve each equation mentally.

9. $j + 3 = 9$

10. $m - 5 = 11$

11. $23 + x = 29$

12. $31 - h = 24$

13. $18 = 5 + d$

14. $35 - a = 25$

15. $y - 26 = 3$

16. $14 + n = 19$

17. $100 = 75 + w$

Mathematics: Applications and Concepts, Course 1

1-7 Practice: Word Problems

Algebra: Solving Equations

INSECTS For Exercises 1–3, use the table that gives the average lengths of several unusual insects in centimeters.

Insect	Length (cm)	Insect	Length (cm)
Walking stick	15	Giant water bug	6
Goliath beetle	15	Katydid	5
Giant weta	10	Silkworm moth	4
Harlequin beetle	7	Flower mantis	3

1. The equation $15 - x = 12$ gives the difference in length between a walking stick and one other insect. If x is the other insect, which insect is it?

2. The equation $7 + y = 13$ gives the length of a Harlequin beetle and one other insect. If y is the other insect, which insect makes the equation a true sentence?

3. Bradley found a silkworm moth that was 2 centimeters longer than average. The equation $m - 4 = 2$ represents this situation. Find the length of the silkworm moth that Bradley found.

4. BUTTERFLIES A Monarch butterfly flies about 80 miles per day. So far it has flown 60 miles. In the equation $80 - m = 60$, m represents the number of miles it has yet to fly that day. Find the solution to the equation.

5. CICADAS The nymphs of some cicada can live among tree roots for 17 years before they develop into adults. One nymph developed into an adult after only 13 years. The equation $17 - x = 13$ describes the number of years less than 17 that it lived as a nymph. Find the value of x in the equation to tell how many years less than 17 years it lived as a nymph.

6. BEETLES A harlequin beetle lays eggs in trees. She can lay up to 20 eggs over 2 or 3 days. After the first day, the beetle has laid 9 eggs. If she lays 20 eggs in all, how many eggs will she lay during the second and third day?
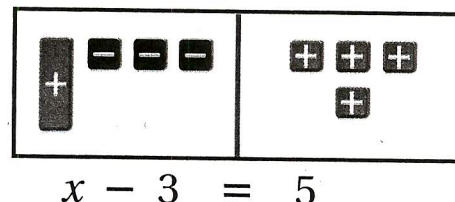
11-8 Solving Integer Equations

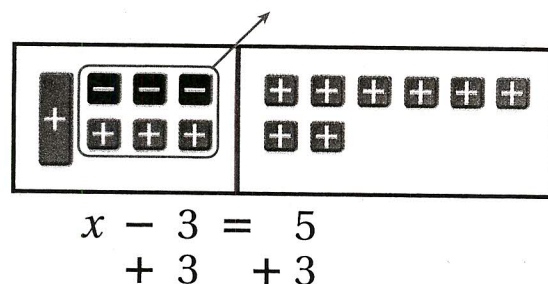You can use algebra tiles to model solving integer equations.

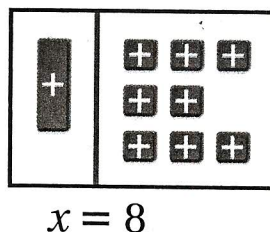 represents −1.
 represents 1.

 represents an unknown amount x.

The equation $x - 3 = 5$ is modeled.

$$x - 3 = 5$$

To get x alone on one side, add three positive tiles to each side of the mat. This allows you to remove three zero pairs from the left side.

$$x - 3 = 5$$
$$+ 3 \quad + 3$$

The solution is 8.

$$x = 8$$

Use algebra tiles to solve each equation.

1. $x + 5 = 9$
2. $x - 6 = 2$
3. $x + 4 = -1$
4. $6 = x - 7$
5. $8 = x + 2$
6. $3 = x - 9$

Think and Discuss

7. **Explain** how you know whether to add positive tiles or negative tiles to each side of the mat.

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Sixth Grade
Vocabulary
SOL 6.23 – One Step Equations

1. **Algebraic Expression:** An expression that is written using one or more <u>variables</u>.

   Examples:

   $$3x \qquad x-4 \qquad 2a+5 \qquad a+b$$

2. **Coefficient:** The number that is multiplied by the <u>variable</u> in an <u>algebraic expression</u> such as 5b.

   Example:

   Coefficient→**5***b*

3. **Equation:** An algebraic or numerical sentence that shows two quantities are equal.

   Examples:
   $$x+3=4$$
   $$7-2=5$$

4. **Inequality:** A mathematical sentence that shows the relationship between quantities that are not equal, using $<, >, \leq, \geq,$ or $\neq$.

   Examples:
   $$6<9$$
   $$3x \geq 12$$
   $$a \neq b$$

5. **Term:** The parts of an <u>expression</u> that are separated by the + or symbols.

   Example:
   $$2x+6$$
   The terms are $2x$ and 6.

6. **Variable:** A letter used to represent one or more numbers in an <u>expression</u>, <u>equation</u>, or <u>inequality</u>.
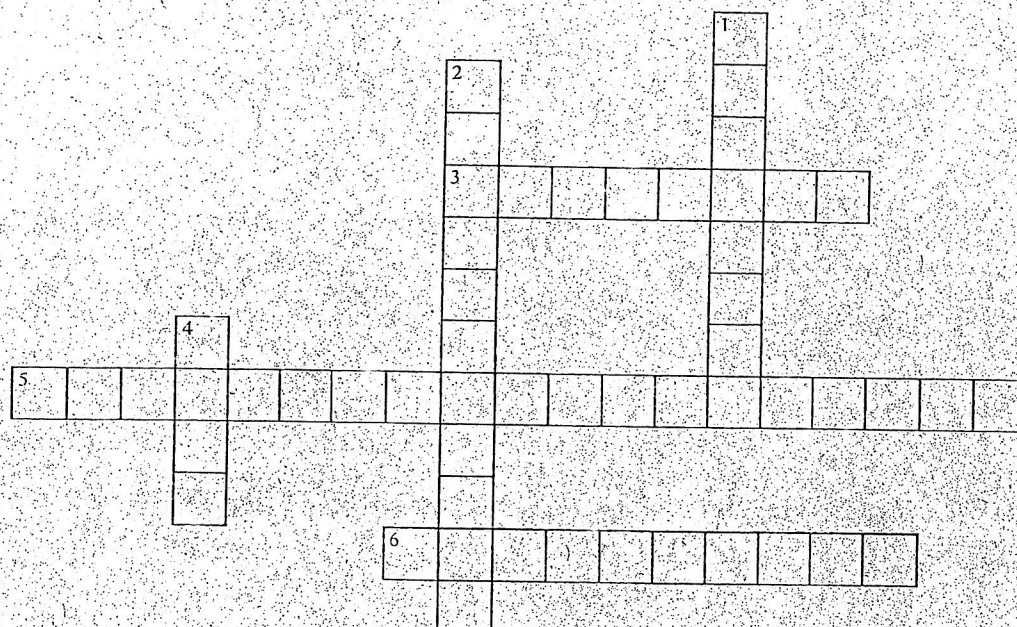
   Examples:
   $$5a; \quad 2x=8; \quad 3y+4 \neq 10$$
   a, x, and y are variables

Vocabulary – Crossword
SOL 6.23 – One Step Linear Equations

ACROSS

3 An algebraic or numerical sentence that shows two quantities are equal.

5 An expression that is written using one or more variables.

6 A mathematical sentence that shows the relationship between quantities that are not equal, using $<, >, \leq, \geq$.

DOWN

1 A letter used to represent one or more numbers in an expression, equation, or inequality.

2 The number that is multiplied by the variable in an algebraic expression such as 5b.

4 The parts of an expression that are separated by the + or - symbols.