

## 2-2

## Adding Integers (Pages 64–68)

You already know that the sum of two positive integers is a positive integer. The rules below will help you find the sign of the sum of two negative integers and the sign of the sum of a positive and a negative integer.

<b>Adding Integers with the Same Sign</b>	To add integers with the same sign, add their absolute values. Give the result the same sign as the integers.
<b>Adding Integers with Different Signs</b>	To add integers with different signs, subtract their absolute values. Give the result the same sign as the integer with the greater absolute value.

**Examples**

a. Solve  $g = -2 + (-10)$ .

Add the absolute values. Give the result the same sign as the integers.

$$g = -(|-2| + |-10|)$$

$$g = -(2 + 10) \text{ or } -12$$

b. Solve  $n = -7 + 2$ .

Subtract the absolute values. The result is negative because  $|-7| > |2|$ .

$$n = -(|-7| - |2|)$$

$$n = -(7 - 2) \text{ or } -5$$

**Practice**

Solve each equation.

1.  $y = 7 + (-14)$

2.  $b = -12 + 4$

3.  $16 + (-4) = z$

4.  $a = 6 + (-15)$

5.  $c = 16 + (-15)$

6.  $-12 + 31 = q$

7.  $-3 + 8 = m$

8.  $-4 + 13 = s$

9.  $t = (-13) + 7$

10.  $-7 + 8 = b$

11.  $d = 10 + (-19)$

12.  $f = -3 + 17$

Write an addition sentence for each situation. Then find the sum.

13. A hot air balloon is 750 feet high. It descends 325 feet.

14. Cameron owes \$800 on his credit card and \$750 on his rent.

Solve each equation.

15.  $y = 4 + (-10) + (-2)$

16.  $-2 + 4 + (-6) = x$

Simplify each expression.

17.  $8x + (-12x)$

18.  $-5m + 9m$

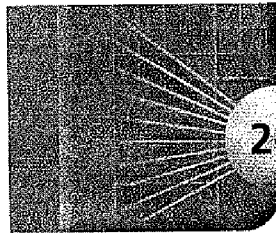
19. **Standardized Test Practice** In the high deserts of New Mexico, the morning temperature averages  $-2^{\circ}\text{C}$  in the spring. During a spring day, the temperature increases by an average of  $27^{\circ}\text{C}$ . What is the average high temperature during the spring?

A  $29^{\circ}\text{C}$

B  $25^{\circ}\text{C}$

C  $-25^{\circ}\text{C}$

D  $-29^{\circ}\text{C}$

**Subtracting Integers** (Pages 70–74)

Adding and subtracting are inverse operations that “undo” each other. Similarly, when you add opposites, like 4 and  $-4$ , they “undo” each other because the sum is zero. An integer and its opposite are called **additive inverses** of each other.

<b>Additive Inverse Property</b>	The sum of an integer and its additive inverse is zero. $5 + (-5) = 0$ or $a + (-a) = 0$
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Use the following rule to subtract integers.

<b>Subtracting Integers</b>	To subtract an integer, add its additive inverse. $3 - 5 = 3 + (-5)$ or $a - b = a + (-b)$
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**Examples**

a. Solve  $s = -4 - 5$ .

$$\begin{aligned} s &= -4 - 5 \\ s &= -4 + (-5) \quad \text{Add the opposite of 5, or } -5. \\ s &= -9 \end{aligned}$$

b. Solve  $w = 12 - (-6)$ .

$$\begin{aligned} w &= 12 - (-6) \\ w &= 12 + 6 \quad \text{Add the opposite of } -6, \text{ or } 6. \\ w &= 18 \end{aligned}$$

**Practice**

Solve each equation.

- |                     |                      |                    |
|---------------------|----------------------|--------------------|
| 1. $x = -3 - 4$     | 2. $a = -7 - 6$      | 3. $-18 - 4 = k$   |
| 4. $-24 - 7 = b$    | 5. $-5 - 12 = c$     | 6. $-18 - 7 = m$   |
| 7. $j = 32 - 8$     | 8. $r = 8 - (-4)$    | 9. $22 - (-3) = z$ |
| 10. $-9 - (-6) = d$ | 11. $-17 - (-6) = g$ | 12. $h = 4 - 10$   |

Evaluate each expression.

- |                              |                            |
|------------------------------|----------------------------|
| 13. $n - (-11)$ , if $n = 4$ | 14. $18 - k$ , if $k = 5$  |
| 15. $9 - (-g)$ , if $g = 9$  | 16. $-11 - k$ , if $k = 5$ |

Simplify each expression.

- |               |                |                |                    |
|---------------|----------------|----------------|--------------------|
| 17. $-x - 7x$ | 18. $8m - 18m$ | 19. $-2a - 7a$ | 20. $9xy - (-8xy)$ |
|---------------|----------------|----------------|--------------------|
21. Is the statement  $n = -(-n)$  true or false?

22. **Standardized Test Practice** The elevation of Death Valley, California, is 282 feet below sea level, or  $-282$  feet. To travel from Death Valley to Beatty, Nevada, you must travel over a mountain pass, Daylight Pass, that has an elevation of 4317 feet above sea level. What is the change in elevation from Death Valley to Daylight Pass?

- A 4599 ft      B 4035 ft      C  $-4035$  ft      D  $-4599$  ft

## 2-4

**Multiplying Integers** (Pages 75–79)

Use the following rules for multiplying integers.

<b>Multiplying Integers with Different Signs</b>	The product of two integers with different signs is negative.
<b>Multiplying Integers with the Same Signs</b>	The product of two integers with the same sign is positive.

**Examples** Find the products.

a.  $13 \cdot (-12)$

The two integers have different signs. Their product is negative.

$$13 \cdot (-12) = -156$$

b.  $(-15)(-8)$

The two integers have the same sign. Their product is positive.

$$(-15)(-8) = 120$$

**Try These Together**

Solve each equation.

1.  $y = 8(-12)$

2.  $s = -6(9)$

3.  $z = (15)(2)$

*HINT: Remember, if the factors have the same sign, the product is positive. If the factors have different signs, the product is negative.*

**Practice**

Solve each equation.

4.  $-4 \cdot 3 = z$

5.  $c = 7(-5)$

6.  $d = (-10)(2)$

7.  $b = (4)(7)$

8.  $t = -6(-2)$

9.  $f = (13)(-2)$

10.  $g = -10(2)(-3)$

11.  $-6(-7)(-2) = a$

12.  $14(4)(-1) = h$

Evaluate each expression.

13.  $4y$ , if  $y = -7$

14.  $gh$ , if  $g = 7$  and  $h = -3$

15.  $6t$ , if  $t = 8$

16.  $-8d$ , if  $d = -4$

17.  $9xy$ , if  $x = 2$  and  $y = -1$

18.  $-3x$ , if  $x = -13$

Find each product.

19.  $7(6x)$

20.  $-3gh(-2)$

21.  $-14(3d)$

22.  $-8x(-2y)$

23.  $5n(-7)$

24.  $-7(7)(-n)$

25. **Standardized Test Practice** The price of a share of stock changed by  $-\$3$  each day for 5 days. What was the overall change in the price of a share of the stock for the 5-day period?

A \$15

B \$8

C  $-\$8$

D  $-\$15$

**Dividing Integers** (Pages 80–84)

The rules for dividing integers are similar to the rules for multiplying integers.

<b>Dividing Integers with Different Signs</b>	The quotient of two integers with different signs is negative.
<b>Dividing Integers with the Same Signs</b>	The quotient of two integers with the same sign is positive.

**Examples** Divide.

a.  $72 \div (-24)$

The two integers have different signs.

Their quotient is negative.

$$72 \div (-24) = -3$$

b.  $(-65) \div (-5)$

The two integers have the same sign.

Their quotient is positive.

$$(-65) \div (-5) = 13$$

**Practice****Divide.**

1.  $-48 \div 6$

2.  $\frac{35}{-7}$

3.  $-42 \div -6$

4.  $-81 \div 9$

5.  $-126 \div (-6)$

6.  $36 \div (-3)$

7.  $63 \div 9$

8.  $-72 \div -9$

9. Divide  $-48$  by  $8$ .

10. Find the quotient of  $110$  and  $-11$ .

**Solve each equation.**

11.  $t = 72 \div -6$

12.  $-84 \div 6 = p$

13.  $-40 \div (-8) = f$

14.  $u = -36 \div (-4)$

15.  $128 \div 16 = a$

16.  $s = -51 \div (-17)$

**Evaluate each expression.**

17.  $a \div 11$  if  $a = -143$

18.  $-54 \div (-c)$  if  $c = 9$

19.  $h \div 12$  if  $h = 84$

20.  $n \div (-12)$  if  $n = -168$

21.  $-80 \div k$  if  $k = 5$

22.  $h \div 7$  if  $h = 91$

23. **Weather** The temperature change at a weather station was  $-28^\circ\text{F}$  in just a few hours. The average hourly change was  $-4^\circ\text{F}$ . Over how many hours did the temperature drop occur?

24. **Standardized Test Practice** Eduardo used money from his savings account to pay back a loan. The change in his balance was  $-\$144$  over the period of the loan. What was the monthly change in his balance if he paid back the loan in 3 equal monthly payments?

A  $-\$432$

B  $-\$48$

C  $\$48$

D  $\$432$

# 3-5 Solving Two-Step Equations (Pages 120–124)

To solve an equation with more than one operation, use the work backward strategy and undo each operation. This means you will follow the order of operations in *reverse* order.

**Examples** Solve each equation. Check your solution.

a.  $4a + 12 = 40$

$4a + 12 - 12 = 40 - 12$  Subtract to undo the addition.

$\frac{4a}{4} = \frac{28}{4}$  Divide to undo the multiplication.

$a = 7$

Does  $4(7) + 12 = 40$ ?

$28 + 12 = 40$

$40 = 40$

True

The solution is 7.

b.  $\frac{g}{5} - 8 = 7$

$\frac{g}{5} - 8 + 8 = 7 + 8$  Add to undo the subtraction.

$\frac{g}{5} = 15$

$\frac{g}{5} \cdot 5 = 15 \cdot 5$  Multiply to undo the division.

$g = 75$

Does  $\frac{75}{5} - 8 = 7$ ?

$15 - 8 = 7$  Do the division first.

$7 = 7$  True

The solution is 75.

## Try These Together

Solve each equation. Check your solution.

1.  $55 = 4x + 5$

2.  $3y - 6 = 3$

3.  $4 - 4b = -8$

HINT: Work backward to undo each operation until the variable is alone on one side of the equation.

## Practice

Solve each equation. Check your solution.

4.  $-5 - 2t = 15$

5.  $-4y + 2 = 7$

6.  $1.5 = 0.3 + 4y$

7.  $14 = 3 + \frac{a}{2}$

8.  $-\frac{3x}{7} = 21$

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

10.  $\frac{q - 15}{5} = 4$

11.  $\frac{6 - x}{4} = -6$

12.  $8 = \frac{n + 5}{6}$

13.  $\frac{b}{-3} - 8 = -12$

14.  $\frac{5 + x}{-12} = -4$

15.  $\frac{-x - (-3)}{7} = 15$

16. **Consumerism** Carlos bought 5 boxes of floppy disks for his computer. He also bought a paper punch. The paper punch cost \$12. The boxes of floppy disks were all the same price. If the total cost before tax was \$27, how much did each box of floppy disks cost?

17. **Standardized Test Practice** Solve the equation  $\frac{-4 - 2x}{9} = 12$ .

A -56

B 56

C 112

D 108

## 3-7

## Using Formulas (Pages 131–136)

Formulas can help you solve many different types of problems. A **formula** shows the relationship among certain quantities. For example, to find the number of miles per gallon that a car gets, you can use the following formula: miles driven ( $m$ ) divided by gallons of gas used ( $g$ ) equals miles per gallon (mpg), or  $m \div g = \text{mpg}$ .

**Example**

Fred bought a sport utility vehicle (SUV), but now he is concerned about the amount of gas it is using. If Fred needs to refill the 25-gallon tank after driving 350 miles, what gas mileage is his SUV getting?

$$m \div g = \text{mpg} \quad \text{Use the formula.}$$

$$350 \div 25 = \text{mpg} \quad \text{Replace } m \text{ with } 350 \text{ and } g \text{ with } 25.$$

$$350 \div 25 = 14 \text{ mpg} \quad \text{Fred's SUV only gets 14 miles per gallon.}$$

**Practice**

Solve by replacing the variables in each formula with the given values.

- $A = \ell w$ , if  $\ell = 12$  and  $w = 9$
- $S = (n - 2)180$ , if  $n = 4$
- $I = \frac{1}{20}pt$ , if  $p = 500$  and  $t = 2$
- $A = \frac{bh}{2}$ , if  $b = 7$  and  $h = 10$
- $d = 50t$ , if  $d = 350$
- $P = 2\ell + 2w$ , if  $P = 40$  and  $\ell = 6$
- $C = \frac{5}{9}(F - 32)$ , if  $F = 32$
- $S = \frac{n(n + 1)}{2}$ , if  $n = 12$
- Physics** The density  $d$  of a substance is given by the formula  $d = \frac{m}{v}$ , where  $m$  is the mass of a sample of the substance and  $v$  is the volume of the sample. Solve  $d = \frac{m}{v}$  if  $m = 14$  and  $v = 2$ .
- Food** The formula for the circumference of a circle is  $C = 2\pi r$ , where  $r$  is the radius of the circle and  $\pi$  is a constant that is about 3.14. If a pizza has a radius of 8 inches, what is the circumference of the pizza? Round your answer to the nearest inch.
- Standardized Test Practice** A train leaves Station A at 11:12 A.M. and arrives at Station B at 2:42 P.M. The train travels at a speed of 80 miles per hour. How many miles does the train travel?  
**A** 216 mi      **B** 280 mi      **C** 200 mi      **D** 680 mi

**5-1**

**Writing Fractions as Decimals** (Pages 200–204)

To change a fraction to an **equivalent decimal**, divide the numerator by the denominator. If the division comes to an end (that is, gives a remainder of zero), the decimal is a *terminating* decimal. If the division never ends (that is, never gives a zero remainder), the decimal is a *repeating* decimal. For example,  $\frac{1}{8}$  gives the terminating decimal 0.125, and  $\frac{5}{6}$  gives the repeating decimal 0.8333..., which is written  $0.8\bar{3}$ . The bar over the 3 indicates that the 3 repeats forever. You can use a calculator to change a fraction to a decimal.

**Examples**

**a. Write  $2\frac{2}{5}$  as a decimal.**

*Method 1: Use paper and pencil.*

$$2\frac{2}{5} = 2 + \frac{2}{5} \qquad \begin{array}{r} .4 \\ 5 \overline{)2.0} \\ \underline{-20} \\ 0 \end{array}$$

So  $2 + 0.4 = 2.4$ .

*Method 2: Use a calculator.*

Enter  $2 \text{ [ + ] } 2 \text{ [ ÷ ] } 5 \text{ [ = ]}$ . Result: 2.4.

Make sure your calculator follows the order of operations.

**b. Replace  $\odot$  with  $<$ ,  $>$ , or  $=$ :  $\frac{2}{3} \odot \frac{3}{4}$ .**

*Method 1: Rewrite as decimals.*

$$\frac{2}{3} = 0.\bar{6} \qquad \frac{3}{4} = 0.75$$

$$0.6 < 0.75$$

*Method 2: Write equivalent fractions with like denominators.*

The LCM is 12.

$$\frac{2}{3} = \frac{8}{12} \text{ and } \frac{3}{4} = \frac{9}{12}$$

$$\frac{8}{12} < \frac{9}{12}, \text{ so } \frac{2}{3} < \frac{3}{4}.$$

**Try These Together**

Write each fraction as a decimal. Use a bar to show a repeating decimal.

1.  $\frac{4}{10}$

2.  $\frac{7}{9}$

3.  $-\frac{1}{2}$

4.  $5\frac{7}{16}$

**Practice**

Write each fraction as a decimal. Use a bar to show a repeating decimal.

5.  $-\frac{3}{4}$

6.  $4\frac{16}{20}$

7.  $\frac{3}{9}$

8.  $\frac{18}{25}$

Replace each  $\odot$  with  $>$ ,  $<$ , or  $=$  to make a true sentence.

9.  $\frac{7}{8} \odot \frac{5}{9}$

10.  $-2\frac{2}{5} \odot -2\frac{1}{4}$

11.  $\frac{7}{12} \odot \frac{21}{36}$

12. **Standardized Test Practice** An airplane flies at about 600 miles per hour. At some point during its landing, it drops to about  $\frac{2}{9}$  of this speed.

Write this fraction as a decimal.

A 0.60

B 0.50

C 0.40

D  $0.\bar{2}$

## 5-3

## Multiplying Rational Numbers (Pages 210–214)

## Multiplying Fractions

To multiply fractions, multiply the numerators and multiply the denominators.

For fractions  $\frac{a}{b}$  and  $\frac{c}{d}$ , where  $b \neq 0$  and  $d \neq 0$ ,  $\frac{a}{b} \cdot \frac{c}{d} = \frac{ac}{bd}$ .

If fractions have common factors in the numerators and denominators, you can simplify before you multiply.

## Examples

a. Solve  $x = \frac{1}{5} \cdot \frac{2}{3}$ .

$$x = \frac{1}{5} \cdot \frac{2}{3}$$

$$= \frac{1 \cdot 2}{5 \cdot 3} \text{ or } \frac{2}{15}$$

b. Solve  $y = \frac{3}{4} \cdot \frac{2}{5}$ .

$$y = \frac{3}{4} \cdot \frac{2}{5}$$

$$= \frac{3 \cdot 2^1}{2^2 \cdot 5} \text{ The GCF of 2 and 4 is 2. Divide 2 and 4 by 2.}$$

$$= \frac{3 \cdot 1}{2 \cdot 5} \text{ or } \frac{3}{10}$$

## Try These Together

Solve each equation. Write the solution in simplest form.

1.  $t = \frac{2}{3} \cdot \frac{1}{4}$

2.  $\left(\frac{3}{5}\right)\left(\frac{1}{2}\right) = g$

3.  $c = \left(\frac{3}{5}\right)\left(-\frac{1}{4}\right)$

## Practice

Solve each equation. Write the solution in simplest form.

4.  $\left(-\frac{9}{10}\right)(-3) = h$

5.  $-\frac{1}{2} \cdot \left(\frac{3}{4}\right) = d$

6.  $m = 18\left(-\frac{2}{3}\right)$

7.  $5\left(-\frac{12}{15}\right) = a$

8.  $n = \left(-\frac{5}{3}\right)\left(\frac{4}{2}\right)$

9.  $\left(-\frac{11}{20}\right) \cdot 4 = k$

10.  $p = 3\left(-\frac{3}{3}\right)$

11.  $\left(-\frac{15}{21}\right)\left(-\frac{3}{5}\right) = w$

12.  $r = \left(-\frac{6}{18}\right)\left(\frac{9}{12}\right)$

13. What is the product of  $\frac{12}{20}$  and  $\frac{2}{3}$ ?

14. What is  $\frac{5}{8}$  of 42?

15. **Standardized Test Practice** Jemeal has \$75 to go shopping. She spends  $\frac{1}{3}$

of her money on CDs and  $\frac{1}{8}$  on food at the food court. About how much money does she have left?

A \$54

B \$41

C \$33

D \$24

## 5-4

## Dividing Rational Numbers (Pages 215–219)

Two numbers whose product is 1 are **multiplicative inverses**, or **reciprocals** of each other. For example, 2 and  $\frac{1}{2}$  are reciprocals of each other since  $2 \times \frac{1}{2} = 1$ .

<b>Inverse Property of Multiplication</b>	For every nonzero number $\frac{a}{b}$ where $a, b \neq 0$ , there is exactly one number $\frac{b}{a}$ such that $\frac{a}{b} \cdot \frac{b}{a} = 1$ .
<b>Division with Fractions</b>	To divide by a fraction, multiply by its multiplicative inverse. For fractions $\frac{a}{b}$ and $\frac{c}{d}$ , where $b, c$ , and $d \neq 0$ , $\frac{a}{b} \div \frac{c}{d} = \frac{a}{b} \cdot \frac{d}{c}$ .

**Examples**

a. Solve  $d = \frac{1}{2} \div \frac{7}{8}$ .

$$\begin{aligned} d &= \frac{1}{2} \div \frac{7}{8} \\ &= \frac{1}{2} \cdot \frac{8}{7} \quad \frac{8}{7} \text{ is the multiplicative inverse of } \frac{7}{8}. \\ &= \frac{1 \cdot 8^1}{2 \cdot 7} \text{ or } \frac{4}{7} \end{aligned}$$

b. Solve  $g = \frac{5}{6} \div 1\frac{1}{2}$ .

$$\begin{aligned} g &= \frac{5}{6} \div 1\frac{1}{2} \\ &= \frac{5}{6} \div \frac{3}{2} \quad \text{Rename } 1\frac{1}{2} \text{ as } \frac{3}{2}. \\ &= \frac{5}{6} \cdot \frac{2}{3} \quad \frac{2}{3} \text{ is the multiplicative inverse of } \frac{3}{2}. \\ &= \frac{5 \cdot 2^1}{3 \cdot 6 \cdot 3} \text{ or } \frac{5}{9} \end{aligned}$$

**Practice**

Estimate the solution to each equation. Then solve. Write the solution in simplest form.

1.  $p = \frac{6}{10} \div \left(-\frac{5}{8}\right)$

2.  $-\frac{19}{21} \div \left(-\frac{3}{7}\right) = w$

3.  $r = -\frac{4}{8} \div \frac{9}{16}$

4.  $k = -\frac{5}{6} \div \frac{3}{4}$

5.  $s = -\frac{8}{9} \div \left(-\frac{8}{18}\right)$

6.  $7 \div \left(-\frac{8}{10}\right) = b$

7. Evaluate  $b - c \div d$  if  $b = 1\frac{4}{5}$ ,  $c = 1\frac{1}{3}$ , and  $d = \frac{5}{8}$ .

8. **Pets** Students at Midtown Middle School decided to make and donate dog leashes to the local animal shelter. They had 150 meters of leash rope. Each leash was to be  $1\frac{2}{3}$  meters long. How many leashes can the students make?

9. **Standardized Test Practice** Solve  $q = \frac{5}{6} \div 1\frac{2}{3}$ . Write the solution in simplest form.

A  $\frac{1}{2}$

B  $\frac{18}{25}$

C  $1\frac{7}{18}$

D 2

**5-7**

# Adding and Subtracting Unlike Fractions

(Pages 232–236)

You can add or subtract fractions with unlike denominators by renaming them with a common denominator. One way to rename unlike fractions is to use the LCD (least common denominator).

**Examples**

a. Solve  $a = 2\frac{3}{4} + 5\frac{2}{3}$ .

$a = 2\frac{3}{4} \cdot \frac{3}{3} + 5\frac{2}{3} \cdot \frac{4}{4}$       The LCD is  $2 \cdot 2 \cdot 3$  or 12.

$a = 2\frac{9}{12} + 5\frac{8}{12}$       Rename each fraction with the LCD.

$a = 7\frac{17}{12}$       Add the whole numbers and then the like fractions.

$a = 7 + 1\frac{5}{12}$  or  $8\frac{5}{12}$       Rename  $\frac{17}{12}$  as  $1\frac{5}{12}$ .

b. Solve  $x = 8\frac{2}{5} - 2\frac{9}{10}$ .

$x = 8\frac{4}{10} - 2\frac{9}{10}$       The LCD is 10. Rename the fractions.

$x = 7\frac{14}{10} - 2\frac{9}{10}$       Rename  $8\frac{4}{10}$  as  $7 + 1\frac{4}{10}$  or  $7\frac{14}{10}$ .

$x = 5\frac{5}{10}$  or  $5\frac{1}{2}$       Subtract and simplify.

**Try These Together**

1. Solve  $a = \frac{2}{3} + \frac{1}{12}$ . Write the solution in simplest form.

*HINT: The LCD of 3 and 12 is 12.*

2. Solve  $x = \frac{5}{8} - \frac{1}{3}$ . Write the solution in simplest form.

*HINT: The LCD of 8 and 3 is 24.*

**Practice**

Solve each equation. Write the solution in simplest form.

3.  $y = \frac{13}{21} - \frac{1}{3}$

4.  $\frac{3}{20} - \frac{1}{2} = n$

5.  $c = \frac{11}{15} + \frac{2}{5}$

6.  $1\frac{1}{6} - \frac{1}{2} = p$

7.  $g = 3\frac{4}{5} + 1\frac{1}{10}$

8.  $8\frac{2}{9} - \frac{1}{3} = d$

9.  $m = \frac{1}{2} + \frac{3}{5}$

10.  $\frac{2}{3} - \frac{1}{2} = q$

11.  $t = \frac{5}{6} - \frac{3}{10}$

12.  $1\frac{1}{2} + 2\frac{1}{6} = j$

13.  $3\frac{2}{5} - 2\frac{1}{6} = w$

14.  $h = \frac{3}{50} + \frac{2}{25}$

Evaluate each expression if  $x = \frac{1}{2}$ ,  $y = -\frac{2}{3}$ , and  $z = \frac{3}{4}$ . Write in simplest form.

15.  $z - x$

16.  $x + y + z$

17.  $x - y - z$

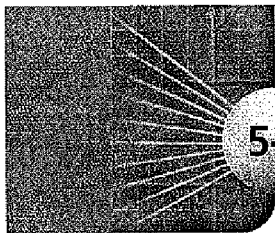
18. **Standardized Test Practice** Simplify the expression  $\frac{3}{8} + \frac{1}{2} + \frac{1}{2}$ .

A  $1\frac{5}{8}$

B  $1\frac{3}{8}$

C  $\frac{9}{8}$

D  $\frac{7}{8}$



5-9

# Solving Equations with Rational Numbers

(Pages 244–248)

You can solve rational number equations using the same skills you used to solve equations involving integers.

<p><b>Solving Equations</b></p>	<ul style="list-style-type: none"> <li>• Solving an equation means getting the variable alone on one side of the equation to find its value.</li> <li>• To get the variable alone, you use inverse operations to undo what has been done to the variable.</li> <li>• Addition and subtraction are inverse operations.</li> <li>• Multiplication and division are inverse operations.</li> <li>• Whatever you do to one side of the equation, you must also do to the other side to maintain the equality.</li> </ul>
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**Examples**

a. Solve  $x + 5.7 = 2.5$ .

$$x + 5.7 = 2.5$$

$$x + 5.7 - 5.7 = 2.5 - 5.7 \quad \text{Subtract 5.7 from each side.}$$

$$x = -3.2 \quad \text{Simplify.}$$

b. Solve  $\frac{2}{3}y = \frac{5}{6}$ .

$$\frac{2}{3}y = \frac{5}{6}$$

$$\frac{3}{2}\left(\frac{2}{3}y\right) = \frac{3}{2}\left(\frac{5}{6}\right) \quad \text{Multiply each side by } \frac{3}{2}.$$

$$y = \frac{5}{4} \text{ or } 1\frac{1}{4} \quad \text{Simplify.}$$

**Try These Together**

1. Solve  $\frac{3}{5} = a - \frac{1}{8}$ .

*HINT: Add  $\frac{1}{8}$  to each side.*

2. Solve  $1.4n = 4.2$ .

*HINT: Divide each side by 1.4.*

**Practice**

Solve each equation. Check your solution.

3.  $p - 3.7 = -2.4$

4.  $b - (-60.25) = 121.6$

5.  $-8.8 + q = 14.3$

6.  $w + \frac{1}{2} = \frac{7}{8}$

7.  $j - \left(-\frac{1}{9}\right) = \frac{1}{6}$

8.  $y - 1\frac{2}{5} = 2\frac{4}{5}$

9.  $-5y = 8.5$

10.  $-2.7t = -21.6$

11.  $4.2d = -10.5$

12.  $9z = \frac{3}{4}$

13.  $\frac{m}{5} = -\frac{1}{10}$

14.  $-\frac{5}{6}a = 20$

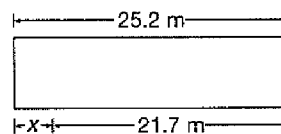
15. **Standardized Test Practice** Solve for the measure of  $x$ .

A 4.5 m

B 4.4 m

C 3.5 m

D 3.4 m



## 7-1

# Solving Equations with Variables on Each Side

(Pages 330–333)

Sometimes we encounter equations that have a variable on both sides of the equal sign. If this situation occurs, then use the Addition or Subtraction Property of Equality to rewrite the equation with a variable on only one side. Once the equation is written with one variable, it can be solved using inverse operations.

### Examples

a. Solve  $4x + 1 = 2x + 5$ .

$$\begin{aligned}
 4x + 1 - 2x &= 2x + 5 - 2x && \text{Subtraction Property} \\
 2x + 1 &= 5 && \text{Simplify.} \\
 2x + 1 - 1 &= 5 - 1 && \text{Subtraction Property} \\
 2x &= 4 && \text{Simplify.} \\
 \frac{2x}{2} &= \frac{4}{2} && \text{Division Property} \\
 x &= 2 && \text{Simplify to solve.}
 \end{aligned}$$

b. Solve  $q - 3 = -3q - 43$ .

$$\begin{aligned}
 q - 3 - q &= -3q - 43 - q \\
 -3 &= -4q - 43 \\
 -3 + 43 &= -4q - 43 + 43 \\
 40 &= -4q \\
 \frac{40}{-4} &= \frac{-4q}{-4} \\
 -10 &= q
 \end{aligned}$$

### Practice

Solve each equation.

1.  $5x + 1 = 4x - 1$

2.  $-10b + 5 = 7b + 5$

3.  $r + 15 = 4r - 6$

4.  $10 - 2v = -5v - 50$

5.  $15y + 3 = 18y$

6.  $-2x + 6 = 4x + 9$

Write an equation then solve.

- Four more than  $-3$  times a number is equal to 8 more than  $-4$  times the same number.
- Twice a number decreased by one equals the same number added to two.
- Six plus  $-2$  times a number is the same as 26 plus six times the same number.
- Negative ten times a number minus five equals negative eleven times the same number.

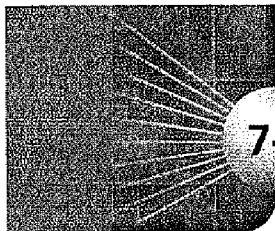
11. **Standardized Test Practice** Solve the equation  $4x + 3 = -2x - 99$  for the variable  $x$ .

A  $-17$

B  $17$

C  $-48$

D  $48$



**7-2**

# Solving Equations with Grouping Symbols

(Pages 334–338)

Some equations have the variable on each side of the equals sign. Use the properties of equality to eliminate the variable from one side. Then solve the equation. You may find that some equations have *no solution*. The solution set is the **null** or **empty set**. It is shown by the symbol  $\{ \}$  or  $\emptyset$ .

**Examples** Solve each equation.

**a.**  $12 + 3a = 7a$

$12 + 3a - 3a = 7a - 3a$  Subtract  $3a$  from each side.

$\frac{12}{4} = \frac{4a}{4}$  Divide each side by 4.

$3 = a$  The solution is 3.

**b.**  $4b - 7 = 13 + 4b$

$4b - 4b - 7 = 13 + 4b - 4b$  Subtract  $4b$  from each side.

$-7 = 13$

This sentence is never true, so there is no solution for this equation. The solution set is  $\emptyset$ .

**Try These Together**

Solve each equation.

1.  $5t = 3 + t$

2.  $6g - 4 = g + 1$

3.  $c = 4c + 8$

HINT: Eliminate the variable from one side of the equation then solve.

**Practice**

Solve each equation.

4.  $9h - 3 = h$

5.  $-16d + 4 = d$

6.  $7m = 18m - 2$

7.  $6 + 3(1 + 3a) = 2a$

8.  $n + 8 = -5 + 4n$

9.  $4 - 2(2 + 4x) = x - 3$

10.  $8p - 2p + 3 = 10p - 6$

11.  $15 + 5(w - 2) = 7w + 4$

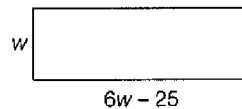
12.  $12r + 34 = -6r - (-9)$

13.  $6k + 3(k + 2) = 5k + 12$

14.  $2s - 4.2 = -8s + 8$

15.  $7x + \frac{1}{-8} = x - \frac{3}{4}$

16. **Geometry** Find the dimensions of the rectangle if the perimeter is 118 feet.



17. **Algebra** Eight times a number plus two is five times the number decreased by three. What is the number?

18. **Standardized Test Practice** Solve the equation  $4k + 2(k + 1) = 3k + 4$ .

A  $\frac{2}{3}$

B 2

C 4

D 6