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Study Guide

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Rational Numbers

The chart below shows the fraction and decimal forms of some rational numbers.

Rational Number	5	$\frac{1}{6}$	$-2\frac{1}{4}$	0.75	$-0.83\overline{3}$
Fraction Form	$\frac{5}{1}$	$\frac{1}{6}$	$-\frac{9}{4}$	$\frac{3}{4}$	$-\frac{5}{6}$
Decimal Form	5.0	$0.16\overline{6}$	-2.25	0.75	$-0.83\overline{3}$

You can compare numbers using a number line or using cross products.

Example: Write <, >, or = in each blank to make a true sentence.

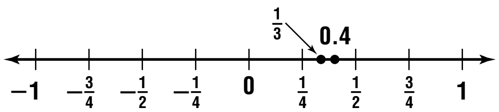
a. $\frac{2}{5}$ ______ $\frac{3}{7}$

$2(7)$ ______ $3(5)$ *Cross multiply.*

$14 < 15$

So $\frac{2}{5} < \frac{3}{7}$.

b. 0.4 ______ $\frac{1}{3}$



Since 0.4 is to the right of $\frac{1}{3}$, $0.4 > \frac{1}{3}$.

Write <, >, or = in each blank to make a true statement.

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

2. $\frac{1}{3}$ ______ $\frac{3}{6}$

3. $\frac{3}{4}$ ______ $\frac{5}{8}$

4. 0.8 ______ $\frac{2}{3}$

5. 1.5 ______ $1\frac{1}{2}$

6. $\frac{2}{3}$ ______ $\frac{2}{5}$

7. $\frac{3}{5}$ ______ $\frac{5}{7}$

8. 0.63 ______ $\frac{2}{3}$

9. $0.\overline{3}$ ______ $\frac{1}{3}$

10. -4 ______ $-\frac{8}{2}$

11. 1.25 ______ $\frac{5}{4}$

12. 0.445 ______ $0.44\overline{4}$

Write the numbers in each set from least to greatest.

13. $\frac{1}{3}, \frac{1}{8}, \frac{1}{2}$

14. $\frac{3}{8}, 0.4, -\frac{2}{5}$

15. $\frac{3}{4}, \frac{1}{5}, 0.8$

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

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Practice

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Rational Numbers

Write <, >, or = in each blank to make a true sentence.

1. 2.5 ______ -2
2. -1 ______ 0.5
3. 0 ______ -1.9
4. -3.6 ______ -3.7
5. $-7(4)$ ______ $-15 + (-13)$
6. $-18 + 3$ ______ $5(0)(-3)$
7. $-5 + 19$ ______ $-2(7)(1)$
8. $6 - 24$ ______ $-3(2)(-4)$
9. $\frac{1}{4}$ ______ $\frac{1}{8}$
10. $-\frac{1}{2}$ ______ $\frac{3}{5}$
11. $\frac{3}{9}$ ______ $\frac{1}{3}$
12. $\frac{2}{5}$ ______ $-\frac{5}{10}$
13. $\frac{3}{8}$ ______ $\frac{2}{6}$
14. $\frac{4}{5}$ ______ $\frac{3}{4}$
15. $-\frac{2}{3}$ ______ $-\frac{4}{6}$
16. $-\frac{1}{5}$ ______ $\frac{2}{10}$

Write the numbers in each set from least to greatest.

17. $\frac{5}{6}, \frac{3}{8}, \frac{1}{3}$
18. $\frac{2}{5}, 0.\overline{3}, \frac{6}{8}$
19. $-\frac{5}{8}, -\frac{3}{4}, -\frac{4}{5}$
20. $-\frac{2}{3}, -\frac{5}{7}, -\frac{3}{5}$
21. $\frac{6}{10}, \frac{3}{4}, \frac{4}{6}$
22. $\frac{4}{10}, \frac{2}{8}, \frac{3}{9}$
23. $-\frac{2}{4}, -\frac{6}{9}, -\frac{7}{8}$
24. $\frac{8}{10}, -\frac{5}{6}, -\frac{6}{8}$

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Enrichment

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Matching Equivalent Fractions

Cut out the pieces below and match the edges so that equivalent fractions meet. The pieces form a rectangle. The outer edges of the rectangle formed will have no fractions on them.

Top $\frac{9}{10}$; Left $\frac{15}{35}$; Right $\frac{5}{9}$; Bottom $\frac{3}{24}$	Top $\frac{1}{7}$; Left $\frac{12}{42}$; Right $\frac{3}{8}$; Bottom $\frac{2}{10}$	Top $\frac{11}{12}$; Left $\frac{16}{28}$; Right $\frac{5}{8}$; Bottom $\frac{45}{50}$	Top $\frac{12}{13}$; Left $\frac{8}{20}$; Right $\frac{4}{7}$; Bottom $\frac{40}{45}$	Top $\frac{8}{9}$; Left $\frac{5}{15}$; Right $\frac{3}{7}$; Bottom $\frac{3}{21}$
Top $\frac{9}{11}$; Left $\frac{15}{21}$; Bottom $\frac{40}{44}$	Top $\frac{3}{10}$; Right $\frac{1}{2}$; Bottom $\frac{52}{56}$	Top $\frac{1}{9}$; Left $\frac{35}{77}$; Right $\frac{7}{13}$	Top $\frac{1}{8}$; Left $\frac{18}{48}$; Right $\frac{4}{9}$; Bottom $\frac{2}{18}$	Left $\frac{8}{10}$; Bottom $\frac{27}{33}$
Top $\frac{1}{12}$; Left $\frac{24}{54}$; Bottom $\frac{2}{20}$	Top $\frac{1}{10}$; Left $\frac{49}{91}$	Left $\frac{6}{8}$; Right $\frac{4}{5}$; Bottom $\frac{21}{33}$	Top $\frac{7}{8}$; Right $\frac{1}{3}$; Bottom $\frac{3}{18}$	Top $\frac{7}{11}$; Left $\frac{9}{15}$; Right $\frac{5}{7}$; Bottom $\frac{44}{48}$
Left $\frac{4}{6}$; Right $\frac{3}{4}$; Bottom $\frac{9}{33}$	Top $\frac{1}{5}$; Left $\frac{14}{56}$; Right $\frac{5}{11}$	Top $\frac{1}{4}$; Right $\frac{2}{8}$	Top $\frac{1}{6}$; Right $\frac{2}{7}$; Bottom $\frac{2}{8}$	Top $\frac{13}{14}$; Right $\frac{2}{5}$; Bottom $\frac{35}{40}$
Right $\frac{2}{3}$; Bottom $\frac{6}{20}$	Top $\frac{6}{7}$; Left $\frac{25}{45}$; Bottom $\frac{3}{36}$		Top $\frac{3}{11}$; Left $\frac{3}{6}$; Right $\frac{3}{5}$; Bottom $\frac{48}{52}$	Top $\frac{10}{11}$; Left $\frac{20}{32}$; Bottom $\frac{30}{35}$

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Study Guide

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Pages 100–103

Adding and Subtracting Rational Numbers

During track practice, Sheila recorded the time it took her to run two consecutive miles. She ran the first mile in 7.26 seconds. She ran the second mile in 7.01 seconds. The net change in times from the first mile to the second mile is $7.01 - 7.26$ or -0.25 seconds. Sheila ran the second mile 0.25 seconds faster.

To add and subtract rational numbers, you use the same rules that you learned for adding and subtracting integers.

Adding Rational Numbers	To add rational numbers with the *same* sign, add their absolute values. Give the result the same sign as the rational numbers. To add rational numbers with *different* signs, subtract their absolute values. Give the result the same sign as the number with the greater absolute value.
Subtracting Rational Numbers	To subtract a rational number, add its opposite.

Examples: Find each sum or difference.

a. $-7.4 + (-10.3)$
$= -(|-7.4| + |-10.3|)$
$= -(7.4 + 10.3)$
$= -17.7$

b. $-5.2 - 9.1$
$= -5.2 + (-9.1)$
$= -14.3$

c. $-8.2 + 5.2 + (-9.1)$
$= [-8.2 + 5.2] + (-9.1)$
$= -3 + (-9.1)$
$= -|3 + 9.1|$
$= -12.1$

Find each sum or difference.

1. $3.1 + 1.2$

2. $-1.4 + 5.6$

3. $4.2 - 1.7$

4. $8.4 + 36.8$

5. $-6.3 + (-0.12)$

6. $13.5 + (-10.2)$

7. $-4.3 - 16.8$

8. $75.25 - 125.55$

9. $18.12 - (-5.66)$

10. $-11.89 + 25.1$

11. $14.6 + 23.4 + (-3.6)$

12. $\frac{1}{2} + \frac{1}{3}$

13. $\frac{2}{3} - \frac{1}{4}$

14. $\frac{3}{8} + \frac{2}{7}$

15. $-\frac{3}{10} + \frac{3}{4}$

Evaluate each expression if $a = \frac{1}{5}$, $b = -2\frac{1}{2}$, $c = -9.5$, and $d = 15.6$.

16. $a + b$

17. $c - d$

18. $d - c$

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Practice

Student Edition
Pages 100–103

Adding and Subtracting Rational Numbers

Find each sum or difference.

1. $6.2 + (-9.4)$

2. $-7.9 + 8.5$

3. $-2.7 - 3.4$

4. $5.6 - 7.1$

5. $-8.3 + (-4.6)$

6. $4.2 - 1.9$

7. $3.7 + (-5.8)$

8. $-1.5 - 2.93$

9. $6.8 + (-4.6) + 5.3$

10. $-4.7 - 8.2 + (-2.5)$

11. $-\frac{1}{4} - \frac{3}{8}$

12. $\frac{1}{3} + \left(-\frac{5}{9}\right)$

13. $-3\frac{3}{8} + \left(-4\frac{1}{2}\right)$

14. $-2\frac{2}{3} + 2\frac{1}{2}$

15. $-7\frac{3}{10} - 2\frac{2}{5}$

16. $5\frac{1}{3} + \left(-3\frac{1}{6}\right)$

17. $2\frac{5}{6} - 6\frac{1}{2}$

18. $-6\frac{1}{5} + 4\frac{7}{10} + \left(-\frac{3}{5}\right)$

19. $3\frac{1}{2} + \left(-5\frac{5}{8}\right) + 3\frac{3}{4}$

20. $2\frac{2}{3} - 9\frac{1}{2} - 8\frac{5}{6}$

21. Evaluate $m + 4\frac{1}{8}$ if $m = -1\frac{3}{4}$.

22. Find the value of k if $k = -7\frac{1}{3} - 1\frac{5}{6} + 4\frac{2}{3}$.

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Enrichment

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Pages 100–103

Rounding Fractions

Rounding fractions is more difficult than rounding whole numbers or decimals. For example, think about how you would round

inches to the nearest quarter-inch. Through estimation, you might realize that $\frac{4}{9}$ is less than $\frac{1}{2}$. But, is it closer to $\frac{1}{2}$ or to $\frac{1}{4}$? Here are two ways to round fractions. Example 1 uses only the fractions; Example 2 uses decimals.

Example 1:

Subtract the fraction twice. Use the two nearest quarters.

$\frac{1}{2} - \frac{4}{9} = \frac{1}{18}$ $\quad$ $\frac{4}{9} - \frac{1}{4} = \frac{7}{36}$

Compare the differences.

$\frac{1}{18} < \frac{7}{36}$

The smaller difference shows you which fraction to round to.

$\frac{4}{9}$ rounds to $\frac{1}{2}$.

Example 2:

Change the fraction and the two nearest quarters to decimals.

$\frac{4}{9} = 0.4\overline{4}$, $\frac{1}{2} = 0.5$, $\frac{1}{4} = 0.25$

Find the decimal halfway between the two nearest quarters.

$\frac{1}{2}(0.5 + 0.25) = 0.375$

If the fraction is greater than the halfway decimal, round up. If not, round down.

$0.4\overline{4} > 0.3675$. So, $\frac{4}{9}$ is more than half way between $\frac{1}{4}$ and $\frac{1}{2}$.

$\frac{4}{9}$ rounds to $\frac{1}{2}$.

Round each fraction to the nearest one-quarter. Use either method.

1. $\frac{1}{3}$ **2.** $\frac{3}{7}$ **3.** $\frac{7}{11}$ **4.** $\frac{4}{15}$

5. $\frac{7}{20}$ **6.** $\frac{31}{50}$ **7.** $\frac{9}{25}$ **8.** $\frac{23}{30}$

Round each decimal or fraction to the nearest one-eighth.

9. 0.6 **10.** 0.1 **11.** 0.45 **12.** 0.85

13. $\frac{5}{7}$ **14.** $\frac{3}{20}$ **15.** $\frac{23}{25}$ **16.** $\frac{5}{9}$

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Study Guide

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Pages 104–109

Mean, Median, Mode, and Range

For his Social Studies class, Carlos surveyed five gas stations and recorded these prices for 1 gallon of gasoline.

\$1.32 \$1.28 \$1.43 \$1.32 \$1.30

The mean, the median, the mode, and the range of these prices can all be used to describe the prices.

mean	The mean, or *average*, of a set of data is the sum of the data divided by the number of pieces of data.
median	The median of a set of data is the middle number when the data in the set are arranged in numerical order. If there are two middle numbers, the median is the mean of those two numbers.
mode	The mode of a set of data is the number that occurs most often in the set. A set can have no mode or more than one mode.
range	The range of a set of data is the difference between the greatest and the least values of the set.

Example: Find the mean, the median, the mode, and the range of the gasoline prices that Carlos recorded.

Find the mean of the data.

$$\frac{1.32 + 1.28 + 1.43 + 1.32 + 1.30}{5} = 1.33$$

The mean is \$1.33.

Find the median of the data.
First arrange the data in order.
Then identify the middle number.
1.28, 1.30, **1.32**, 1.32, 1.43
The median is \$1.32.

Find the mode of the data.
Since \$1.32 occurs most often, \$1.32 is the mode.

Find the range of the data.
Subtract the greatest and least values.
$\$1.43 - \$1.28 = \$0.15$
The range of the data is \$0.15.

Find the mean, median, mode, and range of each set of data.

1. 48, 25, 29, 42, 36, 36

2. 5.1, 2.7, 2.7, 2.7

3. 101, 113, 98

4. 18.2, 20.4, 18.2, 11.6, 20.4

3–3

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Practice

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Pages 104–109

Mean, Median, Mode, and Range

Find the mean, median, mode, and range of each set of data.

1. 33, 41, 17, 25, 62

2. 18, 15, 18, 7, 11, 12

3. 12, 27, 19, 38, 14, 15, 19, 27, 19, 14

4. 7.8, 6.2, 5.4, 5.5, 7.8, 6.1, 5.3

5. 13.5, 11.3, 10.7, 15.5, 11.4, 12.6

6. 0.7, 0.4, 0.4, 0.7, 0.4, 0.7

7. 5, 4.1, 4, 3.3, 2.7, 5.2, 3

8. 6.1, 4, 5.3, 6.7, 4, 5.1, 6.7, 4, 9.8, 6.1

9.

Stem	Leaf
6	2 3 5 7
7	2 7
8	0 1 1

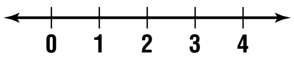
6 | 3 = 63

10.

Stem	Leaf
3	1 1
4	2 5 6
5	3 3 7
6	2 5

5 | 3 = 53

11.

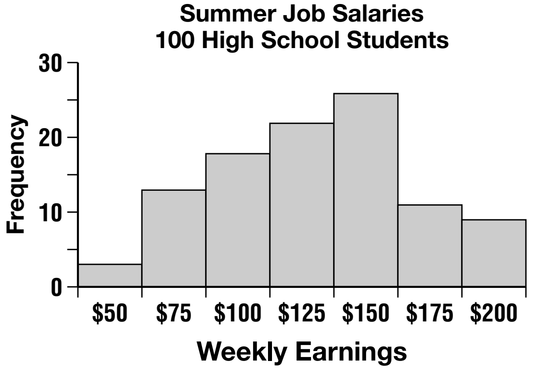


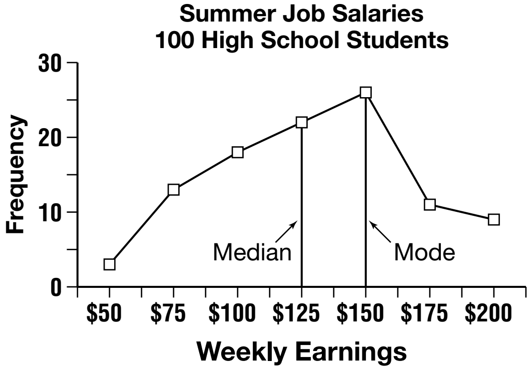
12.

3–3 Enrichment

Frequency Polygons

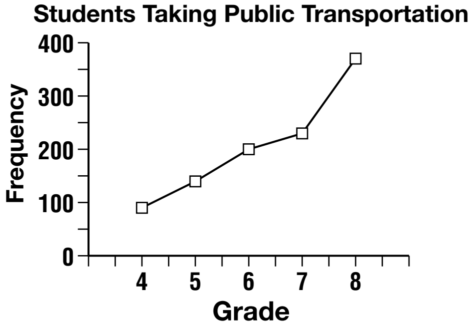
Histigrams are often used to display frequency distributions. A **frequency polygon** can also be used. In the graphs below, a histogram is shown on the left; a frequency polygon on the right. The vertical lines drawn on the frequency polygon show the locations of the median and mode.





Show the median and the mode(s) on each frequency polygon.

1.



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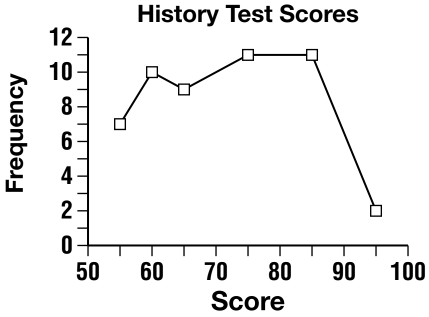

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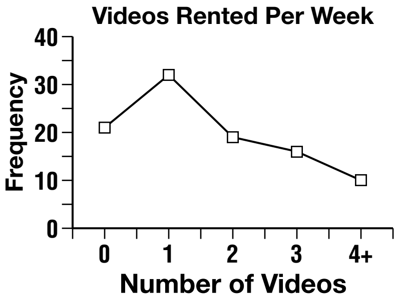

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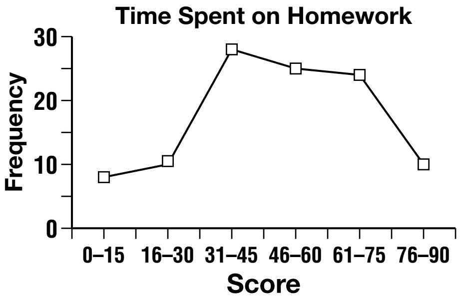

Study Guide

Equations

Jason has won 3 gold medals in swim meets this year. Next Saturday he will swim in 3 events. How many events will he win if he has 5 gold medals at the end of the meet?

Let m = the number of gold medals Jason wins next Saturday. Then the equation $3 + m = 5$ models the number of gold medals Jason will have at the end of the meet. The replacement set for m is {1, 2, 3}. Since 2 is the only number from the replacement set that makes the equation true, 2 is the solution of the equation.

Example 1: Find the solution of $x + 10 = -21$ if the replacement set is $\{-30, -31, -32\}$.

Find the value in the replacement set that makes the equation true.

$x + 10 = -21$	$x + 10 = -21$	$x + 10 = -21$
$-30 + 10 = -21$	$-31 + 10 = -21$	$-32 + 10 = -21$
false	*true*	*false*

Since -31 makes the equation $x + 10 = -21$ true, the solution is -31.

Sometimes you can solve equations by applying the order of operations.

Example 2: Solve each equation.

a. $b = 27 - 2(3)$ *Multiply.*
$b = 27 - 6$ *Subtract.*
$b = 21$
The solution is 21.

b. $\frac{5 + 1}{8(2) - 14} - 8 = h$ *Evaluate the fraction.*
$\frac{6}{2} - 8 = h$ *Divide.*
$3 - 8 = h$ *Subtract.*
$-5 = h$
The solution is -5.

Find the solution of each equation if the replacement sets are x = {1, 2, 3}, y = {−5, −4, −3}, and z = {−2, 0, 2}.

1. $x + 1 = 4$

2. $5 + z = 3$

3. $-6 = -3z$

4. $7y - 2 = -37$

5. $x + 12x = 26$

6. $1 = 7z - (-1)$

7. $\frac{y}{5 - 7} = 2$

8. $\frac{10}{x} + x = 7$

9. $8z + 5 = z - 9$

Solve each equation.

10. $\frac{49}{7} = g$

11. $-6 + 9 = p$

12. $n = 5 - 24 \div 3$

13. $\frac{2 \cdot 4 - 8}{1 - 2} = d$

14. $\frac{8 - 9}{4(5)} = w$

15. $s = \frac{4 + 15 \div 3}{-4(1) + 1}$

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Practice

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Pages 112–116

Equations

Find the solution of each equation if the replacement sets are a = {4, 5, 6}, b = {−2, −1, 0}, and c = {−1, 0, 1, 2}.

1. $8 = a + 3$

2. $b - 3 = -5$

3. $3c = -3$

4. $9 = -a + 13$

5. $5a + 5 = 35$

6. $2c - 4 = 0$

7. $-4b + (-3) = 1$

8. $-9c - 9 = 0$

9. $\frac{8 + 17}{5} = -5c$

10. $\frac{-9 - 23}{4} = 4b$

11. $\frac{11 + 9}{a} + 2 = 7$

12. $\frac{9c}{3} - 5 = -2$

Solve each equation.

13. $q = -9.7 - 0.6$

14. $14 - 1.4 = d$

15. $f = 7 + 6 \cdot 7$

16. $b = -5(3) + 4 - 1$

17. $10 - 8 \cdot 3 \div 3 = w$

18. $z = 6(3 - 6 \div 2)$

19. $-2(-5 + 4 \cdot 3) = h$

20. $g = 3(7) - 9 \div 3$

21. $\frac{6 \cdot 8 - 8}{5} = c$

22. $p = \frac{-18 \div 3 + 2}{16 \div 4}$

23. $\frac{2 \cdot 5 - 8}{9 - 4} = t$

24. $\frac{12 - 3 \cdot 2}{32 \div 4} = m$

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Enrichment

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Solution Sets

Consider the following open sentence.

It is the tallest building in the world.

You know that a replacement for the variable *It* must be found in order to determine if the sentence is true or false. If *It* is replaced by either the Empire State Building or the Sears Tower, the sentence is true.

The set {Empire State Building, Sears Tower} is called the **solution set** of the open sentence given above. This set includes all replacements for the variable that make the sentence true.

Write the solution set of each open sentence.

1. It is the name of a state beginning with the letter A. **1.** ______________

2. It is a primary color. **2.** ______________

3. Its capital is Harrisburg. **3.** ______________

4. It is a New England state. **4.** ______________

5. $x + 4 = 10$ **5.** ______________

6. It is the name of a month that contains the letter *r*. **6.** ______________

7. During the 1970s, she was the wife of a U.S. President. **7.** ______________

8. It is an even number between 1 and 13. **8.** ______________

9. $31 = 72 - k$ **9.** ______________

10. It is the square of 2, 3, or 4. **10.** ______________

Write an open sentence for each solution set.

11. {A, E, I, O, U} **11.** ______________

12. {1, 3, 5, 7, 9} **12.** ______________

13. {June, July, August} **13.** ______________

14. {Atlantic, Pacific, Indian, Arctic} **14.** ______________

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3–5 Study Guide

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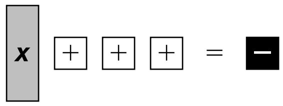
Pages 117–121

Solving Equations by Using Models

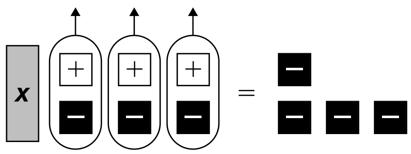
You can use algebra tiles to model and solve equations.

Example: Use algebra tiles to solve $x + 3 = -1$.
Model $x + 3 = -1$ by placing 1 x-tile and 3 one-tiles on one side of the mat to represent $x + 3$. Place 1 negative one-tile on the other side of the mat to represent -1.



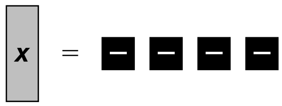
$x + 3 = -1$

To get the x-tile by itself, add 3 negative one-tiles to each side. Then remove the zero pairs.



$x + 3 + (-3) = -1 + (-3)$

The x-tile is matched with 4 negative one-tiles. Therefore, $x = -4$.



$x = -4$

Solve each equation. Use algebra tiles if necessary.

1. $y + 4 = 5$

2. $b - 3 = -2$

3. $6 = 4 + a$

4. $r + (-3) = -5$

5. $1 = h + 6$

6. $8 + m = -6$

7. $n - (-4) = -3$

8. $5 = p - 8$

9. $c + 4 = -2$

10. $-3 = x - 3$

11. $k - 2 = -4$

12. $7 = x - (-3)$

13. Yolanda scored 3 points higher on her math test than she scored on her previous test. If her grade was 83 on this test, what was her score on the previous test?

a. Write an equation that can be used to find Yolanda's score on the previous test.

b. What was Yolanda's score on the previous test?

Practice

Solving Equations by Using Models

Solve each equation. Use algebra tiles if necessary.

1. $-5 = h + (-2)$ **2.** $p + 3 = -1$ **3.** $m - 6 = -8$

4. $7 + c = 4$ **5.** $6 = n - 3$ **6.** $-5 + x = -1$

7. $2 = -8 + w$ **8.** $b + (-5) = -3$ **9.** $z + 4 = 9$

10. $3 + y = -3$ **11.** $a - 4 = 7$ **12.** $-10 + s = -6$

13. $6 + d = -4$ **14.** $f + (-1) = 0$ **15.** $-10 = j - 10$

16. $q + 4 = -5$ **17.** $6 = 12 + t$ **18.** $e - 3 = -2$

19. $u + (-7) = 2$ **20.** $15 + g = 10$ **21.** $-9 + r = -5$

22. $-8 = l - 4$ **23.** $v + (-1) = -2$ **24.** $-3 - i = 2$

25. What is the value of q if $-7 = q + 2$?

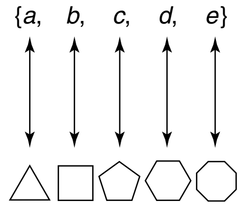
26. What is the value of n if $n - 4 = -2$?

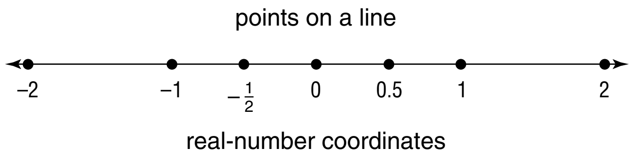
27. If $b + (-3) = -5$, what is the value of b?

Enrichment

Equivalent Sets

Two sets are **equal,** or identical, if they contain exactly the same elements. The order in which we name the elements is unimportant. Thus, $\{a, b, c, d\}$ and $\{c, a, d, b\}$ are equal sets. Two sets are **equivalent** if for every element of one set there is one and only one element in the other set; that is, there exists a one-to-one matching between the elements of the two sets. The one-to-one matchings below show that the sets are equivalent.





Consider these equivalent sets.

Set of whole numbers =
$\{0, 1, 2, 3, 4, 5, \cdots\}$

Set of even whole numbers =
$\{0, 2, 4, 6, 8, 10, \cdots\}$

Are there more whole numbers or more even whole numbers? Or might there be the same number of each, even though we have no counting number to tell how many?

$$\begin{array}{c}\{0, 1, 2, 3, 4, 5, \cdots, n, \cdots\}\\ \updownarrow\ \updownarrow\ \updownarrow\ \updownarrow\ \updownarrow\ \updownarrow\qquad\ \ \updownarrow\\ \{0, 2, 4, 6, 8, 10, \cdots, 2n, \cdots\}\end{array}$$

A one-to-one matching of the whole numbers and the even whole numbers appears at the right. Each whole number n is matched with the even number $2n$, and each even number $2n$ is matched with the whole number n. Therefore, the two sets are equivalent. This means that there are as many even whole numbers as there are whole numbers.

Use a one-to-one matching to show that the two sets are equivalent.

1. {Amy, Betsy, Carol, Dorothy} and {Al, Bob, Carl, David} ______________

2. $\{1, 2, 3, 4, 5, \cdots\}$ and $\{3, 6, 9, 12, 15, \cdots\}$ ______________

3. $\{-1, -2, -3, -4, \cdots\}$ and $\{1, 2, 3, 4, \cdots\}$ ______________

4. $\{1, 2, 3, 4, 5, \cdots\}$ and $\{1, 3, 5, 7, 9, \cdots\}$ ______________

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Study Guide

Student Edition
Pages 122–127

Solving Addition and Subtraction Equations

You can use the addition and subtraction properties of equality to solve equations.

Addition Property of Equality	If you add the same number to each side of an equation, the two sides remain equal. *Example:* If $x = 5$, then $x + 2 = 5 + 2$.
Subtraction Property of Equality	If you subtract the same number from each side of an equation, the two sides remain equal. *Example:* If $x = -1$, then $x - 7 = -1 - 7$.

Example: Solve each equation. Check your solution.

a. $b - 3 = -5$

$$\begin{aligned} b - 3 &= -5 \\ b - 3 + 3 &= -5 + 3 && \textit{Add 3 to each side.} \\ b &= -2 && -3 + 3 = 0 \end{aligned}$$

Check: $b - 3 = -5$

$$\begin{aligned} -2 - 3 &\stackrel{?}{=} -5 && \textit{Replace } b \textit{ with } -2. \\ -5 &= -5 && \checkmark \end{aligned}$$

The solution is -2.

b. $x + 4 = 1$

$$\begin{aligned} x + 4 &= 1 \\ x + 4 - 4 &= 1 - 4 && \textit{Subtract 4 from each side.} \\ x &= -3 && 4 - 4 = 0 \end{aligned}$$

Check: $x + 4 = 1$

$$\begin{aligned} -3 + 4 &\stackrel{?}{=} 1 && \textit{Replace } x \textit{ with } -3. \\ 1 &= 1 && \checkmark \end{aligned}$$

The solution is -3.

Solve each equation. Check your solution.

1. $x + 15 = 18$

2. $n - 6 = -9$

3. $p - (-5) = 1$

4. $27 = k + -10$

5. $d + (-16) = 12$

6. $2 + s = -15$

7. $-7 + w = -2$

8. $38 = 11 + v$

9. $-44 = c - 10$

10. $2.7 = x + 5.8$

11. $y - (-6.1) = 20.5$

12. $-9.9 + a = -25$

13. $m + \frac{2}{3} = -\frac{5}{6}$

14. $-\frac{1}{2} = y - \frac{3}{4}$

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

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Practice

Student Edition
Pages 122–127

Solving Addition and Subtraction Equations

Solve each equation. Check your solution.

1. $b + 8 = -9$

2. $s + (-3) = -5$

3. $-4 + q = -11$

4. $23 = m - 11$

5. $k + (-6) = 2$

6. $x - (-9) = 4$

7. $-16 + z = -8$

8. $-5 + c = -5$

9. $14 = f + (-7)$

10. $x + 12 = -1$

11. $15 - w = -4$

12. $6 = 9 + d$

13. $-31 = 11 + y$

14. $n - (-7) = -1$

15. $a + (-27) = -19$

16. $0 = e - 38$

17. $4.65 + w = 5.95$

18. $g + (-1.54) = 1.07$

19. $u - 9.8 = 0.3$

20. $7.2 = p - (-6.1)$

21. $\frac{7}{8} + t = \frac{1}{4}$

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

23. $q + \left(-\frac{2}{9}\right) = \frac{1}{3}$

24. $\frac{1}{2} + f = -\frac{1}{4}$

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Enrichment

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Pages 122–127

Conditional Statements

If p and q represent statements, the compound statement "if p then q" is called a **conditional**.

symbol: $p \rightarrow q$ read: either "if p then q" or "p only if q"

The statement p is called the **antecedent**, and the statement q is called the **consequent**.

For each conditional statement identify the antecedent (A) and the consequent (C).

1. If it is nine o'clock, then I am late.

A: ______________________

C: ______________________

2. If Karen is home, then we will ask her to come.

A: ______________________

C: ______________________

3. The fish will die if we don't feed them.

A: ______________________

C: ______________________

4. There will be no school if it snows.

A: ______________________

C: ______________________

5. There will be no school only if it snows.

A: ______________________

C: ______________________

6. If $y + 2 = 6$ then $y = 4$.

A: ______________________

C: ______________________

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Study Guide

Student Edition
Pages 128–131

Solving Equations Involving Absolute Value

Some equations involve absolute value.

Example 1: Solve $|x - 5| = 2$. Check your solution.

$|x - 5| = 2$ means $x - 5 = 2$ or $x - 5 = -2$. Solve both equations.

$$x - 5 = 2 \qquad\qquad x - 5 = -2$$
$$x - 5 + 5 = 2 + 5 \qquad \textit{Add 5 to each side.} \qquad x - 5 + 5 = -2 + 5$$
$$x = 7 \qquad\qquad x = 3$$

Check: $|7 - 5| \stackrel{?}{=} 2$; $|2| \stackrel{?}{=} 2$; $2 = 2$ ✓

Check: $|3 - 5| \stackrel{?}{=} 2$; $-2 \stackrel{?}{=} 2$; $2 = 2$ ✓

The solution set is {3, 7}.

Example 2: Solve $3 + |x| = 8$. Check your solution.

$3 - 3 + |x| = 8 - 3$ *Simplify by subtracting 3 from each side.*

$|x| = 5$

$x = -5$ or 5

Check: $3 + |-5| \stackrel{?}{=} 8$; $3 + 5 \stackrel{?}{=} 8$; $8 = 8$ ✓

Check: $3 + |5| \stackrel{?}{=} 8$; $3 + 5 \stackrel{?}{=} 8$; $8 = 8$ ✓

The solution set is {−5, 5}.

Example 3: Solve $|x| - 12 = -16$. Check your solution.

$|x| - 12 + 12 = -16 + 12$ *Simplify by adding 12 to each side.*

$|x| = -4$

This sentence can never be true. The solution is the empty set or ∅.

Solve each equation. Check your solution.

1. $|x| = 7$

2. $|m| = -6$

3. $|x| + 1 = 5$

4. $2 + |z| = 11$

5. $|d - 2| = 10$

6. $|r + 2| = 0$

7. $|p - 1| = 5$

8. $|c + 12| = -12$

9. $|r - (-3)| = 6$

10. Ashley said it was too cold to go snowboarding because the temperature was only 3°F away from 0°F. What are the two possible temperatures?

3–7

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Practice

Student Edition
Pages 128–131

Solving Equations Involving Absolute Value

Solve each equation. Check your solution.

1. $|x| = 7$

2. $|c| = -11$

3. $3 + |a| = 6$

4. $|s| - 4 = 2$

5. $|q| + 5 = 1$

6. $|h - 5| = 8$

7. $|y + 7| = 9$

8. $-2 = |10 + b|$

9. $|p + (-3)| = 12$

10. $|w - 1| = 6$

11. $|4 + r| = -3$

12. $8 = |l - 3|$

13. $|n - 5| = 7$

14. $|-2 + f| = 1$

15. $9 = |e + 8|$

16. $|m - (-3)| = 12$

17. $|k + 2| + 3 = 7$

18. $|g - 5| + 8 = 14$

19. $10 = |4 + v| + 1$

20. $|-6 + p| + 5 = 19$

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Enrichment

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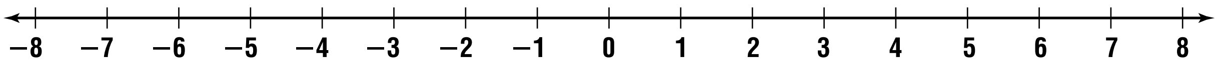
Pages 128–131

Distance on the Number Line

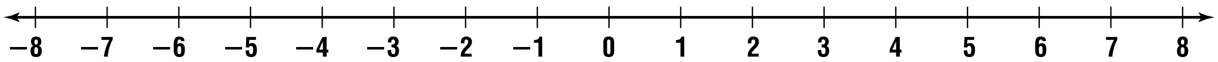
The **absolute value** of the difference between two integers can be interpreted as the distance between two points on a number line. That is, if point A has a as a coordinate and point B has b as a coordinate, then $|a - b|$ is the distance between points A and B.

Graph each pair of points on the number line. Then write an expression using absolute value to find the distance between the points.

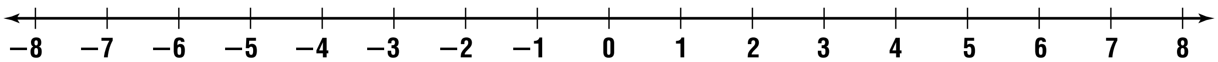
1. H at -4 and G at 2



2. X at -7 and Y at -1

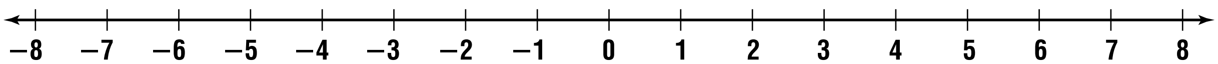


3. A at 5 and B at -5

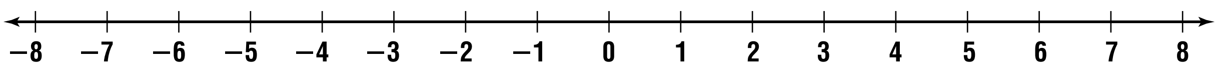


Use the number lines to solve the problems.

4. Graph two points, M and N, that are each 5 units from -2. Make $M > N$.



5. Graph the two solutions to the equation $|y - 2| = 3$. Call the points y_1 and y_2.



3–2

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School-to-Workplace

Student Edition
Pages 100–103

Timing Maneuvers in Space (Space Scientist)

When a space shuttle is launched, attaining the proper Earth orbit depends upon the completion of a series of precisely timed moves, or maneuvers. Times are assigned to these maneuvers relative to lift-off, which is called *T*. Times before lift-off are assigned negative numbers, times after lift-off are positive, and the moment of lift-off itself is zero. For example, the expression *T minus 25 s* refers to twenty-five seconds before lift-off.

Answer each question.

1. Suppose a maneuver begins at *T* minus 30 s and is completed at *T* plus 75 s. What is the duration of this maneuver?

2. A maneuver of duration one and one-half minutes must be completed at *T* plus 55 s. Preparation for this maneuver requires an additional 45 s. At what time must the preparation begin?

3. A maneuver of duration 3 min is scheduled to begin at *T* minus 2 min 45 s. At what time should this maneuver be complete?

4. Suppose a shuttle returns to Earth at *T* plus 3 d (days) 19 h 27 min. At that time, the astronauts have been on board for 4 d 2 h. At what time did the astronauts board the shuttle?

Fill in each blank with the time that will make the statement true.

5. 1 min − __________ = 15 s

6. 3 h − __________ = 6 min

7. 5 min − 45 s − 3 min = ________

8. 35 s + 1 min − 50 s − 2 min = __________

9. __________ − 75 s = − 3 min

10. __________ + 95 min = 1.25 h

11. 1 h − 2 h 35 min = __________

12. 2 h − __________ = 40 min 55 s

