INSTRUCTOR'S SOLUTIONS MANUAL

JAMES LAPP

A PATHWAY TO INTRODUCTORY STATISTICS

SECOND EDITION

Jay Lehmann

College of San Mateo

Pearson

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ISBN-13: 978-0-13-646833-2
ISBN-10: 0-13-646833-0

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Homework 1.1

2. A constant is a symbol that represents a specific number.

4. Data are quantities or categories that describe people, animals, or things.

6. In 2017, about 37% of children aged 6–12 participated in a team sport (organized or unorganized) on a regular basis.

8. The temperature is $-10°\text{F}$. That is, the temperature is 10 degrees below 0 (in Fahrenheit).

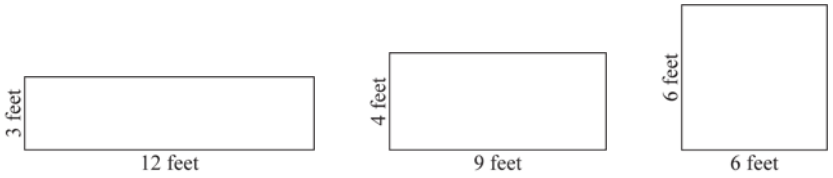
10. The statement $t = -3$ represents the year 2012 (3 years before 2015).

12. Answers may vary. Example: Let s be the annual salary (in thousands of dollars) of a person. Then s can represent the numbers 25 and 32, but s cannot represent the numbers -15 and -9.

14. Answers may vary. Example: Let n be the number of students enrolled in a prestatistics class. Then n can represent the numbers 15 and 28, but n cannot represent the numbers -20 or 0.5.

16. Answers may vary. Example: Let T be the temperature (in degrees Fahrenheit) in an oven. Then T can represent the numbers 300 and 450, but T cannot represent the numbers -300 or -450.

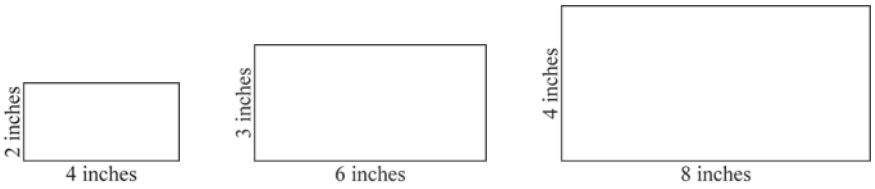
18. a. Answers may vary. Some possible answers are shown below.



b. In the described situation, the symbols W and L are variables. Their values can change.

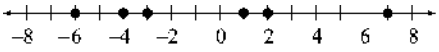
c. In the described situation, the symbol A is a constant. Its value is fixed at 36 square feet.

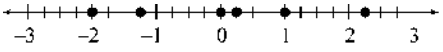
20. a. Answers may vary. Some possible answers are shown below.

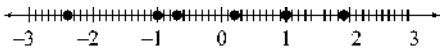


b. In the described situation, the symbols W, L, and A are all variables. All their values can change.

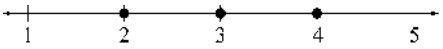
c. In the described situation, none of the symbols are constants. All their values can change.

22. 

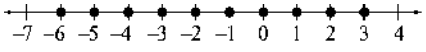
24. 

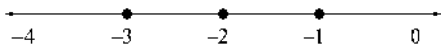
26. 

28. The counting numbers between 1 and 5 are 2, 3, and 4.

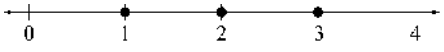


30. The integers between -6 and 3, inclusive, are $-6, -5, -4, -3, -2, -1, 0, 1, 2$, and 3.



32. 

34. The positive integers between -4 and 4 are 1, 2, and 3.



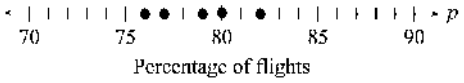
36. Answers may vary. Example: $-2, -5$ and -40.

38. Answers may vary. Example: $-2.1, -2.3$, and -2.8.

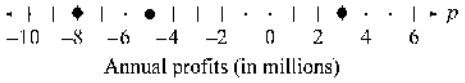
40. The temperature at the top of a skyscraper can be positive or negative, depending on the location of the skyscraper and the time of year. Temperature is not usually reported using fractions. So, among the choices, the integers are the smallest group of number that contains possible data.

42. The commute time of an employee cannot be negative, but it can be measured in fractions. So, among the choices, the nonnegative real numbers are the smallest group of numbers that contains possible data.

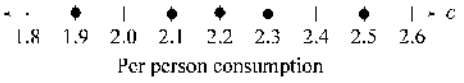
44. McDonald's sells hamburgers every day of every year and there is never just a portion of a hamburger sold. So, among the choices, the counting numbers is the smallest group of numbers that contains possible data.

46. 

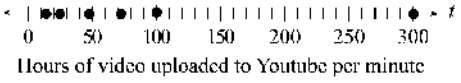
Percentage of flights

50. 

Annual profits (in millions)

48. 

Per person consumption

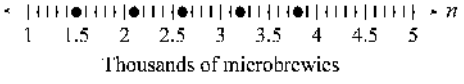
52. a. 

Hours of video uploaded to Youtube per minute

b. The number of hours of video uploaded to YouTube per minute increased between 2009 and 2014. The number of hours of video uploaded to YouTube per minute went up each year.

c. The annual *increases* in the number of hours of video uploaded to YouTube per minute increased between 2009 and 2014. The annual increases are shown below.

Years	Increase
2009 to 2010	$25-14=11$
2010 to 2011	$48-25=23$
2011 to 2012	$73-48=25$
2012 to 2013	$100-73=27$
2013 to 2014	$300-100=200$

54. a. 

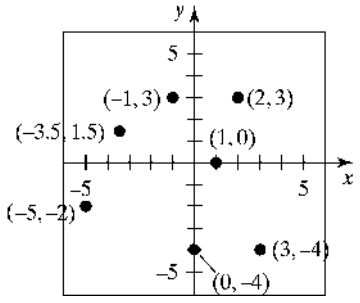
Thousands of microbrewies

b. The number of microbreweries increased from 2013 to 2017.

c. The increases in the number of microbreweries stayed approximately constant from 2013 to 2017. The annual increases are shown below.

Years	Increase
2013 to 2014	$2.1-1.5=0.6$
2014 to 2015	$2.6-2.1=0.5$
2015 to 2016	$3.2-2.6=0.6$
2016 to 2017	$3.8-3.2=0.6$

56. – 68.

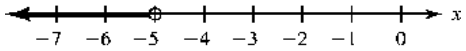


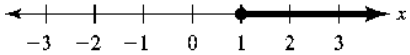
70. The y-coordinate is -4.

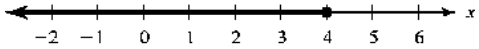
72. Point A is 2 units to the left of the origin and 4 units down. Thus, its coordinates are $(-2,-4)$.
Point B is 3 units to the left of the origin on the x-axis. Thus, its coordinates are $(-3,0)$.
Point C is 5 units to the left of the origin and 4 units up. Thus, its coordinates are $(-5,4)$.
Point D is 4 units to the right of the origin and 2 units up. Thus, its coordinates are $(4,2)$.
Point E is 3 units below the origin on the y-axis. Thus, its coordinates are $(0,-3)$.
Point F is 3 units to the right of the origin and 2 units down. Thus, its coordinates are $(3,-2)$.

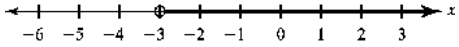
74. True. The number -2 lies to the right of -6 on a number line.

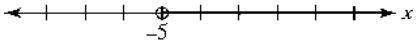
76. False. $-5=-5$, thus -5 is not strictly greater than -5.

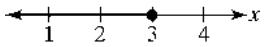
78. 

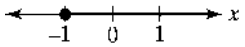
80. 

82. 

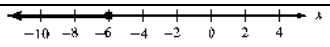
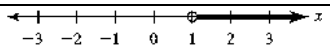
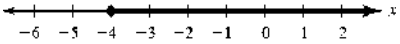
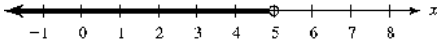
84. 

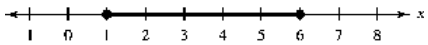
86. Inequality: $x>-5$
Interval notation: $(-5,\infty)$
Graph: 

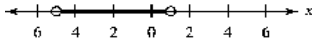
88. Inequality: $x\le 3$
Interval notation: $(-\infty,3]$
Graph: 

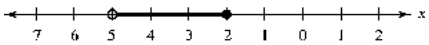
90. Inequality: $x\ge -1$
Interval notation: $[-1,\infty)$
Graph: 

92.

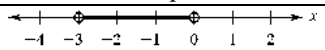
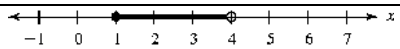
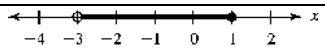
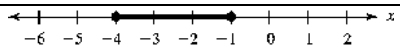
In Words	Inequality	Graph	Interval Notation
numbers less than or equal to -6	$x\le -6$		$(-\infty,-6]$
numbers greater than 1	$x>1$		$(1,\infty)$
numbers greater than or equal to -4	$x\ge -4$		$[-4,\infty)$
numbers less than 5	$x<5$		$(-\infty,5)$

94. 

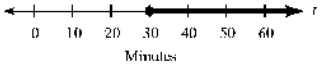
96. 

98. 

100.

In Words	Inequality	Graph	Interval Notation
numbers between -3 and 0	$-3<x<0$		$(-3,0)$
numbers between 1 and 4, as well as 1	$1\le x<4$		$[1,4)$
numbers between -3 and 1, as well as 1	$-3<x\le 1$		$(-3,1]$
numbers between -4 and -1, inclusive	$-4\le x\le -1$		$[-4,-1]$

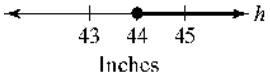
102. The student completes the homework assignment in 30 or more minutes.



104. Inequality: $h \geq 44$

Interval notation: $[44, \infty)$

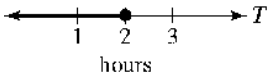
Graph:



106. Inequality: $T \leq 2$

Interval notation: $(-\infty, 2]$

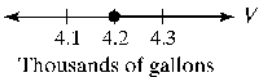
Graph:



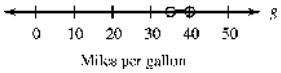
108. Inequality: $V \geq 4.2$

Interval notation: $[4.2, \infty)$

Graph:



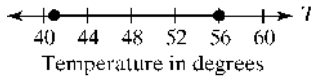
110. The average gas mileage of a car on highways is between 35 and 40 miles per gallon.



112. Inequality: $41 \leq T \leq 56$

Interval notation: $[41, 56]$

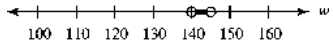
Graph:



114. Inequality: $140 < w < 145$

Interval notation: $(140, 145)$

Graph:



116. No. Answers may vary. Example: The numbers 2 and 5 are not "between 2 and 5." The integers between 2 and 5 are simply 3 and 4.

118. The ordered pairs selected and plotted points may vary. The points will lie on the same horizontal line. Answers may vary.

120. Answers may vary. The inequality represents "4 is less than or equal to 4," and 4 is equal to 4.

122. The types of numbers discussed in this section are real numbers, rational number, irrational numbers, integers, and counting numbers (or natural numbers). Answers may vary.

Homework 1.2

2. We evaluate an expression by substituting a number for each variable in the expression and then calculating the result.

4. The quotient of a and b is a/b, where b is not zero.

6. Substitute 6 for x in $5 + x$: $5 + (6) = 11$

8. Substitute 6 for x in $x - 4$: $(6) - 4 = 2$

10. Substitute 6 for x in $x(9)$: $(6)(9) = 54$

12. Substitute 6 for x in $30 \div x$: $30 \div (6) = 5$

14. Substitute 6 for x in $x - x$: $(6) - (6) = 0$

16. Substitute 6 for x in $x \div x$: $(6) \div (6) = 1$

18. Substitute 47 for r in $r + 29$: $47 + 29 = 76$. So, if 47% of Republicans favor gays to marry legally in 2017, then in that same year, about 76% of Democrats favor gays to marry legally.

20. Substitute 13.5 for U in $U - 6$: $13.5 - 6 = 7.5$. So, in 2016 if the average daily shipping volume for UPS was 13.5 million packages, in that same year, the average daily shipping volume for FedEx was about 7.5 million packages.

22. Substitute 17 for n in $599.99n$: $599.99 \cdot 17 = 10{,}199.83$. So, if 17 thousand Fender Standard Jazz Electric Bass Guitars with maple fingerboards are sold, the total revenue is about $10,200,000.

24. Substitute 328 for T in $T \div 4$: $328 \div 4 = 82$. So, if a student earns a total of 328 points on four tests, the student's average test score is 82 points.

26. a.

Speed Limit (miles per hour)	Driving Speed (miles per hour)
35	$35+5$
40	$40+5$
45	$45+5$
50	$50+5$
s	$s+5$

The expression $s+5$ represents the driving speed if the speed limit is s miles per hour.

b. Substitute 65 for s in $s+5$: $65+5=70$. So, if the speed limit is 65 miles per hour, the person will be driving 70 miles per hour.

28. a.

Number of Shares	Total Value (dollars)
1	$74.74\cdot 1$
2	$74.74\cdot 2$
3	$74.74\cdot 3$
4	$74.74\cdot 4$
n	$74.74n$

The expression $74.74n$ represents the total value of the shares.

b. Substitute 7 for n in $74.74n$: $74.74(7)=523.18$. So, the total value of 7 shares is \$523.18.

30. a.

Number of Siblings	Share of Cost (dollars)
2	$3000\div 2$
3	$3000\div 3$
4	$3000\div 4$
5	$3000\div 5$
n	$3000\div n$

The expression $3000\div n$ represents each sibling's share of the cost in dollars.

b. Substitute 6 for n in $3000\div n$: $3000\div 6=500$. So, the share of each sibling's cost is \$500.

32. a. We can write an expression $10+v$ to represent the total cost of parking and money spent on a vase.

b. Substitute 25 for v in the expression $10+v$: $10+25=35$. So, if \$10 is spent on parking then the total cost of parking and money spent on a vase is \$35.

34. a. We can write an expression $r-2$ to represent the net price of a shaver whose retail price is r dollars.

b. Substitute 6 for r in the expression $r-2$: $6-2=4$. So, if the retail price of a shaver is \$6, then the net price is \$4.

36. a. We can write an expression $105c$ to represent the total cost of tuition when enrolling in c credits of classes.

b. Substitute 15 for c in the expression $105c$: $105\cdot 15=1575$. So, if a student enrolls in 15 credits of classes, then the total cost of tuition is \$1575.

38. a. We can write an expression $420\div n$ to represent the equal share each of n siblings will receive of the inheritance.

b. Substitute 3 for n in the expression $420\div n$: $420\div 3=140$. So, each of 3 siblings will receive an equal share of \$140,000 of a \$420,000 inheritance.

40. $8 - x$; substitute 8 for x in $8 - x$: $8 - (8) = 0$.

42. $6 + x$; substitute 8 for x in $6 + x$: $6 + (8) = 14$.

44. $x + 15$; substitute 8 for x in $x + 15$: $(8) + 15 = 23$.

46. $x - 7$; substitute 8 for x in $x - 7$: $(8) - 7 = 1$.

48. $5x$; substitute 8 for x in $5x$: $5(8) = 40$.

50. The quotient of 6 and the number

52. Two less than the number

54. The sum of 4 and the number

56. The product of the number and 5

58. The sum of the number and 3

60. The quotient of the number and 5

62. Substitute 6 for x and 3 for y in the expression $y + x$: $(3) + (6) = 9$

64. Substitute 6 for x and 3 for y in the expression xy: $(6)(3) = 18$.

66. Substitute 6 for x and 3 for y in the expression $x \div y$: $6 \div 3 = 2$.

68. $x + y$; substitute 9 for x and 3 for y in the expression $x + y$: $(9) + (3) = 12$.

70. $x \div y$; substitute 9 for x and 3 for y in the expression $x \div y$: $(9) \div (3) = 3$.

72. Substitute 90.0 for c and 104.8 for r in the expression $c + r$: $90.0 + 104.8 = 194.8$. So, in 2015 the average annual per-person consumption of chicken and red meat was 194.8 pounds.

74. Substitute 11.26 for w and 19.98 for a in the expression $a - w$: $19.98 - 11.26 = 8.72$. So, in 2015 the college enrollments of all students who were not women was 8.72 million.

76. Substitute 2.5 for N and 1.8 for A in the expression NA: $2.5 \cdot 1.8 = 4.5$. So, in 2016 the average number of AP exams taken was 4.5 million.

78. Substitute 205,200 for s and 3.6 for n in the expression $s \div n$: $205{,}200 \div 3.6 = 57{,}000$. So, in 2014 the average money earned by a teacher was about \$57,000.

80. a. Substitute 4 for x in the expression $x + 2$: $(4) + 2 = 6$. Substitute 5 for x in the expression $x + 2$: $(5) + 2 = 7$. Substitute 6 for x in the expression $x + 2$: $(6) + 2 = 8$.

    b. Substitute 4 for x in the expression $2x$: $2(4) = 8$. Substitute 5 for x in the expression $2x$: $2(5) = 10$. Substitute 6 for x in the expression $2x$: $2(6) = 12$.

    c. Observe the values after substitution are different for the two expressions.

x	$x + 2$	$2x$
4	$4 + 2 = 6$	$2(4) = 8$
5	$5 + 2 = 7$	$2(5) = 10$
6	$6 + 2 = 8$	$2(6) = 12$

82. a.

n	$3n$
1	$3 \cdot 1 = 3$
2	$3 \cdot 2 = 6$
3	$3 \cdot 3 = 9$
4	$3 \cdot 4 = 12$

    The price of bread is \$3, \$6, \$9, and \$12 for 1, 2, 3, and 4 loaves, respectively.

    b. The cost per loaf of bread is \$3. The cost per loaf is a constant while the number of loaves is a variable. In the expression $3n$, the constant is 3 and the variable is n.

    c. Answers may vary. Example: For each additional loaf bought, the total price increases by \$3.

84. a.

t	$2t$
1	$2\cdot 1 = 2$
2	$2\cdot 2 = 4$
3	$2\cdot 3 = 6$
4	$2\cdot 4 = 8$

The elevator rises are 2 yards, 4 yards, 6 yards, and 8 yards for every 1, 2, 3, and 4 seconds, respectively.

b. The elevator is rising at a speed of 2 yards per second. The distance risen is a constant amount of 2 yards while the number of seconds is a variable. In the expression $2t$, the constant is 2 and the variable is t.

c. Answers may vary. Example: For each second that passes, the distance the elevator rises is another 2 yards.

86. Answers may vary.

88. Answers may vary.

Homework 1.3

2. The reciprocal of $\frac{a}{b}$ is $\frac{b}{a}$.

4. If an object is made up of two or more parts, then the sum of their proportions equals 1.

6. The numerator of $\frac{2}{5}$ is 2.

8. $18 = 2\cdot 9 = 2\cdot(3\cdot 3) = 2\cdot 3\cdot 3$

10. $24 = 4\cdot 6 = (2\cdot 2)\cdot(2\cdot 3) = 2\cdot 2\cdot 2\cdot 3$

12. $27 = 3\cdot 9 = 3\cdot(3\cdot 3) = 3\cdot 3\cdot 3$

14. $105 = 5\cdot 21 = 5\cdot(3\cdot 7) = 3\cdot 5\cdot 7$

16. $\frac{10}{14} = \frac{2\cdot 5}{2\cdot 7} = \frac{2}{2}\cdot\frac{5}{7} = \frac{5}{7}$

18. $\frac{27}{54} = \frac{3\cdot 3\cdot 3}{3\cdot 3\cdot 3\cdot 2} = \frac{3\cdot 3\cdot 3}{3\cdot 3\cdot 3}\cdot\frac{1}{2} = \frac{1}{2}$

20. $\frac{9}{81} = \frac{3\cdot 3}{3\cdot 3\cdot 3\cdot 3} = \frac{3\cdot 3}{3\cdot 3}\cdot\frac{1}{3\cdot 3} = \frac{1}{3\cdot 3} = \frac{1}{9}$

22. $\frac{15}{18} = \frac{3\cdot 5}{3\cdot 3\cdot 2} = \frac{3}{3}\cdot\frac{5}{3\cdot 2} = \frac{5}{3\cdot 2} = \frac{5}{6}$

24. $\frac{5}{7}\cdot\frac{4}{9} = \frac{5\cdot 4}{7\cdot 9} = \frac{5\cdot 2\cdot 2}{7\cdot 3\cdot 3} = \frac{20}{63}$

26. $\frac{2}{3}\cdot\frac{5}{6} = \frac{2\cdot 5}{3\cdot 6} = \frac{2\cdot 5}{3\cdot 2\cdot 3} = \frac{5}{3\cdot 3} = \frac{5}{9}$

28. $\frac{5}{12}\cdot 2 = \frac{5}{12}\cdot\frac{2}{1} = \frac{5\cdot 2}{2\cdot 2\cdot 3} = \frac{5}{2\cdot 3} = \frac{5}{6}$

30. $\frac{7}{12}\div\frac{2}{3} = \frac{7}{12}\cdot\frac{3}{2} = \frac{7\cdot 3}{12\cdot 2}$
$= \frac{7\cdot 3}{2\cdot 2\cdot 3\cdot 2} = \frac{7}{2\cdot 2\cdot 2} = \frac{7}{8}$

32. $\frac{4}{7}\div\frac{8}{3} = \frac{4}{7}\cdot\frac{3}{8} = \frac{4\cdot 3}{7\cdot 8} = \frac{2\cdot 2\cdot 3}{7\cdot 2\cdot 2\cdot 2} = \frac{3}{7\cdot 2} = \frac{3}{14}$

34. $\frac{4}{9}\div 2 = \frac{4}{9}\cdot\frac{1}{2} = \frac{4\cdot 1}{9\cdot 2} = \frac{2\cdot 2}{3\cdot 3\cdot 2} = \frac{2}{3\cdot 3} = \frac{2}{9}$

36. $\frac{2}{15}+\frac{8}{15} = \frac{2+8}{15} = \frac{10}{15} = \frac{2\cdot 5}{3\cdot 5} = \frac{2}{3}$

38. $\frac{13}{18}-\frac{9}{18} = \frac{13-9}{18} = \frac{4}{18} = \frac{2\cdot 2}{2\cdot 3\cdot 3} = \frac{2}{3\cdot 3} = \frac{2}{9}$

40. The LCD is 9: $\frac{1}{3}+\frac{5}{9} = \frac{1}{3}\cdot\frac{3}{3}+\frac{5}{9} = \frac{3}{9}+\frac{5}{9} = \frac{8}{9}$

42. The LCD is 24: $\frac{3}{8}+\frac{1}{6} = \frac{3}{8}\cdot\frac{3}{3}+\frac{1}{6}\cdot\frac{4}{4} = \frac{9}{24}+\frac{4}{24}$
$= \frac{13}{24}$

44. The LCD is 7: $2+\frac{3}{7} = \frac{2}{1}\cdot\frac{7}{7}+\frac{3}{7} = \frac{14}{7}+\frac{3}{7} = \frac{17}{7}$

46. The LCD is 4: $\frac{3}{4}-\frac{1}{2} = \frac{3}{4}-\frac{1}{2}\cdot\frac{2}{2} = \frac{3}{4}-\frac{2}{4} = \frac{1}{4}$

48. The LCD is 42: $\frac{5}{6}-\frac{4}{7} = \frac{5}{6}\cdot\frac{7}{7}-\frac{4}{7}\cdot\frac{6}{6} = \frac{35}{42}-\frac{24}{42}$
$= \frac{11}{42}$

50. The LCD is 7: $1-\frac{9}{7} = \frac{1}{1}\cdot\frac{7}{7}-\frac{9}{7} = \frac{7}{7}-\frac{9}{7} = \frac{-2}{7}$
$= -\frac{2}{7}$

52. $\dfrac{\frac{3}{4}}{\frac{7}{5}} = \dfrac{3}{4} \div \dfrac{7}{5} = \dfrac{3}{4} \cdot \dfrac{5}{7} = \dfrac{15}{28}$

54. $\dfrac{\frac{5}{3}}{\frac{20}{21}} = \dfrac{5}{3} \div \dfrac{20}{21} = \dfrac{5}{3} \cdot \dfrac{21}{20} = \dfrac{5 \cdot 3 \cdot 7}{3 \cdot 2 \cdot 2 \cdot 5} = \dfrac{7}{4}$

56. $\dfrac{\frac{25}{9}}{\frac{15}{3}} = \dfrac{25}{9} \div \dfrac{15}{3} = \dfrac{25}{9} \cdot \dfrac{3}{15} = \dfrac{5 \cdot 5 \cdot 3}{3 \cdot 3 \cdot 3 \cdot 5} = \dfrac{5}{9}$

58. Substitute 3 for x and 12 for z in the expression $\dfrac{z}{x} : \dfrac{12}{3} = \dfrac{3 \cdot 2 \cdot 2}{3 \cdot 1} = \dfrac{2 \cdot 2}{1} = \dfrac{4}{1} = 4$

60. Substitute 4 for w, 3 for x, 5 for y, and 12 for z in the expression $\dfrac{y}{z} \cdot \dfrac{w}{x} : \dfrac{5}{12} \cdot \dfrac{4}{3} = \dfrac{5 \cdot 2 \cdot 2}{2 \cdot 2 \cdot 3 \cdot 3} = \dfrac{5}{3 \cdot 3} = \dfrac{5}{9}$

62. Substitute 3 for x, 5 for y, and 12 for z in the expression $\dfrac{y}{x} + \dfrac{y}{z} : \dfrac{5}{3} + \dfrac{5}{12}$

The LCD is 12: $\dfrac{5}{3} + \dfrac{5}{12} = \dfrac{5}{3} \cdot \dfrac{4}{4} + \dfrac{5}{12} = \dfrac{20}{12} + \dfrac{5}{12} = \dfrac{25}{12}$

64. $\dfrac{67}{71} \cdot \dfrac{381}{399} \approx 0.90$

```
(67/71)*(381/399
)
     .9010907551
```

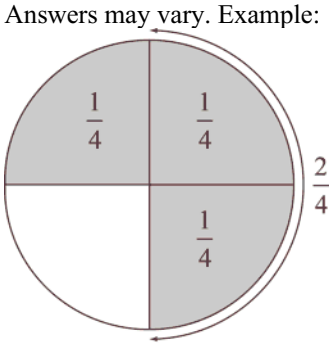
66. $\dfrac{149}{215} \div \dfrac{31}{52} \approx 1.16$

```
(149/215)/(31/52
)
     1.162490623
```

68. $\dfrac{614}{701} + \dfrac{391}{400} \approx 1.85$

```
(614/701)+(391/4
00)
     1.853391583
```

70. Answers may vary. Example:



72. In 2018, since 10 of the top 40 songs sold on iTunes were pop songs, we can write a proportion of the songs that were pop songs as $\dfrac{10}{40} = \dfrac{1}{4}$.

74. The whole survey group consists of the proportions of the three political parties, so the sum of the proportions equals 1.

76. The category of American adults who picked football as their favorite sport to watch OR who picked basketball as their favorite sport to watch is the category of adult Americans who picked football together with the adults who picked basketball. So, we add the fractions $\frac{4}{11}+\frac{1}{9}$.

$$\begin{aligned}\frac{4}{11}+\frac{1}{9} &= \frac{4}{11}\cdot\frac{9}{9}+\frac{1}{9}\cdot\frac{11}{11}\\ &= \frac{36}{99}+\frac{11}{99}\\ &= \frac{47}{99}\end{aligned}$$

78. Proportion of employees who spend at least \$101 on commuting to work: $\frac{1}{5}+\frac{1}{7}=\frac{7}{35}+\frac{5}{35}=\frac{12}{35}$

80. Proportion of the disk that is orange: $1-\frac{2}{7}=\frac{7}{7}-\frac{2}{7}=\frac{5}{7}$

82. Proportion of Hispanic adults that do not use at least one social media site: $1-\frac{8}{11}=\frac{11}{11}-\frac{8}{11}=\frac{3}{11}$.

84. Proportion of the disc that is red and blue: $\frac{1}{2}+\frac{1}{3}=\frac{3}{6}+\frac{2}{6}=\frac{5}{6}$

Proportion of the disc that is yellow: $1-\frac{5}{6}=\frac{6}{6}-\frac{5}{6}=\frac{1}{6}$

86. Proportion of Hispanic and Caucasian undergraduates: $\frac{2}{7}+\frac{1}{2}=\frac{4}{14}+\frac{7}{14}=\frac{11}{14}$.

Proportion of undergraduates of ethnicities other than Hispanic and Caucasian: $1-\frac{11}{14}=\frac{14}{14}-\frac{11}{14}=\frac{3}{14}$.

88. Let m be the proportion of income for mortgage and f be the proportion of income for food. The proportion remaining is given by the expression $1-m-f$. Substitute $\frac{1}{3}$ for m and $\frac{1}{6}$ for f in the expression.

$$\begin{aligned}1-m-f &= 1-\frac{1}{3}-\frac{1}{6}\\ &= \frac{1}{1}\cdot\frac{6}{6}-\frac{1}{3}\cdot\frac{2}{2}-\frac{1}{6}\\ &= \frac{6}{6}-\frac{2}{6}-\frac{1}{6}\\ &= \frac{6-2-1}{6}\\ &= \frac{3}{6}\\ &= \frac{1}{2}\end{aligned}$$

So, $\frac{1}{2}$ of the income remains.

90. a. i. 2370 out of 3180 degrees were bachelor's degrees. Proportion of bachelor's degrees: $\frac{2370}{3180} \approx 0.745$.

ii. $1-\frac{2370}{3180}=\frac{3180}{3180}-\frac{2370}{3180}=\frac{810}{3180}\approx 0.255$

iii. 496 + 84 = 580 degrees were master's and doctoral degrees. Proportion of master's and doctoral degrees: $\frac{580}{3180} \approx 0.182$.

b. The six exact proportions consist of all the degrees the university awards, so the sum of the exact proportions equals 1. This may not be the case for the sum of the approximations. Rounding may cause the sum to differ slightly from 1.

92. $\frac{23 \text{ centimeters}}{1}\cdot\frac{1 \text{ inch}}{2.54 \text{ centimeters}} \approx 9.06 \text{ inches}$

94. $\frac{113 \text{ kilometers}}{1 \text{ hour}}\cdot\frac{1 \text{ mile}}{1.61 \text{ kilometers}} \approx 70.19 \text{ miles per hour}$

96. $\frac{42.5 \text{ milligrams}}{1 \text{ ounce}}\cdot\frac{1 \text{ gram}}{1000 \text{ milligrams}}\cdot\frac{16 \text{ ounces}}{1 \text{ pound}}=\frac{0.68 \text{ grams}}{1 \text{ pound}}=0.68 \text{ grams per pound}$

98. $\frac{25 \text{ meters}}{1 \text{ second}}\cdot\frac{3600 \text{ seconds}}{1 \text{ hour}}\cdot\frac{1 \text{ kilometer}}{1000 \text{ meters}}\cdot\frac{1 \text{ mile}}{1.61 \text{ kilometers}} \approx 55.90 \text{ miles per hour}$

100. $\frac{2250 \text{ milligrams}}{10 \text{ ounces}}\cdot\frac{1 \text{ gram}}{1000 \text{ milligrams}}\cdot\frac{16 \text{ ounces}}{1 \text{ pound}}=3.6 \text{ grams per pound}$

102. $\frac{26 \text{ grams}}{1 \text{ cup}}\cdot\frac{1000 \text{ milligrams}}{1 \text{ gram}}\cdot\frac{\frac{1}{8} \text{ cup}}{1 \text{ ounce}}=\frac{\frac{26,000}{8} \text{ milligrams}}{1 \text{ ounce}}=3250 \text{ milligrams per ounce}$

104. Answers may vary. Example: In this case, Student 2 actually did better. When you compare the proportion of question right for Student 1, $\frac{82}{100}=\frac{41}{50}$ with the proportion of question right for Student 2, $\frac{43}{50}$, we see that Student 2 did better since $\frac{43}{50}>\frac{41}{50}$.

106. a. i. $\frac{2}{3}\cdot\frac{3}{2}=\frac{2\cdot 3}{3\cdot 2}=\frac{6}{6}=1$

ii. $\frac{4}{7}\cdot\frac{7}{4}=\frac{4\cdot 7}{7\cdot 4}=\frac{28}{28}=1$

iii. $\frac{1}{6}\cdot\frac{6}{1}=\frac{1\cdot 6}{6\cdot 1}=\frac{6}{6}=1$

b. Answers may vary. Example: The product of a fraction and its reciprocal equals 1.

108. Answers may vary. Example: The student should have only multiplied the numerator by 2. Rewrite 2 as $\frac{2}{1}$ and then multiply across. $2\cdot\frac{3}{5}=\frac{2}{1}\cdot\frac{3}{5}=\frac{2\cdot 3}{1\cdot 5}=\frac{6}{5}$

110. Answers may vary. Example: The denominator of a fraction is the name of the things it represents. The numerator of a fraction is the number of those things it represents. When we add two fractions with the same denominator, we keep the same denominator, or name, and add the two numerators, or number of things.

Homework 1.4

2. The absolute value of a number is the distance the number is from 0 on the number line.

4. False. The sum of –4 and 2 is negative: $-4+2=-2$. The sum of 5 and –1 is positive: $5+(-1)=4$.

6. $-(-9)=9$

8. $-\left(-(-2)\right)=-(2)=-2$

10. $|6|=6$ because 6 is a distance of 6 units from 0 on a number line.

12. $|-1|=1$ because -1 is a distance of 1 unit from 0 on a number line.

14. $-|5|=-(5)=-5$

16. $-|-9|=-(9)=-9$

18. The numbers have different signs, so subtract the smaller absolute value from the larger.
$|5|-|-3|=5-3=2$
Since $|5|$ is greater than $|-3|$, the sum is positive.
$5+(-3)=2$

20. The numbers have the same sign, so add the absolute values.
$|-3|+|-2|=3+2=5$
The numbers are negative, so the sum is negative.
$-3+(-2)=-5$

22. The numbers have different signs, so subtract the smaller absolute value from the larger.
$|-9|-|6|=9-6=3$
Since $|-9|$ is greater than $|6|$, the sum is negative.
$6+(-9)=-3$

24. The numbers have different signs, so subtract the smaller absolute value from the larger.
$|4|-|-3|=4-3=1$
Since $|4|$ is greater than $|-3|$, the sum is positive.
$-3+4=1$

26. The numbers have the same sign, so add the absolute values.
$|-9|+|-5|=9+5=14$
The numbers are negative, so the sum is negative.
$-9+(-5)=-14$

28. The numbers have different signs, so subtract the smaller absolute value from the larger.
$|8|-|-2|=8-2=6$
Since $|8|$ is greater than $|-2|$, the sum is positive.
$8+(-2)=6$

30. $8+(-8)=0$ because the numbers are opposites and the sum of opposites is 0.

32. $-7+7=0$ because the numbers are opposites and the sum of opposites is 0.

34. The numbers have different signs, so subtract the smaller absolute value from the larger.
$|17|-|-14|=17-14=3$
Since $|17|$ is greater than $|-14|$, the sum is positive.
$17+(-14)=3$

36. The numbers have different signs, so subtract the smaller absolute value from the larger.
$|-89|-|57| = 89-57 = 32$

Since $|-89|$ is greater than $|57|$, the sum is negative.

$-89+57 = -32$

38. The numbers have the same sign, so add the absolute values.
$|-347|+|-594| = 347+594 = 941$

The numbers are negative, so the sum is negative.

$-347+(-594) = -941$

40. $127,512+(-127,512) = 0$ because the numbers are opposites and the sum of opposites is 0.

42. The numbers have the same sign, so add the absolute values.
$|-3.7|+|-9.9| = 3.7+9.9 = 13.6$

The numbers are negative, so the sum is negative.

$-3.7+(-9.9) = -13.6$

44. The numbers have different signs, so subtract the smaller absolute value from the larger.
$|7|-|-0.3| = 7-0.3 = 6.7$

Since $|7|$ is greater than $|-0.3|$, the sum is positive.

$-0.3+7 = 6.7$

46. The numbers have different signs, so subtract the smaller absolute value from the larger.
$|37.05|-|-19.26| = 37.05-19.26 = 17.79$

Since $|37.05|$ is greater than $|-19.26|$, the sum is positive.

$37.05+(-19.26) = 17.79$

48. The numbers have different signs, so subtract the smaller absolute value from the larger.
$\left|\frac{2}{5}\right|-\left|-\frac{1}{5}\right| = \frac{2}{5}-\frac{1}{5} = \frac{1}{5}$

Since $\left|\frac{2}{5}\right|$ is greater than $\left|-\frac{1}{5}\right|$, the sum is positive.

$\frac{2}{5}+\left(-\frac{1}{5}\right) = \frac{1}{5}$

50. The numbers have different signs, so subtract the smaller absolute value from the larger.
$\left|-\frac{5}{6}\right|-\left|\frac{1}{6}\right| = \frac{5}{6}-\frac{1}{6} = \frac{4}{6} = \frac{2}{3}$

Since $\left|-\frac{5}{6}\right|$ is greater than $\left|\frac{1}{6}\right|$, the sum is negative.

$-\frac{5}{6}+\frac{1}{6} = -\frac{2}{3}$

52. The numbers have the same sign, so add the absolute values.
$\left|-\frac{2}{3}\right|+\left|-\frac{5}{6}\right| = \frac{2}{3}+\frac{5}{6} = \frac{2}{3}\cdot\frac{2}{2}+\frac{5}{6} = \frac{4}{6}+\frac{5}{6} = \frac{9}{6} = \frac{3}{2}$

The numbers are negative, so the sum is negative.

$-\frac{2}{3}+\left(-\frac{5}{6}\right) = -\frac{3}{2}$

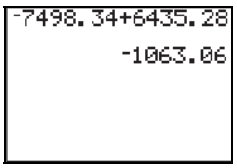
54. The numbers have different signs, so subtract the smaller absolute value from the larger.

$$\left|-\frac{3}{4}\right|-\left|\frac{2}{3}\right|=\frac{3}{4}-\frac{2}{3}=\frac{3}{4}\cdot\frac{3}{3}-\frac{2}{3}\cdot\frac{4}{4}=\frac{9}{12}-\frac{8}{12}=\frac{1}{12}$$

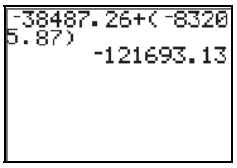
Since $\left|-\frac{3}{4}\right|$ is greater than $\left|\frac{2}{3}\right|$, the sum is negative.

$$\frac{2}{3}+\left(-\frac{3}{4}\right)=-\frac{1}{12}$$

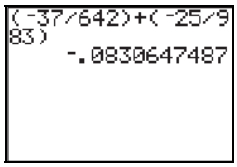
56. $-7498.34+6435.28=-1063.06$



58. $-38,487.26+(-83,205.87)=-121,693.13$



60. $-\frac{37}{642}+\left(-\frac{25}{983}\right)\approx -0.08$



62. The balance is $-112.50+170$ dollars. The numbers have different signs, so subtract the smaller absolute value from the larger.

$|170|-|-112.50|=170-112.50=57.50$

Since $|170|$ is greater than $|-112.50|$, the sum is positive: $-112.50+170=57.50$

So, the balance is \$57.50.

64. We can find the final balance by finding the balance after each transaction.

Transaction	Balance
Paycheck	$-135.00+549.00=414.00$
FedEx Kinko's	$414.00-10.74=403.26$
ATM	$403.26-21.50=381.76$
Barnes and Noble	$381.76-17.19=364.57$

So, the final balance is \$364.57.

66. The new balance is $-2739+530$. The numbers have different signs, so subtract the smaller absolute value from the larger.

$|-2739|-|530|=2739-530=2209$

Since $|-2739|$ is greater than $|530|$, the sum is negative.

$-2739+530=-2209$

So, the new balance is -2209 dollars.

68. The balance after sending the check is $-873+500=-373$.

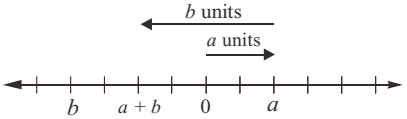
The balance after buying the racquet is $-373+(-249)=-622$.

The balance after buying the outfit is $-622+(-87)=-709$.

So, the final balance is -709 dollars.

70. The current temperature is $-12+8$. The numbers have different signs, so subtract the smaller absolute value from the larger.
$|-12|-|8|=12-8=4$
Since $|-12|$ is greater than $|8|$, the sum is negative.
$-12+8=-4$
So, the current temperature is $-4°$ F.

72. If a is positive and b is negative (but with a larger absolute value), the sum $a+b$ will be negative.



74. If $a+b$ is positive, then both numbers are positive, or the numbers have opposite signs but the number with the larger absolute value is positive.

76. a. Substitute -2 for a and 5 for b:
$a+b=(-2)+5=3$

b. Substitute -2 for a and 5 for b:
$b+a=5+(-2)=3$

c. The results are the same.

d. Substitute -4 for a and -9 for b:
$a+b=-4+(-9)=-13$
$b+a=-9+(-4)=-13$
The results are the same.

e. Answers may vary.

f. Yes; when adding two quantities, the order of the addition does not matter.

78. Answers may vary. Example: The value of a stock investment can be measured in gains and losses. It is possible to assign a as a variable to represent the value of a stock that suffers a loss (when the value of the stock falls below the price of purchase) and to assign b as a variable that represents the value of a stock that experiences a gain (when the value of the stock rises above the price of purchase). Suppose you have two stocks, a and b, in a portfolio and you want to determine the value of the portfolio at the conclusion of a particular day. If on that day $a=-\$300.00$ and $b=\$500.00$ you can find the value of the portfolio by combining a and b: $-300+500=200$. So, the value of the portfolio on that day is \$200.

Homework 1.5

2. To subtract a number, add its opposite.

4. True. A decreasing quantity has negative change.

6. $3-7=3+(-7)=-4$

8. $-3-9=-3+(-9)=-12$

10. $5-(-1)=5+1=6$

12. $-7-(-3)=-7+3=-4$

14. $-4-7=-4+(-7)=-11$

16. $-4-(-7)=-4+7=3$

18. $-7-7=-7+(-7)=-14$

20. $-100-257=-100+(-257)=-357$

22. $-1939-(-352)=-1939+352=-1587$

24. $5.8-3.7=5.8+(-3.7)=2.1$

26. $-1.7-7.4=-1.7+(-7.4)=-9.1$

28. $3.1-(-3.1)=3.1+3.1=6.2$

30. $-159.24-(-7.8)=-159.24+7.8=-151.44$

32. $-\frac{1}{5}-\frac{4}{5}=-\frac{1}{5}+\left(-\frac{4}{5}\right)=-\frac{5}{5}=-1$

34. $-\frac{4}{9}-\left(-\frac{7}{9}\right)=-\frac{4}{9}+\frac{7}{9}=\frac{3}{9}=\frac{1}{3}$

36. $\frac{5}{12}-\left(-\frac{1}{6}\right)=\frac{5}{12}+\frac{1}{6}=\frac{5}{12}+\frac{1}{6}\cdot\frac{2}{2}=\frac{5}{12}+\frac{2}{12}=\frac{7}{12}$

38. $-\frac{2}{3}-\frac{2}{5}=-\frac{2}{3}+\left(-\frac{2}{5}\right)=-\frac{2}{3}\cdot\frac{5}{5}+\left(-\frac{2}{5}\cdot\frac{3}{3}\right)$
$=-\frac{10}{15}+\left(-\frac{6}{15}\right)=-\frac{16}{15}$

40. $-3+9=6$

42. $-4-(-3)=-4+3=-1$

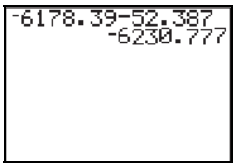
44. $-\frac{5}{6}+\frac{1}{6}=-\frac{4}{6}=-\frac{2}{3}$

46. $-6.4+3.5=-2.9$

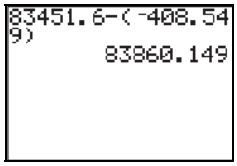
48. $-5+(-8)=-13$

50. $5-9=5+(-9)=-4$

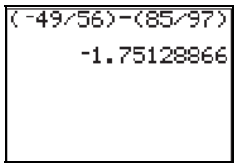
52. $-6178.39-52.387\approx -6230.78$



54. $83,451.6-(-408.549)\approx 83,860.15$



56. $-\frac{49}{56}-\frac{85}{97}\approx -1.75$



58. $-12+18=6$; So, the current temperature is $6°\text{F}$.

60. $-13-(-2)=-13+2=-11$; The change in temperature is $-11°\text{F}$.

62. a. $9-(-6)=9+6=15$; The change in temperature is $15°\text{F}$.

b. To estimate the change in temperature over the past hour, we divide the change over three hours by 3.
$\frac{15}{3}=5$; The estimated change in temperature over the past hour is $5°\text{F}$.

c. Answers may vary. Example: The change in temperature is affected by the time of day in addition to the weather conditions. Thus, temperature change need not be uniform.

64. $29,035-(-1312)=29,035+1312=30,347$; The change in elevation is 30,347 feet.

66. a.

Year	Population	Change in Population
2011	98	–
2012	83	$83-98=-15$
2013	95	$95-83=12$
2014	104	$104-95=9$
2015	99	$99-104=-5$
2016	108	$108-99=9$
2017	97	$97-108=-11$

b. The population increased the most from 2012 to 2013. The change in population was 12.

c. The population decreased the most from 2011 to 2012. The change in population was -15.

d. No; the change in population is the difference between births and deaths. An increase of 12 wolves means there were 12 more births than deaths.

68. a. Add the changes in the number of Patriot Groups from 2010 to 2016:
$824+450+86+(-264)+(-222)+124+(-375)=623$

So, there were 623 Patriot Groups in 2016.

b. An increasing number of groups is indicated by positive changes. Thus, the number of Patriot Groups was increasing from 2010 to 2011, from 2011 to 2012, and from 2014 to 2015.

c. A decreasing number of groups is indicated by negative changes. Thus, the number of Patriot Groups was decreasing from 2012 to 2013, from 2013 to 2014, and from 2015 to 2016.

70. Evaluate $a+c$ for $a=-5$ and $c=-7$: $(-5)+(-7)=-12$

72. Evaluate $c-a$ for $a=-5$ and $c=-7$: $(-7)-(-5)=-7+5=-2$

74. Evaluate $b-a$ for $a=-5$ and $b=2$: $(2)-(-5)=2+5=7$

76. $x-4$; Evaluate the expression for $x=-5$: $-5-4=-5+(-4)=-9$

78. $x-5$; Evaluate the expression for $x=-5$: $(-5)-5=-5+(-5)=-10$

80. $x-(-6)$; Evaluate the expression for $x=-5$: $(-5)-(-6)=-5+6=1$

82. The student changed the order of subtraction without changing the sign of the result.
$2-6=2+(-6)=-4$

84. a. i. $2-8=2+(-8)=-6$

ii. $3-9=3+(-9)=-6$

iii. $1-5=1+(-5)=-4$

b. Answers may vary. Example: Since the quantity decreased, the final number is smaller than the beginning number. When finding the change in quantity, we subtract the beginning number from the final number. Since the final number is smaller, the result will be negative.

86. Answers may vary. Example: It is impossible to find the sign. If $|x|$ is greater than $|y|$, then $x-y$ is negative. If $|x|$ is less than $|y|$, then $x-y$ is positive.

88. Answers may vary. Example: To subtract a negative number from another number, take the opposite of the negative number and add it to the number. For instance, to subtract -6 from 4, we write $4-(-6)=4+6=10$.

Homework 1.6

2. One hundred percent of a quantity is all of the quantity.

4. True. The product or quotient of two numbers that have different signs is negative.

6. $\frac{9}{15}=\frac{3}{5}$

8. $\frac{3.7 \text{ million viewers}}{2.8 \text{ million viewers}} \approx \frac{1.32}{1}$; There were about 1.32 times as many viewers of *Good Morning America* as of *CBS This Morning*.

10. a. $\frac{2 \text{ c mushrooms}}{4 \text{ c cooked noodles}} = \frac{0.5 \text{ c mushrooms}}{1 \text{ c cooked noodles}}$; For each cup of cooked noodles, a half cup of sliced mushrooms is required.

b. $\frac{4 \text{ c cooked noodles}}{2 \text{ c mushrooms}} = \frac{2 \text{ c cooked noodles}}{1 \text{ c mushrooms}}$; For each cup of sliced mushrooms, 2 cups of cooked noodles are required.

12. a. Kershaw: $\frac{9}{5} \approx \frac{1.80}{1}$

Kluber: $\frac{20}{7} \approx \frac{2.86}{1}$

Sale: $\frac{12}{4} = \frac{3.00}{1}$

Scherzer: $\frac{18}{7} \approx \frac{2.57}{1}$

Strasburg: $\frac{10}{7} \approx \frac{1.43}{1}$

12. (continued)

    b. The pitcher with the largest unit ratio of wins to losses is Sale. The pitcher with the smallest ratio of wins to losses is Strasburg.

    c. No, the person is not correct. Answers may vary. Example: Even though Sale's wins are less than Scherzer's wins, Sale had fewer losses than Scherzer's which means that Sale's ratio will be higher than that of Scherzer's.

    d. Kershaw: $\frac{155}{161} \approx \frac{0.96}{1}$ Scherzer: $\frac{300}{220} \approx \frac{1.36}{1}$

    Kluber: $\frac{222}{215} \approx \frac{1.03}{1}$ Strasburg: $\frac{156}{130} = \frac{1.20}{1}$

    Sale: $\frac{237}{158} = \frac{1.50}{1}$

    e. The pitcher with the second largest ratio of strikeouts to innings is Scherzer. The pitcher with the second largest unit ratio of wins to losses is Kluber. The unit ratios differ since the values upon which the ratios are based are not linked. That is, a player's wins and losses stand independent of a player's strikeouts versus innings played—they are not directly proportional.

14. a. $\frac{19,849,399}{9,005,644} \approx \frac{2.20}{1}$; The population of New York is about 2.20 times larger than that of New Jersey.

    b. $\frac{571,951}{155,959} \approx \frac{3.67}{1}$; The land area of Alaska is about 3.67 times larger than that of California.

    c. Alaska: $\frac{739,795}{571,951} \approx \frac{1.29}{1}$ New Jersey: $\frac{9,005,644}{7417} \approx \frac{1214.19}{1}$

    California: $\frac{39,536,653}{155,959} \approx \frac{253.51}{1}$ New York: $\frac{19,849,399}{47,214} = \frac{420.41}{1}$

    Michigan: $\frac{9,962,311}{56,804} \approx \frac{175.38}{1}$

    d. The state with the greatest population density is New Jersey. The state with the least dense population is Alaska.

    e. The person is not correct. Answers may vary. Example: Although Michigan has a larger population than New Jersey, it also has a larger land area which serves to lower its population density.

16. $91\% = 91.0\% = 0.91$

18. $0.01 = 1\%$

20. $4\% = 4.0\% = 0.04$

22. $0.089 = 8.9\%$

24. The proportion of books purchased in stores in 2017 was 0.62.

26. The proportion of teenagers who consider Snapchat their favorite social network is 0.47.

28. 37% of 304 executives said they would quit their job and be a stay-at-home parent if they could afford it.

30. Of the 46.9 million Americans who traveled at least 50 miles from home during Independence Day holiday weekend in 2018, 8.1% traveled by air.

32. The proportion is $\frac{287}{2048} \approx 0.14$. Approximately 14% of 2048 surveyed adults do not have a will because they do not like thinking about death.

34. $0.67(4500) = 3015$; so, 67% of 4500 cars is 3015 cars.

36. $0.03(125.35) = 3.7605 \approx 3.76$; so, the sales tax is \$3.76.

38. $0.111(24,503) = 2719.833 \approx 2720$; so, there were 2720 undergraduate business majors.

40. $\frac{2.39 - 2.12}{2.12} \approx 0.127$; So, the percent change in the average price of regular gasoline from 2016 to 2017 is about 12.7%. This means the average price of regular gasoline increased by 12.7%.

42. $\frac{26.5 - 32.9}{32.9} \approx -0.195$; So, the percent change in viewership for the Academy Awards is −19.5%. This means the viewership for the Academy Awards decreased by about 19.5%.

44. a. McDonald's: $160.84 - 156.69 = 4.15$; McDonald's stock increased by \$4.15.

    b. La-Z-Boy: $32.75 - 30.60 = 2.15$; La-Z-Boy's stock increased by \$2.15.

    c. McDonald's: $\frac{4.15}{156.69} \approx 0.0265$; The percent change in McDonald's stock was about 2.6%.

    d. La-Z-Boy: $\frac{2.15}{30.60} \approx 0.0703$; The percent change in La-Z-Boy's stock was about 7.0%.

    e. Answers may vary. Example: Even though McDonald's stock price increased by a greater amount than La-Z-Boy's, La-Z-Boy's stock is actually a better investment because its percentage increase is more than McDonald's stock.

46. $4(-5) = -20$

48. Since the numbers have the same sign, the product is positive: $-8(-9) = 72$.

50. Since the numbers have different signs, the quotient is negative: $24 \div (-3) = -8$.

52. Since the numbers have the same sign, the quotient is positive: $-1 \div (-1) = 1$.

54. Since the numbers have the same sign, the product is positive: $-124(-29) = 3596$.

56. Since the numbers have different signs, the quotient is negative: $1008 \div (-21) = -48$.

58. Since the numbers have the same sign, the product is positive: $-0.3(-0.3) = 0.09$.

60. Since the numbers have different signs, the quotient is negative: $-0.12 \div 0.3 = -0.4$.

62. Since the numbers have different signs, the quotient is negative: $\frac{9}{-3} = 9 \div (-3) = -3$.

64. Since the numbers have the same sign, the quotient is positive: $\frac{-72}{-8} = -72 \div (-8) = 9$.

66. Since the numbers have different signs, the product is negative: $\frac{1}{3}\left(-\frac{7}{5}\right) = -\frac{7}{15}$.

68. Since the numbers have the same sign, the product is positive: $\left(-\frac{7}{25}\right)\left(-\frac{5}{21}\right) = \frac{35}{525} = \frac{1}{15}$.

70. Since the numbers have different signs, the quotient is negative: $-\frac{5}{7} \div \frac{15}{8} = -\frac{5}{7} \cdot \frac{8}{15} = -\frac{40}{105} = -\frac{8}{21}$.

72. Since the numbers have the same sign, the quotient is positive: $-\frac{3}{8} \div \left(-\frac{9}{20}\right) = \frac{3}{8} \cdot \frac{20}{9} = \frac{60}{72} = \frac{5}{6}$.

74. $-9 + (-4) = -13$

76. $-49 \div (7) = -7$

78. $-2-7=-2+(-7)=-9$

80. $(-5)(-9)=45$

82. $-\frac{3}{8}-\left(-\frac{1}{10}\right)=-\frac{3}{8}+\frac{1}{10}$

$=-\frac{3}{8}\cdot\frac{5}{5}+\frac{1}{10}\cdot\frac{4}{4}$

$=-\frac{15}{40}+\frac{4}{40}$

$=\frac{-15+4}{40}$

$=-\frac{11}{40}$

84. $-\frac{22}{9}\div\left(-\frac{33}{18}\right)=-\frac{22}{9}\cdot\left(-\frac{18}{33}\right)$

$=\frac{2\cdot11\cdot2\cdot9}{9\cdot3\cdot11}$

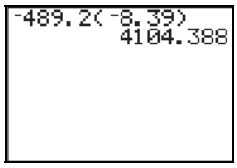
$=\frac{2\cdot2}{3}$

$=\frac{4}{3}$

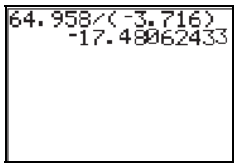
86. $\frac{-15}{35}=-\frac{3\cdot5}{7\cdot5}=-\frac{3}{7}$

88. $\frac{-35}{-21}=\frac{7\cdot5}{7\cdot3}=\frac{5}{3}$

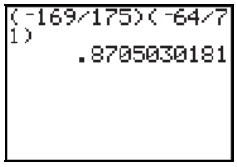
90. $-489.2(-8.39)\approx 4104.39$



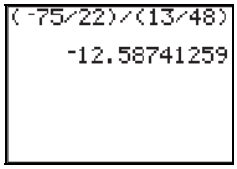
92. $64.958\div(-3.716)\approx -17.48$



94. $-\frac{169}{175}\left(-\frac{64}{71}\right)\approx 0.87$



96. $-\frac{75}{22}\div\frac{13}{48}\approx -12.59$



98. a. $\frac{-6810 \text{ dollars}}{-2950 \text{ dollars}}=\frac{681}{295}\approx\frac{2.31}{1}$

b. For each \$1 he pays towards his Sears account, he should pay about \$2.31 towards his Visa account.

100. $0.35(1590)=556.50$

$-1590+556.5=-1033.50$

The new balance would be $-\$1033.50$.

102. $3(89.50)=268.50$

$0-268.50=-268.50$

The new balance is $-\$268.50$.

104. Answers may vary. Example: The percentage of women in the U.S. Senate is $\frac{24}{100}\times100=24\%$. The percentage of women in the U.S. Supreme Court is $\frac{3}{9}\times100\approx0.33\times100$ which is about 33%. Even though there is a greater number of women in the U.S. Senate vs. the U.S. Supreme Court, the fact that 3 seats are taken up by women in the U.S. Supreme Court out of a total of 9 seats means there is greater representation of women there vs the number of women in the U.S. Senate. It would take as many as 33 women Senators to match the relative representation in the U.S. Senate as there is in the U.S. Supreme Court.

106. a. Negative; the quotient of two numbers with opposite signs is negative.

b. Negative; the quotient of two numbers with opposite signs is negative.

c. No; the variables *a* and *b* can take on positive or negative values, so the sign of the result is not clear without knowing the signs of *a* and *b*.

108. Answers may vary. Example: $3(-6)=(-6)+(-6)+(-6)=-18$

110. a. Answers may vary. Example: 1, 2, 3.
b. Answers may vary. Example: -1, -2, -3.
c. For $2x$ to equal x, x must be 0.

112. Answers may vary. Example: When comparing the performance of two stocks in the past year, it is more helpful to compare the percent changes in value. Percentage change lets you measure the growth rate of stocks over a period of time, whereas a change in the price of a stock only lets you see the difference in its value. If you know how well one stock is growing compared to others, you can identify whether it is a better investment compared to others.

Homework 1.7

2. If a is a nonnegative number, then $\sqrt{a}$ is the nonnegative number we square to get a.

4. To write 3.56×10^{-4} in standard decimal notation, we move the decimal point k places to the left.

6. $3^4 = 3\cdot3\cdot3\cdot3 = 9\cdot3\cdot3 = 27\cdot3 = 81$

8. $5^3 = 5\cdot5\cdot5 = 25\cdot5 = 125$

10. $-7^2 = -(7\cdot7) = -49$

12. $(-7)^2 = (-7)(-7) = 49$

14. $\left(\frac{3}{5}\right)^3 = \left(\frac{3}{5}\right)\left(\frac{3}{5}\right)\left(\frac{3}{5}\right) = \frac{27}{125}$

16. $(-5)^0 = 1$

18. $4^{-2} = \frac{1}{4^2} = \frac{1}{16}$

20. $6^{-1} = \frac{1}{6^1} = \frac{1}{6}$

22. $10^{-3} = \frac{1}{10^3} = \frac{1}{1000}$

24. $\sqrt{16} = 4$, because $4^2 = 16$.

26. $-\sqrt{25} = -5$

28. $\sqrt{-4}$ is not a real number, because the radicand –4 is negative.

30. $-\sqrt{-16}$ is not a real number, because the radicand –16 is negative.

32. The number 62 is not a perfect square, so $\sqrt{62}$ is irrational. $\sqrt{62} \approx 7.87$

34. The number 81 is a perfect square, so $\sqrt{81}$ is rational. $\sqrt{81} = 9$, because $9^2 = 81$.

36. $8\cdot(2-6) = 8\cdot(-4) = -32$

38. $(2+8)(3-8) = (10)(-5) = -50$

40. $\frac{3+5+4+2+6}{5} = \frac{20}{5} = 4$

42. $\frac{1-9}{2-(-4)} = \frac{-8}{2+4} = \frac{-8}{6} = -\frac{4}{3}$

44. $2\sqrt{41+8} = 2\sqrt{49} = 2(7) = 14$

46. $1+9\cdot(-4) = 1+(-36) = -35$

48. $-16\div(-4)\cdot2 = 4\cdot2 = 8$

50. $3-7+1 = -4+1 = -3$

52. $2-4(9-6) = 2-4(3) = 2-12 = -10$

54. $6(2+3)-5\cdot7 = 6(5)-5\cdot7 = 30-35 = -5$

56. $$\begin{aligned} -3-\left[6+2(4-8)\right] &= -3-\left[6+2(-4)\right] \\ &= -3-[6-8] \\ &= -3-[-2] \\ &= -1 \end{aligned}$$

58. $\frac{5}{6}+\frac{2}{3}\div\frac{2}{5} = \frac{5}{6}+\frac{2}{3}\cdot\frac{5}{2} = \frac{5}{6}+\frac{10}{6} = \frac{15}{6} = \frac{5}{2}$

60. $8-3^2 = 8-9 = -1$

62. $8(-2)^3 = 8(-8) = -64$

64. $$\begin{aligned} 2(-4)^2+3(-4)-7 &= 2(16)+3(-4)-7 \\ &= 32+(-12)-7 \\ &= 20-7 \\ &= 13 \end{aligned}$$

66. $(9-7)^2\cdot(-3)-2^4=(2)^2\cdot(-3)-2^4$
$=4(-3)-16$
$=-12-16$
$=-12+(-16)$
$=-28$

68. $\dfrac{(-4)^2+(-1)^2+1^2+4^2}{4-1}$
$=\dfrac{(-4)(-4)+(-1)(-1)+1(1)+4(4)}{4-1}$
$=\dfrac{16+1+1+16}{4-1}=\dfrac{34}{3}$

70. $\dfrac{(1-3)^2+(2-3)^2+(6-3)^2}{3-1}$
$=\dfrac{(-2)^2+(-1)^2+(3)^2}{3-1}$
$=\dfrac{(-2)(-2)+(-1)(-1)+(3)(3)}{3-1}$
$=\dfrac{4+1+9}{2}=\dfrac{14}{2}=7$

72. $(30-40)+2\sqrt{\dfrac{6^2}{9}+\dfrac{8^2}{2}}=-10+2\sqrt{\dfrac{6^2}{9}+\dfrac{8^2}{2}}$
$=-10+2\sqrt{\dfrac{6(6)}{9}+\dfrac{8(8)}{2}}$
$=-10+2\sqrt{\dfrac{36}{9}+\dfrac{64}{2}}$
$=-10+2\sqrt{4+32}$
$=-10+2\sqrt{36}$
$=-10+2(6)$
$=-10+12=2$

74. $\dfrac{84.7+82.9+89.3+80.1}{4}=\dfrac{337.0}{4}=84.25$

76. $\sqrt{\dfrac{0.35(1-0.35)}{50}}=\sqrt{\dfrac{0.35(0.65)}{50}}=\sqrt{\dfrac{0.2275}{50}}$
$=\sqrt{0.00455}\approx 0.07$

78. $\dfrac{\dfrac{951-944}{24}}{\dfrac{24}{\sqrt{75}}}=\dfrac{7}{\dfrac{24}{\sqrt{75}}}$
$=7\div\dfrac{24}{\sqrt{75}}$
$=7\cdot\dfrac{\sqrt{75}}{24}$
$=7\cdot\dfrac{5\sqrt{3}}{24}$
$=\dfrac{35\sqrt{3}}{24}\approx 2.53$

80. $\sqrt{\dfrac{(5.8-6.2)^2+(9.4-6.2)^2+(3.4-6.2)^2}{3-1}}$
$=\sqrt{\dfrac{(-0.4)^2+(3.2)^2+(-2.8)^2}{2}}$
$=\sqrt{\dfrac{(-0.4)(-0.4)+(3.2)(3.2)+(-2.8)(-2.8)}{2}}$
$=\sqrt{\dfrac{0.16+10.24+7.84}{2}}$
$=\sqrt{\dfrac{18.24}{2}}=\sqrt{9.12}\approx 3.02$

82. Evaluate $\bar{x}+zs$ for $\bar{x}=15$, $z=-2$, and $s=5$: $15+(-2)(5)=15+(-10)=5$

84. Evaluate $\dfrac{x-\bar{x}}{s}$ for $x=5$, $\bar{x}=11$, and $s=2$: $\dfrac{5-11}{2}=\dfrac{-6}{2}=-3$

86. Evaluate $\dfrac{y_2-y_1}{x_2-x_1}$ for $x_1=-3$, $x_2=-8$, $y_1=-5$, and $y_2=-3$: $\dfrac{-3-(-5)}{-8-(-3)}=\dfrac{2}{-5}=-\dfrac{2}{5}$

88. Evaluate $\bar{x}-t\dfrac{s}{\sqrt{n}}$ for $\bar{x}=25$, $t=2$, $s=8$, and $n=4$: $25-2\left(\dfrac{8}{\sqrt{4}}\right)=25-2\left(\dfrac{8}{2}\right)=25-2(4)=25-8=17$

90. Evaluate ab^x for $a=8$, $b=2$, and $x=-3$: $8(2)^{-3}=8\left(\dfrac{1}{2^3}\right)=8\left(\dfrac{1}{8}\right)=\dfrac{8}{1}\cdot\dfrac{1}{8}=\dfrac{8}{8}=1$