

Cycle 1: Where Do We Start?

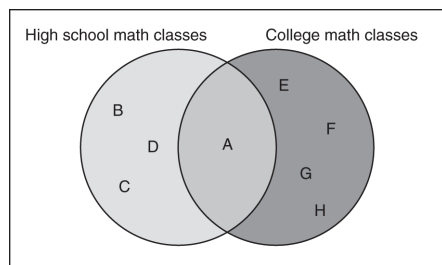
1.2 Getting Started: Reviewing Prealgebra

Skills

1. a. $\frac{2}{15} + \frac{1}{9} = \frac{2 \cdot 3}{15 \cdot 3} + \frac{1 \cdot 5}{9 \cdot 5} = \frac{6}{45} + \frac{5}{45} = \frac{11}{45}$
b. $\frac{4}{21} - \frac{1}{12} = \frac{4 \cdot 4}{21 \cdot 4} - \frac{1 \cdot 7}{12 \cdot 7} = \frac{16}{84} - \frac{7}{84} = \frac{9}{84} = \frac{3}{28}$
2. a. $\frac{2}{15} \cdot \frac{3}{8} = \frac{6}{120} = \frac{1}{20}$
b. $\frac{2}{15} \div \frac{1}{9} = \frac{2}{15} \cdot \frac{9}{1} = \frac{18}{15} = \frac{6}{5} \text{ or } 1\frac{1}{5}$

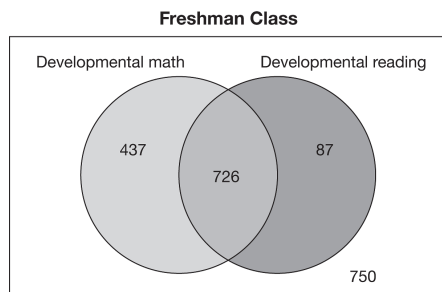
Concepts and Applications

3. a.



A–H Answers will vary.

- b. If a statement is in the overlap of the two circles on the Venn diagram, then the statement applies to both high school and college math classes.
 - c. If a statement is outside of both circles on the Venn diagram, then it does not apply to high school or college math classes.
4. a.



- b. There are 1,250 students taking either developmental math or developmental reading. Since 726 of them are taking both math and reading and 437 of them are taking only take developmental math that leaves $1,250 - 726 - 437 = 87$ students who are taking only developmental reading. This is represented by the region with the darkest shading to the right.
- c. There are 2,000 students in the freshman class at this particular college. Since 1,250 of them are taking either developmental math or developmental reading, that leaves $2,000 - 1,250 = 750$ students who are not taking either developmental reading or developmental math. This is represented by the unshaded region outside the overlapping circles.

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5. $\frac{3}{4}$ of a serving

6. Answers will vary, but may include the need to get a common denominator as a difference and a need to simplify the answer as a common trait.

7. a. $\frac{2}{3}(0.75) = \frac{1}{2}$

b. $\frac{1}{3}(0.90) = \frac{3}{10}$

c. $\frac{1}{2} + \frac{3}{10} = \frac{4}{5}$

8. a. $4 \cdot \frac{2}{3} = \frac{8}{3} = 2\frac{2}{3}$ cups of flour

b. $10 \div \frac{2}{3} = 15$ batches of 2 dozen cookies or 30 dozen cookies

9. a. Addition

- b. Multiply the whole number by the denominator, add that result to the numerator, and write the total over the denominator.

c. $4\frac{2}{3} = \frac{4 \cdot 3 + 2}{3} = \frac{14}{3}$

d. $4.\overline{6}$; yes

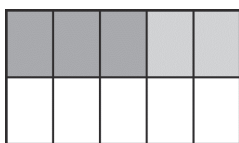


f. $\frac{14}{3}$

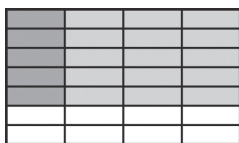
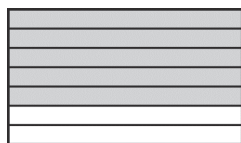


10. It is often considered easier to multiply, since you do not have to get a common denominator. Examples will vary.

11. a. $\frac{3}{5} \cdot \frac{1}{2} = \frac{3}{10}$



b. $\frac{1}{4} \cdot \frac{5}{7}$



$$\frac{1}{4} \cdot \frac{5}{7} = \frac{5}{28}$$

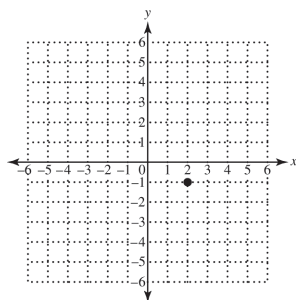
12. $\frac{60 \text{ min}}{12 \text{ min}} = \frac{x \text{ mi}}{1 \text{ mi}}$
 $\frac{60 \cdot 1}{12} = x$
 $5 = x$

You can walk 5 miles in an hour.

1.3 Hello, My Name Is: Graphing Points

Skills

1. Quadrant IV



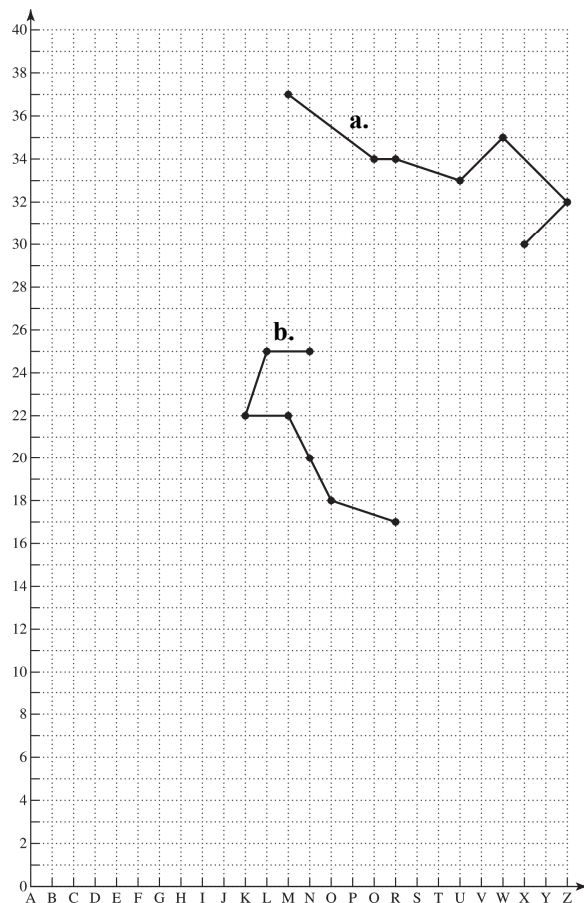
2. $(-3, 5)$; Quadrant II

Concepts and Applications

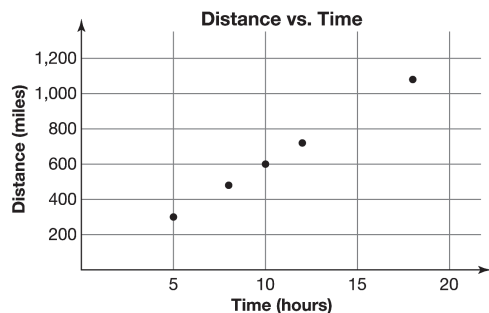
3. a. Neither outgoing nor reserved, a logical thinker
- b. Neither intuitive nor logical; outgoing; uses thoughts and feelings equally to solve problems and is social in communication style.
- c. Very neutral personality, in the middle for communication and problem solving styles; exhibits some of each characteristic.
- d. Outgoing and uses an intuitive approach to solve problems; creative and social.

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4. a., b.



5.



6. 32.5%

1.4 A Tale of Two Numbers: Ratios and Proportions

Skills

1. a. $\frac{18 \text{ pounds}}{8 \text{ weeks}} = 18 \div 8 \text{ pounds per week} = 2.25 \text{ pounds per week}$
- b. $\frac{27 \text{ hours}}{3 \text{ days}} = \frac{27 \text{ hours}}{3 \cdot 24 \text{ hours}} = \frac{27}{72} = \frac{3}{8}$

2. a. $\frac{2}{10} = \frac{1}{5} = \frac{4}{20} = \frac{20}{100}$
- b. $\frac{2}{10} \cdot \frac{10}{10} = \frac{20}{100}$; 20%

Concepts and Applications

3. Answers will vary. Possible answers include:
 You will pay 8 cents in sales tax for every dollar purchase.
 You will pay 8 dollars in sales tax for every \$100 purchase.
 You will pay \$80 in sales tax for a \$1,000 purchase.
4. The second student is assuming that the ratio also identifies the total number of students, but it may not. There are many different combinations of boys and girls that could give a ratio of 5 to 7. There could be 10 boys and 14 girls, for example, or 20 boys and 28 girls.
5. If the ratio of boys to girls is 5 to 7, then the ratio of boys to students is 5 to 12. So $\frac{5}{12}$ of the students are boys. The remaining $\frac{7}{12}$ of the students are girls.
6. Answers will vary. Possible answers include:
 3 desktops and 4 laptops $\left(\frac{3}{4}\right)$
 6 desktops and 8 laptops $\left(\frac{6}{8} = \frac{3}{4}\right)$
 9 desktops and 12 laptops $\left(\frac{9}{12} = \frac{3}{4}\right)$
7. If the ratio of desktops to laptops is 3 to 4, then the ratio of desktops to total computers is 3 to 7.

$$\frac{3 \text{ desktops}}{7 \text{ computers}} = \frac{3 \cdot 10 \text{ desktops}}{7 \cdot 10 \text{ computers}} = \frac{30 \text{ desktops}}{70 \text{ computers}}$$
 If there are 70 computers total, then 30 of them are desktops.
8. If the baby panda weighed 8 oz (0.5 lb) at birth and 75 pounds at one year, then the panda gained 74.5 lb during the first year.

$$\frac{74.5 \text{ lb}}{1 \text{ year}} = \frac{74.5 \text{ lb}}{12 \text{ months}} \approx 6.21 \text{ pounds/month}$$

$$\frac{74.5 \text{ lb}}{1 \text{ year}} = \frac{74.5 \text{ lb}}{52 \text{ weeks}} \approx 1.43 \text{ pounds/week}$$
9. $\frac{75 \text{ miles}}{5 \text{ hours}} = 15 \text{ mph}$; $\frac{97.5 \text{ miles}}{6.5 \text{ hours}} = 15 \text{ mph}$.
 Since the rates are equal, distance and time are proportional.
10. a. $\frac{4 \text{ g}}{6 \text{ g}} \approx 67\%$
- b. 13% of 1,000 mg = 130 mg
- c. $\frac{100\%}{13\%} \approx 7.7$ servings. Each serving is 1 ounce, so 7.7 ounces.

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11. $\frac{240 \text{ calories}}{2 \text{ pieces}} = \frac{120 \text{ calories}}{1 \text{ pieces}} = \frac{600 \text{ calories}}{5 \text{ pieces}}$; 600 calories in a 5-piece plate.
12. a. No; the Hispanic students are approximately only 13.9% of the student population, but 27% of the town population.
b. $27\% \text{ of } 20,250 \approx 5,468$
 $5,468 - 2,815 = 2,653$ students
13. a. No; one poll showed that 41% planned to watch the debate, while the other poll showed that 46% planned to watch.
b. $41\% \text{ of } 2,000 = 820$ voters
14. a. $\frac{8}{11} + \frac{3}{5} = \frac{8 \cdot 5}{11 \cdot 5} + \frac{3 \cdot 11}{5 \cdot 11} = \frac{40}{55} + \frac{33}{55} = \frac{73}{55}$
b. $\frac{8}{11} - \frac{3}{5} = \frac{8 \cdot 5}{11 \cdot 5} - \frac{3 \cdot 11}{5 \cdot 11} = \frac{40}{55} - \frac{33}{55} = \frac{7}{55}$
c. $\frac{8}{11} \cdot \frac{3}{5} = \frac{24}{55}$
d. $\frac{8}{11} \div \frac{3}{5} = \frac{8}{11} \cdot \frac{5}{3} = \frac{40}{33}$

1.5 Chances Are: Probability Basics

Skills

1. $\frac{4,060}{14,500} = .28 = 28\%$
2. $\frac{744}{1,200} = .62 = 62\%$

Concepts and Applications

3. $\frac{2,247}{4,000,000} = 0.00056175 \approx 0.0006$; Approximately 6 out of every 10,000 births are naturally occurring triplets.

4.

	Less Than High School	High School	Junior College	Bachelor's Degree	Graduate Degree	Total
Frequency	330	1,269	186	472	281	2,538
Relative Frequency	13.0%	50%	7.3%	18.6%	11.1%	100%

5.

	Pregnant	Not Pregnant	Total
Positive Test Result	16	4	20
Negative Test Result	6	74	80
Total	22	78	100

a. $\frac{4}{78} \approx 0.05 = 5\%$

b. $\frac{6}{22} \approx 0.27 = 27\%$

c. $\frac{90}{100} = 0.90 = 90\%$

6. Answers will vary.

7. Yes; both are in the ratio of 1:8

1.6 It's All Relative: Understanding Integers

Skills

1. $-|-15| = -15$

2. -2

Concepts and Applications

3. a. Negative; $-\$10,000$

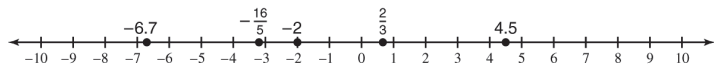
b. Negative; -400

4. a. Loss of 20 yards

b. Loss of 120.62 points for the day

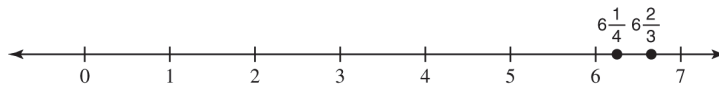
5. The iPhone 4S generated the greatest percent change in stock value within 30 days of Apple's announcement of the phone.

6.

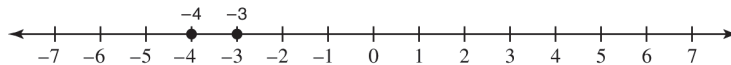


7. a.

$$6\frac{1}{4} < 6\frac{2}{3}$$

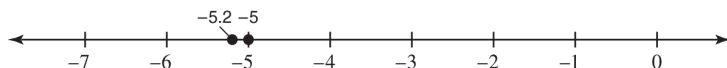


b. $-3 > -4$

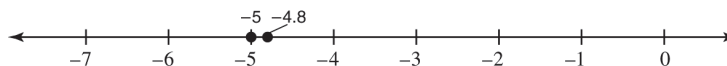


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c. $-5 > -5.2$



d. $-5 < -4.8$



8. The student's analogy with money is actually correct. However, that does not mean that -5 is bigger than -4 . The bigger the debt, the more the person is "in the hole" and the less money he or she has. Therefore, -5 is less than -4 .
9. a. -7
 b. 7
 c. $7, 7$
 d. a

1.7 Sign and Size: Integer Operations

Skills

1. a. $5.2 - (-1.1) = 5.2 + 1.1 = 6.3$
 b. $-13 + (-31) = -(13 + 31) = -44$
2. a. $(0)(-15) = 0$
 b. $\frac{-15}{3} = -5$
 c. $(-4)(-2)(-7) = (8)(-7) = -56$

Concepts and Applications

3. a. $-\$10 - \$25 = -(\$10 + \$25) = -\$35$
 She will owe him \$35 in total.
 b. $-\$11,500 + \$20,000 = \$20,000 - \$11,500 = \$8,500$
 She will have \$8,500 after the debt is paid.
4. $6 - 15 + 12 = 3$
 The team has already gained 3 yards on the first three downs. They will need $10 - 3 = 7$ more yards on the fourth down to have a 10-yard gain (and get a first down).
5. a. $47 - 22 = 25$
 25 degree rise in temperature
 b. Ending temperature – starting temperature
 c. $26 - (-5) = 26 + 5 = 31$
 31 degree rise in temperature
 d. $-5 - 26 = -31$
 31 degree drop in temperature
6. a. Example: $(-4) \times (-4) = 16$ Example: $(-4) + (-4) = -8$
 b. No

7.	Problem with parentheses	Answer	Problem without Parentheses	New Result	Do parentheses matter?
a.	$2(-4)$	-8	$2 - 4$	-2	Yes
b.	$(-2) + (-4)$	-6	$-2 + -4$	-6	No
c.	$2 - (4)$	-2	$2 - 4$	-2	No
d.	$(-2)(-4)$	8	$-2 - 4$	-6	Yes

8. a. $6 \times ? = 0$ $0 \div 6 = 0$; $? = 0$
 b. $0 \times ? = 6$ $6 \div 0$ is undefined; no such number
 c. A number cannot be divided by zero. Zero divided by any number (other than zero) is zero.
9. a. Positive
 b. It depends. Possible examples: $3 + (-7) = -4$, $7 + (-3) = 4$
 c. Negative
 d. Positive
 e. Positive
 f. Negative
 g. Negative

10. Answers will vary. Sample answers:

	Negative number	Fraction
Pick a number.	-3	$\frac{2}{3}$
Subtract 1.	$-3 - 1 = -4$	$\frac{2}{3} - 1 = -\frac{1}{3}$
Multiply by 3.	$(-4)(3) = -12$	$\left(-\frac{1}{3}\right)(3) = -1$
Add 6.	$-12 + 6 = -6$	$-1 + 6 = 5$
Divide by 3.	$-6 \div 3 = -2$	$5 \div 3 = \frac{5}{3}$
Subtract the original number.	$-2 - (-3) = -2 + 3 = 1$	$\frac{5}{3} - \frac{2}{3} = \frac{3}{3} = 1$

Yes, the result is always 1, even if you start with a negative number or fraction.

11.
$$\frac{-8 + (-30) + 15 + \left(-\frac{4}{5}\right) + (-1.2)}{5} = \frac{-25}{5} = -5$$

1.8 An Ounce of Prevention: Means

Skills

1.
$$\frac{-2 + 7 + 8 + 4 + (-1) + (-10) + 1}{7} = \frac{7}{7} = 1$$

2. Current average: $\frac{75 + 74 + 71}{3} = \frac{220}{3} \approx 73.3$

To average an 80, $\frac{\text{point total}}{4} = 80$. So her point total must be $4 \cdot 80 = 320$ points. She needs $320 - 220 = 100$ on the last test to have a B average.

Concepts and Applications

3. Answers will vary. Any 3 scores, between 0 and 10 inclusive, which total 21 will work.

Possible answers: 10, 7, and 4; 7, 7 and 7.

4. To split the check evenly, the total bill must be divided by five.

You would each pay $\frac{\$155}{5} = \31 . This amount also represents the average of the individual bills.

5. a. $\frac{32 + 36 + 38 + 39 + 42 + 43 + 44 + 47 + 49 + 50}{10} = \frac{420}{10} = 42$

The mean income for Group 1 is \$42,000/year.

$$\frac{32 + 36 + 38 + 39 + 42 + 43 + 44 + 47 + 49 + 150}{10} = \frac{520}{10} = 52$$

The mean income for Group 2 is \$52,000/year

- b. The mean is affected by one extreme value in a data set. When the last income was increased from \$50,000 to \$150,000, the mean increased by \$10,000. The mean changes as the extreme values change.
- c. No. For Group 2, a mean of \$52,000/year is not very representative of the typical income since only one of the ten incomes is greater than the mean.
6. a. Answers will vary. Possible answer: 40, 45, 50, 55, 60
- b. 50, 55, 60, 65, 70
- c. New mean: 60
- d. When 10 was added to each number, the mean also increased by 10.
- e. To increase the mean by 8 points, the teacher should add 8 points to each student's test score.
7. a. $\frac{50 + 100}{2} = \frac{150}{2} = 75$
- b. $\frac{75 + 75}{2} = \frac{150}{2} = 75$
- c. The mean does not tell us whether the two test scores are close to the mean of 75 or more spread out. The mean only tells us about the center, not the spread of the data.
8. $\frac{7 + 13 + 6 + 14 + 5 + 15}{6} = \frac{60}{6} = 10$

9. $\frac{-3 + x}{2} = 3$ $\frac{9 + y}{2} = 3$

$(\cancel{2}) \cdot \frac{-3 + x}{\cancel{2}} = 3 \cdot (\cancel{2})$ $(\cancel{2}) \cdot \frac{9 + y}{\cancel{2}} = 3 \cdot (\cancel{2})$

$-3 + x = 6$ $9 + y = 6$

$-3 + x + 3 = 6 + 3$ $9 + y - 9 = 6 - 9$

$x = 9$ $y = -3$

The other endpoint of the line segment is (9, -3).

10. a. $-\frac{9}{7} + \frac{8}{3} = -\frac{9 \cdot 3}{7 \cdot 3} + \frac{8 \cdot 7}{3 \cdot 7} = -\frac{27}{21} + \frac{56}{21} = \frac{29}{21}$
- b. $-\frac{9}{7} - \frac{8}{3} = -\frac{9 \cdot 3}{7 \cdot 3} - \frac{8 \cdot 7}{3 \cdot 7} = -\frac{27}{21} - \frac{56}{21} = -\frac{83}{21}$
- c. $-\frac{9}{7} \cdot \frac{8}{3} = -\frac{\overset{3}{\cancel{9}} \cdot 8}{7 \cdot \underset{1}{\cancel{3}}} = -\frac{24}{7}$
- d. $-\frac{9}{7} \div \frac{8}{3} = -\frac{9}{7} \cdot \frac{3}{8} = -\frac{27}{56}$

Mid-Cycle Recap

Skills

1. $\frac{\$50,000}{1 \text{ year}} \div 50 \text{ weeks/year} \div 40 \text{ hours/week} = \$25/\text{hour}$

Concepts and Applications

2. a. 75 miles and 1 hour
- b. $\frac{179 \text{ miles}}{2\frac{37}{60} \text{ hours}} \approx 68.4 \text{ miles per hour}$
3. $-\$50 \times 4 - \$25 \times 3 - \$100 + \$75 \times 2 = -\$200 - \$75 - \$100 + \$150 = -\$225$
You are \$225 in debt.
4. a. Yes; the sum of negative numbers will always be negative. The average will be the negative sum divided by a positive number and will always be negative.
- b. Answers will vary. Possible answers: 0, 0, 0, 0, 0, 0 or -3, -2, -1, 1, 2, 3

1.9 Picture This: Making and Interpreting Graphs

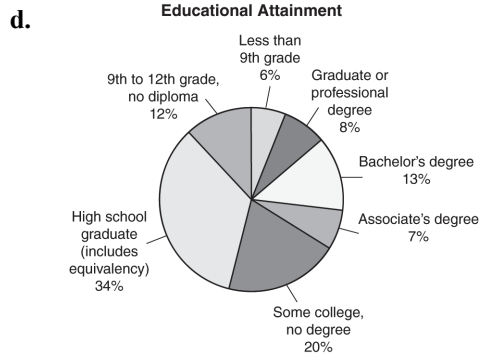
Skills

1. part-to-whole, part-to-part
2. a. 2010, 2013
- b. $0.48(950) = 456$ people

Concepts and Applications

3. a. $0.27(1,839) = 496.53$ or 497 students
- b. Include the “Never” and “Rarely” categories for a total of 56%.
 $0.56(1,839) = 1,029.84$ or 1,030 students
- c. Sharing Links has the smallest percent of students who claim to use it “Very frequently” and the largest percent of students who claim to use it “Never.”
4. a. Less than 9th grade, 9th to 12th grade (no diploma), and high school graduate (includes equivalency)
- b. High school graduate (includes equivalency)

c. Percents seem to total to 100%. All levels seem to be listed.



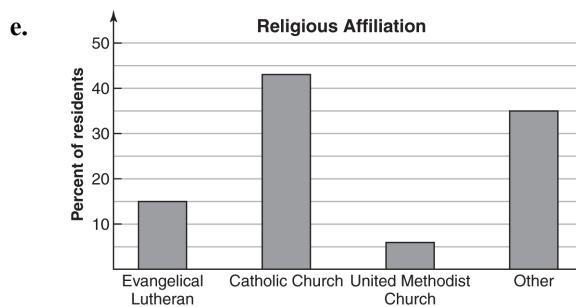
e. Bar Graph

5. a. Residents who claim no religious affiliation

b. No; the percents total to 99%, likely due to rounding

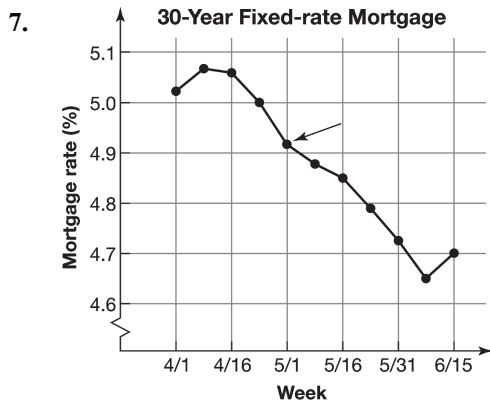
c. $0.5(156,300) = 78,150$ residents; $0.43(78,150) = 33,604.5$ residents

d. Estimates around 150° ; sector angle is actually $0.43(360^\circ) = 154.8^\circ$



f. Answers may vary.

6. Pie graphs are not used for quantitative data



a. Mortgage rates generally decreased during April and May, but started to rise at the beginning of June.

b. Approximately April 7

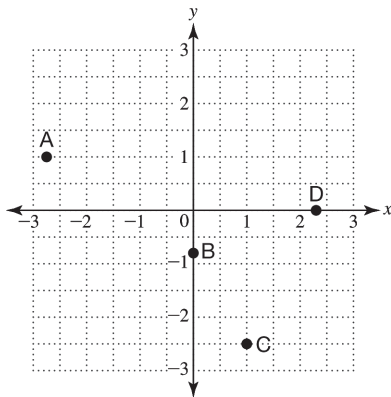
c. Approximately June 8

d. (5/1, 4.91)

On 5/1, the interest rate on a 30-year fixed-rate mortgage was 4.91%.

- e. With the new scale, the interest rates would appear to change less over these months, since the vertical changes would be diminished with the broader vertical scale.
8. a. The unemployment rate increased from 2001 to 2004, then decreased from 2004 to 2007. The unemployment rate rose sharply until 2010, when it began to level off and then decrease after 2011.
- b. 2011; 16%; (2011,16)
- c. 2011; approximately 5%; (2011,5)
- d. $(16\% - 5\%)150,000 = (11\%)150,000 = (0.11)150,000 = 16,500$ people
- e. A bar graph could have been used instead, but the line graph smooths out the changes and illustrates a trend in a way that bar graphs do not.

9.



1.10 Two by Two: Scatterplots

Skills

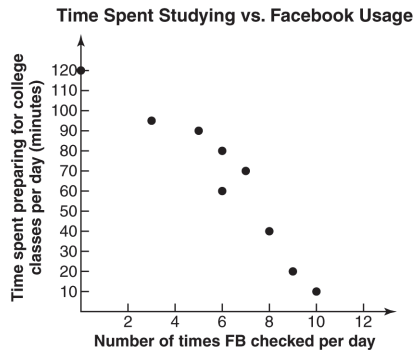
1. a. Independent variable: Time in years
Dependent variable: Tree height in feet
- b. Independent variable: Sleep time in hours
Dependent variable: Swim time in minutes
2. C; Independent variable: Day of the year
Dependent variable: Number of hours of day light

Concepts and Applications

- | | | | | |
|----|-----------------------|---------------------|---------------------|--------------------------------|
| 3. | Independent Variable: | Number of FB checks | Dependent variable: | Time spent preparing for class |
| | Axis: | Horizontal | Axis: | Vertical |
| | Minimum value: | 0 | Minimum value: | 0 |
| | Maximum value: | 12 | Maximum value: | 120 |
| | Increment | 2 | Increment: | 10 |

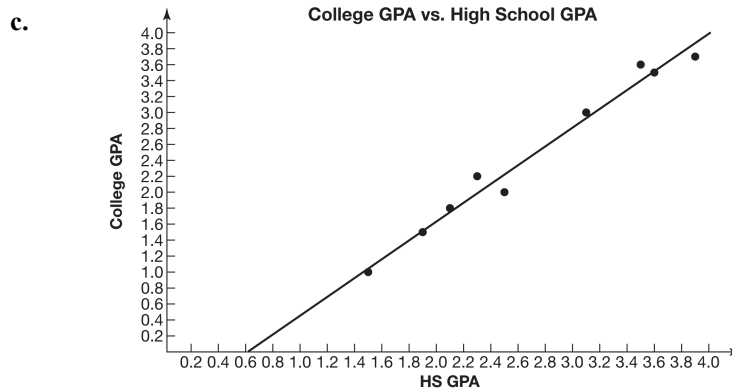
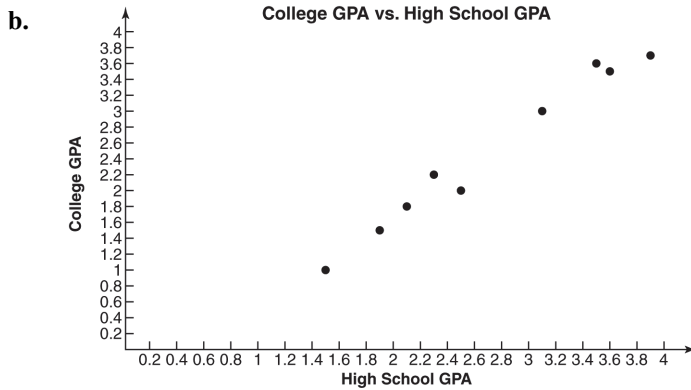
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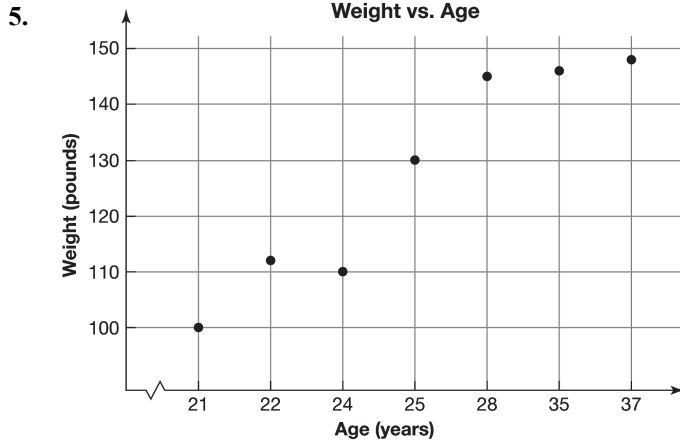


Preparation times tends to decrease as the number of FB checks increases.

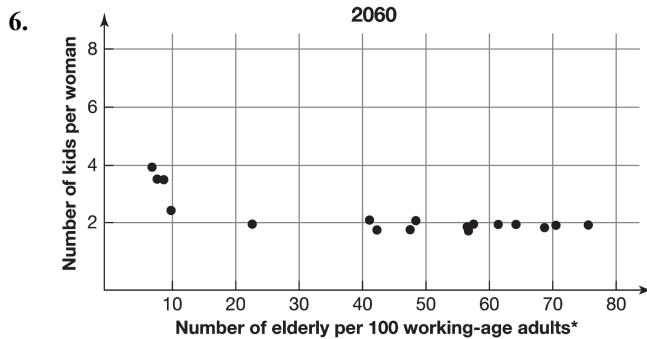
4. a. Independent Variable: HS GPA Dependent variable: College GPA
 Axis: Horizontal Axis: Vertical
 Minimum value: 0 Minimum value: 0
 Maximum value: 4 Maximum value: 4
 Increment: 0.2 Increment: 0.2



- d. The higher your HS GPA, the higher your college GPA is likely to be.



The vertical axis should show a jagged start, since it begins at 100 and not 0. The scale on the horizontal axis is not consistent. The first increment between tick marks is 1, while the second is 2. One way to fix the scale on the horizontal axis would be to show a jagged start and begin at 20 with an increment of 2.



*Elderly refers to 65 and over. Working-age refers to people age 20–64.

In 2060, the predictions show that many more countries will have high ratios of elderly to working-age adults and low ratios of children per woman.

7. 1 mile per minute

1.11 Multiply vs. Divide: Converting Units

Skills

- $1257 \text{ mg} \div 1000 \text{ mg/g} = 1.257 \text{ grams}$
- $12.5 \text{ mi} \cdot 5,280 \text{ ft/mi} = 66,000 \text{ ft}$
 $66,000 \text{ ft} \cdot 12 \text{ in./ft} = 792,000 \text{ in.}$

Concepts and Applications

- No. It depends on the conversion fact you are using. For example, to convert 3 miles to kilometers using the fact that $1 \text{ km} \approx 0.62 \text{ mi}$, you would divide by 0.62. However, to convert 3 miles to kilometers using the fact that $1 \text{ mi} \approx 1.61 \text{ km}$, you would multiply by 1.61.
- $30 \text{ days} \cdot 24 \text{ hours/day} = 720 \text{ hours}$
 $720 \text{ hours} \cdot 60 \text{ minutes/hour} = 43,200 \text{ minutes}$
 $43,200 \text{ minutes} \cdot 60 \text{ seconds/minute} = 2,592,000 \text{ seconds}$
 - $30 \text{ days} \cdot 86,400 \text{ seconds/day} = 2,592,000 \text{ seconds}$
 - They are the same.

16 Cycle 1: Where Do We Start?

5. a. smaller
b. larger
6. a. 1 centimeter \div 2.54 centimeters/inch = 0.39 inch
b. 1 foot \div 5,280 feet/mile = 0.000189 mile
7. 84 inches \cdot 5 = 420 inches
420 inches $\cdot \frac{1 \text{ foot}}{12 \text{ inches}} = 35 \text{ feet}$
8. $\frac{70 \text{ miles}}{1 \text{ hour}} \cdot \frac{5280 \text{ feet}}{1 \text{ miles}} \cdot \frac{1 \text{ hour}}{60 \text{ min}} \cdot \frac{1 \text{ min}}{60 \text{ sec}} = \frac{102.\overline{6} \text{ feet}}{1 \text{ sec}}; \frac{102.\overline{6} \text{ feet}}{1 \text{ sec}} \cdot 3 \text{ sec} = 308 \text{ feet}$
9. 3,600 gallon $\cdot \frac{3.78541 \text{ liters}}{1 \text{ gallon}} = 13,627.476 \text{ liters} \cdot \frac{1 \text{ min}}{20 \text{ liters}}$
 $= 681.3738 \text{ min} \cdot \frac{1 \text{ hour}}{60 \text{ min}} \approx 11.35623 \text{ hours}$
 $= 11.35623 \text{ hours} \approx 11 \text{ hour and } 21 \text{ min } (0.35623 \cdot 60 \text{ min} \approx 21 \text{ min})$
10. $\frac{10 \text{ miles}}{1 \text{ sec}} \cdot \frac{60 \text{ sec}}{1 \text{ min}} \cdot \frac{60 \text{ min}}{1 \text{ hr}} = \frac{36,000 \text{ miles}}{1 \text{ hr}}$
11. $35\% = \frac{35}{100} = \frac{7}{20}$

1.12 Up and Down: Percent Change

Skills

1. Total amount with tax: $\$42(1.2) = \50.4
2. a. $70 - 51 = 19$ percentage points
b. $70\% - 51\% = 19\%$
 $\frac{19}{70} \approx 0.271 = 27.1\%$

Concepts and Applications

3. a. Salaries are for illustration purposes only.

Salary	Add \$1,000, then Increase by 3.5%	Increase by 3.5%, then Add \$1,000
\$10,000	\$11,385	\$11,350
\$20,000	\$21,735	\$21,700
\$30,000	\$32,085	\$32,050
\$40,000	\$42,435	\$42,400
\$50,000	\$52,785	\$52,750

- b. Order matters, increasing by \$1,000 first and then adding 3.5% always produces a higher salary than using the other order because we apply the percent increase to a larger amount.

- c. Method 1: New salary = $1.035(S + 1,000)$
Method 2: New salary = $1.035S + 1,000$
 - d. If the \$1,000 increment is applied first, then the 3.5% is applied to that as well. So the final amount with the increment applied first is always larger by 3.5% of \$1,000, or \$35.
 - e. Management would prefer the second way, which adds the percent first. Employees would prefer the first method, which applies the percent second.
4. Option 1: $0.90P - 20$
Option 2: $0.90(P - 20)$
Option 1 always results in a lower number and is a better for the consumer.
5. She is not correct. She needs to divide by the first score of 80 instead of the second score of 100. Her percent increase is really 25%.
6. Statements b and c are correct.
7. a. $\$1000(0.90) = \900
b. $\$900(1.10) = \990
c. No; the amount to which the percent is applied is not the same in each case, so the two percents do not just “cancel each other out.”
8. The goal should be $1.5(0.3) = .45 = 45\%$ of students completing their studies.
9. $(1.05)(1.05)(1.05)(1.05)(1.05)(1.05)(1.05)(1.05)(1.05)(1.05) \approx 1.629 \approx 63\%$
10. 9, 9.5, 9.75, 9.875
This is found by recognizing the difference between the first two numbers is 16, the next two numbers is 8, the next two is 4 and so on. The next number in the sequence is found by adding half of the previous difference.
- $$\begin{aligned} -22 + 16 &= -6 \\ -6 + 8 &= 2 \\ 2 + 4 &= 6 \\ 6 + 2 &= 8 \\ 8 + 1 &= 9 \\ 9 + .5 &= 9.5 \\ 9.5 + 0.25 &= 9.75 \\ 9.75 + 0.125 &= 9.875 \end{aligned}$$

1.13 The X Factor: Algebraic Terminology

Skills

1. a. $3x - 7$; -18
b. $3x - 7 = -18$
c. x
d. $3, -7, -18$
e. $3x, -7, -18$
f. $3, x$
g. 3

18 Cycle 1: Where Do We Start?

2. a. expression
- b. equation
- c. expression
- d. expression
- e. equation
- f. expression

Concepts and Applications:

3. The second student is correct. The acceleration due to gravity is a constant since its value is 9.8 m/sec^2 . Although it is represented with a letter, the quantity is considered a constant.
4. $5x - 9$ is an expression, not an equation. It should not be solved. It does not have “sides”, so adding 9 twice increases the quantity by 18.

5. a. $5x - 20 = 5(4) - 20$
 $= 20 - 20$
 $= 0$

b. $5(4) - 20 = 0$
 $20 - 20 = 0$
 $0 = 0$

This is a true statement.

6. Expression or Equation	Term(s)	Factor(s)
$5x$	$5x$	5 and x
$5x - 8 = 0$	$5x, 8, 0$	5 and x
$x(5x - 8) = 0$	$5x, -8$	x and $5x$, 5 and x
$\frac{x}{(5x - 8)(y + 7)}$	$x, 5x, -8, y, 7$	5 and x , $5x - 8$, and $y + 7$

7. a. Answers will vary. One possible answer: $2xyz + 3 + 5w$
- b. Answers will vary. One possible answer: $-2x + 4 = 3x - 1$
8. a. Pi is constant. Volume, radius, and height can vary.
- b. The volume increases as the radius and height of the cylinder increase.
- c. The volume increases by a factor of 8 because the radius is squared, $(2r)^2 = 4r^2$, and then multiplied by twice the height, $2h$. The new volume is $4r^2 \cdot 2h = 8r^2h$.
9. $1.15F + 10$

1.14 General Number: Recognizing Patterns

Skills

1.
 - a. Each number is 12 greater than the previous number.
53, 65
 - b. Each number is 4 less than the previous number.
2, -2
 - c. The pattern is to add 13, subtract 12, add 13, subtract 12, ...
-6, 7
2. Each term adds $x + 1$ to the previous term.
 $7x + 4$

Concepts and Applications

3.
 - a. 25, 32, 39, 46, 53
 - b. 36, 12, 4, $\frac{4}{3}$, $\frac{4}{9}$
4.
 - a. Each fraction is one divided by the entry number.
Fraction: $\frac{1}{10}$, $\frac{1}{50}$, $\frac{1}{100}$, $\frac{1}{150}$, $\frac{1}{200}$, $\frac{1}{n}$
Decimal: 0.5, $0.\bar{3}$, 0.25, 0.2, 0.1, 0.02, 0.01, $0.00\bar{6}$, 0.005
 - b. The numbers are decreasing and appear to be approaching zero.
5.
 - a. Each fraction has the form $\frac{2n}{2n+1}$, where n is the entry number.
Fraction: $\frac{12}{13}$, $\frac{14}{15}$, $\frac{16}{17}$, $\frac{18}{19}$, $\frac{400}{401}$, $\frac{2n}{2n+1}$
Decimal: 0.8, 0.86, 0.89, 0.91, 0.92, 0.93, 0.94, 0.95, 1 (rounded to two decimal places)
 - b. Each number's denominator will be greater than its numerator. So the fractions will always be proper and therefore always less than 1.
$$\frac{2n}{2n+1} < 1$$
6. If you square a positive number less than 1, the result will be less than the original number. Also, if 0 or 1 is squared, the result is equal to the number, but not greater.
7. \$200, \$210, \$220.50, \$231.53, \$243.10, \$255.26
 $200(1.05)^n$ or $210(1.05)^{n-1}$
8. Each figure has three more squares than the previous figure. The sequence for the number of squares is 3, 6, 9, 12, ... Since the number of squares is increasing by 3 each time, the sequence is arithmetic.
 n th term: $3 + (n-1)3$ or $3n$
9.
 - a. 1.15
 - b. 0.85

1.15 The Social Network: Linear and Exponential Change

Skills

1. a. Exponential growth; $y = 5^x$

x	y
0	1
1	5
2	25
3	125
4	625
5	3,125

- b. Linear growth; $y = 5x$

x	y
0	0
1	5
2	10
3	15
4	20
5	25

2. Exponential. As each x -value increases by 1, the previous y -value is multiplied by $\frac{1}{2}$.

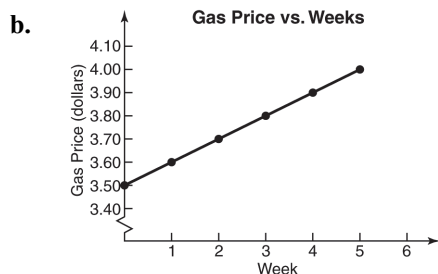
Function: $y = -16\left(\frac{1}{2}\right)^x$

Concepts and Applications

3. No; there is not one unique y -value for each x -value. Specifically, 5 corresponds to two different y -values, 62,000 and 64,000.
4. Answers will vary. National debt, human populations, and bacteria populations can all grow exponentially. Hair growth and tree growth are examples of linear growth.

5. a.

Week (w)	Gas Price per Gallon (\$)
0	3.50
1	3.60
2	3.70
3	3.80
4	3.90
5	4.00



- c. Linear, because each output is \$0.10 more than the previous output.
- d. Gas price per gallon = $3.50 + 0.10w$

e. $3.50 + 0.10w = 6$
 $3.50 + 0.10w - 3.50 = 6 - 3.50$
 $0.10w = 2.5$
 $\frac{0.10w}{0.10} = \frac{2.5}{0.10}$
 $w = 25$

The gas price will reach \$6 per gallon on week 25.

- f. It's unlikely that this growth would continue. At some point, the growth will probably slow or the prices might begin to fall due to other economic factors.

6. a.

Quarter, q	Total Customers, T
0	1,500
1	1,650
2	1,815
3	1,997
4	2,196
5	2,416

- b. Exponential, because each output is 1.1 times the previous output.

c. $T = 1500(1.10)^q$

- d. It will take 13 quarters (or 3.25 years) for the total number of customers to surpass 5,000. This can be found by continuing the pattern in the table.

e. $T = 1500(1.10)^{100} \approx 20,670,919$

7. Falling by \$20,000 each year is a linear change. Falling by the same percent each year is an exponential change.
8. Answers will vary. One possible answer for each scenario is given.

Linear with an increase of \$5 per year.

Year	Tuition
0	100
1	105
2	110
3	115
4	120
5	125
6	130
7	135
8	140
9	145
10	150

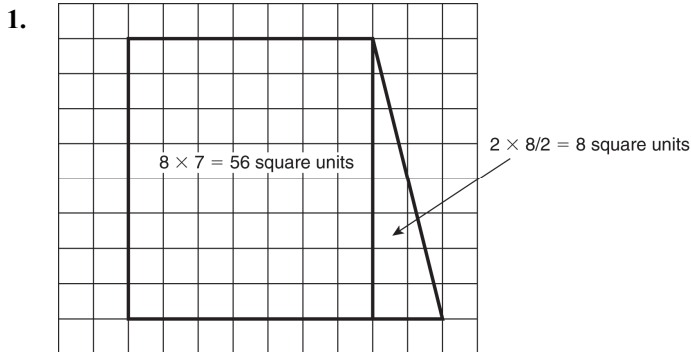
Exponential with an increase of 5% per year.

Year	Tuition
0	100
1	105
2	110.25
3	115.76
4	121.55
5	127.63
6	134.01
7	140.71
8	147.75
9	155.13
10	162.89

9. $3 \text{ hours} \cdot \frac{60 \text{ minutes}}{1 \text{ hour}} = 180 \text{ minutes}$
 $180 \text{ minutes} \div 54 \text{ outs in a game} = 3.\bar{3} \text{ minutes per out}$
Each out takes around $3.\bar{3}$ minutes.

1.16 Infinity and Beyond: Perimeter and Area

Skills

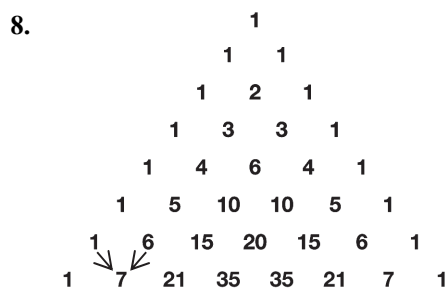


The area of the figure is 64 square units.

2. Perimeter = 7 units + 8 units + 9 units + 8.2 units = 32.2 units

Concepts and Applications

3. The student is ignoring the units. The perimeter and area are not the same since the units are different. They are both 10, but the perimeter is 10 *inches* and the area is 10 *square inches*.
4. a. The relevant shoreline measure would be perimeter or length, not area.
 b. The size of the house should be described in square feet, not feet.
 c. Mulch is sold by volume, usually cubic yards.
5. 1"×1" bars: $9 \cdot 13 = 117$
 2"×2" bars: $8 \cdot 12 = 96$; $96 \div (2 \cdot 2) = 24$
 $117 - 96 = 21$ inches wasted
6. a. Perimeter: 12 feet + 12 feet + 20 feet + 20 feet = 64 feet
 Area: 12 feet × 20 feet = 240 square feet
- b. 12 feet(1.2) = 14.4 feet, 20 feet(1.2) = 24 feet
 Perimeter: 14.4 feet + 14.4 feet + 24 feet + 24 feet = 76.8 feet
 Area: 14.4 feet × 24 feet = 345.6 square feet
- c. Percent increase of perimeter: $\frac{76.8 \text{ feet} - 64 \text{ feet}}{64 \text{ feet}} = \frac{12.8 \text{ feet}}{64 \text{ feet}} = 0.2 = 20\% \text{ increase}$
 Percent increase of area: $\frac{345.6 \text{ square feet} - 240 \text{ square feet}}{240 \text{ square feet}} = \frac{105.6 \text{ square feet}}{240 \text{ square feet}} = 0.44 = 44\% \text{ increase}$
7. Follow directions in the exercise.



To build the triangle, start with “1” at the top, then continue placing numbers below it in a triangular pattern. Each number is the sum of the numbers directly above it.

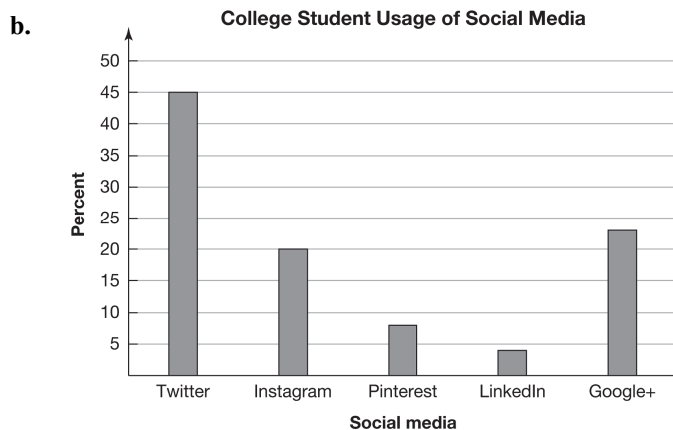
Cycle 1 Wrap-Up: Vocabulary Check

1. Venn diagram
2. Cartesian coordinate system, axes, origin, quadrants
3. ordered pair
4. ratio, rate
5. proportion, proportional
6. scale
7. Experimental probability
8. negative number
9. integers
10. opposite
11. absolute value
12. real numbers
13. mean
14. bar graph, pie graph
15. scatterplot
16. independent variable, dependent variable
17. algebra
18. constant
19. variable
20. term, factors
21. expression, equation
22. polynomial
23. monomial, binomial, trinomial
24. degree
25. inductive reasoning, deductive reasoning
26. conjecture, counterexample
27. percent change

- 28. function
- 29. exponential function, geometric
- 30. linear function, arithmetic
- 31. perimeter
- 32. similar

Cycle 1 Wrap-Up: Concepts and Applications Review

1. a. $\frac{1.1 \text{ MB}}{5.8 \text{ MB}} \approx 19\%$
 b. $23.1 \text{ MB} - 1.5 \text{ MB} = 21.6 \text{ MB}$
 c. $\frac{21.6 \text{ MB}}{23.1 \text{ MB}} \approx 94\%$
 d. 60.8 KB/sec
 e. For the Firefox Setup file, 60.8 kilobytes are being downloaded per second.
 f. Total downloaded so far: $1.1 \text{ MB} + 1.3 \text{ MB} + 1.5 \text{ MB} = 3.9 \text{ MB}$
 Total to download: $5.8 \text{ MB} + 47.1 \text{ MB} + 23.1 \text{ MB} = 76 \text{ MB}$
 $\frac{3.9 \text{ MB}}{76 \text{ MB}} \approx 5\%$
2. $-8 + (-8) = -16$
 $-8 - (-8) = 0$
 $-8 \cdot (-8) = 64$
 $-8 \div (-8) = 1$
3. a. Friday:
 $200 - 100 - 150 - 15 - 20 = -105$; $-105 - 20$ (overdraft fee) = $-\$125$
 Saturday:
 $-125 - 10 - 35 = -170$; $-170 - 5$ (consecutive day overdraft fee) = $-\$185$
 Sunday:
 $-185 - 85 = -270$; $-270 - 5$ (overdraft fee) $- 5$ (consecutive day overdraft fee) = $-\$280$
 b. It would be better if the smaller charges cleared first on Friday. Then there would be fewer overdraft charges.
 c. No; transferring \$150 on Saturday morning would avoid one of the overdraft fees on Saturday.
4. a. $\frac{72 + 78 + 75 + 82}{4} = 76.75$
 b. $\frac{72 + 78 + 75 + 8}{4} = 58.25$
 c. $\frac{58.25 - 76.75}{76.75} \cdot 100 \approx -24\%$
5. a. A pie graph is not appropriate to represent this data, since some students in the class are in more than one social media category. A pie graph can be used only when the categories do not overlap and all the categories make up the whole. So a bar graph would be more appropriate.



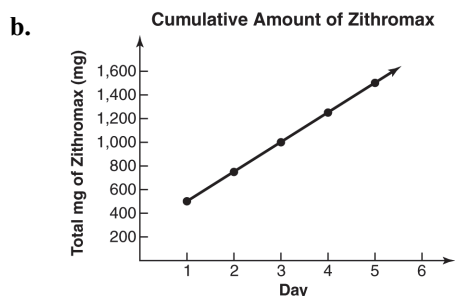
6. For a 2,000-calorie diet: $\frac{\text{dietary fiber}}{\text{total fat}} = \frac{25 \text{ g}}{65 \text{ g}} \approx 0.3846$

For a 2,500-calorie diet: $\frac{\text{dietary fiber}}{\text{total fat}} = \frac{30 \text{ g}}{80 \text{ g}} \approx 0.375$

When the decimals for the ratios are rounded to two decimal places, they are equal. So the dietary fiber is approximately proportional to the total fat in a diet.

7. a.

Day	Cumulative Amount of Zithromax Taken (mg)
1	500
2	750
3	1,000
4	1,250
5	1,500



c. Yes, the data is linear. The amount of Zithromax increases by the same amount, 250 mg, each day. Also, from the graph, it appears that the points lie in a line.

d. If this formula is used, the amount of Zithromax will be off by 250 mg for each day. On day 2, you should calculate $500 + 250$ not $500 + 250(2)$.

e. Total amount = $500 + 250(D - 1)$ or Total amount = $250 + 250D$

8.

Age (years)	Value (\$)
0	20,000
1	18,500
2	17,000
3	15,500
4	14,000
5	12,500

a. Value = $\$20,000 - \$1500n$, where n is the age of the car in years

b. $N = 5$

Value = $\$20,00000 - \$1500(5) = \$12,500$

c. Value = $\$20,000 - \$1500n$

$$0 = \$20,00000 - \$1500n$$

$$0 - \$20,000 = \$20,00000 - \$1500n - \$20,000$$

$$-\$20,000 = -\$1500n$$

$$\frac{-\$20,000}{-\$1500} = \frac{-\$1500n}{-\$1500}$$

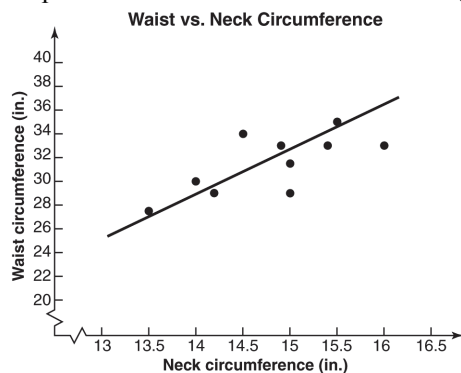
$$\frac{-\$20,000}{-\$1500} = \frac{-\$1500n}{-\$1500}$$

$$13.\bar{3} = n$$

The car will be worthless in about 13 to 14 years

9. Independent variable: neck circumference (in.)

Dependent variable: waist circumference (in.)



10. a. $1.035S + 15,000$

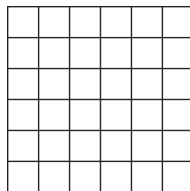
b. $1.035S + 15,000 = 2S$

11. a. 50, 65, n th term: $1 + n^2$

b. -4, 2, n th term: $-22 + 6(n - 1)$ or $-28 + 6n$

12. $\frac{10 \text{ km}}{1 \text{ hr}} \div 1.61 \text{ km/mi} \cdot 24 \text{ hr/day} \approx 149 \text{ miles/day}$

13. a.



$$P = 6 + 6 + 6 + 6 = 24 \text{ units}$$

b.



$$A = (9 \text{ units})(9 \text{ units}) = 81 \text{ square units}$$

14. a. The statement is false. If the cost of a \$100 item is increased 50%, the cost rises to \$150. If the cost is then decreased 50%, the cost falls to \$75, not to the original of \$100.
- b. The statement is true. The original quantity, 100%, is increased by 200%, resulting in 300% or three times the original quantity.
15. a. The medicine can be administered at most five times a day. The dose for a 5-year-old is $\frac{3}{4}$ teaspoon.
- $0.75 \text{ tsp} \cdot 5 \text{ times per day} = 3.75 \text{ tsp}$
 Each teaspoon contains 320 mg of acetaminophen.
 $3.75 \text{ tsp} \cdot 320 \text{ mg act/tsp} = 1,200 \text{ mg acetaminophen}$
 One thousand milligrams is 1 gram, so $\frac{1,200}{1,000} = 1.2$ grams.
 So the child consumes 1.2 grams of acetaminophen in a 24-hour period.
- b. By her weight, she should have been given only $\frac{1}{2}$ teaspoon per dose. This would have resulted in in
- $5 \times \frac{1}{2} = \frac{5}{2} = 2\frac{1}{2}$ teaspoons over the 24-hour period, or $2.5 \text{ tsp} \times 320 \text{ mg/tsp} = 800 \text{ mg} = 0.8 \text{ g}$ of acetaminophen.
- c. She has been given $1.2 \text{ g} - 0.8 \text{ g} = 0.4 \text{ g}$ extra or $\frac{0.4}{0.8} \cdot 100 = 50\%$.
16. a. 2 and π are constant; C , r , and d vary.
- b. Circumference depends on the radius or diameter of the circle, so circumference is dependent, and radius and diameter are independent.
- c. $C = 2\pi r = 2(3.14)(0.67) \approx 4.21$ inches
- d. $C = 2\pi r = 2\pi\left(\frac{2}{3}\right) \approx 4.19$ inches
- e. The error is $4.21 - 4.19 = 0.02$ inch, which is $\frac{0.02}{4.19} \approx 0.0048 = 0.48\%$ of 4.19 inches.