Dear Students and Parents:

Summer is a time to relax and have fun. It's also a great time to stay sharp on your math problem solving skills. Some of the problems in this packet will be easy, and others more challenging. Use the problems in this packet in the way that is best for you. You can find the answers on the District Website http://www.clayton.k12.mo.us/summermath so you can check your work along the way. The problems in this packet reflect the content learned during the previous school year. You will continue to have access to your online textbook, which can be used to help you remember any of your previous learning. Spread your time practicing out over the summer weeks; your goal might be 3-4 pages per week.

- **Math in Focus Text Series Website (6-8)**
  - my.hrw.com
    - username: firstnamelastname
    - password: clayton

Below you will find additional web-based resources to support summer learning.

**Fact Fluency Practice:**

- **Kakooma (Web-based & free app)**
  - http://gregtangmath.com/kakooma
    Do you love the challenge of a great puzzle? KAKOOMA® provides an alternative way to practice math facts.

- **24 Game (Free app)**
  - The 24 Game is a math puzzle game for all ages used to exercise or improve quick thinking and mental math. The goal of the game is to combine 4 numbers into 1 number, equal to 24 by adding, subtracting, and multiplying

**Problem Solving**

- http://www.gregtangmath.com/games
  These games represent a revolutionary new approach to teaching math that combines common sense, creativity and clever thinking. They incorporate proven math strategies that are the foundation for great computational skills, challenging activities that appeal to kids and adults of all ages, and social gaming features that add a friendly, competitive dimension. Best of all, they're so fun they're addicting. Just learn to play - then play to learn!

**Math Contests & Competition Problems**

  Art of Problem Solving's For the Win is an online multiplayer math game, based on thousands of problems from MATHCOUNTS, Math Olympiad for Elementary and Middle Schools, the American Mathematics Competitions, the Centre for Education in Mathematics and Computing, and other sources.

* Continued on Back
Bar Modeling:

- Bar Modeling Practice: Thinking Blocks (Web-based & free app)

Bar models are used to solve multi-step problems that involve larger numbers and move students away from a “key word” strategy and concentrate more on the relationship being described.

**Consider the problem:** Keisha has 213 stamps in her collection. She has 78 fewer stamps than Fran. How many stamps are in Fran’s collection?

Using the “key word” strategy, children often use the word fewer to signal subtraction, when the solution for this problem should involve addition. By using the bar model the operation is clear. Students use of bar models are expanded to include multiplication and division problems, and problems involving fractions and decimals. Worth noting is the thoroughness with which these real-world problems prepare students for algebra. In translating their problem-solving skills to algebra, students will merely substitute a variable for each question mark in the bar model and solve the problem using a similar number sentence.

**Additional Concept Practice and Learning:**

- Additional Practice Websites:
  - [http://www.woksheetworks.com](http://www.woksheetworks.com)
  - [https://www.thatquiz.org](https://www.thatquiz.org)

- Math tutorial website:
  - Khan Academy: [www.khanacademy.org](http://www.khanacademy.org)
  - Math Playground: [www.mathplayground.com](http://www.mathplayground.com)

Keep your summer packets so you can show off all your hard work to your teacher next year!

Have a Great Summer!
Cumulative Practice
for Chapters 1 to 3

Draw a horizontal number line to represent each set of numbers.

1. Prime numbers less than 25

2. Mixed numbers between $-6$ and $-7$ with an interval of $\frac{1}{5}$ between each pair of mixed numbers

Arrange the following numbers from least to greatest.

3. $13, -5, -8, 2, -10, 6, -20, 0$

___ ___ ___ ___ ___ ___ ___ ___ least greatest

Arrange the following numbers from greatest to least.

4. $-12, 7, 20, -16, -4, 25, 0, -30$

___ ___ ___ ___ ___ ___ ___ ___ greatest least

Complete each inequality using $>$ or $<$.

5. $-36 \square 2$

6. $\frac{7}{8} \square -\frac{7}{9}$

7. $8 \square -10$

8. $-12 \square -25$

9. $\sqrt[3]{216} \square \sqrt[3]{81}$

10. $3^3 \square 2^4$

11. $|80| \square |-100|$

12. $|600| \square |-700|$
Express each number as a product of its prime factors.

13. 56  
14. 180  

Find the greatest common factor of each set of numbers.

15. 36 and 42  
16. 24, 48, and 84  

Find the least common multiple of each set of numbers.

17. 6 and 14  
18. 21, 28, and 42  

Find the value of each of the following.

19. The square of 14  
20. The cube of 30  
21. The square root of 324  
22. The cube root of 1,728  
23. $10^2 - \sqrt{729} = $  
24. $\sqrt[3]{512} + \sqrt[3]{64} \times \sqrt[3]{343} = $  
25. $\frac{2^2}{5} \times \frac{3}{4} = $  
26. $1\frac{5}{6} \div \frac{4}{9} = $  
27. $3.7 \times 2.5 = $  
28. $18.5 \div 2.5 = $  

Solve. Show your work.

29. The mass of a bag of flour is 7 kg 500 g. Joyce repacks the flour into 12 small packs of equal mass. What is the mass, in kilograms, of each small pack of flour? (1 kg = 1,000 g)
30. A chef buys $4\frac{1}{2}$ pounds of broccoli. A casserole recipe calls for $\frac{3}{4}$ pound of broccoli. How many casseroles can the chef prepare before she runs out of broccoli?

31. A bottle has a mass of 1.8 kilograms when it is completely filled with juice. It has a mass of 1.23 kilograms when $\frac{3}{8}$ of the juice is removed. What is the mass of the empty bottle?

32. Paul paid $25.50 for 3 cups of hot chocolate and 4 cups of hot tea. The cost of each cup of tea was $\frac{2}{3}$ the cost of each cup of hot chocolate. How much did each cup of hot chocolate cost?
33. Josie spent \(\frac{4}{7}\) of the money in her purse on some books, and the rest of the money on 18 markers. Each marker cost $1.20. How much money was in Josie’s purse to begin with?

34. A cereal bar is sold individually for $2.40 or in packs of 4 for $8 per pack. Roxie wants to buy exactly 38 cereal bars. What is the least amount of money that Roxie can spend on cereal bars?

35. At a festival, \(\frac{2}{7}\) of the number of girls was equal to \(\frac{3}{5}\) of the number of boys. There were 165 fewer boys than girls, how many children were at the festival in all?
36. Madison spent $\frac{5}{8}$ of her savings on a microwave oven and a refrigerator. She used $\frac{4}{7}$ of the amount she spent to buy the refrigerator. The refrigerator cost $280$ more than the microwave oven. How much savings did Madison start with?

37. Michael and Mateo begin running around a circular track from the starting point at the same time. It takes Michael 48 seconds to complete one lap around the track. It takes Mateo 60 seconds to complete one lap around the track. 
   a) How many minutes does it take before the two boys will meet at the starting point again? 
   b) How many laps will each boy have run by then?

38. Jaden wants to cover a floor with square tiles of the same size. The floor measures 315 inches by 108 inches. If she uses only whole tiles, find 
   a) the greatest possible length of each tile; 
   b) the number of tiles needed to cover the floor.
Solve.

1. Use the digit 4 four times in combined operations (+, −, ×, or ÷), with or without parentheses, to make the numbers 1 to 9. For example: \((4 + 4) ÷ (4 + 4) = 1\)
   a) \(4\ \ 4\ \ 4\ \ 4\ \ =\ \ 2\)
   b) \(4\ \ 4\ \ 4\ \ 4\ \ =\ \ 3\)
   c) \(4\ \ 4\ \ 4\ \ 4\ \ =\ \ 4\)
   d) \(4\ \ 4\ \ 4\ \ 4\ \ =\ \ 5\)
   e) \(4\ \ 4\ \ 4\ \ 4\ \ =\ \ 6\)
   f) \(4\ \ 4\ \ 4\ \ 4\ \ =\ \ 7\)
   g) \(4\ \ 4\ \ 4\ \ 4\ \ =\ \ 8\)
   h) \(4\ \ 4\ \ 4\ \ 4\ \ =\ \ 9\)

2. When a number is divided by 6, the remainder is 5. When the same number is divided by 7, the remainder is 6. When the same number is divided by 9, the remainder is 8. What is the number?
1. The following table records the maximum and minimum daily temperatures of a city over a five-day period.

<table>
<thead>
<tr>
<th>Day</th>
<th>Mon</th>
<th>Tue</th>
<th>Wed</th>
<th>Thu</th>
<th>Fri</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Maximum temperature (°C)</strong></td>
<td>−5</td>
<td>2</td>
<td>−1</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td><strong>Minimum temperature (°C)</strong></td>
<td>−10</td>
<td>−4</td>
<td>−9</td>
<td>−6</td>
<td>−7</td>
</tr>
</tbody>
</table>

a) Which day has the greatest difference in temperature?

b) Which day has the least difference in temperature?

c) What is the difference between the highest temperature and the lowest temperature over the five-day period?

d) Draw a vertical number line to represent the maximum and minimum daily temperatures of the city over the five-day period.
Solve. Show your work.

1. Miley made coupon books for a fundraiser. On the first day, she made \(\frac{1}{6}\) of the total number of coupon books she made for the fundraiser. On the second day, she made 48 coupon books. The number of coupon books she made on the second day is \(\frac{1}{5}\) more than the number of coupon books she made on the first day. What was the total number of coupon books Miley made for the fundraiser?

2. A wooden crate, half full of oranges, weighs 6.9 pounds. If the crate is only \(\frac{1}{3}\) full of oranges, the crate weighs 1.8 pounds less than it does when it is half full of oranges. How much does the crate weigh if it is \(\frac{5}{8}\) full of oranges?
3. Mr. Lee owns a toy store. He orders 20 toys consisting of airplanes, cars, and trains. The number of airplanes is \( \frac{2}{3} \) the number of cars. The number of cars is \( \frac{3}{5} \) the number of trains. The price of each toy airplane is $12 and the price of each toy car is $8. Each toy train costs \( \frac{1}{2} \) as much as the toy airplane.

a) How many toy cars does Mr. Lee buy?

b) How much does Mr. Lee spend for the toys?

4. Jared has 42 more stickers than Heather. Jared gives away \( \frac{1}{6} \) of his stickers to his friends and Heather gives away \( \frac{1}{4} \) of her stickers to her cousins. Now Jared has 45 more stickers than Heather. How many stickers did Jared start with?
Cumulative Practice
for Chapters 4 to 7

Find the missing term in each pair of equivalent ratios.

1. $7 : 15 = 63 : \underline{\phantom{00}}$
2. $\underline{\phantom{00}} : 13 = 48 : 104$

Write each ratio in simplest form.

3. $36 : 90$
4. $56 : 91$
5. $60 \text{ inches} : 3 \text{ feet}$
6. $2 \text{ pounds} : 24 \text{ ounces}$

Express each decimal as a percent.

7. $0.76$
8. $1.09$

Express each fraction as a percent.

9. $\frac{13}{20}$
10. $\frac{7}{12}$

Express each percent as a decimal.

11. $9\%$
12. $150\%$

Express each percent as a fraction in simplest form.

13. $88\%$
14. $120\%$
Find the quantity represented by each percent.

15. 45% of 96 quarts

16. 60% of 60 minutes

Evaluate each expression for the given value of the variable.

17. $9x - 29$ if $x = 6$

18. $7y - 10$ if $y = 4$

19. $2(3x + 6) - \frac{5x - 4}{2}$ if $x = 10$

20. $\frac{10 + 4y - 6}{3} + \frac{5y - 4}{3}$ if $y = 5$

Simplify each expression.

21. $9w + 8 - 6w - 3 + 4w$

22. $7 + 8y - 3 + 3y + 5 - 6y$

Expand each expression.

23. $4(6q - 3)$

24. $7(5 + 7y) + 3(y + 1)$

Factor each expression.

25. $12g + 4g + 4$

26. $40 - 10h + 9 - 4h$
Write an algebraic expression for each of the following.

27. A number is 7 more than the product of 6 and \( p \).

28. The total cost of 2 notebooks if 8 notebooks cost a total of \( y \) dollars.

29. Jacob has \( m \) nails and twice as many bolts as nails. He buys another 20 nails and 30 bolts. Find the total number of nails and bolts Jacob has now.

30. Anya has \( 2p \) trading cards. Ben has three times as many trading cards as Anya. Colin has half as many trading cards as Ben. Find the total number of trading cards they have altogether.

31. Jon has \( y \) stickers. He uses 20 stickers and divides the remainder equally between his two sisters. Find the number of stickers each sister receives.
Solve. Show your work.

32. A car traveled a distance of 124 miles in 2.5 hours. Find the speed of the car.

33. Wyatt swims 500 yards in 5 minutes and 15 seconds. What is his swimming speed in yards per minute, to the nearest whole yard?

34. The table shows the rental fees for a concert hall.

<table>
<thead>
<tr>
<th>First 2 hours</th>
<th>$180 per hour</th>
</tr>
</thead>
<tbody>
<tr>
<td>Each additional hour</td>
<td>$115</td>
</tr>
</tbody>
</table>

What is the total rental fee if Mrs. Wu rents the concert hall for 5 hours?

35. \( \frac{2}{5} \) of Abel’s books are equal to \( \frac{4}{7} \) of Bella’s books. What is the ratio of Abel's books to Bella's books?
36. There are 84 students in the Glee Club. There are 12 more boys than girls. What is the ratio of the number of girls to the number of boys?

37. The table shows how much money Jake spent last week.

<table>
<thead>
<tr>
<th>Expense</th>
<th>Entertainment</th>
<th>Bus fare</th>
<th>School supplies</th>
<th>Food</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amount</td>
<td>$12</td>
<td>$5</td>
<td>$6</td>
<td>?</td>
</tr>
</tbody>
</table>

Jake spent 40% of his money on entertainment and school supplies. How much did he spend on food?
38. Of the people at Sunrise School, 40% are female students, 5% are staff, and the remaining people are male students. There are 270 more male students than female students. How many people are at Sunrise School?

Solve. Draw a model to help you.

39. At a cafeteria, 25% of the sandwiches for sale are chicken sandwiches. The remaining sandwiches are tuna sandwiches and turkey sandwiches. The ratio of tuna sandwiches to turkey sandwiches is 5 : 4. There are 152 more tuna sandwiches than chicken sandwiches. How many sandwiches does the cafeteria have for sale?
Solve. Show your work.

1. \(\frac{3}{4}\) of Ana’s books are equal to \(\frac{2}{3}\) of Jake’s books.
   a) Find the ratio of the number of Ana’s books to the number of Jake’s books. Draw models to help you.
   
   b) How many times the number of Ana’s books is the number of Jake’s books?

2. \(\frac{4}{5}\) of Sarah’s pens are equal to \(\frac{1}{3}\) of Matt’s pens. Express the number of Matt’s pens as a fraction of the total number of pens he and Sarah have. Draw models to help you.
3. Mr. Lynch buys some turkey slices, wheat rolls, and cheese for $45. The ratio of the amount of money he spends on cheese to the amount he spends on turkey slices is 2 : 3. The ratio of the amount of money he spends on cheese to the amount he spends on wheat rolls is 6 : 5. The cost of each turkey slice is $0.75.
   a) How much does Mr. Lynch spend on each item?

   b) How many slices of turkey does Mr. Lynch buy?

4. In a swimming club, the ratio of the number of girls to the number of boys was 5 : 3. After 3 more girls and 5 more boys joined the club this spring, the ratio became 7 : 5. How many girls and how many boys were there in the swimming club before spring? (Hint: Make a list, and use before-and-after concept.)
1. A 14.4-liter fish tank is being filled by 2 water faucets. Water flows out of Faucet A at the rate of 140 milliliters per minute. Water flows out of Faucet B at the rate of 100 milliliters per minute. How long will it take the 2 faucets together to fill the fish tank completely? (1 liter = 1,000 milliliters)

2. Water flows from a faucet into a tank at the rate of 150 milliliters per minute, and water leaks out of the tank at the rate of 270 milliliters per minute. If there are 4.8 liters of water in the tank, how long will it take to empty the tank?
1. Ali, Clara, and Shan raised money for new books for the school library. Ali raised 20% more than Clara and $58 more than Shan. Clara raised $\frac{1}{4}$ times more than Shan.
   a) How much money did they raise altogether?

   b) What percent of the total amount of money did Clara raise?

2. 20% of the books in a library are fiction, and the rest are non-fiction. When 30% of the fiction books and 15% of the non-fiction books are borrowed, there are 1,312 books left in the library. How many books are borrowed?
3. Last year, a total of 360 students attended a school camp. There were 20% more 6th graders than 5th graders, and 20% fewer 4th graders than 5th graders at the school camp. This year, 120 more students joined the school camp. The number of 4th graders increased by 50% and the number of 6th graders increased by 25%. What was the percent increase in the number of 5th graders?

4. Lincoln spends $55 of his allowance every month and saves the rest. This month he decides to spend only $45, increasing his savings by 40%. What is his monthly allowance?
Solve. Show your work.

1. A swimming pool can be filled by a large water pump operating alone in \( w \) hours. If the pool is to be filled by a small water pump alone, it will take 6 hours longer than the larger water pump filling it alone. Write an expression in terms of \( w \) for the part of the pool that:
   a) the large water pump can fill in 1 hour.
   b) the small water pump can fill in 1 hour.
   c) both water pumps can fill together in 4 hours.

2. Teresa can paint a house in \( \frac{3y + 2}{H} \) days. Teresa’s brother takes 5 days longer to paint the same house. Write down an expression for the part of the house that:
   a) Teresa can paint in 1 day.
   b) Teresa’s brother can paint in 2 days.
   c) Teresa and her brother can paint in 3 days.
Cumulative Practice for Chapters 8 to 11

Represent the solution set of each inequality on a number line.

1. \( w > -15 \)

2. \( x \geq \frac{8}{2} \)

3. \( y \leq 12.25 \)

4. \( z < -\frac{1}{3} \)

Plot the points on the coordinate plane below and answer each question.

5. a) Points \( R \) and \( S \) are reflections of each other about the \( y \)-axis. What are the coordinates of point \( S \) if point \( R \) is located at \( (-4, 1) \)? Connect the two points to form a line segment.

b) Point \( T \) lies below \( \overline{RS} \) and forms a right angle \( RST \). \( \overline{RS} \) is the base of triangle \( RST \). The height of triangle \( RST \) is 4 units. What are the coordinates of point \( T \)?
Find the area of each triangle.

6. \[\triangle PQR\]
   - \(PQ = 9\) in.
   - \(QR = 24\) in.

7. \[\triangle ABC\]
   - \(AB = 8\) cm
   - \(BC = 28\) cm

The area of each triangle is 60 square inches. Find the measure of \(x\).

8. \[\triangle PQR\]
   - \(PQ = 8\) in.
   - \(QR = x\)

9. \[\triangle ABC\]
   - \(AB = 12\) in.
   - \(BC = x\)

Find the area of each polygon.

10. \(\text{DEFG is a parallelogram.}\)
    - \(DE = 13\) in.
    - \(EF = 19\) in.

11. \(\text{HJKL is a trapezoid.}\)
    - \(HL = 13\) ft
    - \(JK = 14\) ft
    - \(JL = 17\) ft
12. Find the area of the regular pentagon.

13. Find the area of the regular hexagon.

Find the circumference of each circle.

14. Use $\frac{22}{7}$ as an approximation for $\pi$.

15. Use 3.14 as an approximation for $\pi$. 
Find the perimeter of each figure.

16. Use \(\frac{22}{7}\) as an approximation for \(\pi\).

17. Use 3.14 as an approximation for \(\pi\).

Find the area of each figure. Use 3.14 as an approximation for \(\pi\).

18.

19.

Find the area of each figure. Use \(\frac{22}{7}\) as an approximation for \(\pi\).

20.

21.
Solve. Show your work.

22. A tube has a circular base with a radius of 6 centimeters. Find the area of the circular base. Use 3.14 as an approximation for $\pi$.

23. The opening of a tunnel is in the shape of a semicircle. The area of the semicircle is 77 square feet. Find its diameter. Use $\frac{22}{7}$ as an approximation for $\pi$.

24. The circumference of a circular hoop is 132 inches. Find its radius. Use $\frac{22}{7}$ as an approximation for $\pi$.

25. Faye has $x$ yards of ribbon. Faye’s ribbon is 4 times as long as Janelle’s ribbon. If Janelle has 12 yards of ribbon, write and solve an equation to find the length of Faye’s ribbon.
26. Mrs. Lim is $y$ years old. She was 25 years old when her son was born. Their total age in 12 years’ time will be $n$ years.
   a) Express $n$ in terms of $y$.

   b) Find $n$ when $y = 38$.

27. Mick and LaToya have some shirts. The ratio of the number of shirts Mick has to the number of shirts LaToya has is $3:8$. If they have a total of $k$ shirts, how many fewer shirts does Mick have than LaToya?

28. A square tray has a side length of $9p$ inches. The perimeter of a rectangular tray is $\frac{1}{3}$ the perimeter of the square tray. If the width of the rectangular tray is $\frac{1}{2}$ its length, find the width of the rectangle in terms of $p$.

29. The hour hand of a clock is 8 centimeters long. How far does the tip of the hour hand travel in one day? Use $3.14$ as an approximation for $\pi$. 
30. The area of trapezoid WXYZ is 255 square inches. Find its height $h$.

31. In rectangle $ABCD$ shown, $AD = 40$ yards and $CD = 30$ yards. Find the area of the shaded regions.

32. The figure shows rectangle $ABCD$ overlapping with triangle $BCE$. The area of triangle $BCE$ is 12 square centimeters larger than the area of rectangle $ABCD$. Find the length of $AB$. 

Cumulative Practice for Chapters 8 to 11
33. The figure shows two identical circles with centers $O$ and $R$, and a rectangle $OPQR$. If $PQ = 28$ inches, find the total area of the shaded regions. Use $\frac{22}{7}$ as an approximation for $\pi$.

34. If $BC = CD = DE$, what is the area of triangle $ACD$?
35. Plot points $P(2, 5)$, $Q(-3, -3)$, and $R(3, -3)$ on a coordinate plane.

a) Find the area of triangle $PQR$.

b) Figure $PQRS$ is a parallelogram. Point $S$ has a positive $x$-coordinate and the same $y$-coordinate as point $P$. Plot point $S$ on the coordinate plane and give its coordinates.

c) Find the area of parallelogram $PQRS$.

d) Triangle $TQR$ is a right triangle, and its area is one-half the area of triangle $PQR$. Point $T$ is above point $Q$. Plot point $T$ on the coordinate plane and give its coordinates.
36. To print greeting cards, a company charges a flat fee of $10 plus $2 per card. The total cost, $C$ dollars, for printing $n$ greeting cards is given by $C = 10 + 2n$. The table shows the total cost for printing $n$ greeting cards.

<table>
<thead>
<tr>
<th>Number of Cards ($n$)</th>
<th>0</th>
<th>5</th>
<th>10</th>
<th>15</th>
<th>25</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Cost ($C$ dollars)</td>
<td>10</td>
<td>20</td>
<td></td>
<td>50</td>
<td></td>
</tr>
</tbody>
</table>

a) Complete the table.

b) Graph the relationship between $n$ and $C$. Use 1 unit on the horizontal axis to represent 5 cards and 1 unit on the vertical axis to represent $10$.

c) Olivia wants to print 30 greeting cards. What is her total cost?

d) Jaime wants to print 200 greeting cards. What is his total cost?

e) If Chloe has $50, how many greeting cards can she print? Express your answer in the form of an inequality, in terms of $x$.

f) Name the dependent and independent variables.
37. The maximum load of an elevator is 480 pounds. Assuming that the average mass of a student is 45 pounds, and \( m \) represents the number of students in the elevator, how many students can take the elevator at the same time?
   a) Express your answer in the form of an inequality in terms of \( m \).

   b) Will the inequality in part a) be true if \( m = 11 \)?

   c) Draw a number line to represent the solution of the inequality. Then state the maximum value of \( m \).

38. The figure shown is made up of triangle \( ABF \) and rectangle \( BCDE \). The area of the figure is 90 square feet. If \( AB = BC = BF = FE \), find \( AC \).
39. The figure shows a square, a semicircle, two identical quadrants, and a triangle. Find the total area of the shaded regions. Use \(\frac{22}{7}\) as an approximation for \(\pi\).

40. The figure shows three semicircles and a circle. If \(AB = BC = CD = DE\), find the area of the shaded regions. Use \(\frac{22}{7}\) as an approximation for \(\pi\).
1. Montell is 30 years younger than his mother. In 5 years, Montell’s age will be \( \frac{1}{3} \) of his mother’s age. Find Montell’s mother’s age now.

2. The length of a rectangle is twice its width. If the perimeter of the rectangle is less than 74 inches, find its maximum whole-number width.
Chapter 9 Brain @ Work

1. a) Plot each set of points on a coordinate plane. Then join the points in order with line segments to form a closed figure and label it. Name each figure formed.
   i. A (−1, 0), B (0, −1), C (1, 0), D (0, 1)
   ii. E (−2, 0), F (0, −2), G (2, 0), H (0, 2)
   iii. J (−3, 0), K (0, −3), M (3, 0), N (0, 3)

b) Find the area of figures ABCD, EFGH, and JKMN if each unit on the coordinate plane represents 1 centimeter.

c) What conclusion can you draw about the relationship among the areas of figures ABCD, EFGH, and JKMN?
1. Triangle ABC and triangle XYZ are equilateral triangles, each having an area of 18 square centimeters. Each side of each triangle is divided into three equal parts, as shown.

When triangle ABC and triangle XYZ intersect, a composite figure is formed as shown below.

a) Find the area of the shaded region

b) Find the area of the composite figure.
2. Rectangle $PQRS$ has a length of 18 inches and a width of 12 inches. Each side is divided into three equal sections.

![Diagram of rectangle PQRS with shaded region]

a) Find the area of the shaded region.

b) In the rectangle $PQRS$, $MN$ is drawn to meet $QR$ at point $N$ such that the shaded region is divided into two equal parts. Find the length of $QN$.
CHAPTER 11 Brain @ Work

1. The figure shows a square $ABCD$ and a quadrant. Point $A$ is the center of the quadrant and $BD$ is 10 centimeters long. Find the area of the shaded region. Use 3.14 as an approximation for $\pi$.

![Diagram of a square with a quadrant]

2. The figure shows a circle that touches each square at exactly four points. The length of square $PQRS$ is 8 inches. Find the area of square $ABCD$. Use 3.14 as an approximation for $\pi$.

![Diagram of a circle touching a square]
Cumulative Practice for Chapters 12 to 14

Match each of the solid figures to its nets.

1.  
2.  
3.  

a)  
b)  
c)  

Find the surface area and volume of each prism.

4.  

5.  

9.2 cm  
10.6 cm  
14 cm  
10 cm  

The volume of each rectangular prism is 232 cubic meters. The rectangular prisms have square bases. Find the lengths of an edge of one of the square bases. Round your answers to the nearest tenth of a meter.

6. 15 m

7. 2 m

Solve. Show your work.

8. The solid below is made up of identical cubes. The edge length of each cube is 4 inches. Find the volume of the solid.

9. The solid below is made up of identical cubes. The volume of the solid is 243 cubic inches. Find the surface area of the solid.
Solve. Show your work.

10. The data set shows the ages of eight students.
    10 yr, 15 yr, 16 yr, 8 yr, 12 yr, 15 yr, 14 yr, 10 yr
    Find the mean, and median ages of these eight students.

11. The data set shows the times of ten runners in a race.
    56.0 s, 55.5 s, 55.4 s, 55.9 s, 55.7 s, 56.3 s, 56.2 s, 55.9 s, 55.6 s, 56.5 s
    Find the mean, and median times of these ten runners.

12. The data set shows the duration of twelve songs, in minutes, on an album.
    4, 3 $\frac{1}{3}$, 4 $\frac{1}{3}$, 2 $\frac{8}{15}$, 5 $\frac{2}{3}$, 3 $\frac{8}{15}$, 2, 6, 1 $\frac{4}{15}$, 5 $\frac{2}{3}$, 5 $\frac{4}{5}$, 5 $\frac{11}{30}$
    Find the mean, and median durations of these twelve songs.
The weights, in ounces, of 30 peaches are recorded below. Use the data to answer questions 13 to 15.

<table>
<thead>
<tr>
<th>4.5</th>
<th>5.0</th>
<th>4.0</th>
<th>6.0</th>
<th>4.5</th>
<th>5.0</th>
<th>5.0</th>
<th>6.0</th>
<th>7.0</th>
<th>5.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.0</td>
<td>6.5</td>
<td>5.5</td>
<td>5.5</td>
<td>5.0</td>
<td>4.0</td>
<td>5.5</td>
<td>5.5</td>
<td>6.0</td>
<td>5.5</td>
</tr>
<tr>
<td>4.5</td>
<td>3.5</td>
<td>4.5</td>
<td>4.0</td>
<td>3.5</td>
<td>5.0</td>
<td>6.5</td>
<td>4.5</td>
<td>6.0</td>
<td>6.5</td>
</tr>
</tbody>
</table>

13. Represent the set of data with a dot plot. Give the dot plot a title.

14. Group the data into suitable intervals and tabulate them.

15. Draw a histogram using the interval. Include a title. Briefly describe the data.
Describe the data.

16. The histogram shows the duration, in minutes, of people waiting for a taxi. The durations were recorded to the nearest minute. Briefly describe the data.

![Histogram of Waiting Times for a Taxi]

The data set shows the vertical jump height, in inches, of 24 students. Use the data to answer questions 17 to 18.

17. Represent the set of data with a dot plot. Give the dot plot a title.
18. Find the mean, median, and mode of the data set. Round your answers to the nearest whole number.

The data set shows the number of muffins a bakery makes each day for a month. Use the data to answer questions 19 to 20.

101 100 102 101 100 105 100 101 102 101
103 101 102 103 100 102 101 104 103 100
101 102 101 104 102 101 103 102 101 102

19. Represent the set of data with a dot plot. Give the dot plot a title.

20. Find the mean, median, and mode of the data set. Round your answers to the nearest number of muffins.
Solve. Show your work.

21. The surface area of the square pyramid is 576 square inches. The square pyramid has congruent triangular faces. The ratio of the area of each triangular face to the area of the square base is 3 : 4. Find the length of an edge of the square base.

\[ 18 \text{ in.} \]

\[ 19 \text{ in.} \]

22. A rectangular glass container is 160 centimeters long, 80 centimeters wide, and \( x \) centimeters high. The height of the water in the rectangular container was \( \frac{5}{8} \) the height of the container. Edward poured out 156,000 cubic centimeters of water from the container. The height of the water is now \( \frac{1}{4} \) the height of the container.

a) Find the height of the rectangular container.

b) Find the amount of glass, in square centimeters, used to make the bottom and sides of the container.
23. The table shows the number of telephones in 25 offices.

<table>
<thead>
<tr>
<th>Number of Telephones</th>
<th>12–15</th>
<th>16–19</th>
<th>20–23</th>
<th>24–27</th>
<th>28–31</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Offices</td>
<td>3</td>
<td>a</td>
<td>8</td>
<td>5</td>
<td>1</td>
</tr>
</tbody>
</table>

a) Find the value of a.

b) Draw a histogram to represent the data. Include a title. Briefly describe the data.

c) What percent of the offices had more than 23 telephones?

d) What percent of the offices had less than 20 telephones?
Make a dot plot to show the data. Use your dot plot to answer each question.

24. The table shows the time taken, in seconds, by 52 students to solve a puzzle.

<table>
<thead>
<tr>
<th>Time (s)</th>
<th>21</th>
<th>22</th>
<th>23</th>
<th>24</th>
<th>25</th>
<th>26</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Students</td>
<td>2</td>
<td>q</td>
<td>8</td>
<td>14</td>
<td>p</td>
<td>8</td>
</tr>
</tbody>
</table>

The total number of students that took at least 24 seconds to solve the puzzle is 37.

a) Find the values of p and q. Then represent this set of data with a dot plot. Give the dot plot a title.

b) Find the mean of the data set. Round your answers to the nearest second.

c) Another school tested 30 more students, and the mean time is 25 seconds. If the two data sets are combined, find the mean time of the combined data set. Round your answer to the nearest tenth of a second.
Solve. Show your work.

1. A rectangular piece of cardboard measuring 30 inches by 20 inches is made into an open box by first cutting an identical square from each corner, and then folding up the sides. The edge of each identical square is a whole number.

   ![Diagram of cardboard with squares cut from corners]

   a) Find the maximum volume of the box. (Hint: Use a table to help you.)

   b) Using the box with the maximum volume, what is the side length of each identical square?
2. The solid below is made of identical cubes. Each cube has an edge length of 3 inches.

a) Find the volume of the solid.

b) Find the surface area of the solid.
The numbers of years some teachers have been employed are shown in the table. Use the data to answer questions 1 to 2.

<table>
<thead>
<tr>
<th>Number of Years Employed (yr)</th>
<th>0–1</th>
<th>2–3</th>
<th>4–5</th>
<th>6–9</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td>14</td>
<td>13</td>
<td>8</td>
<td>5</td>
</tr>
</tbody>
</table>

A histogram was drawn to represent the data.

1. Explain why the histogram above is not appropriate.
2. Draw a histogram to correctly represent the data. Include a title.
Find the values of the missing numbers.

1. The number of members in a society for each of four months is 102, 104, 75, and 70, as shown in the table. The mean number of members during a six month period is $92\frac{1}{6}$.

<table>
<thead>
<tr>
<th>Month</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Members</td>
<td>102</td>
<td>104</td>
<td>?</td>
<td>75</td>
<td>70</td>
<td>?</td>
</tr>
</tbody>
</table>

If one of the missing numbers in the table drops by 25%, the mean number of members becomes $87\frac{5}{6}$. What are the two missing numbers?
Cumulative Practice for Chapters 1 to 3

1. 3 units $\rightarrow 1.8 - 1.23 = 0.57$ kilogram
   1 unit $\rightarrow 0.57 + 3 = 0.19$ kilogram
   5 units $\rightarrow 5 \times 0.19 = 0.95$ kilogram
   $1.23 - 0.95 = 0.28$ kilogram

2. A cup of tea $\quad \begin{array}{c} 2 \text{ units} \times 4 \text{ units} = 8 \text{ units} \end{array}$
   A cup of hot chocolate $\quad \begin{array}{c} 3 \text{ units} \times 3 \text{ units} = 9 \text{ units} \end{array} \quad \rightarrow 17 \text{ units}$

3. 7 units $\rightarrow 7 \times 3 = 21.60$ dollars
   8 units $\rightarrow 8 \times 3 = 24.00$ dollars

4. 38 $\div 4 = 9 R2$
   $9 \times 8 + 2 \times 2.40 = 76.80$

5. Difference $\rightarrow 21 - 10 = 11$ units
   11 units $\rightarrow 165$ children
   1 unit $\rightarrow 165 + 11 = 15$ children
   Total $\rightarrow 31$ units $\rightarrow 31 \times 15$
   $= 465$ children

There were 465 children at the festival.

6. Difference $\rightarrow 1 \text{ unit} \rightarrow 2$80
   7 units $\rightarrow 7 \times 2$80 = $1,960$
   (microwave oven and refrigerator)
   $\frac{1,960}{5} \times 8 = 3,136$

Madison started with $3,136$ in savings.

37. a) LCM of 48 and 60: 240 seconds
   $= 4 \text{ minutes}$

   b) Michael: $240 + 48 = 5 \text{ laps}$
   Mateo: $240 + 60 = 4 \text{ laps}$

38. a) GCF of 315 and 108: 9
   The greatest length of each tile is 9 inches.

   b) $315 \div 9 = 35$
   $108 \div 9 = 12$
   $35 \times 12 = 420$
   Jaden will need 420 tiles to cover the floor.

Brain @ Work (Chap. 1)

1. Answers vary. Possible answers:
   a) $4 \div 4 + 4 + 4 = 2$
   b) $(4 + 4 + 4) + 4 = 3$
   c) $4 + 4 \times (4 - 4) = 4$
   d) $(4 \times 4 + 4) + 4 = 5$
   e) $(4 + 4) + 4 + 4 = 6$
   f) $4 + 4 - 4 + 4 = 7$
   g) $4 + 4 + 4 - 4 = 8$
   h) $4 + 4 + 4 + 4 = 9$

2. LCM of 6, 7, and 9:
   $2 \times 3 \times 3 \times 7 = 126$
   $126 \div 1 = 125$
   $125 \div 6 = 20 \text{ R}5$
   $125 \div 7 = 17 \text{ R}6$
   $125 \div 9 = 13 \text{ R}8$

   The number is 125.
Brain @ Work  Chap. 2

1. a) Friday has the greatest difference in temperature: 12°C.
   b) Monday has the least difference in temperature: 5°C.
   c) Highest → 5°C; Lowest → -10°C; Difference → 5 + |-10| = 15°C

d)

   5
   4
   3
   2
   1
   0
   -1
   -2
   -3
   -4
   -5
   -6
   -7
   -8
   -9
   -10

Brain @ Work  Chap. 3

1. 1st day

2nd day

6 units → 48
5 units → 40 (1st day)
6 × 40 = 240

Miley made a total of 240 coupon books.

2. \( \frac{1}{2} - \frac{1}{3} = \frac{1}{6} \)

\( \frac{1}{6} \) of the oranges → 1.8 lb
\( \frac{3}{6} \) of the oranges → 3 × 1.8 = 5.4 lb

Weight of empty crate = 6.9 - 5.4 = 1.5 lb

\( \frac{6}{5} \) of the oranges → 6 × 1.8 = 10.8 lb
\( \frac{6}{5} \) × 10.8 lb = 6.75 lb
6.75 + 1.5 = 8.25 lb

The crate weighs 8.25 pounds if it is \( \frac{5}{8} \) full of oranges.

3. Airplanes

   2

Cars

   3

Trains

   20

   a) 10 units → 20
   1 unit → 20 ÷ 10 = 2
   3 units → 6
   Mr. Lee buys 6 toy cars.

   b) 2 × 2 = 4 airplanes
   5 × 2 = 10 trains
   Total amount = 4 × $12 + $8 + 10 × $36 = $156
   Mr. Lee spends $156 for the toys.

4. Method 1:

   45 - 42 = 3

Heather

Jared

   3

2 units → 42 + 4 × 3 = 54
1 unit → 27
6 units → 6 × 27 = 162
Jared started with 162 stickers.

Method 2:

Common multiples of 4 and 6:
12, 24, 36, 48, 60, 72, 84, 96, 108, 120, 132 ...

<table>
<thead>
<tr>
<th>Product</th>
<th>Jared (4x)</th>
<th>3 of Jared</th>
<th>Difference of Jared</th>
<th>Difference of Jared</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
<td>54</td>
<td>9</td>
<td>45</td>
<td>45 - 9 = 36</td>
</tr>
<tr>
<td>60</td>
<td>102</td>
<td>45</td>
<td>85</td>
<td>85 - 45 = 40</td>
</tr>
<tr>
<td>120</td>
<td>162</td>
<td>90</td>
<td>135</td>
<td>135 - 90 = 45</td>
</tr>
</tbody>
</table>

Jared started with 162 stickers.

Cumulative Practice

for Chapters 4 to 7+++  
1. 135
2. 6
3. 2 : 5
   4. 8 : 13
5. 5 : 3
   6. 4 : 3
7. 76%
   8. 109%
9. 65%
   10. 58\(\frac{1}{3}\)%
11. 0.09
12. 1.5
13. 22
14. 1\(\frac{1}{5}\)
15. 43.2 quarts
16. 36 minutes
17. 25
18. 18
19. 49
20. 15
21. 7w + 5
22. 9 + 5y
23. 24q - 12
24. 38 + 52y
25. 4(4g + 1)
26. 7(7 - 2h)
27. 6p + 7
28. 8 notebooks → y dollars
   2 notebooks → \( \frac{1}{4} \) dollars
29. Nails → m + 20
   Bolts → 2m + 30
   Total → 3m + 50 nails and bolts
30. Anya → 2p
    Ben → 3 × 2p = 6p
    Colin → 6p = 2 = 3p
    Total → 2p + 6p = 11p trading cards
31. \( \sqrt{20} \) stickers
32. 124 + 25 = 49.6
   The speed of the car was 49.6 miles per hour.
33. 5 minutes 15 seconds = 15.25 minutes
   500 + 15.25 = 32.79 yards per minute
   His swimming speed is 33 yards per minute, to the nearest whole yard.
34. \(180 \times 2 + 115 \times 3 = 705\)
   The total rental fee is $705.
35. Abel : Bella = \(\frac{2}{5} : \frac{4}{7} = \frac{4}{10} : \frac{7}{10}\)
   Abel : Bella = 10 : 7
36. Girls \(\rightarrow (84 - 12) \div 2 = 36\)
   Boys \(\rightarrow 36 + 12 = 48\)
   Girls : Boys \(\rightarrow 36 : 48 = 3 : 4\)
37. 40% \(\rightarrow \$12 + \$6 = \$18\)
   100% \(\rightarrow \frac{18}{40} \times 100 = \$45\)
   Food \(\rightarrow \$45 - (\$12 + \$5 + \$6) = \$22\)
   Jake spent $22 on food.

38. Boys: 100% - 40% - 5% = 55%
   Difference: 55% - 40% = 15%
   15% \(\rightarrow 135\)
   100% \(\rightarrow \frac{135}{15} \times 100 = 900\)
   There are 900 people at Sunrise School.

39. 

![Diagram of food options]

3. a) cheese : turkey = 2 : 3
   \[\frac{2}{3} \times 3 \times 6 = 9\]
   cheese : wheat rolls = 6 : 5
   cheese : turkey : wheat rolls = 6 : 9 : 5
   20 units \(\rightarrow \$45\)
   1 unit \(\rightarrow \$45 + 20 = \$2.25\)
   6 units \(\rightarrow 6 \times \$2.25 = \$13.50\)
   9 units \(\rightarrow 9 \times \$2.25 = \$20.25\)
   5 units \(\rightarrow 5 \times \$2.25 = \$11.25\)
   Mr. Lynch spends $13.50 on cheese,
   $20.25 on turkey slices, and $11.25 on wheat rolls.
   b) \$20.25 \div \$0.75 = 27\)
   Mr. Lynch buys 27 slices of turkey.

4. Strategies: Make a list and use before-and-after concept

<table>
<thead>
<tr>
<th>Before</th>
<th>After</th>
</tr>
</thead>
<tbody>
<tr>
<td>Girls</td>
<td>Boys</td>
</tr>
<tr>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>10</td>
<td>6</td>
</tr>
<tr>
<td>15</td>
<td>9</td>
</tr>
<tr>
<td>20</td>
<td>12</td>
</tr>
<tr>
<td>25</td>
<td>15</td>
</tr>
</tbody>
</table>

There were 25 girls and 15 boys in the club before spring.

Brain @ Work Chap. 4

1. a) \(8 : 9\)

![Diagram of food options]

b) \(\frac{9}{8} = 1 \frac{1}{8}\) times

2. 

![Diagram of food options]

Sarah’s pens : Matt’s pens = 5 : 12
Total number of units = 12 + 5 = 17
Matt’s pens are \(\frac{12}{17}\) of the total number of pens he and Sarah have.

Brain @ Work Chap. 5

1. \(14.4 \times 1,000 = 14,400 \text{ mL}\)
   1 min \(\rightarrow 140 + 100 = 240 \text{ mL}\)
   \(\frac{14,400}{240} = 60 \text{ min} = 1 \text{ h}\)
   It will take the 2 faucets together 1 hour to fill the fish tank completely.
2. \(4.8 \times 1,000 = 4,800 \text{ mL}\)
   Water leaking out of the tank in 1 minute \(\rightarrow 270 - 150 = 120 \text{ mL}\)
   \(4.8 \times 1,000 = 4,800 \text{ mL}\)
   \(4,800 \div 120 = 40 \text{ min}\)
   It will take 40 minutes to empty the tank.
Brain @ Work  Chap. 6

1. a) \( \frac{20}{5} = \frac{1}{5} \)
   \[ \frac{4}{4} = 25\% \]

<table>
<thead>
<tr>
<th>Shan</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Clara</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Total units = 4 + 5 + 6 = 15
2 units \( \rightarrow \$58 \)
1 unit \( \rightarrow \$29 \)
15 units \( \rightarrow 15 \times \$29 = \$435 \)
They raised \$435 altogether.

b) Amount that Clara raised
\( 5 \times \$29 = \$145 \)
\( \frac{145}{435} \times 100\% = 33\frac{1}{3}\% \)

Clara raised \( 33\frac{1}{3}\% \) of the money.

2. Fiction \( \rightarrow \frac{30}{100} \times 20\% = 6\% \)
Non-fiction \( \rightarrow \frac{15}{100} \times 80\% = 12\% \)

6\% - 12\% = 18\%
100\% - 18\% = 82\%
82\% \( \rightarrow 1,312 \)
1\% \( \rightarrow 1,312 + 82 = 16 \)
18\% \( \rightarrow 18 \times 16 = 288 \)
288 books are borrowed.

3. Last year:
   
   | 6th graders | | | | | | | 6 units |
   | 5th graders | | | | | | | 5 units \( \rightarrow 100\% \) |
   | 4th graders | | | | | | | 4 units |

15 units \( \rightarrow 360 \)
1 unit \( \rightarrow 360 \div 15 = 24 \)
6th graders: \( 24 \times 6 = 144 \)
5th graders: \( 24 \times 5 = 120 \)
4th graders: \( 24 \times 4 = 96 \)

This year:
25\% \( \times 144 = 36 \) more 6th graders joined
50\% \( \times 96 = 48 \) more 4th graders joined
120 - (36 + 48) = 36 more 5th graders joined
\( \frac{36}{120} \times 100\% = 30\% \)
The number of 5th graders increased by 30%.

4. $55 - $45 = $10
40\% of his savings = $10
100\% of his savings = $\frac{10}{40} \times 100$
\( = \$25 \)
$55 + $25 = $80
His monthly allowance is $80.

Brain @ Work  Chap. 7

1. a) \( \frac{1}{w} \) of the pool
   b) \( \frac{1}{w + 6} \) of the pool
   c) \( 4 \left( \frac{1}{w} + \frac{1}{w + 6} \right) \) of the pool

2. a) \( \frac{1}{3y + 2} \) of the house
   b) \( 2 \left( \frac{1}{3y + 2} \right) = \frac{2}{3y + 2} \) of the house
   c) \( 3 \left( \frac{1}{3y + 2} \right) = \frac{3}{3y + 2} \) of the house

Cumulative Practice
for Chapters 8 to 11

1. \[ 0 - 1 - 2 - 3 - 4 - 5 - 6 - 7 - 8 - 9 - 10 - 11 - 12 - 13 - 14 - 15 - 16 \]

2. \[ 8 - 8\frac{1}{2} - 9 - 9\frac{1}{2} - 10 - 10\frac{1}{2} \]

3. \[ 9 - 10 - 11 - 12 - 12.25 - 13 \]

4. \[ -3 - 2 - 1 - 0 - 1 \]

5. a) \( S(4, 1) \)
   b) \( T(4, -3) \)

6. \( \frac{1}{2} \cdot 24 \cdot 9 = 108 \) square inches
7. \( \frac{1}{2} \cdot 8 \cdot 28 = 112 \) square centimeters
8. \( \frac{60 \cdot 2}{8} = 15 \) inches
9. \( \frac{60 \cdot 2}{12} = 10 \) inches
10. \( 19 \cdot 13 = 247 \) square inches
11. \( \frac{1}{2} \cdot 14(13 + 17) = 210 \) square feet
12. Area of a triangle
\( \frac{1}{2} \cdot 18 \cdot 12 = 108 \text{ cm}^2 \)
Area of the pentagon
\( 5 \cdot 108 = 540 \) square centimeters
13. Area of a triangle
   \[ \frac{1}{2} \cdot 16 \cdot 15 = 120 \text{ in.}^2 \]

   Area of the hexagon
   \[ = 6 \cdot 120 = 720 \text{ square inches} \]

14. \[ 2 \cdot \frac{22}{7} \cdot 21 = 132 \text{ inches} \]

15. \[ 3.14 \cdot 30 = 94.2 \text{ centimeters} \]

16. Length of semicircular arc
   \[ \approx \frac{1}{2} \cdot \frac{22}{7} \cdot 49 = 77 \text{ in.} \]

   Perimeter
   \[ = 77 + 49 = 126 \text{ inches} \]

17. Length of the arc of the quadrant
   \[ \approx \frac{1}{4} \cdot 2 \cdot 3.14 \cdot 20 = 31.4 \text{ in.} \]

   Perimeter
   \[ = 31.4 + 20 + 20 = 71.4 \text{ inches} \]

18. \[ \frac{1}{4} \cdot 3.14 \cdot 8 \cdot 8 \]
   \[ = 50.24 \text{ square inches} \]

19. Radius = \[ 20 \div 2 = 10 \text{ cm} \]
   \[ \frac{1}{2} \cdot 3.14 \cdot 10 \cdot 10 \]
   \[ = 157 \text{ square inches} \]

20. \[ \frac{22}{7} \cdot 21 \cdot 21 \]
   \[ = 1,386 \text{ square centimeters} \]

21. \[ \frac{3}{4} \cdot \frac{22}{7} \cdot 14 \cdot 14 \]
   \[ = 462 \text{ square centimeters} \]

22. Area of the base
   \[ \approx 3.14 \cdot 6 \cdot 6 \]
   \[ = 113.04 \text{ square centimeters} \]

23. \[ \frac{1}{2} \cdot \frac{22}{7} \cdot r^2 = 77 \]
   \[ r^2 = \frac{77 \cdot 7}{11} = 49 \]
   \[ r = \sqrt{49} = 7 \text{ ft} \]

   Diameter of the semicircle
   \[ = 2 \cdot 7 = 14 \text{ feet} \]

24. \[ 132 = 2 \cdot \frac{22}{7} \cdot r \]
   \[ 132 = \frac{44}{7} \cdot r \]
   \[ r = \frac{132 \cdot 7}{44} = 21 \text{ in.} \]

   The radius of the circular hoop is 21 inches.

25. \[ \frac{x}{4} = 12 \]
   \[ x = 12 \cdot 4 = 48 \]

   Faye has 48 yards of ribbon.

26. a) Son’s age now = \( y - 25 \)
   \[ n = (y + 12) + (y - 25 + 12) \]
   \[ n = 2y - 1 \]

   b) \[ n = 2 \cdot 38 - 1 = 75 \]

27. Mick has \( \frac{5}{11} \) fewer shirts than LaToya.

28. Perimeter of the square
   \[ = 9p \cdot 4 = 36p \text{ in.} \]

   Perimeter of the rectangle
   \[ = 36p + 3 = 12p \text{ in.} \]

   Width of the rectangle
   \[ = 12p + 6 = 2p \text{ in.} \]

   The width of the rectangle is \( 2p \) inches.

29. 12 hours \( \rightarrow 2 \cdot 3.14 \cdot 8 \)
   \[ = 50.24 \text{ cm} \]

   24 hours \( \rightarrow 50.24 \cdot 2 \)
   \[ = 100.48 \text{ cm} \]

   The tip of the hour hand travels 100.48 centimeters in one day.

30. \[ \frac{1}{2} \cdot h(12 + 18) = 255 \]

    \[ 30h = 255 \cdot 2 \]
    \[ h = 510 + 30 \]
    \[ h = 17 \text{ in.} \]

   The height of trapezoid \( WXYZ \) is 17 inches.

31. Length of the shaded regions
   \[ = 40 - 6 = 34 \text{ yd} \]

   Width of the shaded regions
   \[ = 30 - 6 = 24 \text{ yd} \]

   Area of the shaded regions
   \[ = 34 \cdot 24 = 816 \text{ yd}^2 \]

   The area of the shaded regions is 816 square yards.

32. Area of triangle \( BCE \)
   \[ = \frac{1}{2} \cdot 18 \cdot 6 = 54 \text{ cm}^2 \]

   Area of rectangle \( ABCD \)
   \[ = 54 - 12 = 42 \text{ cm}^2 \]

   \( AB = 42 + 6 = 7 \text{ centimeters} \)

33. The total area of the shaded regions is equal to the sum of the area of a circle and the area of a rectangle.

   Area of a circle
   \[ \approx \frac{22}{7} \cdot 14 \cdot 14 = 616 \text{ in.}^2 \]

   Area of rectangle \( OPOR \)
   \[ = 28 \cdot 14 = 392 \text{ in.}^2 \]

   Total area of the shaded regions
   \[ = 616 + 392 = 1,008 \text{ in.}^2 \]

   The total area of the shaded regions is 1,008 square inches.

34. Area of triangle \( ABC \)
   \[ = \frac{1}{2} \cdot 15 \cdot 36 = 270 \text{ in.}^2 \]

   Area of triangle \( ACD \)
   \[ = \frac{1}{3} \text{ of area of triangle } ABC \]
   \[ = \frac{1}{3} \cdot 270 = 90 \text{ square inches} \]
35. (Diagram of a triangle labeled PQR with coordinates T and S)

a) Base = 6 units; height = 8 units
Area of triangle PQR = \( \frac{1}{2} \cdot 6 \cdot 8 = 24 \) square units

b) The coordinates of point S are (8, 5).

c) Area of parallelogram PQRS = 6 \cdot 8 = 48 square units

d) Area of triangle TQR = 24 + 2 = 12 square units
So, TQ = (12 - 2) + 6 = 4 units
Point T has the same x-coordinate as point Q and is 4 units above point Q.
So, the coordinates of point T are (-3, 1).

36. a) 

<table>
<thead>
<tr>
<th>Number of cards (n)</th>
<th>0</th>
<th>5</th>
<th>10</th>
<th>15</th>
<th>20</th>
<th>25</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total cost (C dollars)</td>
<td>10</td>
<td>20</td>
<td>30</td>
<td>40</td>
<td>50</td>
<td>60</td>
</tr>
</tbody>
</table>

b) Printing Costs

- $70
- $410

- \( n \leq 20 \)
- Dependent variable: \( C \);
  independent variable: \( n \)

Brain @ Work Chap. 8

1. If \( c \) is Montell's present age, then his mother's present age is \( c + 30 \).
   In 5 years, Montell will be \( c + 5 \) years old
   and his mother will be \( c + 35 \) years old.
   \[ 3(c + 5) = c + 35 \]
   \[ 3c + 15 = c + 35 \]
   \[ 3c + 15 - 15 = c + 35 - 15 \]
   \[ 3c = c + 20 \]
   \[ 3c - c = c - c + 20 \]
   \[ 2c = 20 \]
   \[ c = 10 \] (Montell)
   \[ 10 + 30 = 40 \]
   Montell's mother is 40 years old now.

2. If \( w \) inches is the width, then the length is \( 2w \) inches.
   The perimeter of the rectangle is
   \[ (w + 2w + w + 2w) = 6w \] inches.
   \[ 6w < 74 \]
   \[ w < 12 \frac{1}{3} \]
   Its maximum width is 12 inches.

Brain @ Work Chap. 9

1. a) 

i. square
ii. square
iii. square

b) Area of \( ABCD = \left( \frac{1}{2} \cdot 2 \cdot 1 \right) \cdot 2 \)
   = 2 square centimeters

Area of \( EFGH = \left( \frac{1}{2} \cdot 4 \cdot 2 \right) \cdot 2 \)
   = 8 square centimeters

Area of \( JKMN = \left( \frac{1}{2} \cdot 6 \cdot 3 \right) \cdot 2 \)
   = 18 square centimeters

- The area of figure \( ABCD \) is 2 times the square of 1.
- The area of figure \( EFGH \) is 2 times the square of 2.
- The area of figure \( JKMN \) is 2 times the square of 3.

\[ 1^2 \times 2 = 2 \]
\[ 2^2 \times 2 = 8 \]
\[ 3^2 \times 2 = 18 \]
1. a) Each equilateral triangle can be divided into 9 smaller equilateral triangles. 
Area of each smaller triangle
= $8 \cdot 9 = 2 \text{ cm}^2$
Area of the shaded region is formed by six smaller equilateral triangles
= $6 \cdot 2 = 12 \text{ square centimeters}$

b) Area of composite figure
= $18 \cdot 2 - 12$
= 24 square centimeters

2. a)

Area of $PQRS$
= $18 \cdot 12 = 216 \text{ in}^2$
Area of triangle $X$
= $\frac{1}{2} \cdot 6 \cdot 8 = 24 \text{ in}^2$
Area of triangle $Y$
= $\frac{1}{2} \cdot 12 \cdot 8 = 48 \text{ in}^2$
Area of triangle $W$
= area of triangle $Z$
= $\frac{1}{2} \cdot 6 \cdot 4 = 12 \text{ in}^2$
Shaded region
= $216 - (24 + 48 + 12 + 12)$
= 120 square inches
One equal part
= $120 \div 2 = 60 \text{ in}^2$

Area of triangle $MBA$
= $\frac{1}{2} \cdot 12 \cdot 6 = 36 \text{ in}^2$
Area of triangle $AMN$
= $60 - 36 = 24 \text{ in}^2$
Length of base $AN$
= $\frac{24 \cdot 2}{12}$
Length of $ON$
= $6 + 4 = 10 \text{ inches}$

2. Area of square $PQRS$
= $8 \cdot 8 = 64 \text{ in}^2$
Area of square $ABCD$
= $2 \cdot \text{ area of square } PQRS$
= $2 \cdot 64$
= 128 square inches

3. Area of the triangle
= $\frac{1}{2} \cdot 14 \cdot 7 = 49 \text{ in}^2$
Area of the rectangle
= $14 \cdot 7 = 98 \text{ in}^2$
Area of the semicircle
= $\frac{1}{2} \cdot \frac{22}{7} \cdot 7 \cdot 7 = 77 \text{ in}^2$
Area of rectangle - area of semicircle
= $98 - 77 = 21 \text{ in}^2$
Area of the shaded region
= $49 + 21 = 70 \text{ in}^2$
The total area of the shaded parts is 70 square inches.

4. a) Area of fishpond
= area of square $ABCD$ - area of the circle
= $7 \cdot 7 - \frac{22}{7} \cdot \frac{7}{2} \cdot \frac{7}{2}$
= $10 \frac{1}{2} \text{ square feet}$

b) Area of the 4 flowerbeds = area of the circle - area of the 4 triangles
= $\frac{22}{7} \cdot \frac{7}{2} \cdot \frac{7}{2} - 4 \left( \frac{1}{2} \cdot \frac{7}{2} \cdot \frac{7}{2} \right)$
= 14 square feet

Cumulative Practice
for Chapters 12 to 14

1. c 2. b 3. a

4. Surface area
= $(2 \cdot 12^3) + (4 \cdot 12 \cdot 3)$
= $288 + 144$
= $432 \text{ in}^2$
Volume = $12^2 \cdot 3$
= $432 \text{ in}^3$

5. Surface area
= $(2 \cdot \frac{1}{2} \cdot 14 \cdot 7) + 10 \cdot (9.2 + 10.6 + 14)$
= $98 + 338$
= $436 \text{ cm}^2$
Volume = $\frac{1}{2} \cdot 14 \cdot 7 \cdot 10$
= $490 \text{ cm}^3$

6. edge = $\sqrt{\frac{232}{15}} = 3.9 \text{ m}$
7. \( \text{edge} = \sqrt[3]{\frac{232}{3}} \approx 10.8 \text{ m} \)

8. The solid is made up of 12 cubes.
   Volume of the solid = 12(4 \cdot 4 \cdot 4) = 768 \text{ in.}^3.
   The volume of the solid is 768 cubic inches.

9. The solid is made up of 9 cubes.
   Volume of each cube = 243 + 9 = 27 \text{ in.}^3.
   Edge length = \( \sqrt{27} = 3 \text{ in.} \).
   Total number of faces = \( 5 + 5 + 6 + 6 + 4 + 4 = 30 \).
   Surface area = \( 3^2 \cdot 30 = 270 \text{ in.}^2 \).
   The surface area of the solid is 270 square inches.

10. Arrange the ages from least to greatest:
    8, 10, 10, 12, 14, 15, 15, 16
    Mean
    \[ \frac{8 + 10 + 10 + 12 + 14 + 15 + 15 + 16}{8} = \frac{100}{8} = 12.5 \]
    The mean age is 12.5 years.
    Median = \( \frac{12 + 14}{2} = \frac{26}{2} = 13 \)
    The median age is the mean of the two middle values, which is 13 years.

11. Arrange the times from the least to the greatest:
    55.4, 55.5, 55.6, 55.7, 55.9, 56.0, 56.2, 56.3, 56.5
    Mean
    \[ \frac{55.4 + 55.5 + 55.6 + 55.7 + 55.9 + 56.0 + 56.2 + 56.3 + 56.5}{10} = 55.9 \]
    = 55.9 s
    The median time is the middle value, which is 55.9 seconds.

12. Arrange the durations of the songs from the least to the greatest:
    \( \frac{4}{15}, \frac{2}{3}, \frac{8}{15}, \frac{3}{4}, \frac{1}{3}, \frac{3}{8}, \frac{4}{5}, \frac{1}{11}, \frac{5}{30}, \frac{5}{2}, \frac{4}{3}, \frac{2}{5}, \frac{4}{5}, \frac{6}{5} \)
    Mean
    \[ \left( \frac{4}{15} + 2 + \frac{8}{15} + \frac{3}{4} + \frac{3}{8} + \frac{4}{5} + \frac{1}{3} + \frac{1}{11} + \frac{5}{3} + \frac{2}{5} + \frac{2}{3} + \frac{5}{2} + \frac{4}{5} + 6 \right) + 12 \]
    = 49 \( \frac{1}{2} \) + 12 = 4 \( \frac{1}{8} \)
    The mean duration is 4 \( \frac{1}{8} \) minutes.
    Median = \( \left( \frac{4 + 4}{3} \right) + 2 = 4 \frac{1}{3} \) min
    The median duration is the mean of the two middle values, which is 4 \( \frac{1}{3} \) minutes.

13.

14.

15.

16. There are 29 people in the group.
    Most of the people waited 4 to 9 minutes for a taxi. The histogram has a "tail" on the left, and the shape of the histogram is left-skewed.

17.

18. Mean
    \[ = (32 + 3 \cdot 33 + 5 \cdot 34 + 4 \cdot 35 + 4 \cdot 36 + 2 \cdot 37 + 3 \cdot 38 + 2 \cdot 39) + 24 \]
    = \( \frac{851}{24} \) = 35 in.
    The median vertical jump height is the middle value, which is 35 inches.
    The modal vertical jump height is 34 inches.
The maximum volume of the box is 1,056 cubic inches.

b) From part a), the side length of each identical square is 4 inches.

2. a) Number of cubes = 1 + 4 + 9 + 16 + 25 = 55
Volume of cube = $3^3 = 27$ in.$^3$
Volume of solid = $27 \cdot 55 = 1,485$ in.$^3$
The volume of the solid is 1,485 cubic inches.

b) Number of faces from the top view or bottom view = 25
Number of faces from the front view or back view = 15
Number of faces from the left view or right view = 15
Total number of faces = $(25 + 15 + 15) \cdot 2 = 110$
Surface area of solid = $(3^2) \cdot 110 = 990$ in.$^2$
The surface area of the solid is 990 square inches.

Chapter 13

Lesson 13.1

1. a) Number of customers = 12 + 11 + 9 + 8 = 40
There were 40 customers who took part in the survey.

b) Number of customers = 12 - 8 = 4
4 more customers prefer model A than model D.

c) $\frac{12}{40} \times 100\% = 30\%$
30% of the customers surveyed stated model A as their favorite.

2. a) Number of students = 10 + 6 + 5 + 15 = 36
36 students were questioned.

b) Number of students = 15 + 5 = 20
20 students named swimming or hockey as their favorite Olympic sport.

c) Percent = $\frac{6}{36} \times 100\% = 16\frac{2}{3}\%$
16$\frac{2}{3}$% of the students named soccer as their favorite Olympic sport.

3. a) 0, 1, 2, 2, 2, 2, 2, 2, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 4, 4, 4, 5, 5, 5, 5, 6, 6, 6, 6

b) Number of students = 12 + 8
= 20 students
20 students surf the Internet for more than 2 hours each day.

4. a) 0, 0, 0, 0, 0, 0, 1, 1, 1, 1, 1, 1, 1, 2, 2, 2, 2, 2, 2, 2, 3, 3, 3, 3, 3, 3, 3, 3, 3, 4, 4

b) Number of families = 14 + 2 = 16
16 families own at least 2 pets.

Number of families = 14 + 2 = 16
16 families own at least 2 pets.

Percent = $\frac{2}{30} \times 100\% = 6\frac{2}{3}\%$
6$\frac{2}{3}$% of the families own 4 to 5 pets.