Chapter 7 - Proportions and Similarity - Get Ready for Chapter 7

Solve each equation.

1. \[ \frac{3x}{8} = \frac{6}{x} \]

2. \[ \frac{7}{3} = \frac{x - 4}{6} \]

3. \[ \frac{x + 9}{2} = \frac{3x - 1}{8} \]

4. \[ \frac{3}{2x} = \frac{3x}{8} \]

5. **EDUCATION** The student to teacher ratio at Elder High School is 17 to 1. If there are 1088 students in the school, how many teachers are there?

ALGEBRA In the figure, \( \overline{AB} \) and \( \overline{BC} \) are opposite rays and \( \overline{BD} \) bisects \( \angle ABF \).

6. If \( m \angle ABF = 3x - 8 \) and \( m \angle ABD = x + 14 \), find \( m \angle ABD \).

7. If \( m \angle FBC = 2x + 25 \) and \( m \angle ABF = 10x - 1 \), find \( m \angle DBF \).

8. **LANDSCAPING** A landscape architect is planning to add sidewalks around a fountain as shown below. If \( \overline{AB} \) and \( \overline{BC} \) are opposite rays and \( \overline{BD} \) bisects \( \angle ABF \), find \( \angle FBC \).
7-1 Ratios and Proportions - Check Your Understanding

1. **PETS** Out of a survey of 1000 households, 460 had at least one dog or cat as a pet. What is the ratio of pet owners to households?

2. **SPORTS** Thirty girls tried out for 15 spots on the basketball team. What is the ratio of open spots to the number of girls competing?

3. The ratio of the measures of three sides of a triangle is 2:5:4, and its perimeter is 165 units. Find the measure of each side of the triangle.

4. The ratios of the measures of three angles of a triangle are 4:6:8. Find the measure of each angle of the triangle.

   Solve each proportion.

5. \[ \frac{2}{3} = \frac{x}{24} \]

6. \[ \frac{x}{5} = \frac{28}{100} \]

7. \[ \frac{2.2}{x} = \frac{26.4}{96} \]

8. \[ \frac{x-3}{3} = \frac{5}{8} \]

9. **BAKING** Ella is baking apple muffins for the Student Council bake sale. The recipe that she is using calls for 2 eggs per dozen muffins, and she needs to make 108 muffins. How many eggs will she need?
MOVIES For Exercises 10 and 11, refer to the graphic below.

10. Of the films listed, which had the greatest ratio of Academy Awards to number of nominations?

11. Which film listed had the lowest ratio of awards to nominations?
12. **GAMES** A video game store has 60 games to choose from, including 40 sports games. What is the ratio of sports games to video games?

13. The ratio of the measures of the three sides of a triangle is 9:7:5. Its perimeter is 191.1 inches. Find the measure of each side.

14. The ratio of the measures of the three sides of a triangle is 3:7:5, and its perimeter is 156.8 meters. Find the measure of each side.

15. The ratio of the measures of the three sides of a triangle is \( \frac{1}{4} : \frac{1}{8} : \frac{1}{6} \). Its perimeter is 4.75 feet. Find the length of the longest side.

16. The ratio of the measures of the three sides of a triangle is \( \frac{1}{4} : \frac{1}{3} : \frac{1}{6} \), and its perimeter is 31.5 centimeters. Find the length of the shortest side.

**Find the measures of the angles of each triangle.**

17. The ratio of the measures of the three angles is 3:6:1.

18. The ratio of the measures of the three angles is 7:5:8.

19. The ratio of the measures of the three angles is 10:8:6.

20. The ratio of the measures of the three angles is 5:4:7.

**Solve each proportion.**

21. \( \frac{5}{8} = \frac{y}{3} \)

22. \( \frac{w}{6.4} = \frac{1}{2} \)

23. \( \frac{4x}{24} = \frac{56}{112} \)

24. \( \frac{11}{20} = \frac{55}{20x} \)

25. \( \frac{2x+5}{10} = \frac{42}{20} \)

26. \( \frac{a+2}{a-2} = \frac{3}{2} \)

27. \( \frac{3x-1}{4} = \frac{2x+4}{5} \)
28. \[ \frac{3x - 6}{2} = \frac{4x - 2}{4} \]

29. **NUTRITION** According to a recent study, 7 out of every 500 Americans aged 13 to 17 years are vegetarian. In a group of 350 13- to 17-year-olds, about how many would you expect to be vegetarian?

30. **CURRENCY** Your family is traveling to Mexico on vacation. You have saved $500 to use for spending money. If 269 Mexican pesos is equivalent to 25 United States dollars, how much money will you get when you exchange your $500 for pesos?

**ALGEBRA** Solve each proportion. Round to the nearest tenth.

31. \[ \frac{2x + 3}{3} = \frac{6}{x - 1} \]

32. \[ \frac{x^2 + 4x + 4}{40} = \frac{x + 2}{10} \]

33. \[ \frac{9x + 6}{18} = \frac{20x + 4}{3x} \]

34. The perimeter of a rectangle is 98 feet. The ratio of its length to its width is 5:2. Find the area of the rectangle.

35. The perimeter of a rectangle is 220 inches. The ratio of its length to its width is 7:3. Find the area of the rectangle.

36. The ratio of the measures of the side lengths of a quadrilateral is 2:3:5:4. Its perimeter is 154 feet. Find the length of the shortest side.

37. The ratio of the measures of the angles of a quadrilateral is 2:4:6:3. Find the measures of the angles of the quadrilateral.

In June of 2000, 60.2% of American teens 16 to 19 years old had summer jobs. By June of 2006, 51.6% of teens in that age group were a part of the summer work force.

38. **SUMMER JOBS** Refer to the information at the left.
   a. Has the number of 16- to 19-year-olds with summer jobs increased or decreased since 2000? Explain your reasoning.
   b. In June 2006, how many 16- to 19-year-olds would you expect to have jobs out of 700 in that age group? Explain your reasoning.

39. **GOLDEN RECTANGLES** Many artists have used golden rectangles in their work. In a golden rectangle, the ratio of the length to the width is about 1.618. This is known as the golden ratio.
   a. A rectangle has dimensions of 19.42 feet and 12.01 feet. Determine if the rectangle is a golden rectangle. Then find the length of the diagonal.
   b. Recall from page 457 that a standard television screen has an aspect ratio of 4:3, while a high definition television screen has an aspect ratio of 16:9. Is either type of screen a golden rectangle? Explain.

40. **SCHOOL ACTIVITIES** A survey of club involvement showed that, of the 36 students surveyed, the ratio of French Club members to Spanish Club members to Drama Club members was 2:3:7. How many of those surveyed participate in Spanish Club? Assume that each student is active in only one club.
41. **PROOF** Write an algebraic proof of the Cross Products Property.

42. **SPORTS** Jane jogs the same path every day in the winter to stay in shape for track season. She runs at a constant rate, and she spends a total of 39 minutes jogging. If the ratio of the times of the four legs of the jog is 3:5:1:4, how long does the second leg of the jog take her?

43. **MULTIPLE REPRESENTATIONS** In this problem, you will explore proportional relationships in triangles.
   a. **GEOMETRIC** Draw an isosceles triangle $ABC$. Measure and label the legs and the vertex angle. Draw a second triangle $MNO$ with a congruent vertex angle and legs twice as long as $ABC$. Draw a third triangle $PQR$ with a congruent vertex angle and legs half as long as $ABC$.
   b. **TABULAR** Complete the table below using the appropriate measures.

<table>
<thead>
<tr>
<th>Triangle</th>
<th>ABC</th>
<th>MNO</th>
<th>PQR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leg length</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perimeter</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

c. **VERBAL** Make a conjecture about the change in the perimeter of an isosceles triangle if the vertex angle is held constant and the leg length is increased or decreased by a factor.

44. **FIND THE ERROR** Mollie and Eva have solved the proportion $\frac{x - 3}{4} = \frac{1}{2}$. Is either of them correct? Explain your reasoning.

   Mollie
   
   $(x - 3) = 4(2)$
   
   $x - 3 = 8$
   
   $x = 11$

   Eva
   
   $x - 3(2) = 4(1)$
   
   $x - 3 = 4$
   
   $x = 7$

45. **CHALLENGE** The dimensions of a rectangle are $y$ and $y^2 + 1$ and the perimeter of the rectangle is 14 units. Find the ratio of the longer side of the rectangle to the shorter side of the rectangle.

46. **REASONING** The ratio of the lengths of the diagonals of a quadrilateral is 1:1. The ratio of the lengths of the consecutive sides of the quadrilateral is 3:4:3:5. Classify the quadrilateral. Explain.

47. **WHICH ONE DOESN'T BELONG?** Identify the proportion that does not belong with the other three. Explain your reasoning.

   $\frac{3}{8} = \frac{8.4}{22.4}$  
   $\frac{2}{3} = \frac{5}{7.5}$  
   $\frac{5}{6} = \frac{14}{16.8}$  
   $\frac{7}{9} = \frac{19.6}{25.2}$

48. **OPEN ENDED** Write four ratios that are equivalent to the ratio 2:5. Explain why all of the ratios are equivalent.

49. **WRITING IN MATH** Compare and contrast a ratio and a proportion. Explain how you use both to solve a problem.
50. Solve the following proportion.
\[
\frac{x}{-8} = \frac{12}{6}
\]
A -12
B -14
C -16
D -18

51. What is the area of rectangle \(WXYZ\)?

\[
\text{Area} = \text{length} \times \text{width} = 5.8 \text{ cm} \times 3.2 \text{ cm}
\]
F 18.6 cm²
G 20.4 cm²
H 21.2 cm²
J 22.8 cm²

52. **GRIDDED RESPONSE** Mrs. Sullivan’s rectangular bedroom measures 12 feet by 10 feet. She wants to purchase carpet for the bedroom that costs $2.56 per square foot, including tax. How much will it cost in dollars to carpet her bedroom?

53. **SAT/ACT** Kamilah has 5 more than 4 times the number of DVDs that Mercedes has. If Mercedes has \(x\) DVDs, then in terms of \(x\), how many DVDs does Kamilah have?
A \(4(x + 5)\)
B \(4(x + 3)\)
C \(9x\)
D \(4x + 5\)

For trapezoid \(ABCD\), \(S\) and \(T\) are midpoints of the legs.

54. If \(CD = 14\), \(ST = 10\), and \(AB = 2x\), find \(x\).

55. If \(AB = 3x\), \(ST = 15\), and \(CD = 9x\), find \(x\).

56. If \(AB = x + 4\), \(CD = 3x + 2\), and \(ST = 9\), find \(AB\).
57. **SPORTS** The infield of a baseball diamond is a square, as shown at the right. Is the pitcher’s mound located in the center of the infield? Explain.

Write an inequality for the range of values for \( x \).

58.

59.

Use the Exterior Angle Inequality Theorem to list all of the angles that satisfy the stated condition.

60. measures less than \( m \angle 5 \)

61. measures greater than \( m \angle 6 \)

62. measures greater than \( m \angle 10 \)

63. measures less than \( m \angle 11 \)

64. **REASONING** Find a counterexample for the following statement.

If lines \( p \) and \( m \) are cut by transversal \( t \) so that consecutive interior angle are congruent, then lines \( p \) and \( m \) are parallel and \( t \) is perpendicular to both lines.

Write a paragraph proof.
Extend 7-1 Graphing Technology Lab: Fibonacci Sequence and Ratios - Analyze the Results

Analyze the Results

1. What happens to the Fibonacci number as the number of the term increases?

2. What pattern of odd and even numbers do you notice in the Fibonacci sequence?

3. As the number of terms gets greater, what pattern do you notice in the ratio column?

4. Extend the spreadsheet to calculate fifty terms of the Fibonacci sequence. Describe any differences in the patterns you described in Exercises 1–3.

5. MAKE A CONJECTURE How might the Fibonacci sequence relate to the golden ratio?
7-2 Similar Polygons - Check Your Understanding

List all pairs of congruent angles, and write a proportion that relates the corresponding sides for each pair of similar polygons.

1. \( \triangle ABC \sim \triangle ZYX \)

2. \( JKLM \sim TSRQ \)

Determine whether each pair of figures is similar. If so, write the similarity statement and scale factor. If not, explain your reasoning.

3.

4.
Each pair of polygons is similar. Find the value of $x$.

5.  

6.  

7. **DESIGN** On the blueprint of the apartment shown, the balcony measures 1 inch wide by 1.75 inches long. If the actual length of the balcony is 7 feet, what is the perimeter of the balcony?

7-2 Similar Polygons - Practice and Problem Solving

List all pairs of congruent angles, and write a proportion that relates the corresponding sides for each pair of similar polygons.

8. $\triangle CHF \sim \triangle YWS$
9. \( JHFM \sim PQST \)

10. \( ABDF \sim VXZT \)

11. \( \triangle DFG \sim \triangle KMJ \)

Determine whether each pair of figures is similar. If so, write the similarity statement and scale factor. If not, explain your reasoning.

12.

13.

14.
15. 

16. **GAMES** The dimensions of a hockey rink are 200 feet by 85 feet. Are the hockey rink and the air hockey table shown similar? Explain your reasoning.

17. **COMPUTERS** The dimensions of a 17-inch flat panel computer screen are approximately $13 \frac{1}{4}$ by $10 \frac{3}{4}$ inches. The dimensions of a 19-inch flat panel computer screen are approximately $14 \frac{1}{2}$ by 12 inches. Are the computer screens similar? Explain your reasoning.

**Each pair of polygons is similar. Find the value of x.**

18. 

19. 

20. 

21.
22. Rectangle $ABCD$ has a width of 8 yards and a length of 20 yards. Rectangle $QRST$, which is similar to rectangle $ABCD$, has a length of 40 yards. Find the scale factor of rectangle $ABCD$ to rectangle $QRST$ and the perimeter of each rectangle.

**Find the perimeter of the given triangle.**

23. $\triangle DEF$, if $\triangle ABC \sim \triangle DEF$, $AB = 5$, $BC = 6$, $AC = 7$, and $DE = 3$

![Diagram of triangle DEF with sides labeled](image1)

24. $\triangle WZX$, if $\triangle WZX \sim \triangle SRT$, $ST = 6$, $WX = 5$, and the perimeter of $\triangle SRT = 15$

![Diagram of triangle WZX with sides labeled](image2)

25. $\triangle CBH$, if $\triangle CBH \sim \triangle FEH$, $ADEG$ is a parallelogram, $CH = 7$, $FH = 10$, $FE = 11$, and $EH = 6$

![Diagram of parallelogram and triangle CBH with sides labeled](image3)

26. $\triangle DEF$, if $\triangle DEF \sim \triangle CBF$, perimeter of $\triangle CBF = 27$, $DF = 6$, $FC = 8$

![Diagram of triangle DEF with sides labeled](image4)

27. Two similar rectangles have a scale factor of 2: 4. The perimeter of the large rectangle is 80 meters. Find the perimeter of the small rectangle.

28. Two similar squares have a scale factor of 3: 2. The perimeter of the small rectangle is 50 feet. Find the perimeter of the large rectangle.

List all pairs of congruent angles, and write a proportion that relates the corresponding sides.

29. ![Diagram of two quadrilaterals with angles labeled](image5)
30. **SHUFFLEBOARD** A shuffleboard court forms three similar triangles in which \( \angle AHB \equiv \angle AGC \equiv \angle AFD \). Find the side(s) that correspond to the given side or angles that are congruent to the given angle.

31. \( AB \)

32. \( FD \)

33. \( \angle ACG \)

34. \( \angle A \)

Find the value of each variable.

35. \( ABCD \sim QSRP \)

36. \( \triangle JKL \sim \triangle WYZ \)

37. **SLIDE SHOW** You are using a digital projector for a slide show. The photos are 13 inches by \( \frac{9}{4} \) inches on the computer screen, and the scale factor of the computer image to the projected image is 1:4. What are the dimensions of the projected image?
COORDINATE GEOMETRY For the given vertices, determine whether rectangle $ABCD$ is similar to rectangle $WXYZ$. Justify your answer.

38. $A(-1, 5), B(7, 5), C(7, -1), D(-1, -1);
   W(-2, 10), X(14, 10), Y(14, -2), Z(-2, -2)$

39. $A(5, 5), B(0, 0), C(5, -5), D(10, 0);
   W(1, 6), X(-3, 2), Y(2, -3), Z(6, 1)$

Determine whether the polygons are *always*, *sometimes*, or *never* similar. Explain your reasoning.

40. two obtuse triangles

41. a trapezoid and a parallelogram

42. two right triangles

43. two isosceles triangles

44. a scalene triangle and an isosceles triangle

45. two equilateral triangles

46. **PROOF** Write a paragraph proof of Theorem 7.1.

   ![Diagram of triangles](image)

   **Given:** $\triangle ABC \sim \triangle DEF$ and $\frac{AB}{DE} = \frac{m}{n}$

   **Prove:** $\frac{\text{perimeter of } \triangle ABC}{\text{perimeter of } \triangle DEF} = \frac{m}{n}$

47. **PHOTOS** You are enlarging the photo shown at the left for your school yearbook. If the dimensions of the original photo are $2 \frac{1}{3}$ inches by $1 \frac{2}{3}$ inches and the scale factor of the old photo to the new photo is 2:3, what are the dimensions of the new photo?
48. **CHANGING DIMENSIONS** Rectangle $QRST$ is similar to rectangle $JKLM$ with sides in a ratio of 4:1.
   a. What is the ratio of the areas of the two rectangles?
   b. Suppose the dimension of each rectangle is tripled. What is the new ratio of the sides of the rectangles?
   c. What is the ratio of the areas of these larger rectangles?

49. **CHANGING DIMENSIONS** In the figure shown, $\triangle FGH \sim \triangle XYZ$.
   a. Show that the perimeters of $\triangle FGH$ and $\triangle XYZ$ have the same ratio as their corresponding sides.
   b. If 6 units are added to the lengths of each side, are the new triangles similar? Explain.

```
   X
   |
   |
   |
 3b----------3a
     |    |
     |    |
  b     c...
```

50. **MULTIPLE REPRESENTATIONS** In this problem, you will investigate similarity in squares.
   a. **GEOMETRIC** Draw three different-sized squares. Label them $ABCD$, $PQRS$, and $WXYZ$. Measure and label each square with its side length.
   b. **TABULAR** Calculate and record in a table the ratios of corresponding sides for each pair of squares: $ABCD$ and $PQRS$, $PQRS$ and $WXYZ$, and $WXYZ$ and $ABCD$. Is each pair of squares similar?
   c. **VERBAL** Make a conjecture about the similarity of all squares.

51. **CHALLENGE** For what value(s) of $x$ is $BEFA \sim EDCB$?

```
   A
   |
   |
   B
   |
   E
   |
   F
```

52. **REASONING** Recall that an *equivalence relation* is any relationship that satisfies the Reflexive, Symmetric, and Transitive Properties. Is similarity an equivalence relation? Explain.

53. **OPEN ENDED** Find a counterexample for the following statement.
   *All rectangles are similar.*

54. **REASONING** Draw two regular pentagons of different sizes. Are the pentagons similar? Will any two regular polygons with the same number of sides be similar? Explain.

55. **WRITING IN MATH** Compare and contrast congruent, similar, and equal figures.

56. **ALGEBRA** If the arithmetic mean of $4x$, $3x$, and 12 is 18, then what is the value of $x$?
   A 6
   B 5
   C 4
   D 3
Name:

57. Two similar rectangles have a scale factor of 3: 5. The perimeter of the large rectangle is 65 meters. What is the perimeter of the small rectangle?
   F 29 m
   G 39 m
   H 49 m
   J 59 m

58. SHORT RESPONSE If a jar contains 25 dimes and 7 quarters, what is the probability that a coin selected from the jar at random will be a dime?

59. SAT/ACT If the side of a square is \( x + 3 \), then what is the diagonal of the square?
   A \( x^2 + 3 \)
   B \( 3x + 3 \)
   C \( x\sqrt{2} + 3\sqrt{2} \)
   D \( x\sqrt{3} + 3\sqrt{3} \)

60. COMPUTERS In a survey of 5000 households, 4200 had at least one computer. What is the ratio of computers to households?

61. PROOF Write a flow proof.
   Given: \( E \) and \( C \) are midpoints of \( \overline{AD} \) and \( \overline{DB} \), \( \overline{AD} \equiv \overline{DB} \), \( \angle A \equiv \angle 1 \).
   Prove: \( ABCE \) is an isosceles trapezoid.

62. COORDINATE GEOMETRY Determine the coordinates of the intersection of the diagonals of \( \square JKLM \) with vertices \( J(2, 5) \), \( K(6, 6) \), \( L(4, 0) \), and \( M(0, -1) \).

   State the assumption you would make to start an indirect proof of each statement.

63. If \( 3x > 12 \), then \( x > 4 \).

64. \( \overline{PQ} \equiv \overline{ST} \)

65. The angle bisector of the vertex angle of an isosceles triangle is also an altitude of the triangle.

66. If a rational number is any number that can be expressed as \( \frac{a}{b} \), where \( a \) and \( b \) are integers and \( b \neq 0 \), then 6 is a rational number.

Find the measures of each numbered angle.
Name:

67. \( m \angle 1 \)

68. \( m \angle 2 \)

69. \( m \angle 3 \)

ALGEBRA Find \( x \) and the unknown side measures of each triangle.

70.

71.

72.
7-3 Similar Triangles - Check Your Understanding

Determine whether the triangles are similar. If so, write a similarity statement. Explain your reasoning.

1. [Diagram of triangle XYZ with vertices X, Y, and Z]

2. [Diagram of triangle ADE with vertices A, D, and E]

3. [Diagram of triangle VUY with vertices V, U, and Y]

4. [Diagram of triangle JKL with vertices J, K, and L]

5. **MULTIPLE CHOICE** In the figure, \( AB \) intersects \( DE \) at point \( C \). Which additional information would be enough to prove that \( \triangle ADC \sim \triangle BEC \)?
   
   A \( \angle DAC \) and \( \angle ECB \) are congruent.
   
   B \( AC \) and \( BC \) are congruent.
   
   C \( AD \) and \( EB \) are parallel.
   
   D \( \angle CBE \) is a right angle.

6. **ALGEBRA** Identify the similar triangles. Find each measure.

6. [Diagram of triangle XJK with vertices X, J, and K]
8. **COMMUNICATION** A cell phone tower casts a 100-foot shadow. At the same time, a 4-foot 6-inch post near the tower casts a shadow of 3 feet 4 inches. Find the height of the tower.
7-3 Similar Triangles - Practice and Problem Solving

Determine whether the triangles are similar. If so, write a similarity statement. If not, what would be sufficient to prove the triangles similar? Explain your reasoning.

9.

10.

11.

Determine whether the triangles are similar. If so, write a similarity statement. If not, what would be sufficient to prove the triangles similar? Explain your reasoning.

12.

13.

14.
15. **VISION** When we look at an object, it is projected on the retina through the pupil. The distances from the pupil to the top and bottom of the object are congruent and the distances from the pupil to the top and bottom of the image on the retina are congruent. Are the triangles formed between the object and the pupil and the object and the image similar? Explain your reasoning.

![Diagram of VISION](image)

**ALGEBRA** Identify the similar triangles. Then find each measure.

16. **JK**

![Diagram of JK](image)

17. **ST**

![Diagram of ST](image)

18. **WZ, UZ**

![Diagram of WZ, UZ](image)

19. **HJ, HK**

![Diagram of HJ, HK](image)
20. $DB, CB$

21. $GD, DH$

22. **STATUES** Mei is standing next to a statue in the park. If Mei is 5 feet tall, her shadow is 3 feet long, and the statue’s shadow is $\frac{10}{2}$ feet long, how tall is the statue?

23. **SPORTS** When Alonzo, who is 5'11" tall, stands next to a basketball goal, his shadow is 2' long, and the basketball goal’s shadow is 4'4" long. About how tall is the basketball goal?

24. **FORESTRY** A hypsometer, as shown, can be used to estimate the height of a tree. Bartolo looks through the straw to the top of the tree and obtains the readings given. Find the height of the tree.

   ![Hypsometer Image]

   **PROOF** Write a two-column proof.

25. Theorem 7.3

26. Theorem 7.4

   **PROOF** Write a two-column proof.

27. Given: $\triangle XYZ$ and $\triangle ABC$ are right triangles; $\frac{XY}{AB} = \frac{YZ}{BC}$.

   **Prove:** $\triangle XYZ \sim \triangle BAC$
28. **Given:** \(ABCD\) is a trapezoid.

**Prove:** \(\frac{DP}{PB} = \frac{CP}{PA}\)

![Diagram of a trapezoid](image)

29. **SPORTS** When Luis’s dad threw a bounce pass to him, the angles formed by the basketball’s path were congruent. The ball landed \(\frac{2}{3}\) of the way between them before it bounced back up. If Luis’s dad released the ball 40 inches above the floor, at what height did Luis catch the ball?

![Basketball player](image)

**COORDINATE GEOMETRY** \(\triangle XYZ\) and \(\triangle WYV\) have vertices \(X(-1, -9), Y(5, 3), Z(-1, 6), W(1, -5),\) and \(V(1, 5)\).

30. Graph the triangles, and prove that \(\triangle XYZ : \triangle WYV\).

31. Find the ratio of the perimeters of the two triangles.

32. **BILLIARDS** When a ball is deflected off a smooth surface, the angles formed by the path are congruent. Booker hit the orange ball and it followed the path from \(A\) to \(B\) to \(C\) as shown below. What was the total distance traveled by the ball from the time Booker hit it until it came to rest at the end of the table?

![Billiards](image)

33. **PROOF** Use similar triangles to show that the slope of the line through any two points on that line is constant. That is, if points \(A, B, A'\) and \(B'\) are on line \(l\), use similar triangles to show that the slope of the line from \(A\) to \(B\) is equal to the slope of the line from \(A'\) to \(B'\).
34. **CHANGING DIMENSIONS** Assume that \( \triangle ABC : \triangle JKL \).
   a. If the lengths of the sides of \( \triangle JKL \) are half the length of the sides of \( \triangle ABC \), and the area of \( \triangle ABC \) is 40 square inches, what is the area of \( \triangle JKL \)? How is the area related to the scale factor of \( \triangle ABC \) to \( \triangle JKL \)?
   b. If the lengths of the sides of \( \triangle ABC \) are three times the length of the sides of \( \triangle JKL \), and the area of \( \triangle ABC \) is 63 square inches, what is the area of \( \triangle JKL \)? How is the area related to the scale factor of \( \triangle ABC \) to \( \triangle JKL \)?

35. **MEDICINE** Refer to the information at the left and the diagram at the right. How far apart should the laser sources be placed to ensure that the areas treated by each source do not overlap?

![Diagram of laser sources and skin]

36. **MULTIPLE REPRESENTATIONS** In this problem, you will explore proportional parts of triangles.
   a. **GEOMETRIC** Draw a \( \triangle ABC \) with \( \overline{DE} \) parallel to \( \overline{AC} \) as shown at the right.
   b. **TABULAR** Measure and record the lengths \( AD, DB, CD, \) and \( EB \) and the ratios \( \frac{AD}{DB} \) and \( \frac{CE}{EB} \) in a table.
   c. **VERBAL** Make a conjecture about the segments created by a line parallel to one side of a triangle and intersecting the other two sides.

![Diagram of \( \triangle ABC \) with line \( \overline{DE} \)]

37. **WRITING IN MATH** Compare and contrast the AA Similarity Postulate, the SSS Similarity Theorem, and the SAS similarity theorem.

38. **CHALLENGE** \( \overline{YW} \) is an altitude of \( \triangle XYZ \). Find \( YW \).

![Diagram of \( \triangle XYZ \) with altitude \( \overline{YW} \)]

39. **REASONING** A pair of similar triangles has angle measures of 50°, 85°, and 45°. The sides of one triangle measure 3, 4, and 5.2 units, and the sides of the second triangle measure \( x, x - 1.5, \) and \( x + 1.8 \) units. Find the value of \( x \).
40. OPEN ENDED Draw a triangle that is similar to \( \triangle ABC \) shown. Explain how you know that it is similar.

41. WRITING IN MATH Given a triangle, explain a process you can use to draw a similar triangle that is twice as large.

42. PROBABILITY \( \frac{x!}{(x-3)!} = \)

   A 3.0
   B 0.33
   C \( x^2 - 3x + 2 \)
   D \( x^3 - 3x^2 + 2x \)

43. EXTENDED RESPONSE In the figure below, \( \overline{EB} \parallel \overline{DC} \).

   a. Write a proportion that could be used to find \( x \).
   b. Find the value of \( x \) and the measure of \( \overline{AB} \).

44. ALGEBRA Which polynomial represents the area of the shaded region?

   F \( \pi r^2 \)
   G \( \pi r^2 + r^2 \)
   H \( \pi r^2 + r \)
   J \( \pi r^3 - r^3 \)

45. SAT/ACT The volume of a certain rectangular solid is 16x cubic units. If the dimensions of the solid are integers \( x, y, \) and \( z \) units, what is the greatest possible value of \( z \)?

   A 32
   B 16
   C 8
   D 4

List all pairs of congruent angles, and write a proportion that relates the corresponding sides for each pair of similar polygons.
Name:

46. \( \triangle JKL \sim \triangle CDE \)

47. \( WXYZ \sim QRST \)

48. \( FGHJ \sim MPQS \)

Solve each proportion.

49. \( \frac{3}{4} = \frac{x}{16} \)

50. \( \frac{x}{10} = \frac{22}{50} \)

51. \( \frac{20}{88} = \frac{12}{x} \)

52. \( \frac{x - 2}{2} = \frac{3}{8} \)

53. **TANGRAMS** A tangram set consists of seven pieces: a small square, two small congruent right triangles, two large congruent right triangles, a medium-sized right triangle, and a quadrilateral. How can you determine the shape of the quadrilateral? Explain.

Determine which postulate can be used to prove that the triangles are congruent. If it is not possible to prove congruence, write *not possible*.

54.
55.

56.

Write a two-column proof.

57. Given: \( r \parallel t; \angle 5 \cong \angle 6 \)
Prove: \( 1 \parallel m \)
7-4 Parallel Lines and Proportional Parts - Check Your Understanding

1. If $XM = 4$, $XN = 6$, and $NZ = 9$, find $XY$.

2. If $XN = 6$, $XM = 2$, and $XY = 10$, find $NZ$.

3. In $\triangle ABC$, $BC = 15$, $BE = 6$, $DC = 12$, and $AD = 8$. Determine whether $\overline{DE} \parallel \overline{AB}$. Justify your answer.

4. In $\triangle JKL$, $JK = 15$, $JM = 5$, $LK = 13$, and $PK = 9$. Determine whether $\overline{JL} \parallel \overline{MP}$. Justify your answer.

$\overline{JH}$ is a midsegment of $\triangle KLM$. Find the value of $x$.

5.

6.
7. **MAPS** Refer to the map at the right. 3rd Avenue and 5th Avenue are parallel. If the distance from 3rd Avenue to City Mall along State Street is 3201 feet, find the distance between 5th Avenue and City Mall along Union Street. Round to the nearest tenth.

![Map Diagram]

**ALGEBRA** Find $x$ and $y$.

8. 

![Diagram 2]

9. 

![Diagram 3]
7-4 Parallel Lines and Proportional Parts - Practice and Problem Solving

10. If \( AB = 6 \), \( BC = 4 \), and \( AE = 9 \), find \( ED \).

11. If \( AB = 12 \), \( AC = 16 \), and \( ED = 5 \), find \( AE \).

12. If \( AC = 14 \), \( BC = 8 \), and \( AD = 21 \), find \( ED \).

13. If \( AD = 27 \), \( AB = 8 \), and \( AE = 12 \), find \( BC \).

Determine whether \( VY \parallel ZW \). Justify your answer.

14. \( ZX = 18 \), \( ZV = 6 \), \( WX = 24 \), and \( YX = 16 \)

15. \( VX = 7.5 \), \( ZX = 24 \), \( WY = 27.5 \), and \( WX = 40 \)

16. \( ZV = 8 \), \( VX = 2 \), and \( YX = \frac{1}{2} WY \)

17. \( WX = 31 \), \( YX = 21 \), and \( ZX = 4ZV \)

\( \overline{JH} \), \( \overline{JP} \), and \( \overline{PH} \) are midsegments of \( \triangle KLM \). Find the value of \( x \).

18.

19.
20. 

21. 

22. **MAPS** In Charleston, South Carolina, Logan Street is parallel to both King Street and Smith Street between Beaufain Street and Queen Street. What is the distance from Smith to Logan along Beaufain? Round to the nearest foot.

23. **ART** Tonisha drew the line of dancers shown below for her perspective project in art class. Each of the dancers is parallel. Find the lower distance between the first two dancers.

**ALGEBRA** Find $x$ and $y$. 

24. 

25.
ALGEBRA Find \( x \) and \( y \).

26. \[ \begin{array}{c}
\frac{x}{9} + 3 = 2y + 1 \\
4x - 35 = 5y - 8
\end{array} \]

27. \[ \begin{array}{c}
\frac{1}{x} + 5 = \frac{1}{y} - 6 \\
\frac{1}{x} - 7 = 9 - \frac{2}{y}
\end{array} \]

PROOF Write a paragraph proof.

28. Corollary 7.1

29. Corollary 7.2

30. Theorem 7.5

PROOF Write a two-column proof.

31. Theorem 7.6

32. Theorem 7.7

Refer to \( \triangle QRS \).

33. If \( ST = 8 \), \( TR = 4 \), and \( PT = 6 \), find \( QR \).

34. If \( SP = 4 \), \( PT = 6 \), and \( QR = 12 \), find \( SQ \).

35. If \( CE = t - 2 \), \( EB = t + 1 \), \( CD = 2 \), and \( CA = 10 \), find \( t \) and \( CE \).
36. If $WX = 7$, $WY = a$, $WV = 6$, and $VZ = a - 9$, find $WY$.

37. If $QR = 2$, $XW = 12$, $QW = 15$, and $ST = 5$, find $RS$ and $WV$.

38. If $LK = 4$, $MP = 3$, $PQ = 6$, $KJ = 2$, $RS = 6$, and $LP = 2$, find $ML$, $QR$, $QK$, and $JH$.

39. **MATH HISTORY** The sector compass was a tool perfected by Galileo in the sixteenth century for measurement. To draw a segment two-fifths the length of a given segment, align the ends of the arms with the given segment. Then draw a segment at the 40 mark. Write a justification that explains why the sector compass works for proportional measurement.

40. $AB = x + 5$, $BD = 12$, $AC = 3x + 1$, and $CF = 15$

41. $AC = 15$, $BD = 3x - 2$, $CF = 3x + 2$, and $AB = 12$

42. **COORDINATE GEOMETRY** $\triangle ABC$ has vertices $A(-8, 7)$, $B(0, 1)$, and $C(7, 5)$. Draw $\triangle ABC$. Determine the coordinates of the midsegment of $\triangle ABC$ that is parallel to $\overline{BC}$. Justify your answer.

Determine the value of $x$ so that $\overline{BC} \parallel \overline{DF}$. 

Determine the coordinates of the midsegment of $\triangle ABC$ that is parallel to $\overline{BC}$. Justify your answer.
43. **HOUSES** Refer to the diagram of the gable at the right. Each piece of siding is a uniform width. Find the lengths of $FG$, $EH$, and $DJ$.

![Diagram of a gable]

**CONSTRUCTIONS** Construct each segment as directed.

44. a segment separated into five congruent segments

45. a segment separated into two segments in which their lengths have a ratio of 1 to 3

46. a segment 3 inches long, separated into four congruent segments

47. **MULTIPLE REPRESENTATIONS** In this problem, you will explore angle bisectors and proportions.
   a. **GEOMETRIC** Draw three triangles, one acute, one right, and one obtuse. Label one triangle $ABC$ and draw angle bisector $BD$. Label the second $MNP$ with angle bisector $NQ$ and the third $WXY$ with angle bisector $XZ$.
   b. **TABULAR** Complete the table at the right with the appropriate values.
   c. **VERBAL** Make a conjecture about the segments of a triangle created by an angle bisector.

<table>
<thead>
<tr>
<th>Triangle</th>
<th>Length</th>
<th>Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>$ABC$</td>
<td>$AD$</td>
<td>$AD$</td>
</tr>
<tr>
<td></td>
<td>$CD$</td>
<td>$CD$</td>
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<td></td>
<td>$AB$</td>
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<tr>
<td></td>
<td>$CB$</td>
<td>$CB$</td>
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<tr>
<td>$MNP$</td>
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<td></td>
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<td></td>
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<tr>
<td>$WXY$</td>
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<tr>
<td></td>
<td>$YZ$</td>
<td>$YZ$</td>
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<td></td>
<td>$WX$</td>
<td>$WX$</td>
</tr>
<tr>
<td></td>
<td>$YX$</td>
<td>$YX$</td>
</tr>
</tbody>
</table>

48. **FIND THE ERROR** Jacob and Sebastian are finding the value of $x$ in $\triangle JHL$. Jacob says that $MP$ is one half of $JL$, so $x$ is 4.5. Sebastian says that $JL$ is one half of $MP$, so $x$ is 18. Is either of them correct? Explain.

![Diagram of a triangle]
49. **REASONING** In $\triangle ABC$, $AF = FB$ and $AH = HC$. If $D$ is $\frac{3}{4}$ of the way from $A$ to $B$ and $E$ is $\frac{3}{4}$ of the way from $A$ to $C$, is $DE$ sometimes, always, or never $\frac{3}{4}$ of $BC$? Explain.

![Triangle Diagram]

**CHALLENGE** Write a two-column proof.

50. **Given:** $AB = 4$ and $BC = 4$, $CD = DE$

**Prove:** $BD \parallel AE$

![Diagram with parallel lines]

51. **OPEN ENDED** Draw three segments, $a$, $b$, and $c$, of all different lengths. Draw a fourth segment, $d$, such that

$$\frac{a}{b} = \frac{c}{d}.$$

52. **WRITING IN MATH** Compare the Triangle Proportionality Theorem and the Triangle Midsegment Theorem.

53. **SHORT RESPONSE** What is the value of $x$?

![Triangle with expressions]

54. If the vertices of triangle $JKL$ are $(0, 0)$, $(0, 10)$ and $(10, 10)$ then the area of triangle $JKL$ is

- A 20 units$^2$
- B 30 units$^2$
- C 40 units$^2$
- D 50 units$^2$

55. **ALGEBRA** A breakfast cereal contains wheat, rice, and oats in the ratio 2:4:1. If the manufacturer makes a mixture using 110 pounds of wheat, how many pounds of rice will be used?

- F 120 lb
- G 220 lb
- H 240 lb
- J 440 lb
56. **SAT/ACT** If the area of a circle is 16 square meters, what is its radius in meters?

A \( \frac{8}{\pi} \)

B \( \frac{4\sqrt{\pi}}{\pi} \)

C \( 12\pi \)

D \( \frac{16}{\pi} \)

**ALGEBRA** Identify the similar triangles. Then find the measure(s) of the indicated segment(s).

57. \( \overline{AB} \)

58. \( \overline{RT}, \overline{RS} \)

59. \( \overline{TY} \)

60. **SURVEYING** Mr. Turner uses a carpenter’s square to find the distance across a stream. The carpenter’s square models right angle \( NOL \). He puts the square on top of a pole that is high enough to sight along \( \overline{OL} \) to point \( P \) across the river. Then he sights along \( \overline{ON} \) to point \( M \). If \( MK \) is 1.5 feet and \( OK \) is 4.5 feet, find the distance \( KP \) across the stream.

**COORDINATE GEOMETRY** For each quadrilateral with the given vertices, verify that the quadrilateral is a trapezoid and determine whether the figure is an isosceles trapezoid.

61. \( Q(-12, 1), R(-9, 4), S(-4, 3), T(-11, -4) \)
62. \( A(-3, 3), B(-4, -1), C(5, -1), D(2, 3) \)

Point S is the incenter of \( \triangle JPL \). Find each measure.

63. \( SQ \)

64. \( QJ \)

65. \( m \angle MPQ \)

66. \( m \angle SIP \)

Solve each proportion.

67. \( \frac{1}{3} = \frac{x}{2} \)

68. \( \frac{3}{4} = \frac{5}{x} \)

69. \( \frac{2.3}{4} = \frac{x}{3.7} \)

70. \( \frac{x - 2}{2} = \frac{4}{5} \)

71. \( \frac{x}{12 - x} = \frac{8}{3} \)
Chapter 7 - Proportions and Similarity - Mid-Chapter Quiz:
Lessons 7-1 through 7-4

Solve each proportion.

1. \( \frac{2}{5} = \frac{x}{25} \)
2. \( \frac{10}{3} = \frac{7}{x} \)
3. \( \frac{y + 4}{11} = \frac{y - 2}{9} \)
4. \( \frac{z - 1}{3} = \frac{8}{z + 1} \)

5. **BASEBALL** A pitcher’s earned run average or ERA is the product of 9 and the ratio of earned runs the pitcher has allowed to the number of innings pitched. During the 2007 season, Johan Santana of the Minnesota Twins allowed 81 earned runs in 219 innings pitched. Find his ERA to the nearest hundredth.

Each pair of polygons is similar. Find the value of \( x \).

6. 

7. 

8. **MULTIPLE CHOICE** Two similar polygons have a scale factor of 3: 5. The perimeter of the large polygon is 120 feet. Find the perimeter of the small polygon.
   A 68 ft
   B 72 ft
   C 192 ft
   D 200 ft

Determine whether the triangles are similar. If so, write a similarity statement. If not, what would be sufficient to prove the triangles similar? Explain your reasoning.
Name:

10. \[ \text{ALGEBRA Identify the similar triangles. Find each measure.} \]

11. \[ SR \]

12. \[ AF \]

13. \[ HISTORY \] In the fifteenth century, mathematicians and artists tried to construct the perfect letter. A square was used as a frame to design the letter “A,” as shown below. The thickness of the major stroke of the letter was \( \frac{1}{12} \) the height of the letter.

a. Explain why the bar through the middle of the A is half the length of the space between the outside bottom corners of the sides of the letter.

b. If the letter were 3 centimeters tall, how wide would the major stroke be?

\[ \text{ALGEBRA Find } x \text{ and } y. \]

14. \[ \text{ } \]
7-5 Parts of Similar Triangles - Check Your Understanding

Find $x$.

1.

2.

3. VISION A cat that is 10 inches tall forms a retinal image that is 7 millimeters tall. If $\triangle ABE : \triangle DBC$ and the distance from the pupil to the retina is 25 millimeters, how far away from your pupil is the cat?

Find the value of each variable.

4.

5.
7-5 Parts of Similar Triangles - Practice and Problem Solving

Find $x$.

6.
7.

8.

9.

10. **ROADWAYS** The intersection of the two roads shown forms two similar triangles. If $AC$ is 382 feet, $MP$ is 248 feet, and the gas station is 50 feet from the intersection, how far from the intersection is the bank?

Find the value of each variable. Note that figures are not drawn to scale.

11.

12.
13. [Image of a triangle with side lengths and angles labeled]

14. [Image of a triangle with side lengths and angles labeled]

15. **ALGEBRA** If \(AB\) and \(JK\) are altitudes, \(\triangle DAC : \triangle MJL\), \(AB = 9\), \(AD = 4x - 8\), \(JK = 21\), \(JM = 5x + 3\), find \(x\).

16. **ALGEBRA** If \(NQ\) and \(VX\) are medians, \(\triangle PNR : \triangle WYV\), \(NQ = 8\), \(PR = 12\), \(WY = 7x - 1\), and \(VX = 4x + 2\), find \(x\).

17. If \(\triangle SRY : \triangle WXQ, RT\) is an altitude of \(\triangle SRY\), \(\overline{VX}\) is an altitude of \(\triangle WXQ\), \(RT = 5\), \(RQ = 4\), \(QY = 6\), and \(YX = 2\), find \(XV\).

18. **PROOF** Write a paragraph proof of Theorem 7.9.

19. **PROOF** Write a two-column proof of Theorem 7.10.

**ALGEBRA** Find \(x\).
20.

21.

22.

23.

24. **SPORTS** Consider the triangle formed by the path between a batter, center fielder, and right fielder as shown. If the batter gets a hit that bisects the triangle at \( \angle B \), is the center fielder or the right fielder closer to the ball? Explain your reasoning.

**PROOF** Write a two-column proof.
25. Theorem 7.11
Given: \( CD \) bisects \( \angle ACB \). By construction, \( AE \parallel CD \).
Prove: \( \frac{AD}{DB} = \frac{AC}{BC} \)

26. Given: \( \angle H \) is a right angle. \( L, K, \) and \( M \) are midpoints.
Prove: \( \angle LKM \) is a right angle.

PROOF Write a two-column proof.

27. Given: \( \triangle QTS \cong \triangle XWZ \), \( TR \) and \( WY \) are angle bisectors.
Prove: \( \frac{TR}{WY} = \frac{QT}{XW} \)

28. Given: \( FD \parallel BC \), \( BF \parallel CD \), \( AC \) bisects \( \angle C \).
Prove: \( \frac{DE}{EC} = \frac{BA}{AC} \)
29. **SPORTS** During football practice, Trevor threw a pass to Ricardo as shown below. If Eli is farther from Trevor when he completes the pass to Ricardo and Craig and Eli move at the same speed, who will reach Ricardo to tackle him first?

![Diagram of football players]

30. **SHELVING** In the triangular bookshelf shown, the distance between each of the shelves is 13 inches and \( AK \) is a median of \( \triangle ABC \). If \( EF = 3\frac{1}{3} \) inches, what is \( BK \)?

![Diagram of bookshelf]

31. **FIND THE ERROR** Chun and Traci are determining the value of \( x \) in the figure. Chun says to find \( x \), solve the proportion \( \frac{5}{8} = \frac{15}{x} \), but Traci says to find \( x \), the proportion \( \frac{5}{x} = \frac{8}{15} \) should be solved. Is either of them correct? Explain.

![Diagram of triangle]

32. **REASONING** Find a counterexample to the following statement. Explain.

*If the measure of an altitude and side of a triangle are proportional to the corresponding altitude and corresponding side of another triangle, then the triangles are similar.*

33. **CHALLENGE** The perimeter of \( \triangle PQR \) is 94 units. \( QS \) bisects \( \angle PQR \). Find \( PS \) and \( RS \).

![Diagram of triangle with bisector]
34. **OPEN ENDED** Draw two triangles so that the measures of corresponding medians and a corresponding side are proportional, but the triangles are not similar.

35. **WRITING IN MATH** Compare and contrast Theorem 7.9 and the Triangle Angle Bisector Theorem.

36. **ALGEBRA** Which shows 0.00234 written in scientific notation?
   
   A. $2.34 \times 10^{-5}$
   B. $2.34 \times 10^{3}$
   C. $2.34 \times 10^{-2}$
   D. $2.34 \times 10^{-3}$

37. **SHORT RESPONSE** In the figures below, $\overline{DB} \cong \overline{BC}$ and $\overline{FH} \cong \overline{HE}$.

   ![Diagram](Image)

   If $\triangle ACD \sim \triangleGEF$, find $AB$.

38. Quadrilateral $HJKL$ is a parallelogram. If the diagonals are perpendicular, which statement must be true?
   
   F. Quadrilateral $HJKL$ is a square.
   G. Quadrilateral $HJKL$ is a rectangle.
   H. Quadrilateral $HJKL$ is a rhombus.
   J. Quadrilateral $HJKL$ is an isosceles trapezoid.

39. **SAT/ACT** The sum of three numbers is 180. Two of the numbers are the same, and each of them is one third of the greatest number. What is the least number?

   A. 30
   B. 36
   C. 45
   D. 60

   **ALGEBRA** Find $x$ and $y$.

40. ![Diagram](Image)

41. ![Diagram](Image)
42. Find the indicated measure(s).

43. If \( PR \parallel KL \), \( KN = 9 \), \( LN = 16 \), \( PM = 2(KP) \), find \( KP \), \( KM \), \( MR \), \( ML \), \( MN \), and \( PR \).

44. If \( PR \parallel WX \), \( WX = 10 \), \( XY = 6 \), \( WY = 8 \), \( RY = 5 \), and \( PS = 3 \), find \( PY \), \( SY \), and \( PQ \).

45. **GEES** A flock of geese flies in formation. Prove that \( \triangle EFG \cong \triangle HFG \) if \( EF \cong HF \) and that \( G \) is the midpoint of \( EH \).

Find the distance between each pair of points.

46. \( E(-3, -2), F(5, 8) \)

47. \( A(2, 3), B(5, 7) \)

48. \( C(-2, 0), D(6, 4) \)

49. \( W(7, 3), Z(-4, -1) \)

50. \( J(-4, -5), K(2, 9) \)

51. \( R(-6, 10), S(8, -2) \)
Extend 7-5 Geometry Lab: Fractals - Analyze the Results

Analyze the Results

1. If you continue the process, how many unshaded triangles will you have at Stage 3?

2. What is the perimeter of an unshaded triangle in Stage 4?

3. If you continue the process indefinitely, what will happen to the perimeters of the unshaded triangles?

CHALLENGE Complete the proof below.

4. Given: $\triangle KAP$ is equilateral. $D, F, M, B, C,$ and $E$ are midpoints of $KA, AP, PK, DA, AF,$ and $FD$, respectively.
   Prove: $\triangle BAC \sim \triangle KAP$

5. A fractal tree can be drawn by making two new branches from the endpoint of each original branch, each one-third as long as the previous branch.
   a. Draw Stages 3 and 4 of a fractal tree. How many total branches do you have in Stages 1 through 4? (Do not count the stems.)
   b. Write an expression to predict the number of branches at each stage.

Analyze the Results

6. Write a formula for the sum $S$ of any row $n$ in the Pascal Triangle.

7. What is the sum of the values in the eighth row of Pascal’s Triangle?

Write a recursive formula for $F(x)$. 

<table>
<thead>
<tr>
<th>$x$</th>
<th>2</th>
<th>4</th>
<th>6</th>
<th>8</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>$F(x)$</td>
<td>3</td>
<td>7</td>
<td>11</td>
<td>15</td>
<td>19</td>
</tr>
</tbody>
</table>
10. \[\begin{array}{c|cccc} x & 1 & 2 & 4 & 9 & 10 \\ \hline f(x) & 1 & 0.5 & 0.25 & 0.125 & 0.1 \end{array}\]

11. \[\begin{array}{c|cccc} x & 4 & 9 & 16 & 25 & 36 \\ \hline f(x) & 5 & 6 & 7 & 8 & 9 \end{array}\]

12. **CHALLENGE** The pattern below represents a sequence of *triangular numbers*. How many dots will be in the 8th term in the sequence? Is it possible to write a recursive formula that can be used to determine the number of dots in the nth triangular number in the series? If so, write the formula. If not, explain why not.

![Triangular Number Pattern](image)
7-6 Similarity Transformations - Check Your Understanding

Determine whether the dilation from A to B is an *enlargement* or a *reduction*. Then find the scale factor of the dilation.

1. 

2. 

3. **GAMES** The dimensions of a regulation tennis court are 27 feet by 78 feet. The dimensions of a table tennis table are 152.5 centimeters by 274 centimeters. Is a table tennis table a dilation of a tennis court? If so, what is the scale factor? Explain.

Verify that the dilation is a similarity transformation.

4. 

5. 
7-6 Similarity Transformations - Practice and Problem Solving

Determine whether the dilation from $A$ to $B$ is an enlargement or a reduction. Then find the scale factor of the dilation.

6.

7.

8.

9.

Determine whether each dilation is an enlargement or reduction.

10.
12. **YEARBOOK** Jordan is putting a photo of the lacrosse team in a full-page layout in the yearbook. The original photo is 4 inches by 6 inches. If the photo in the yearbook is \(6\frac{2}{3}\) inches by 10 inches, is the yearbook photo a dilation of the original photo? If so, what is the scale factor? Explain.

13. **SCHOOL SPIRIT** Candace created a design to be made into temporary tattoos for a homecoming game as shown. Is the temporary tattoo a dilation of the original design? If so, what is the scale factor? Explain.

   ![Original Design](image1)
   ![Temporary Tattoo](image2)

   **Graph the original figure and its dilated image. Then verify that the dilation is a similarity transformation.**

14. \(M(1, 4), P(2, 2), Q(5, 5), S(-3, 6), T(0, 0), U(9, 9)\)

15. \(A(1, 3), B(-1, 2), C(1, 1), D(-7, -1), E(1, -5)\)

16. \(V(-3, 4), W(-5, 0), X(1, 2), Y(-6, -2), Z(3, 1)\)

17. \(J(-6, 8), K(6, 6), L(-2, 4), D(-12, 16), G(12, 12), H(-4, 8)\)

   If \(\triangle ABC \sim \triangle AYZ\), find the missing coordinate.

18. ![Graph](image3)
19. 

20. **GRAPHIC ART** Aimee painted the sample sign shown using $\frac{1}{2}$ bottle of glass paint. The actual sign she will paint in a shop window is to be 3 feet by $7\frac{1}{2}$ feet.

   a. Explain why the actual sign is a dilation of her sample.
   b. How many bottles of paint will Aimee need to complete the actual sign?

21. **MULTIPLE REPRESENTATIONS** In this problem, you will investigate similarity of triangles on the coordinate plane.
   a. **GEOMETRIC** Draw a triangle with vertex $A$ at the origin. Make sure that the two additional vertices $B$ and $C$ have whole-number coordinates. Draw a similar triangle that is twice as large as $\triangle ABC$ with its vertex also located at the origin. Label the triangle $\triangle ADE$.
   b. **GEOMETRIC** Repeat the process in part a two times. Label the second pair of triangles $\triangle MNP$ and $\triangle MQR$ and the third pair $\triangle TWX$ and $\triangle TYZ$. Use different scale factors than part a.
   c. **TABULAR** Complete the table below with the appropriate values.

<table>
<thead>
<tr>
<th>Coordinates</th>
<th>$\triangle ABC$</th>
<th>$\triangle ADE$</th>
<th>$\triangle MNP$</th>
<th>$\triangle MQR$</th>
<th>$\triangle TWX$</th>
<th>$\triangle TYZ$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$A$</td>
<td>$A$</td>
<td>$M$</td>
<td>$M$</td>
<td>$T$</td>
<td>$T$</td>
<td>$T$</td>
</tr>
<tr>
<td>$B$</td>
<td>$D$</td>
<td>$N$</td>
<td>$Q$</td>
<td>$W$</td>
<td>$Y$</td>
<td>$Y$</td>
</tr>
<tr>
<td>$C$</td>
<td>$E$</td>
<td>$P$</td>
<td>$R$</td>
<td>$X$</td>
<td>$Z$</td>
<td>$Z$</td>
</tr>
</tbody>
</table>

d. **VERBAL** Make a conjecture about how you could predict the coordinates of a dilated triangle with a scale factor of $n$ if the two similar triangles share a corresponding vertex at the origin.

22. **CHALLENGE** $\triangle NOP$ is a dilation of $\triangle ABC$. How is the scale factor of the dilation related to the similarity ratio of $\triangle ABC$ to $\triangle NOP$? Explain your reasoning.
23. **REASONING** The coordinates of two triangles are provided in the table at the right. Is \( \triangle XYZ \) a dilation of \( \triangle PQR \)? Explain.

<table>
<thead>
<tr>
<th>( \triangle PQR )</th>
<th>( \triangle XYZ )</th>
</tr>
</thead>
<tbody>
<tr>
<td>( P \ (a, b) )</td>
<td>( X \ (3a, 2b) )</td>
</tr>
<tr>
<td>( Q \ (c, d) )</td>
<td>( Y \ (3c, 2d) )</td>
</tr>
<tr>
<td>( R \ (e, f) )</td>
<td>( Z \ (3e, f) )</td>
</tr>
</tbody>
</table>

**OPEN ENDED** Describe a real-world example of each transformation other than those given in this lesson.

24. enlargement

25. reduction

26. congruence transformation

27. **WRITING IN MATH** Explain how you can use scale factor to determine whether a transformation is an enlargement, a reduction, or a congruence transformation.

28. **ALGEBRA** Which equation describes the line that passes through \((-3, 4)\) and is perpendicular to \(3x - y = 6\)?

   A. \( y = \frac{-1}{3}x + 4 \)

   B. \( y = \frac{1}{3}x + 3 \)

   C. \( y = 3x + 4 \)

   D. \( y = 3x + 3 \)

29. **SHORT RESPONSE** What is the scale factor of the dilation shown below?
30. In the figure below, \( \angle A = \angle C \).

![Diagram of \( \triangle ABC \) with points A, B, and C labeled, and \( \angle A \) and \( \angle C \) marked.]

Which additional information would not be enough to prove that \( \triangle ADB \sim \triangle CEB \)?

F. \( \frac{AB}{CB} = \frac{AD}{CE} \)

G. \( \angle ADB \equiv \angle CEB \)

H. \( \frac{ED}{DB} \)

J. \( EB \perp AC \)

31. SAT/ACT If \( x = \frac{6}{4p+3} \) and \( xy = \frac{3}{4p+3} \), then \( y = \)

A 4
B 2
C \( \frac{1}{2} \)
D \( \frac{1}{4} \)

32. LANDSCAPING Shea is designing two gardens shaped like similar triangles. One garden has a perimeter of 53.5 feet, and the longest side is 25 feet. She wants the second garden to have a perimeter of 32.1 feet. Find the length of the longest side of this garden.

Determine whether \( AB \parallel CD \). Justify your answer.

![Diagram of \( \triangle ABC \) with points A, B, C, D, and E labeled, and \( AB \parallel CD \) marked.]

33. \( AC = 8.4, BD = 6.3, DE = 4.5 \), and \( CE = 6 \)

34. \( AC = 7, BD = 10.5, BE = 22.5 \), and \( AE = 15 \)

35. \( AB = 8, AE = 9, CD = 4 \), and \( CE = 4 \)

If each figure is a kite, find each measure.

36. \( QR \)
37. \[ m \angle K \]

38. \[ BC \]

39. **PROOF** Write a coordinate proof for the following statement.
   *If a line segment joins the midpoints of two sides of a triangle, then it is parallel to the third side.*

Solve each equation.

40. \[ 145 = 29 \cdot t \]
41. \[ 216 = d \cdot 27 \]
42. \[ 2r = 67 \cdot 5 \]
43. \[ 100t = \frac{70}{240} \]
44. \[ \frac{80}{4} = 14d \]
45. \[ \frac{2t + 15}{t} = 92 \]
7-7 Scale Drawings and Models - Check Your Understanding

MAPS Use the map of Maine shown and a customary ruler to find the actual distance between each pair of cities. Measure to the nearest sixteenth of an inch.

1. Bangor and Portland

2. Augusta and Houlton

3. SCALE MODELS Carlos made a scale model of a local bridge. The model spans 6 inches; the actual bridge spans 50 feet.
   a. What is the scale of the model?
   b. What scale factor did Carlos use to build his model?

4. SPORTS A volleyball court is 9 meters wide and 18 meters long. Choose an appropriate scale and construct a scale drawing of the court to fit on a 3-inch by 5-inch index card.
7-7 Scale Drawings and Models - Practice and Problem Solving

MAPS Use the map of Oklahoma shown and a metric ruler to find the actual distance between each pair of cities. Measure to the nearest centimeter.

5. Guymon and Oklahoma City
Name:

6. Lawton and Tulsa

7. Enid and Tulsa

8. Ponca City and Shawnee

9. SCULPTURE A replica of *The Thinker* is 10 inches tall. A statue of *The Thinker* at the University of Louisville is 10 feet tall.
   a. What is the scale of the replica?
   b. How many times as tall as the actual sculpture is the replica?

![The Thinker](image)

10. MAPS The map below shows a portion of Frankfort, Kentucky.

![Map of Frankfort](image)

a. If the actual distance from the intersection of Conway Street and 4th Street to the intersection of Murray Street and 4th Street is 0.47 mile, use a customary ruler to estimate the scale of the map.
   b. What is the approximate scale factor of the map? Interpret its meaning.

SPORTS Choose an appropriate scale and construct a scale drawing of each playing area so that it would fit on an 8.5-by-11-inch sheet of paper.

11. A baseball diamond is a square 90 feet on each side with about a 128-foot diagonal.

12. A high school basketball court is a rectangle with length 84 feet and width 50 feet.
MAPS Use the map shown and an inch ruler to answer each question. Measure to the nearest sixteenth of an inch and assume that you can travel along any straight line.

13. About how long would it take to drive from Valdosta, Georgia, to Daytona Beach, Florida, traveling at 65 miles per hour?

14. How long would it take to drive from Gainesville to Miami, Florida, traveling at 70 miles per hour?

At forty miles from Pluto to the Sun, the Maine Solar System Model on U.S. Route is the largest complete three-dimensional scale model of the solar system in the world. Its scale factor is 1: 93,000,000

15. **SCALE MODELS** If the distance between Earth and the Sun is actually 150,000,000 kilometers, how far apart are Earth and the Sun in the model?

16. **LITERATURE** In the book, Alice's Adventures in Wonderland, Alice's size changes from her normal height of about 50 inches. Suppose Alice came across a door about 15 inches high and her height changed to 10 inches.
   a. Find the ratio of the height of the door to Alice's height in Wonderland.
   b. How tall would the door have been in Alice's normal world?

17. **ROCKETS** Peter bought a \( \frac{1}{12} \) scale model of the Mercury-Redstone rocket.
   a. If the height of the model is 7 inches, what is the approximate height of the rocket?
   b. If the diameter of the rocket is 70 inches, what is the diameter of the model? Round to the nearest half inch.

18. **ARCHITECTURE** A replica of the Statue of Liberty in Austin, Texas, is \( 16 \frac{3}{4} \) feet tall. If the scale factor of the actual statue to the replica is 9: 1, how tall is the statue in New York Harbor?

19. **AMUSEMENT PARK** The Eiffel Tower in Paris, France, is 986 feet tall, not including its antenna. A replica of the Eiffel Tower was built as a ride in an amusement park. If the scale factor of the actual tower to the replica is approximately 3: 1, how tall is the ride?
20. **MULTIPLE REPRESENTATIONS** In this problem, you will explore the altitudes of right triangles.

\[
\begin{array}{c}
A \\
B \\
C \\
D \\
\end{array}
\]

a. **GEOMETRIC** Draw right \( \triangle ABC \) with the right angle at vertex \( B \). Draw altitude \( \overline{BD} \). Draw right \( \triangle MNP \), with right angle \( N \) and altitude \( \overline{NQ} \), and right \( \triangle WXY \), with right angle \( X \) and altitude \( \overline{XZ} \).

b. **TABULAR** Measure and record indicated angles in the table below.

<table>
<thead>
<tr>
<th>Angle Measure</th>
<th>( \triangle ABC )</th>
<th>( \triangle BDC )</th>
<th>( \triangle ADB )</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \triangle ABC )</td>
<td>ABC</td>
<td>BDC</td>
<td>ADB</td>
</tr>
<tr>
<td>( \triangle MNP )</td>
<td>MNP</td>
<td>NQP</td>
<td>MQN</td>
</tr>
<tr>
<td>( \triangle WXY )</td>
<td>WXY</td>
<td>WZP</td>
<td>XZY</td>
</tr>
<tr>
<td>( \triangle WXY )</td>
<td>WXY</td>
<td>WZP</td>
<td>XZY</td>
</tr>
<tr>
<td>( \triangle WXY )</td>
<td>WXY</td>
<td>WZP</td>
<td>XZY</td>
</tr>
<tr>
<td>( \triangle WXY )</td>
<td>WXY</td>
<td>WZP</td>
<td>XZY</td>
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<tr>
<td>( \triangle WXY )</td>
<td>WXY</td>
<td>WZP</td>
<td>XZY</td>
</tr>
<tr>
<td>( \triangle WXY )</td>
<td>WXY</td>
<td>WZP</td>
<td>XZY</td>
</tr>
<tr>
<td>( \triangle WXY )</td>
<td>WXY</td>
<td>WZP</td>
<td>XZY</td>
</tr>
<tr>
<td>( \triangle WXY )</td>
<td>WXY</td>
<td>WZP</td>
<td>XZY</td>
</tr>
</tbody>
</table>


c. **VERBAL** Make a conjecture about the altitude of a right triangle originating at the right angle of the triangle.

21. **FIND THE ERROR** Felix and Tamara are building a replica of their high school. The high school is 75 feet tall and the replica is 1.5 feet tall. Felix says the scale factor of the actual high school to the replica is 50: 1, while Tamara says the scale factor is 1: 50. Is either of them correct? Explain your reasoning.

22. **CHALLENGE** You can produce a scale model of a certain object by extending each dimension by a constant. What must be true of the shape of the object? Explain your reasoning.

23. **REASONING** Sofia is making two scale drawings of the lunchroom. In the first drawing, Sofia used a scale of 1 inch = 1 foot, and in the second drawing she used a scale of 1 inch = 6 feet. Which scale will produce a larger drawing? What is the scale factor of the first drawing to the second drawing? Explain.

24. **OPEN ENDED** Draw a scale model of your classroom using any scale.

25. **WRITING IN MATH** Compare and contrast scale and scale factor.

26. **SHORT RESPONSE** If \( 3^x = 27^{(x-4)} \), then what is the value of \( x \)?
27. In \( \triangle ABC \), \( BD \) is a median. If \( AD = 3x + 5 \) and \( CD = 5x - 1 \), find \( AC \).

A 6  
B 12  
C 14  
D 28

28. In a triangle, the ratio of the measures of the sides is 4:7:10, and its longest side is 40 centimeters. Find the perimeter of the triangle in centimeters.

F 37 cm  
G 43 cm  
H 84 cm  
J 168 cm

29. SAT/ACT If Lydia can type 80 words in two minutes, how long will it take Lydia to type 600 words?

A 30 min  
B 15 min  
C 10 min  
D 5 min

30. PAINTING Aaron is painting a portrait of a friend for an art class. Since his friend doesn’t have time to model, he uses a photo that is 6 inches by 8 inches. If the canvas is 24 inches by 32 inches, is the painting a dilation of the original photo? If so, what is the scale factor? Explain.

Find \( x \).

31.

32.

33.
**ALGEBRA**  Quadrilateral $JKMN$ is a rectangle.

34. If $NQ = 2x + 3$ and $QK = 5x - 9$, find $JQ$.

35. If $m \angle NJM = 2x - 3$ and $m \angle KJM = x + 5$, find $x$.

36. If $NM = 8x - 14$ and $JK = x^2 + 1$, find $JK$.

In $\triangle ABC$, $MC = 7$, $RM = 4$, and $AT = 16$. Find each measure.

37. $MS$

38. $AM$

39. $SC$

40. $RB$

41. $MB$

42. $TM$

Determine whether $\triangle JKL \cong \triangle XYZ$. Explain.

43. $J(3, 9), K(4, 6), L(1, 5), X(1, 7), Y(2, 4), Z(-1, 3)$

44. $J(-1, -1), K(0, 6), L(2, 3), X(3, 1), Y(5, 3), Z(8, 1)$

Simplify each expression.

45. $\sqrt{4 \cdot 16}$

46. $\sqrt{3 \cdot 27}$

47. $\sqrt{32 \cdot 72}$

48. $\sqrt{15 \cdot 16}$
Study Guide and Review - Vocabulary Check - Chapter 7

Choose the letter of the word or phrase that best completes each statement.
a. ratio
b. proportion
c. means
d. extremes
e. similar
f. scale factor
g. AA Similarity Post
h. SSS Similarity Theorem
i. SAS Similarity Theorem
j. midsegment
k. dilation
l. enlargement
m. reduction

1. A(n) ____ of a triangle has endpoints that are the midpoints of two sides of the triangle.

2. A(n) ____ is a comparison of two quantities using division.

3. If \( \angle A \equiv \angle X \) and \( \angle C \equiv \angle Z \), then \( \triangle ABC \sim \triangle XYZ \) by the ____.

4. A(n) ____ is an example of a similarity transformation.

5. If \( \frac{a}{b} = \frac{c}{d} \), then \( a \) and \( d \) are the ____.

6. The ratio of the lengths of two corresponding sides of two similar polygons is the ____.

7. A(n) ____ is an equation stating that two ratios are equivalent.

8. A dilation with a scale factor of \( \frac{2}{5} \) will result in a(n) ____.
Solve each proportion.

9. \( \frac{x+8}{6} = \frac{2x-3}{10} \)

10. \( \frac{3x+9}{x} = \frac{12}{5} \)

11. \( \frac{x}{12} = \frac{50}{6x} \)
12. \[
\frac{7}{x} = \frac{14}{9}
\]

13. The ratio of the lengths of the three sides of a triangle is 5:8:10. If its perimeter is 276 inches, find the length of the longest side of the triangle.

14. **CARPENTRY** A board that is 12 feet long must be cut into two pieces that have lengths in a ratio of 3 to 2. Find the lengths of the two pieces.

Determine whether each pair of figures is similar. If so, write the similarity statement and scale factor. If not, explain your reasoning.

15. 

16. 

17. The two triangles in the figure below are similar. Find the value of \(x\).

18. **MAPS** On a map of Colorado, the cities of Denver and Colorado Springs are 10.5 inches apart. If the scale of the map shows that 1.5 inches represents 10 miles, find the actual distance from Denver to Colorado Springs.

Determine whether the triangles are similar. If so, write a similarity statement. Explain your reasoning.

19. 

20.

21.

22.

23. **TREES** To estimate the height of a tree, Dave stands in the shadow of the tree so that his shadow and the tree’s shadow end at the same point. Dave is 6 feet 4 inches tall and his shadow is 15 feet long. If he is standing 66 feet away from the tree, what is the height of the tree?

   **Find x.**

24.

25.
26. **STREETS** Find the distance along Broadway between 37th St. and 36th St.

![Diagram of Broadway between 37th and 36th St.]

Find the value of each variable.

27. 

![Diagram of a triangle with sides 8, 10, and 13.5]

28. 

![Diagram of a triangle with sides 36, w, and 10]

29. **MAPS** The scale given on a map of the state of Missouri indicates that 3 inches represents 50 miles. The cities of St. Louis, Springfield, and Kansas City form a triangle. If the measurements of the lengths of the sides of this triangle on the map are 15 inches, 10 inches, and 13 inches, find the perimeter of the actual triangle formed by these cities to the nearest mile.

Determine whether the dilation from $A$ to $B$ is an **enlargement** or a **reduction**. Then find the scale factor of the dilation.

30. 

![Diagram of a triangle AB on a coordinate plane.]

31. 

![Diagram of a triangle AB on a coordinate plane.]

Name:
32. **GRAPHIC DESIGN** Jamie wants to use a photocopier to enlarge her design for the Honors Program at her school. She sets the copier to 250%. If the original drawing was 6 inches by 9 inches, find the dimensions of the enlargement.

33. **BUILDING PLANS** In a scale drawing of a school’s floor plan, 6 inches represents 100 feet. If the distance from one end of the main hallway to the other is 175 feet, find the corresponding length in the scale drawing.

34. **MODEL TRAINS** A popular scale for model trains is the 1:48 scale. If the actual train car had a length of 72 feet, find the corresponding length of the model in inches.

35. **MAPS** A map of the eastern United States has a scale where 3 inches = 25 miles. If the distance on the map between Columbia, South Carolina, and Charlotte, North Carolina, is 11.5 inches what is the actual distance between the cities?
Chapter 7 - Proportions and Similarity - Practice Test

- Chapter 7

Solve each proportion.

1. \( \frac{3}{7} = \frac{12}{x} \)
2. \( \frac{2x}{5} = \frac{x+3}{3} \)
3. \( \frac{4x}{15} = \frac{60}{x} \)
4. \( \frac{5x-4}{4x+7} = \frac{13}{11} \)

Determine whether each pair of figures is similar. If so, write the similarity statement and scale factor. If not, explain your reasoning.

5.

6.

7. **CURRENCY** Jane is traveling to Europe this summer with the French Club. She plans to bring $300 to spend while she is there. If $90 in U.S. currency is equivalent to 63 euros, how many euros will she receive when she exchanges her money?

**ALGEBRA** Find \( x \) and \( y \). Round to the nearest tenth if necessary.

8.
9.  \[20y - 217y + 3\]

10. **ALGEBRA** Equilateral \(\triangle MNP\) has perimeter \(12a + 18b\). \(\overline{QR}\) is a midsegment. What is \(QR\)?

11. **ALGEBRA** Right isosceles \(\triangle ABC\) has hypotenuse length \(h\). \(\overline{DE}\) is a midsegment with length \(4x\). What is the perimeter of \(\triangle ABC\)?

12. **MODELS** Jimmy has a diecast metal car that is a scale model of an actual race car. If the actual length of the car is 10 feet and 6 inches and the model has a length of 7 inches, what is the scale factor of model to actual car?

   Find \(x\).

13.  \[21 \quad 18 \quad 25 \quad x\]

14.  \[26 \quad 30 \quad 40 \quad x\]

   Determine whether the dilation from \(A\) to \(B\) is an **enlargement** or a **reduction**. Then find the scale factor of the dilation.

15.  

16.  

   **ALGEBRA** Identify the similar triangles. Find each measure.
17. \( WZ, UZ \)
Chapter 7 - Proportions and Similarity - Preparing for Standardized Tests - Chapter 7

Read each problem. Identify what you need to know. Then use the information in the problem to solve.

1. The ratio of the measures of the angles of the quadrilateral below is 6:5:4:3. Which of the following is not an angle measure of the figure?

- A 60°
- B 80°
- C 120°
- D 140°

2. Which figure can serve as a counterexample to the conjecture below?

If all angles of a quadrilateral are right angles, then the quadrilateral is a square.

- F parallelogram
- G rectangle
- H rhombus
- J trapezoid

3. Consider the figure below. Which of the following is not sufficient to prove that \( \triangle GIK \sim \triangle HIG \)?

- A \( \angle GKI \cong \angle HGI \)
- B \( \frac{HI}{GI} = \frac{GI}{IK} \)
- C \( \frac{GH}{GI} = \frac{GK}{IK} \)
- D \( \angle IGK \cong \angle IHG \)

4. Which triangles are not necessarily similar?

- F two right triangles with one angle measuring 30°
- G two right triangles with one angle measuring 45°
- H two isosceles triangles
- J two equilateral triangles
Chapter 7 - Proportions and Similarity - Standardized
Test Practice - Cumulative, Chapters 1-7

Read each question. Then fill in the correct answer on the answer document provided by your teacher or on a sheet of paper.
1. Adrian wants to measure the width of a ravine. He marks distances as shown in the diagram.

Using this information, what is the approximate width of the ravine?
A 5 ft  
B 6 ft  
C 7 ft  
D 8 ft

2. Kyle and his family are planning a vacation in Cancun, Mexico. Kyle wants to convert 200 US dollars to Mexican pesos for spending money. If 278 Mexican pesos are equivalent to $25, how many pesos will Kyle get for $200?
F 2178  
G 2224  
H 2396  
J 2504

3. Which of the following terms best describes the transformation below?

A dilation  
B reflection  
C rotation  
D translation

4. Refer to the figures below. Which of the following terms best describes the transformation?

F congruent  
G enlargement  
H reduction  
J scale
5. The ratio of North Carolina residents to Americans is about 295 to 10,000. If there are approximately 300,000,000 Americans, how many of them are North Carolina residents?
   A 7,950,000
   B 8,400,000
   C 8,850,000
   D 9,125,000

6. Solve for $x$.
   \begin{align*}
   3x + 1 &= 7x - 4 \\
   60 &= 4x \\
   x &= 15
   \end{align*}
   F 3
   G 4
   H 5
   J 6

7. Two similar trapezoids have a scale factor of 3:2. The perimeter of the larger trapezoid is 21 yards. What is the perimeter of the smaller trapezoid?
   A 14 yd
   B 17.5 yd
   C 28 yd
   D 31.5 yd

Record your answers on the answer sheet provided by your teacher or on a sheet of paper.

8. **GRIDDED RESPONSE** Colleen surveyed 50 students in her school and found that 35 of them have homework at least four nights a week. If there are 290 students in the school altogether, how many of them would you expect to have homework at least four nights a week?

9. **GRIDDED RESPONSE** In the triangle below, $\overline{MN} \parallel \overline{BC}$. Solve for $x$.
   \[ 4x - 6 = 3x - 2 \]
   \[ x = 4 \]

10. Quadrilateral $WXYZ$ is a rhombus. If $m \angle XYZ = 110^\circ$, find $m \angle ZYW$.

11. What is the contrapositive of the statement below?
    If Tom was born in Louisville, then he was born in Kentucky.
12. **GRIDDED RESPONSE** In the triangle below, $RS$ bisects $\angle VRU$. Solve for $x$.

![Triangle with labeled sides 11, 7, 16, and x](image)

13. **GRIDDED RESPONSE** The scale of a map is 1 inch $= 2.5$ miles. What is the distance between two cities that are 3.3 inches apart on the map? Round to the nearest tenth, if necessary.

14. What is the value of $x$ in the figure?

![Angle with labeled measures 62° and (6x + 2)°](image)

**Record your answers on a sheet of paper. Show your work.**

15. Refer to triangle $XYZ$ to answer each question.

![Triangle with labeled points X, Y, Z, and Q, R](image)

a. Suppose $QR \parallel XY$. What do you know about the relationship between segments $XQ$, $QZ$, $YR$, and $RZ$?

b. If $QR \parallel XY$, $XQ = 15$, $QZ = 12$, and $YR = 20$, what is the length of $RZ$?

c. Suppose $QR \parallel XY$, $XQ = QZ$, and $QR = 9.5$ units. What is the length of $XY$?