Skills Practice Workbook

Contents Include:

96 worksheets—one for each lesson
To The Student:

This Skills Practice Workbook gives you additional problems for the concept exercises in each lesson. The exercises are designed to aid your study of geometry by reinforcing important mathematical skills needed to succeed in the everyday world. The material is organized by chapter and lesson, with one skills practice worksheet for every lesson in Geometry: Concepts and Applications.

To the Teacher:

Answers to each worksheet are found in Geometry: Concepts and Applications Chapter Resource Masters and also in the Teacher Wraparound Edition of Geometry: Concepts and Applications.
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Patterns and Inductive Reasoning

Tell how to find the next term in each pattern.

1. 7, 12, 17, 22, . . .  Add 5.
2. 1, 3, 9, 27, . . .  Multiply by 3.
3. 50, 46, 42, 38, . . .  Subtract 4.
4. 10, 20, 40, 80, . . .  Multiply by 2.
5. −4, −1, 2, 5, 8, . . .  Add 3.

Find the next three terms of each sequence.

7. 2, 7, 12, 17, . . .  22, 27, 32
8. 100, 93, 86, 79, . . .  72, 65, 58
9. 11, 22, 33, 44, . . .  55, 66, 77
10. 1, 4, 14, 56, . . .  224, 896, 3584
11. −2, 4, −8, 16, −32, . . .  64, −128, 256
12. 0, 6, 12, 18, . . .  24, 30, 36
13. 99, 86, 73, 60, . . .  47, 34, 21
14. 25, 26, 24, 25, . . .  23, 24, 22, 23
15. 30, 31, 33, 36, . . .  40, 45, 51
16. 5, 10, 20, 40, . . .  80, 160, 320
17. 220, 210, 190, 160, . . .  120, 70, 10
18. 7, 7, 14, 42, . . .  168, 840, 5040

Draw the next figure in each pattern.

19.  
20.  
21.  

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Geometry: Concepts and Applications
Skills Practice

Points, Lines, and Planes

Use the figure at the right to name examples of each term. 1–10. Samples answers are given.

1. four points four of the following: S, T, M, R, X, Y
2. two lines SX, YR
3. four segments MR, MS, MT, MX
4. one ray whose endpoint is M MY
5. three collinear points S, M, and X
6. one point that is not on YR S
7. a segment with points T and M as its endpoints TM
8. a line that does not contain R SX
9. a line containing M RY
10. a segment that lies on YR MR

Determine whether each model suggests a point, a line, a ray, a segment, or a plane.

11. a toothpick segment
12. a floor plane
13. the tip of a pin point
14. the surface of the water in a swimming pool plane
15. a beam of light from a laser ray
16. fence pole segment

Draw and label a figure for each situation described. 17–20. Sample answers are given.

17. point K lies on RT

18. plane \( \mathcal{H} \) contains line a

19. \( AB \) lies in plane \( \mathcal{M} \) containing point R not on \( AB \)

20. \( AX \) and \( AY \) such that point A is the only point common to both rays
Skills Practice

Postulates

Refer to the figure at the right.

1. Name all of the different lines that can be drawn through the set of points.
   \( \overline{AX}, \overline{AM}, \overline{AC}, \overline{XM}, \overline{XC}, \overline{MC} \)

2. Name the intersection of \( \overline{AX} \) and \( \overline{AM} \).
   point \( A \)

Name all of the planes that are represented in each figure.

3. \( \text{planes } RSTV, SXYT, WXYS, RWSV, RWXS, VSYT \)

4. \( \text{planes } GXA, XEA, DEA, GDA, DEXG \)

Refer to the figure at the right.

5. Name the intersection of plane \( JLM \) and plane \( JKL \).
   \( JL \)

6. Name the intersection of plane \( JKO \) and plane \( JOM \).
   \( JO \)

7. Name two planes that intersect in \( \overline{ML} \).
   \( \text{planes } JLM \text{ and } MLKO \)

8. Name two planes that intersect in \( \overline{JM} \).
   \( \text{planes } JOM \text{ and } JLM \)

Determine whether each statement is true or false. If a statement is false, explain why.

9. If you have two points, then there is only one line that contains both points. \( \text{true} \)

10. The intersection of two distinct lines is two points.
    \( \text{False; two distinct lines intersect at one point.} \)

11. If you have three noncollinear points, then you have two different planes.
    \( \text{False; three noncollinear points determine one plane.} \)

12. A line is the intersection of two distinct planes. \( \text{true} \)

13. One point can be the only intersection of two planes.
    \( \text{False; two planes intersect in a line.} \)

14. Three planes can intersect in one line. \( \text{true} \)
Conditional Statements and Their Converse
Identify the hypothesis and the conclusion of each statement.

1. If you purchase a computer and do not like it, then you can return it within 30 days.
   - Hypothesis: you purchase a computer and do not like it
   - Conclusion: you can return it within 30 days

2. If \[ x + 8 = 15 \], then \( x = 7 \)
   - Hypothesis: \( x + 8 = 15 \)
   - Conclusion: \( x = 7 \)

3. If the drama club raises $2000, then they will go on tour.
   - Hypothesis: the drama club raises $2000
   - Conclusion: they will go on tour

4. If the temperature today is 80° or more, then you will go swimming.
   - Hypothesis: the temperature today is 80° or more
   - Conclusion: you will go swimming

5. If two lines intersect, then the intersection is a point.
   - Hypothesis: two lines intersect
   - Conclusion: the intersection is a point

Write two other forms of each statement.

6. If two planes intersect, then the intersection is a line.
   - The intersection of two planes is a line. All planes that intersect will intersect in a line.

7. If it snows, then you will go sledding.
   - You will go sledding if it snows. All people will go sledding on days that it snows.

8. Your dog will be happy if you feed him Doggy Chow.
   - If you feed your dog Doggy Chow, then he will be happy. All dogs that eat Doggy Chow are happy.

9. Hiking will be easier if you have hiking boots.
   - If you have hiking boots, then hiking will be easier. All people with hiking boots can hike easier.

10. All squares have four sides of equal length and four right angles.
    - If a figure has four sides of equal length and four right angles, then it is a square. A figure is a square if it has four sides of equal length and four right angles.

Write the converse of each statement.

11. If a figure is a triangle, then it has three sides.
    - If a figure has three sides, then it is a triangle.

12. If you find a penny, then you will have good luck.
    - If you have good luck, then you found a penny.

13. If you ride your bicycle recklessly, then you can get hurt.
    - If you get hurt, then you rode your bicycle recklessly.

14. If two distinct lines intersect, then their intersection is one point.
    - If the intersection of two lines is one point, then the lines are distinct.

15. If your cat purrs, then it is contented.
    - If your cat is contented, then it purrs.
Skills Practice

Tools of the Trade

Use a straightedge or compass to answer each question.

1. Which segment is longest? **G**

2. Which of the three segments at the upper right forms a straight line with the segment at the lower left? **b**

3. Does the inner arc or the outer arc on the right side of the segments go with the arc on the left side to form part of a circle? **outer arc**

4. Is C the midpoint of \( \overline{AB} \)? **no**

5. If the circle with center C is drawn completely, will point X lie on the circle? **no**

6. If extended, will \( \overline{VX} \) intersect \( \overline{ZY} \) at Y? **no**
A Plan for Problem Solving

Find the perimeter and area of each rectangle.

1. \( P = 96 \text{ ft} \), \( A = 540 \text{ ft}^2 \)
2. \( P = 24 \text{ cm} \), \( A = 27 \text{ cm}^2 \)
3. \( P = 4 \text{ mi} \), \( A = 1 \text{ mi}^2 \)
4. \( P = 70 \text{ in.} \), \( A = 250 \text{ in}^2 \)
5. \( P = 98 \text{ mm} \), \( A = 594 \text{ mm}^2 \)
6. \( P = 16 \text{ m} \), \( A = 16 \text{ m}^2 \)

Find the perimeter and area of each rectangle described.

7. \( \ell = 7 \text{ ft} \), \( w = 2 \text{ ft} \)
   \( P = 18 \text{ ft} \), \( A = 14 \text{ ft}^2 \)
8. \( \ell = 2 \text{ in.} \), \( w = 1 \text{ in.} \)
   \( P = 6 \text{ in.} \), \( A = 2 \text{ in}^2 \)
9. \( \ell = 26 \text{ cm} \), \( w = 23 \text{ ft} \)
   \( P = 98 \text{ cm} \), \( A = 598 \text{ cm}^2 \)
10. \( \ell = 9 \text{ mi} \), \( w = 1 \text{ mi} \)
    \( P = 20 \text{ mi} \), \( A = 9 \text{ mi}^2 \)
11. \( \ell = 7 \text{ m} \), \( w = 7 \text{ m} \)
    \( P = 28 \text{ m} \), \( A = 49 \text{ m}^2 \)
12. \( \ell = 5 \text{ yd} \), \( w = 25 \text{ yd} \)
    \( P = 60 \text{ yd} \), \( A = 125 \text{ yd}^2 \)

Find the area of each parallelogram.

13. \( 308 \text{ ft}^2 \)
14. \( 27 \text{ in}^2 \)
15. \( 35 \text{ mi}^2 \)
16. \( 1080 \text{ cm}^2 \)
17. \( 5 \text{ m}^2 \)
18. \( 240 \text{ mm}^2 \)
2–1

Skills Practice

Real Numbers and Number Lines
Write a real number with five digits to the right of the decimal point.
1-8. Sample answers given.
1. an irrational number between 2 and 3  2.43473. . .
2. a rational number between −2 and −3 with a 2-digit repeating pattern −2.57575. . .
3. two rational numbers between 3 and 4  3.01265 and 3.78659
4. an irrational number greater than 10  11.12123. . .
5. a rational number greater than 15 but less than 20  18.97531
6. an irrational number less than 30  26.54854. . .
7. an irrational number less than −5  −6.10100. . .
8. a rational number greater than −8 with a 2-digit repeating pattern −6.13131. . .

Use a number line to find each measure.

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9. LX  10
10. TX  4
11. ZT  3
12. LZ  3
13. QM  1
14. MS  1
15. BX  2 ½
16. BT  1 ½
17. ST  ½
18. LQ  3 ½
19. BY  ½
20. AX  8 ½

Consider 0.27, 0.27, and 0.27.
21. How are these numbers alike?  All three numbers are rational.
22. How are they different?  0.27 = 0.27; 0.27 = 0.277777. . . ; 0.27 = 0.27272727. . .
23. Which number is greatest?  0.27
24. How would you read each number?  Sample answers: Read 0.27 as 27 hundredths. Read 0.27 as zero point two seven repeating. Read 0.27 as zero point two seven all repeating.
Segments and Properties of Real Numbers

Three segment measures are given. The three points named are collinear. Determine which point is between the other two.

1. \( XY = 15, \; AY = 31, \; AX = 46 \) \( Y \)
2. \( AB = 12, \; BC = 20, \; AC = 32 \) \( B \)
3. \( MO = 75, \; MC = 34, \; OC = 41 \) \( C \)
4. \( DE = 58, \; GE = 12, \; DG = 70 \) \( E \)
5. \( HM = 2, \; JM = 1, \; HJ = 3 \) \( M \)
6. \( WX = 8, \; WA = 4, \; AX = 4 \) \( A \)

Use the line to find each measure.

7. If \( AC = 10 \) and \( CG = 21 \), find \( AG \). \( 31 \)
8. If \( AI = 72 \) and \( GI = 11 \), find \( AG \). \( 61 \)
9. If \( CG = 24 \) and \( EG = 14 \), find \( CE \). \( 10 \)
10. If \( AK = 80 \) and \( IK = 24 \), find \( AI \). \( 56 \)
11. If \( AC = 18 \) and \( CK = 72 \), find \( AK \). \( 90 \)
12. If \( CI = 65 \) and \( GI = 13 \), find \( CG \). \( 52 \)

Find the length of each segment in centimeters and in inches.

13. \( 2 \text{ cm}; \; \frac{13}{16} \text{ in.} \)
14. \( 7.6 \text{ cm}; \; 3 \text{ in.} \)
15. \( 1 \text{ cm}; \; \frac{7}{16} \text{ in.} \)
16. \( 4.5 \text{ cm}; \; 1 \frac{3}{4} \text{ in.} \)
Skills Practice

**Congruent Segments**

Use the number line to determine whether each statement is true or false. Explain your reasoning.

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1. $LM$ is congruent to $NO$.  
   **false; $LM = 1$ and $NO = 3$**

2. $OS$ is congruent to $OL$.  
   **false; $OS = 6$ and $OL = 5$**

3. $M$ is the midpoint of $LN$.  
   **true; $LM = 1$ and $MN = 1$**

4. $PS$ is congruent to $NO$.  
   **true; $PS = 3$ and $NO = 3$**

5. $O$ is the midpoint of $LS$.  
   **false; $OS = 6$ and $OL = 5$**

6. $KS$ is congruent to $LT$.  
   **false; $KS = 14$ and $LT = 15$**

7. $PS$ is congruent to $KL$.  
   **true; $PS = 3$ and $KL = 3$**

8. The origin is the midpoint of $KT$.  
   **true; the distance from $K$ to the origin is 9 and the distance from $T$ to the origin is 9**

**Determine whether each statement is true or false. Explain your reasoning.**

9. If $GH \cong AZ$, then $GH = AZ$.  
   **true; definition of congruent segments**

10. Every segment has only one midpoint.  
    **true; definition of midpoint**

11. A ray cannot bisect a segment.  
    **false; a ray is a geometric figure that can bisect a segment.**

12. If $DE \cong WX$ and $WX \cong SP$, then $DE \cong SP$.  
    **true; segment congruence is transitive.**

13. If a segment has been bisected, then it is separated into two congruent segments.  
    **true; definition of segment bisector**

14. If $M$ is the midpoint of $AB$, then $AM \cong MB$.  
    **true; definition of midpoint**

15. A plane cannot bisect a segment.  
    **false; a plane can bisect a segment.**

16. If points $A$, $B$, and $C$ are collinear, then $B$ lies between $A$ and $C$.  
    **false; the order of the points may not be $A$, then $B$, then $C$.**

17. A segment can have several midpoints.  
    **false; by definition, the midpoint is unique, meaning only one.**

18. If $Y$ is between $X$ and $Z$, then $XY = YZ$.  
    **false; $Y$ does not have to be the midpoint of $XZ$.**
The Coordinate Plane

Graph and label each point on the coordinate plane.

1. Z(0, 5)  
2. T(5, -5)  
3. B(5, 2)

4. Q(-3, 3)  
5. D(-4, -4)  
6. X(0, -4)

7. M(2, 5)  
8. H(-4, 0)  
9. F(-3, 1)

10. R(1, 1)  
11. C(3, 4)  
12. A(2, 0)

Name the ordered pair for each point.

13. R(0, 6)  
14. T(0, -5)

15. Z(-5, 2)  
16. B(4, 0)

17. D(-1, 1)  
18. Q(0, -1)

19. Y(1, -3)  
20. M(3, 3)

21. A(-1, 0)  
22. C(2, -5)

23. Graph \(x = 2\).

24. Graph \(y = -1\).
Skills Practice

Midpoints

Use the number line to find the coordinate of the midpoint of each segment.

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1. \(\overline{CE}\) 2
2. \(\overline{FC}\) 0
3. \(\overline{HF}\) -2

4. \(\overline{HC}\) -1
5. \(\overline{AD}\) -5
6. \(\overline{DB}\) 1

7. \(\overline{CG}\) 3
8. \(\overline{GB}\) 5\(\frac{1}{2}\)
9. \(\overline{DH}\) -3\(\frac{1}{2}\)

The coordinates of the endpoints of a segment are given. Find the coordinates of the midpoint of each segment.

10. (0, 10), (0, 0)  (0, 5)
11. (8, 0), (0, 0)  (4, 0)

12. (0, -6), (0, 0)  (0, -3)
13. (-20, 0), (0, 0)  (-10, 0)

14. (4, 12), (8, 20)  (6, 16)
15. (-2, 3), (2, 5)  (0, 4)

16. (1, -6), (-5, -10)  (-2, -8)
17. (-5, -14), (-1, -8)  (-3, -11)

18. (-1, -15), (9, 15)  (4, 0)
19. (7, 2), (-7, -2)  (0, 0)

20. (7, -5), (3, 15)  (5, 5)
21. (-9, 7), (3, 5)  (-3, 6)

22. (1, 3), (4, 8)  \(\left(\frac{2}{2}, \frac{5}{2}\right)\)
23. (-6, 7), (9, 10)  \(\left(\frac{1}{2}, \frac{8}{2}\right)\)
Angles

Name each angle in four ways. Then identify its vertex and its sides.

1. \( \angle AXC, \angle CXA, \angle X, \angle 1; \angle 1 ; X \); \( \angle MOR, \angle ROM, \angle O, \angle 6; \angle DFH, \angle HFD, \angle F, \angle 4; \angle 4 ; F \);

2. \( \angle XA \), \( \angle XC \)

Name all angles having \( A \) as their vertex.

3. \( \angle XAZ, \angle 1, \angle 2 \)

4. \( \angle MAZ, \angle 5, \angle 6 \)

5. \( \angle ABC, \angle ABD, \angle EBC, \angle 7, \angle 8, \angle 9 \)

Tell whether each point is in the interior, exterior or on the angle.

6. \( L \) on

7. \( X \) exterior

8. \( A \) interior

9. \( B \) on

10. \( C \) exterior

11. \( D \) exterior

12. \( Z \) exterior

Determine whether each statement is true or false.

13. The figure formed by opposite rays is sometimes referred to as a straight angle. **true**

14. The vertex is in the exterior of an angle. **false**

15. An angle separates the plane into two parts: the interior and the exterior of the angle. **false**
Angle Measure

Use a protractor to find the measure of each angle. Then classify each angle as acute, obtuse, or right.

1. $\angle TAR$ 30; acute
2. $\angle BAX$ 90; right
3. $\angle CAX$ 25; acute
4. $\angle TAX$ 150; obtuse
5. $\angle BAR$ 90; right
6. $\angle QAB$ 20; acute
7. $\angle RAC$ 155; obtuse
8. $\angle TAC$ 125; obtuse
9. $\angle QAC$ 85; acute
10. $\angle QAR$ 65; acute
11. $\angle QAX$ 115; obtuse
12. $\angle TAB$ 60; acute

Use a protractor to draw an angle having each measurement. Then classify each angle as acute, obtuse, or right.

13. $50^\circ$ acute
14. $120^\circ$ obtuse
15. $90^\circ$ right
16. $25^\circ$ acute
17. $100^\circ$ obtuse
18. $140^\circ$ obtuse
19. $10^\circ$ acute
20. $135^\circ$ obtuse
21. $85^\circ$ acute
The Angle Addition Postulate

Refer to the figure at the right.

1. If $m\angle ABE = 100$ and $m\angle ABF = 65$, find $m\angle 1$. 35
2. Find $m\angle 4$ if $m\angle EBC = 80$ and $m\angle EBD = 44$. 36
3. Find $m\angle 3$ if $m\angle FBD = 85$ and $m\angle FBE = 42$. 43
4. If $m\angle ABE = 105$ and $m\angle EBD = 46$, find $m\angle ABD$. 151
5. If $m\angle ABF = 46$ and $m\angle FBE = 54$, find $m\angle ABE$. 100
6. Find $m\angle FBC$ if $m\angle 2 = 45$ and $m\angle EBC = 78$. 123
7. If $m\angle FBD = 102$ and $BE$ bisects $\angle FBD$, find $m\angle FBE$. 51

Refer to the figure at the right.

8. If $m\angle WAZ = 95$ and $m\angle ZAO = 40$, find $m\angle WAO$. 135
9. If $\angle WAZ$ is a right angle and $m\angle YAZ = 35$, find $m\angle WAY$. 55
10. If $m\angle XAZ = 82$ and $AY$ bisects $\angle XAZ$, find $m\angle YAZ$. 41
11. If $m\angle WAY = 66$ and $AX$ bisects $\angle WAY$, find $m\angle XAY$. 33
12. Find $m\angle YAO$ if $m\angle WAO = 130$ and $m\angle WAY = 70$. 60
13. If $m\angle WAO = 142$, and $AY$ bisects $\angle WAO$, find $m\angle WAY$. 71
14. Find $m\angle XAO$ if $m\angle XAY = 35$, $m\angle YAZ = 40$, and $m\angle ZAO = 42$. 117
Adjacent Angles and Linear Pairs of Angles

Use the terms adjacent angles, linear pair, or neither to describe angles 1 and 2 in as many ways as possible.

1. neither

2. adjacent angles

3. adjacent angles; linear pair

4. neither

5. adjacent angles

6. adjacent angles

7. adjacent angles

8. neither

9. adjacent angles; linear pair

In the figure at the right, $\overrightarrow{MA}$ and $\overrightarrow{MG}$ are opposite rays. Also, $\overrightarrow{MC}$ and $\overrightarrow{MJ}$ are opposite rays.

10. Which angle forms a linear pair with $\angle AMC$? $\angle CMG$ or $\angle AMJ$

11. Do $\angle CME$ and $\angle EMJ$ form a linear pair? Justify your answer. Yes, their noncommon sides are opposite rays.

12. Name two angles that are adjacent to $\angle EMG$.
   Sample answer: $\angle CME, \angle GMJ$

13. Name two angles that form a linear pair with $\angle JMG$.
   $\angle AMJ, \angle CMG$

14. Name three angles that are adjacent to $\angle AMK$. $\angle AMC, \angle KMJ, \angle KMG$
Complementary and Supplementary Angles

Refer to the figures at the right.

1. Name a pair of complementary angles. 
   \( \measuredangle BOD, \measuredangle DOF \)

2. Name two right angles. 
   \( \measuredangle BOJ, \measuredangle BOF \)

3. Name three pairs of adjacent supplementary angles. 
   \( \measuredangle JOB, \measuredangle BOF; \measuredangle JOD, \measuredangle DOF; \measuredangle JOH, \measuredangle HOF \)

4. Find the measure of an angle that is complementary to \( \measuredangle JOH \). 
   \( 5 \)

5. Find the measure of an angle that is supplementary to \( \measuredangle DOF \). 
   \( 147 \)

6. Find the measure of \( \measuredangle BOH \). 
   \( 175 \)

7. Name a pair of complementary angles. 
   \( \measuredangle WMR, \measuredangle RMS \) or \( \measuredangle SMT, \measuredangle TMZ \)

8. Name two right angles. 
   \( \measuredangle WMS, \measuredangle ZMS \)

9. Find the measure of an angle that is complementary to \( \measuredangle YMZ \). 
   \( 58 \)

10. Find the measure of an angle that is supplementary to \( \measuredangle WMT \). 
    \( 60 \)

11. Find the measure of \( \measuredangle XMY \). 
    \( 28 \)

12. Is \( \measuredangle YMT \) a right angle? Justify your answer. 
    No, its measure is \( 32 + 60 \), or \( 92 \).

13. Find the measure of an angle that is supplementary to \( \measuredangle XMR \). 
    \( 25 \)

14. Find \( m \measuredangle 3 \) if \( \measuredangle 3 \) and \( \measuredangle 4 \) form a linear pair and \( m \measuredangle 4 = 55 \). 
    \( 125 \)

15. If \( \measuredangle 1 \) and \( \measuredangle 2 \) form a linear pair and \( m \measuredangle 1 = 130 \), find \( m \measuredangle 2 \). 
    \( 50 \)

16. Angles \( DEF \) and \( XYZ \) form a linear pair. If \( m \measuredangle DEF = 170 \), what is \( m \measuredangle XYZ \)? 
    \( 10 \)

17. If \( \measuredangle 4 \) and \( \measuredangle 8 \) are complementary and \( m \measuredangle 4 = 45 \), find \( m \measuredangle 8 \). 
    \( 45 \)

18. If \( m \measuredangle 3 = 10 \) and \( \measuredangle 3 \) and \( \measuredangle 7 \) are complementary, what is \( m \measuredangle 7 \)? 
    \( 80 \)
Skills Practice

3–6

Congruent Angles

Find the value of $x$ in each figure.

1. $\angle x^\circ$
   - $152^\circ$

2. $\angle 58^\circ$

3. $\angle 122^\circ$
   - $(x + 8)^\circ$

4. $\angle (3x) 78^\circ$
   - $26^\circ$

5. $\angle (4x - 10)^\circ$
   - $90^\circ$

6. $\angle 25^\circ$

7. What is the measure of an angle complementary to $\angle XYZ$ if $\angle MOR \cong \angle XYZ$? $42^\circ$

8. $\overline{OA}$ and $\overline{OB}$ are opposite rays and $\overline{OC}$ and $\overline{OD}$ are also opposite rays. If $m\angle 2 = 90$ and $m\angle 1$ and $m\angle 4 = 45$, what is $m\angle 4$? $45^\circ$

Use the figure at the right.

9. If $\angle 1 \cong \angle 3$ and $m\angle 1 = 64$, find the measure of an angle that is supplementary to $\angle 3$. $116^\circ$

10. If $\angle AOB$ is supplementary to $\angle BOC$, $\angle BOC$ is supplementary to $\angle COD$, and $m\angle AOB = 58$, find $m\angle BOC$ and $m\angle COD$. $122^\circ; 58^\circ$

11. Find the measure of an angle that is complementary to $\angle 1$ if $\angle 1 \cong \angle 2$ and $m\angle 2 = 75$. $15^\circ$

12. Find the measure of an angle that is supplementary to $\angle 4$ if $\angle 4 \cong \angle 9$ and $m\angle 9 = 24$. $156^\circ$
3–7
Skills Practice

Perpendicular Lines

$AB \perp BE$, $FC \perp BE$, and point $X$ is the midpoint of $AC$. Determine whether each of the following is true or false.

1. $\angle XCB \cong \angle DCE$ true
2. $\angle BCY$ is a right angle. true
3. $\angle FCE$ and $\angle FCX$ are supplementary. false
4. $AB \perp BC$ true
5. $\angle FCD$ is a right angle. false
6. $\angle FCX$ and $\angle XCB$ are complementary. true
7. $m\angle WBZ > m\angle WBA$ false
8. $FC$ is the only line $\perp$ to $WE$ at $C$ true
9. $\angle FCE$ and $\angle YCE$ are supplementary. true
10. $AX \parallel XC$ true
11. $\angle FCD \cong \angle WBA$ false
12. $AX \parallel FC$ false
13. $AB \perp AC$ false
14. $\angle XCF \cong \angle DCY$ true

$BM \perp MC$, $MA$ and $MD$ are opposite rays.
15. If $m\angle DMC = 25$, find $m\angle AMB$. 65
16. If $m\angle AMB = 72$, find $m\angle DMC$. 18
17. If $m\angle DMC = 2x + 2$ and $m\angle AMB = 8x - 2$, find $m\angle DMC$ and $m\angle AMB$. 20; 70
Skills Practice

Parallel Lines and Planes

Describe each pair of segments in the prism as parallel, skew, or intersecting.

1. $\overline{EG}, \overline{ML}$ parallel
2. $\overline{LK}, \overline{EG}$ skew

3. $\overline{LK}, \overline{GH}$ parallel
4. $\overline{EG}, \overline{GH}$ intersecting

5. $\overline{JN}, \overline{ML}$ skew
6. $\overline{LK}, \overline{NK}$ intersecting

7. $\overline{NK}, \overline{JH}$ parallel
8. $\overline{EG}, \overline{HK}$ skew

9. $\overline{MN}, \overline{LK}$ parallel
10. $\overline{MN}, \overline{GL}$ skew

Use the figure for Exercises 1–10. Name the parts of the rectangular prism.

11. six planes $\overline{EGH}, \overline{GLK}, \overline{MLK}, \overline{EMN}, \overline{EMG}, \overline{JNK}$

12. all pairs of parallel planes $\overline{EGH} \parallel \overline{MLK}, \overline{MLG} \parallel \overline{NKH}, \overline{EMN} \parallel \overline{GLK}$

13. all segments skew to $\overline{JH} \overline{MN}, \overline{LK}$

14. all segments parallel to $\overline{EG} \overline{JH}, \overline{ML}, \overline{NK}$

15. all segments intersecting $\overline{ML} \overline{EM}, \overline{MN}, \overline{LK}, \overline{GL}$

16. all segments parallel to $\overline{JN} \overline{HK}, \overline{EM}, \overline{GL}$

Name the parts of the triangular prism.

17. all pairs of intersecting planes $\overline{BFD}$ and $\overline{BFY}, \overline{BFD}$ and $\overline{FDZ}, \overline{BFD}$ and $\overline{BDZ}, \overline{XYZ}$ and $\overline{XZD}, \overline{XYZ}$ and $\overline{XYF}, \overline{XYZ}$ and $\overline{YZD}$

18. all pairs of parallel segments $\overline{FD} \parallel \overline{YZ}, \overline{BX} \parallel \overline{DZ}, \overline{BX} \parallel \overline{FY}, \overline{DZ} \parallel \overline{FY}, \overline{BD} \parallel \overline{XZ}, \overline{BF} \parallel \overline{XY}$

19. all pairs of skew segments $\overline{BF}$ and $\overline{XZ}, \overline{BF}$ and $\overline{YZ}, \overline{FD}$ and $\overline{XY}, \overline{FD}$ and $\overline{XZ}, \overline{BD}$ and $\overline{XY}, \overline{BD}$ and $\overline{YZ}, \overline{FY}$ and $\overline{XZ}, \overline{FY}$ and $\overline{BD}, \overline{BX}$ and $\overline{FD}, \overline{BX}$ and $\overline{YZ}, \overline{DZ}$ and $\overline{XY}, \overline{DZ}$ and $\overline{BF}$

20. all points at which three segments intersect $\overline{B}, \overline{F}, \overline{D}, \overline{X}, \overline{Y}, \overline{Z}$
Skills Practice

**Parallel Lines and Transversals**

*Identify each pair of angles as alternate interior, alternate exterior, consecutive interior, or vertical.*

1. \( \angle 1 \) and \( \angle 6 \) \hspace{1cm} alternate exterior
2. \( \angle 2 \) and \( \angle 3 \) \hspace{1cm} consecutive interior
3. \( \angle 2 \) and \( \angle 7 \) \hspace{1cm} alternate interior
4. \( \angle 1 \) and \( \angle 8 \) \hspace{1cm} alternate exterior
5. \( \angle 2 \) and \( \angle 5 \) \hspace{1cm} vertical
6. \( \angle 10 \) and \( \angle 11 \) \hspace{1cm} consecutive interior
7. \( \angle 13 \) and \( \angle 12 \) \hspace{1cm} alternate exterior
8. \( \angle 5 \) and \( \angle 4 \) \hspace{1cm} alternate exterior
9. \( \angle 3 \) and \( \angle 8 \) \hspace{1cm} vertical
10. \( \angle 14 \) and \( \angle 15 \) \hspace{1cm} consecutive interior
11. \( \angle 9 \) and \( \angle 14 \) \hspace{1cm} vertical
12. \( \angle 14 \) and \( \angle 11 \) \hspace{1cm} alternate interior

*Find the measure of each angle. Give a reason for each answer.*

13. \( \angle 7 \) \hspace{1cm} 45; Vertical angles are congruent.
14. \( \angle 4 \) \hspace{1cm} 45; Alternate interior angles are congruent.
15. \( \angle 3 \) \hspace{1cm} 135; Consecutive interior angles are supplementary.
16. \( \angle 6 \) \hspace{1cm} 135; Linear pairs are supplementary.

*Find the measure of each angle. Give a reason for each answer.*

17. \( \angle 1 \) \hspace{1cm} 125; Linear pairs are supplementary.
18. \( \angle 3 \) \hspace{1cm} 55; Vertical angles are congruent.
19. \( \angle 12 \) \hspace{1cm} 80; Consecutive interior angles are supplementary.
20. \( \angle 11 \) \hspace{1cm} 100; Alternate interior angles are congruent.
Skills Practice

Transversals and Corresponding Angles

In the figure, m || p. Name all angles congruent to the given angle. Give a reason for each answer.

1. \( \angle 1 \) \( \angle 6 \), vertical; 
   \( \angle 9 \), corresponding; 
   \( \angle 14 \), alternate exterior

3. \( \angle 13 \) \( \angle 10 \), vertical; 
   \( \angle 5 \), corresponding; 
   \( \angle 2 \), alternate exterior

5. \( \angle 9 \) \( \angle 14 \), vertical; 
   \( \angle 6 \), alternate interior; 
   \( \angle 1 \), corresponding

Find the measure of each numbered angle.

7. \( m\angle 1 = 40 \), \( m\angle 2 = 140 \), \( m\angle 3 = 140 \), \( m\angle 4 = 40 \), \( m\angle 5 = 140 \), 
   \( m\angle 6 = 140 \), \( m\angle 7 = 40 \)

8. \( m\angle 1 = 35 \), \( m\angle 2 = 80 \), \( m\angle 3 = 80 \), \( m\angle 4 = 100 \), \( m\angle 5 = 65 \), 
   \( m\angle 6 = 65 \), \( m\angle 7 = 65 \), \( m\angle 8 = 115 \), \( m\angle 9 = 65 \), \( m\angle 10 = 115 \), 
   \( m\angle 11 = 100 \), \( m\angle 12 = 80 \)

9. \( m\angle 1 = 70 \), \( m\angle 2 = 70 \), \( m\angle 3 = 60 \), \( m\angle 4 = 70 \), \( m\angle 5 = 110 \), 
   \( m\angle 6 = 110 \), \( m\angle 7 = 110 \), \( m\angle 8 = 70 \), \( m\angle 9 = 40 \), \( m\angle 10 = 70 \), 
   \( m\angle 11 = 60 \), \( m\angle 12 = 120 \), \( m\angle 13 = 60 \), \( m\angle 14 = 120 \), \( m\angle 15 = 70 \)

10. \( m\angle 1 = 102 \), \( m\angle 2 = 78 \), \( m\angle 3 = 102 \), \( m\angle 4 = 78 \), \( m\angle 5 = 102 \), 
    \( m\angle 6 = 78 \), \( m\angle 7 = 102 \), \( m\angle 8 = 102 \), \( m\angle 9 = 78 \), \( m\angle 10 = 102 \), 
    \( m\angle 11 = 78 \), \( m\angle 12 = 102 \), \( m\angle 13 = 102 \), \( m\angle 14 = 78 \)
Skills Practice

Proving Lines Parallel
Find x so that \( c \parallel d \).

1. \[ \angle 48 \quad \angle x \quad \angle d \]
   \[ 48 \]

2. \[ \angle (2x + 8) \quad \angle c \quad \angle d \]
   \[ 41 \]

3. \[ \angle (5x)^\circ \quad \angle c \quad \angle 115 \circ \quad \angle d \]
   \[ 23 \]

4. \[ \angle 135 \circ \quad \angle 4x - 3 \circ \quad \angle c \quad \angle d \]
   \[ 12 \]

5. \[ \angle (7x - 2) \circ \quad \angle 82 \circ \quad \angle c \quad \angle d \]
   \[ 12 \]

6. \[ \angle (5x - 11) \circ \quad \angle 24 \circ \quad \angle c \quad \angle d \]
   \[ 7 \]

7. \[ \angle 85 \circ \quad \angle (9x + 4) \circ \quad \angle c \quad \angle d \]
   \[ 9 \]

8. \[ \angle (6x + 1) \circ \quad \angle (3x + 8) \circ \quad \angle d \]
   \[ 19 \]

9. \[ \angle (6x + 6) \circ \quad \angle d \]
   \[ 14 \]

Name the pairs of parallel lines or segments.

10. \[ \angle 55 \circ \quad \angle 55 \circ \quad \angle a \parallel \angle b \]

11. \[ \angle 40 \circ \quad \angle 75 \circ \quad \angle 75 \circ \quad \angle 75 \circ \quad \angle A \quad \angle B \quad \angle C \quad \angle D \quad \angle E \]
    \[ AB \parallel DE \]

12. \[ \angle 56 \circ \quad \angle 124 \circ \quad \angle 124 \circ \quad \angle 56 \circ \quad \angle W \quad \angle X \quad \angle Z \quad \angle Y \]
    \[ WX \parallel ZY, \quad WZ \parallel XY \]

13. \[ \angle 75 \circ \quad \angle 100 \circ \quad \angle 75 \circ \quad \angle c \parallel \angle d \]

14. \[ \angle 95 \circ \quad \angle 85 \circ \quad \angle 85 \circ \quad \angle C \quad \angle D \quad \angle F \quad \angle 110 \circ \quad \angle E \quad \angle 70 \circ \quad \angle 70 \circ \quad \angle a \parallel \angle b \parallel \angle c \]
    \[ CD \parallel EF \]

15. \[ \angle d \]

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Skills Practice

Slope

Find the slope of each line.

1. \( \frac{1}{4} \)
2. \(-2\)
3. undefined

4. \(0\)
5. \(-1\)
6. 6

7. \(-\frac{1}{2}\)
8. undefined
9. \(\frac{1}{2}\)

Given each set of points, determine if \( \overline{AB} \) and \( \overline{CD} \) are parallel, perpendicular, or neither.

10. \( A(1, 1), B(-2, 3), C(4, -1), D(6, 2) \) perpendicular

11. \( A(0, 5), B(5, 0), C(3, 2), D(4, 1) \) parallel

12. \( A(-2, 3), B(4, 5), C(0, 3), D(1, 0) \) perpendicular

13. \( A(0, 0), B(4, 5), C(0, 3), D(5, -4) \) neither

14. \( A(-1, 1), B(3, -2), C(5, 0), D(3, -7) \) neither

15. \( A(2, -5), B(5, -2), C(-3, 1), D(-4, 0) \) parallel

16. \( A(2, -1), B(5, -3), C(-2, -2), D(3, 3) \) neither

17. \( A(3, 0), B(6, -3), C(4, 3), D(5, 4) \) perpendicular
Equations of Lines

Name the slope and y-intercept of the graph of each equation.

1. \(y = 3x + 2\) \(3; 2\)
2. \(y = -4x + 1\) \(-4; 1\)
3. \(y = 2x + 5\) \(2; 5\)
4. \(y = -5x - 1\) \(-5; -1\)
5. \(x = 2\) undefined; none
6. \(10x + y = 7\) \(-10; 7\)
7. \(y + 3x = -1\) \(-3; -1\)
8. \(y = x\) \(1; 0\)
9. \(2x - y = 3\) \(2; -3\)
10. \(y = -6\) \(0; -6\)
11. \(-4x - y = 8\) \(-4; -8\)
12. \(2x + 2y = 14\) \(-1; 7\)
13. \(9x - 3y = 12\) \(3; -4\)
14. \(5x + 10y = 20\) \(-\frac{1}{2}; 2\)

Graph each equation using the slope and y-intercept.

15. \(y = 2x + 1\)

16. \(y = x - 3\)

17. \(x - y = 4\)

18. \(3x - y = 2\)

19. \(2x + y = -1\)

20. \(-3x - y = 2\)
5–1 Skills Practice

Classifying Triangles
Classify each triangle by its angles and by its sides.

1. acute, equilateral
2. right, scalene
3. isosceles, obtuse

4. isosceles, acute
5. scalene, obtuse
6. isosceles, acute

7. obtuse, scalene
8. acute, equilateral
9. isosceles, right

Make a sketch of each triangle. If it is not possible to sketch the figure, write not possible.

10. right scalene

11. obtuse isosceles

12. right isosceles

13. right equilateral
   not possible

**Angles of a Triangle**

*Find the value of each variable.*

1. \(x\)
   - \(55°\)
   - \(35°\)
   - \(40°\)

2. \(x\)
   - \(70°\)
   - \(70°\)

3. \(x\)
   - \(110°\)

4. \(x\)
   - \(50°\)
   - \(45°\)

5. \(x\)
   - \(52°\)

6. \(x\)
   - \(44°\)
   - \(84°\)

7. \(x\)
   - \(18°\)

8. \(x\)
   - \(135°\)

9. \(x\)
   - \(60°\)
   - \(75°\)

10. \(x\)
    - \(50°\)

11. \(x\)
    - \(48°\)

12. \(x\)
    - \(45°\)
    - \(45°\)
    - \(105°\)

*Find the measure of each angle in each triangle.*

13. \(43°\)
    - \(64°\)
    - \(73°\)

14. \((3x + 10)^°\)
    - \((2x)^°\)
    - \(32, 58°\)
Geometry in Motion

Identify each motion as a translation, reflection, or rotation.

1. translation

2. rotation

3. translation

4. reflection

5. translation

6. rotation

7. reflection

8. translation

9. rotation

10. Which angle corresponds to \( \angle D \)? \( \angle Z \)

11. Which side corresponds to \( \overline{XY} \)? \( \overline{BC} \)

12. Name the image of point A. point W

13. Name the image of \( \overline{AD} \). \( \overline{WZ} \)

14. Which vertex of \( ABCD \) corresponds to \( Y \)? C

15. Name the side that corresponds to \( \overline{AB} \). \( \overline{WX} \)
5–4

Skills Practice

Congruent Triangles
Name the congruent angles and sides for each pair of congruent triangles. Then draw arcs and slash marks to show the congruent angles and sides.

1. \( \triangle ACE \cong \triangle XYZ \)
   \( \angle A \cong \angle X, \angle C \cong \angle Y, \angle E \cong \angle Z, \)
   \( AC \cong XY, CE \cong YZ, AE \cong XZ \)

2. \( \triangle MNO \cong \triangle CBA \)
   \( \angle M \cong \angle C, \angle N \cong \angle B, \angle O \cong \angle A, \)
   \( MN \cong CB, NO \cong BA, MO \cong CA \)

3. \( \triangle BDE \cong \triangle ZNQ \)
   \( \angle B \cong \angle Z, \angle D \cong \angle N, \angle E \cong \angle Q, \)
   \( BD \cong ZN, DE \cong NQ, BE \cong QZ \)

4. \( \triangle TRI \cong \triangle ZAC \)
   \( \angle T \cong \angle Z, \angle R \cong \angle A, \angle I \cong \angle C, \)
   \( TR \cong ZA, RI \cong AC, TI \cong ZC \)

Complete each congruence statement.

5. \( \triangle CAX \cong \triangle ? \quad BRX \)

6. \( \triangle ZWO \cong \triangle ? \quad ARO \)

7. \( \triangle MAB \cong \triangle ? \quad MCD \)

8. \( \triangle EIX \cong \triangle ? \quad OIY \)

9. \( \triangle ABD \cong \triangle ? \quad CDB \)

10. \( \triangle LMO \cong \triangle ? \quad CBA \)

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SSS and SAS

Write a congruence statement for each pair of triangles represented.

1. $\triangle ABC \cong \triangle NOP$
   
2. $\triangle WXYZ \cong \triangle ABC$
   
3. $\triangle EGH \cong \triangle PST$
   
4. $\triangle HEY \cong \triangle RAP$
   
5. $\triangle ZAP \cong \triangle QRS$
   
6. $\triangle MRL \cong \triangle ZBN$

Determine whether each pair of triangles is congruent. If so, write a congruence statement and explain why the triangles are congruent.

7. $\triangle ABD \cong \triangle CBD$; SAS

8. $\triangle AER \cong \triangle WDG$; SSS

9. $\triangle HGE \cong \triangle HIJ$; SAS

10. $\triangle QAD \cong \triangle QAU$; SAS

11. $\triangle PLR \cong \triangle RAP$; SSS

12. $\triangle UWZ \cong \triangle XWY$; SAS

Use the given information to determine whether the two triangles are congruent by SAS. Write yes or no.

13. $\angle L \cong \angle M$, $\overline{LD} \cong \overline{MR}$, $\overline{LO} \cong \overline{MA}$ yes

14. $\angle L \cong \angle M$, $\overline{LD} \cong \overline{MR}$, $\angle O \cong \angle A$, no

15. $\overline{LD} \cong \overline{MR}$, $\overline{LO} \cong \overline{MA}$, $\angle O \cong \angle A$, no

16. $\overline{LD} \cong \overline{MR}$, $\overline{LO} \cong \overline{MA}$, $\angle DO \cong \angle RA$ no
5–6

Skills Practice

ASA and AAS

Write a congruence statement for each pair of triangles represented.

1. In $\triangle ABC$ and $\triangle ZXR$, $\angle C \cong \angle X$, $\angle A \cong \angle Z$, and $AB \cong ZR$. $\triangle ABC \cong \triangle ZRX$

2. In $\triangle DEF$ and $\triangle BGO$, $\angle D \cong \angle B$, $\angle E \cong \angle O$, and $DE \cong BO$. $\triangle DEF \cong \triangle BOG$

3. In $\triangle TRI$ and $\triangle GAN$, $\angle T \cong \angle A$, $\overline{TI} \cong \overline{AG}$, and $TR \cong AN$. $\triangle TRI \cong \triangle ANG$

4. In $\triangle ZIP$ and $\triangle LOS$, $\angle P \cong \angle O$, $\angle I \cong \angle L$, and $\overline{PI} \cong \overline{OL}$. $\triangle ZIP \cong \triangle SOL$

Name the additional congruent parts needed so that the triangles are congruent by the postulate or theorem indicated.

5. AAS

6. ASA

7. AAS

8. ASA

ON $\cong AC$ or $MO \cong BA$

$XZ \cong BC$

Determine whether each pair of triangles is congruent by SSS, SAS, ASA, or AAS. If it is not possible to prove that they are congruent, write not possible.

9. SSS

10. ASA

11. not possible

12. AAS
**Skills Practice**

**Medians**

**AD, BE, and CF are medians of △ACE.**

1. If \( AE = 24 \), find \( AF \). 12
2. Find \( AE \), if \( FE = 15 \). 30
3. What is \( BC \) if \( AC = 36 \)? 18
4. Find \( CE \), if \( DE = 7 \). 14
5. What is \( CD \) if \( CE = 68 \)? 34
6. If \( AF = 3 \), find \( AE \). 6

**TR, ZX, and SW are medians of △TXS.**

7. If \( TX = 18 \), find \( TW \). 9
8. If \( TO = 26 \), find \( OR \). 13
9. If \( WO = 5 \), find \( OS \). 10
10. Find \( ZO \) if \( OX = 50 \). 25
11. What is \( TZ \) if \( TS \) is 2? 1
12. What is \( OS \) if \( OW \) is 9? 18

**RN, PM, and LO are medians of △LNP.**

13. What is \( LP \) if \( RL \) is 4? 8
14. Find \( AO \) if \( LO = 18 \) 6
15. What is \( RA \) if \( AN \) is 42? 21
16. If \( MA = 13 \), find \( MP \). 39
17. Find \( AN \) if \( RN = 30 \). 20
18. If \( LO = 15 \), find \( AO \). 5
Altitudes and Perpendicular Bisectors
Tell whether the bold segment or line is an altitude, a perpendicular bisector, both, or neither.

1. both
2. neither
3. altitude
4. neither
5. both
6. perpendicular bisector
7. both
8. altitude
9. perpendicular bisector
10. neither
11. perpendicular bisector
12. both

Use the figure at the right.

13. Name a segment in the triangle that is an altitude. \( AC \) or \( BC \)
14. Name a segment in the triangle that is a perpendicular bisector. \( FD \)
14. Name a segment in the triangle that is not an altitude and is not a perpendicular bisector. \( AG \)
Angle Bisectors of Triangles

In \( \triangle ACD \), \( \overline{DB} \) bisects \( \angle ADC \), and \( \overline{CE} \) bisects \( \angle ACD \).
1. If \( m\angle 1 = 40 \), what is \( m\angle 2 \)? \( 40 \)
2. Find \( m\angle ACD \) if \( m\angle 4 = 25 \). \( 50 \)
3. What is \( m\angle 3 \) if \( m\angle ACD = 36 \)? \( 18 \)
4. If \( m\angle 1 = 45 \), what is \( m\angle ADC \)? \( 90 \)
5. What is \( m\angle DCA \) if \( m\angle DCE = 20 \)? \( 40 \)
6. Find \( m\angle ADB \) if \( m\angle BDC = 39 \). \( 39 \)
7. What is \( m\angle ACD \) if \( m\angle 4 = 18 \)? \( 36 \)
8. Find \( m\angle 2 \) if \( m\angle 1 = 43 \). \( 43 \)
9. If \( m\angle 3 = 21 \), what is \( m\angle 4 \)? \( 21 \)
10. What is \( m\angle ECD \) if \( m\angle ECA = 24 \)? \( 24 \)

In \( \triangle MOR \), \( \overline{MP} \) bisects \( \angle OMR \), \( \overline{RN} \) bisects \( \angle MRO \), and \( \overline{OS} \) bisects \( \angle MOR \).
11. Find \( m\angle 6 \) if \( m\angle MOR = 34 \). \( 17 \)
12. What is \( m\angle OMR \) if \( m\angle 1 = 23 \)? \( 46 \)
13. If \( m\angle 3 = 55 \), what is \( m\angle 4 \)? \( 55 \)
14. What is \( m\angle MOS \) if \( m\angle MOR = 32 \)? \( 16 \)
15. Find \( m\angle 1 \) if \( m\angle 2 = 27 \). \( 27 \)
16. If \( m\angle 4 = 60 \), what is \( m\angle MRO \)? \( 120 \)
17. What is \( m\angle SOR \) if \( m\angle 6 = 15 \)? \( 15 \)
18. If \( m\angle MRP = 112 \), what is \( m\angle 3 \)? \( 56 \)
19. Find \( m\angle OMP \) if \( m\angle PMR = 30 \). \( 30 \)
20. What is \( m\angle 4 \) if \( \angle MRO \) is a right angle? \( 45 \)
Skills Practice

Isosceles Triangles

Find the values of the variables for each triangle.

1. \(a = 60; \quad b = 10\)

2. \(x = 40; \quad y = 100\)

3. \(c = 54; \quad d = 63\)

4. \(x = 45; \quad y = 4\)

5. \(a = 60; \quad b = 68\)

6. \(x = 70; \quad y = 110\)

7. \(a = 102; \quad b = 78\)

8. \(x = 90; \quad y = 60\)

9. \(a = 60; \quad b = 64\)

10. \(a = 45; \quad x = 90\)

11. \(c = 92; \quad d = 44\)

12. \(a = 46; \quad b = 96\)

Use the figure at the right.

13. In \(\triangle ADF\), if \(AD = x + 6\) and \(DF = 3x - 10\), what is \(AD\)? 14

14. In \(\triangle ADH\), if \(m\angle ADH = 2x - 4\), find the value of \(x\). 24

15. If \(AH = 5x - 1\) and \(FH = 3x + 21\), what is \(A\)\(\angle H\)? 54

16. In \(\triangle ADF\), what is \(m\angle ADF\)? 88
Right Triangles

Determine whether each pair of right triangles is congruent by LL, HA, LA, or HL. If it is not possible to prove that they are congruent, write not possible.

1. LL

2. HL

3. not possible

4. HA

5. not possible

6. LL

7. HL

8. HA

9. HL

10. HA

not possible
6–6

Skills Practice

The Pythagorean Theorem

Find the missing measure in each right triangle. Round to the nearest tenth, if necessary.

1. 4 cm b \( \phantom{c \, \text{cm}} \) 3 cm

2. 10 in. b \( \phantom{c \, \text{in.}} \) 25 in.

3. 20 ft b \( \phantom{c \, \text{ft}} \) 33 ft

4. 8 in. a \( \phantom{c \, \text{in.}} \) 9 in.

5. 4.1

6. a \( \phantom{c \, \text{m}} \) 28 m b \( \phantom{c \, \text{m}} \) 10 m

7. 5 in. a \( \phantom{c \, \text{in.}} \) 3 in.

8. 25 m a \( \phantom{c \, \text{m}} \) 29 m

9. 24 ft b \( \phantom{c \, \text{ft}} \) 6 ft

Find each missing measure if \( c \) is the measure of the hypotenuse. Round to the nearest tenth, if necessary.

10. \( a = 15, b = 10, c = ? \) 18.0

11. \( b = 6, c = 10, a = ? \) 8

12. \( c = 100, b = 60, a = ? \) 80

13. \( c = 16, a = 9, b = ? \) 13.2

14. \( a = 2, b = 3, c = ? \) 3.6

15. \( c = 5, b = 2, a = ? \) 4.6

16. \( b = 7, c = 15, a = ? \) 13.3

17. \( c = 30, a = 20, b = ? \) 22.4

The lengths of three sides of a triangle are given. Determine whether each triangle is a right triangle.

18. 3 cm, 4 cm, 5 cm yes

19. 1 ft, 1 ft, 2 ft no

20. 2 in., 2 in., 4 in. no

21. 8 m, 15 m, 17 m yes

22. 5 in., 10 in., 15 in. no

23. 14 cm, 48 cm, 50 cm yes

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Geometry: Concepts and Applications
Distance on the Coordinate Plane

Find the distance between each pair of points. Round to the nearest tenth, if necessary.

1. \(X(4, 0), Y(2, 0)\) \(\sqrt{4}\)

2. \(C(–3, 0), D(–8, 0)\) \(\sqrt{25}\)

3. \(F(5, 0), G(–1, 0)\) \(\sqrt{36}\)

4. \(F(0, 8), G(0, 1)\) \(\sqrt{65}\)

5. \(M(0, –1), N(0, –6)\) \(\sqrt{36}\)

6. \(R(0, 6), S(0, –2)\) \(\sqrt{64}\)

7. \(A(2, –1), B(5, 3)\) \(\sqrt{18}\)

8. \(D(1, –5), E(1, 5)\) \(\sqrt{50}\)

9. \(H(–3, 4), I(5, 4)\) \(\sqrt{64}\)

10. \(G(0, 0), H(6, 8)\) \(\sqrt{64}\)

11. \(K(0, 0), M(–3, –4)\) \(\sqrt{25}\)

12. \(A(0, 7), C(24, 0)\) \(\sqrt{625}\)

13. \(E(1, 1), A(–1, –1)\) \(2.8\)

14. \(M(0, 4), Z(–2, 5)\) \(2.2\)

15. \(A(–1, –2), Z(2, 1)\) \(4.2\)

16. \(Y(5, 6), B(–5, –6)\) \(\sqrt{200}\)

17. \(C(2, –3), X(2, 7)\) \(\sqrt{100}\)

18. \(D(6, 9), U(9, 6)\) \(\sqrt{13}\)

19. \(L(5, 3), M(–1, 0)\) \(\sqrt{36}\)

20. \(S(–2, –6), T(7, 6)\) \(\sqrt{225}\)

21. \(H(1, –1), A(–5, 4)\) \(\sqrt{41}\)

22. \(G(8, –9), X(–1, 0)\) \(\sqrt{106}\)

23. \(B(–7, 4), T(–10, –1)\) \(\sqrt{106}\)

24. \(W(4, –2), N(1, 2)\) \(\sqrt{5}\)
Skills Practice

Segments, Angles, and Inequalities

For Exercises 1–12, use the figure below.

Replace each \( \circ \) with <, >, or = to make a true sentence.

1. \( AB \circ FH < \)
2. \( AD \circ EH = \)
3. \( AE \circ HE > \)
4. \( AE \circ DE > \)
5. \( DF \circ OG = \)
6. \( CG \circ BF = \)

Determine whether each statement is true or false.

7. \( AF \geq BG \) true
8. \( OE \leq DF \) true
9. \( CG = OH \) false
10. \( BD \geq FG \) true
11. \( OH \geq OA \) true
12. \( AG \geq BH \) true

For Exercises 13–24, use the figure at the right.
Lines \( AJ, DM, \) and \( GO \) intersect at \( P \).

Replace each \( \circ \) with <, >, or = to make a true sentence.

13. \( m\angle APD \circ m\angle MPJ = \)
14. \( m\angle DPG \circ m\angle APD > \)
15. \( m\angle DPG \circ m\angle GPJ < \)
16. \( m\angle APO \circ m\angle GPJ = \)
17. \( m\angle MPJ \circ m\angle OPM < \)
18. \( m\angle APO \circ m\angle DPG > \)

Determine if each statement is true or false.

19. \( m\angle OPJ = m\angle APG \) true
20. \( m\angle OPJ = m\angle GPJ \) false
21. \( m\angle OPJ > m\angle DPG \) true
22. \( m\angle APG < m\angle GPJ \) false
23. \( m\angle DPG = m\angle APM \) false
24. \( m\angle APO = 2 \cdot m\angle APD \) false
Exterior Angle Theorem

**Name the angles.**

1. an exterior angle of $\triangle ABX$  
   $\angle 7$ or $\angle 9$
2. an exterior angle of $\triangle BEA$  
   $\angle 5$
3. an interior angle of $\triangle ABX$  
   $\angle 1$, $\angle 6$, or $\angle ABX$
4. an interior angle of $\triangle BEA$  
   $\angle 1$, $\angle 2$, or $\angle 3$
5. a remote interior angle of $\triangle ABX$ with respect to $\angle 7$  
   $\angle 1$ or $\angle ABX$
6. a remote interior angle of $\triangle BEA$ with respect to $\angle 5$  
   $\angle 1$ or $\angle 2$

**Find the measure of each angle.**

7. $\angle C$  
   32
8. $\angle 1$  
   40
9. $\angle 2$  
   122

10. $\angle 3$  
    148
11. $\angle 4$  
    115
12. $\angle 5$  
    55

**Use the figure at the right.**

13. Find the value of $x$.  
   50
14. Find $m \angle B$.  
   50
15. Find $m \angle BMA$.  
   105
16. Find $m \angle BMZ$.  
   75

**Replace each $\bigcirc$ with $<, >$, or $=$ to make a true sentence.**

17. $m \angle 3 \bigcirc m \angle 1$  
   $<$
18. $m \angle 5 \bigcirc m \angle 3$  
   $>$
19. $m \angle 2 \bigcirc m \angle 4 + m \angle 6$  
   $=$
Inequalities Within a Triangle
List the angles in order from least to greatest measure.

1. \(\angle C, \angle A, \angle D\)

2. \(\angle X, \angle Z, \angle W\)

3. \(\angle O, \angle A, \angle M\)

4. \(\angle B, \angle C, \angle A\)

5. \(\angle R, \angle O, \angle Z\)

List the sides in order from least to greatest measure.

7. \(\overline{AB}, \overline{BC}, \overline{AC}\)

8. \(\overline{AT}, \overline{RT}, \overline{RA}\)

9. \(\overline{MY}, \overline{YL}, \overline{ML}\)

Identify the angle with the greatest measure.

10. \(\angle B\)

11. \(\angle F\)

12. \(\angle I\)

Identify the side with the greatest measure.

13. \(\overline{LJ}\)

14. \(\overline{MN}\)

15. \(\overline{PQ}\)
Skills Practice

Triangle Inequality Theorem

Determine if the three numbers can be measures of the sides of a triangle. Write yes or no. Explain.

1. 6, 7, 8  yes;  
   \[6 + 7 > 8, \quad 7 + 8 > 6, \quad 6 + 8 > 7\]

2. 1, 1, 2  no;  
   \[1 + 1 \not> 2\]

3. 2, 4, 6  no;  
   \[2 + 4 \not> 6\]

4. 5, 8, 10  yes;  
   \[5 + 8 > 10, \quad 8 + 10 > 5, \quad 5 + 10 > 8\]

5. 10, 20, 30  no;  
   \[10 + 20 \not> 30\]

6. 3, 4, 5  yes;  
   \[3 + 4 > 5, \quad 4 + 5 > 3, \quad 3 + 5 > 4\]

7. 3, 5, 7  yes;  
   \[3 + 5 > 7, \quad 5 + 7 > 3, \quad 3 + 7 > 5\]

8. 6, 12, 24  no;  
   \[6 + 12 \not> 24\]

9. 1, 7, 10  no;  
   \[1 + 7 \not> 10\]

10. 10, 15, 26  no;  
   \[10 + 15 \not> 26\]

11. 8, 12, 19  yes;  
   \[8 + 12 > 19, \quad 12 + 19 > 8, \quad 8 + 19 > 12\]

12. 4, 7, 10  yes;  
   \[4 + 7 > 10, \quad 7 + 10 > 4, \quad 4 + 10 > 7\]

Find the range of possible measures for the third side of a triangle with the measures given for two sides.

13. 7, 13  \[6 < x < 20\]

14. 20, 25  \[5 < x < 45\]

15. 1, 5  \[4 < x < 6\]

16. 32, 38  \[6 < x < 70\]

17. 50, 70  \[20 < x < 120\]

18. 8, 20  \[12 < x < 28\]

19. 55, 10  \[45 < x < 65\]

20. 2, 10  \[8 < x < 12\]

21. 60, 70  \[10 < x < 130\]

22. 45, 70  \[25 < x < 115\]

23. 9, 19  \[10 < x < 28\]

24. 100, 120  \[20 < x < 220\]
Quadrilaterals

Refer to quadrilaterals $ABCD$ and $MNOZ$.

1. Name the side opposite $BC$. $\overline{AD}$
2. Name a side that is consecutive with $\overline{AB}$. $\overline{BC}$ or $\overline{AD}$
3. Name a pair of consecutive vertices in $ABCD$. $A$ and $B$ or $B$ and $C$ or $C$ and $D$ or $A$ and $D$
4. Name the vertex opposite $B$. $D$
5. Name the two diagonals in $ABCD$. $\overline{AC}$ and $\overline{BD}$
6. Name a pair of consecutive angles in $MNOZ$. Sample answer: $\angle M$ and $\angle N$
7. Name the vertex opposite $O$. $M$
8. Name the side opposite $\overline{MZ}$. $\overline{NO}$
9. Name a side that is consecutive with $\overline{MN}$. $\overline{NO}$ or $\overline{MZ}$
10. Name the diagonals in $MNOZ$. $\overline{MO}$ and $\overline{NZ}$

Find the missing measure(s) in each figure.

11. $110^\circ$ $75^\circ$ $70^\circ$ $105$

12. $72^\circ$ $120^\circ$ $70^\circ$ $98$

13. $110^\circ$ $130^\circ$ $80^\circ$ $40$

14. $x^\circ$ $x^\circ$ $x^\circ$ $x^\circ$ $90, 90, 90, 90$

15. $2x^\circ$ $x^\circ$ $2x^\circ$ $60, 120, 60, 120$

16. $x^\circ$ $50^\circ$ $x^\circ$ $130, 130$
Parallelograms

Find each measure.

1. \( m \angle H \)  130
2. \( m \angle G \)  50
3. \( GH \)  25
4. \( FG \)  40

Find each measure.

5. \( m \angle Z \)  60
6. \( m \angle W \)  120
7. \( XY \)  7
8. \( WX \)  7

In the figure, \( TQ = 42 \) and \( SA = 14 \). Find each measure.

9. \( TA \)  21
10. \( m \angle QST \)  110
11. \( SR \)  28
12. \( m \angle STR \)  70
13. \( SQ \)  22
14. \( ST \)  30
15. \( AQ \)  21
16. \( AR \)  14

17. In a parallelogram, the measure of one side is 38. Find the measure of the opposite side. 38

18. The measure of one angle of a parallelogram is 45. Determine the measures of the other three angles. 45, 135, 135
Skills Practice

Tests for Parallelograms

Determine whether each quadrilateral is a parallelogram. Write yes or no. If yes, give a reason for your answer.

1. yes, Theorem 8-7
2. yes, Theorem 8-9
3. yes, definition of parallelogram

4. no
5. yes, definition of parallelogram
6. no

7. yes, Theorem 8-8
8. yes, Theorem 8-9
9. no

10. yes, definition of parallelogram
11. no
12. yes, Theorem 8-8
8–4

Identify each parallelogram as a rectangle, rhombus, square, or none of these.

1. none of these  
2. square  
3. rhombus  
4. none of these  
5. rectangle  
6. none of these

Find each measure.

7. $BO$ 10
8. $OC$ 10
9. $AC$ 20
10. $BD$ 20
11. $\angle AOB$ 90
12. $\angle ABC$ 90
13. $\angle ADB$ 45
14. $\angle DCA$ 45
15. $MG$ 18
16. $HF$ 20
17. $\angle EHG$ 120
18. $\angle FEH$ 60
19. $\angle EMF$ 90
20. $FG$ 22
21. $EF$ 22
22. $\angle FGE$ 30

Exercises 7 - 14
Exercises 15 - 22
Skills Practice

Trapezoids

For each trapezoid, name the bases, the legs, and the base angles.

1. \( \overline{AC}, \overline{GE}; \angle A \) and \( \angle C, \angle G \) and \( \angle E \)

2. \( \overline{WZ}, \overline{XY}; \angle W \) and \( \angle X, \angle Y \) and \( \angle Z \)

3. \( \overline{TR}, \overline{PA}; \angle T \) and \( \angle R, \angle P \) and \( \angle A \)

Find the length of the median in each trapezoid.

4. 5 ft

5. 15 m

6. 16 m

7. 26 yd

8. 4 in.

9. 8.5 m

Find the missing angle measures in each isosceles trapezoid.

10. 55, 125, 125

11. 124, 56, 56

12. 105, 75, 75

13. 64, 116, 116

14. 150, 30, 30

15. 72, 108, 108
Skills Practice

Using Ratios and Proportions

Write each ratio in simplest form.

1. \( \frac{15}{20} \) to \( \frac{3}{4} \)
2. \( \frac{7}{49} \) to \( \frac{1}{7} \)
3. \( \frac{10}{15} \) to \( \frac{2}{3} \)

4. \( \frac{28}{35} \) to \( \frac{4}{5} \)
5. \( \frac{11}{22} \) to \( \frac{1}{2} \)
6. \( \frac{20}{25} \) to \( \frac{4}{5} \)

7. \( \frac{3}{15} \) to \( \frac{1}{5} \)
8. \( \frac{18}{81} \) to \( \frac{2}{9} \)
9. \( \frac{36}{27} \) to \( \frac{4}{3} \)

10. \( \frac{55}{33} \) to \( \frac{5}{3} \)
11. \( \frac{12}{2} \) to \( \frac{6}{1} \) or \( \frac{6}{1} \)
12. \( \frac{40}{25} \) to \( \frac{8}{5} \)

13. 15 feet to 25 feet
14. 48 centimeters to 15 centimeters

15. 45 meters to 60 meters
16. 14 inches to 24 inches

17. 12 inches to 3 feet
18. 80 centimeters to 2 meters

19. 4 feet to 10 yards
20. 8 quarts to 5 gallons

Solve each proportion.

21. \( \frac{3}{8} = \frac{6}{x} \)
22. \( \frac{24}{18} = \frac{x}{3} \)
23. \( \frac{7}{12} = \frac{14}{x} \)

24. \( \frac{8}{28} = \frac{x}{21} \)
25. \( \frac{4}{8} = \frac{x}{12} \)
26. \( \frac{32}{6} = \frac{16}{x} \)

27. \( \frac{9}{5} = \frac{x}{20} \)
28. \( \frac{5}{x} = \frac{35}{70} \)
29. \( \frac{22}{18} = \frac{x}{27} \)

30. \( \frac{2}{x} = \frac{14}{21} \)
31. \( \frac{8}{x} = \frac{56}{7} \)
32. \( \frac{x}{5} = \frac{6}{30} \)
Similar Polygons

Determine whether each pair of polygons is similar. Justify your answer.

1. Yes; corresponding angles are congruent and \( \frac{3}{6} = \frac{4}{8} \).

2. Yes; corresponding angles are congruent and \( \frac{2}{5} = \frac{2}{5} \).

3. No; \( \frac{1}{3} \neq \frac{2}{5} \).

4. No; corresponding angles are not congruent.

5. Yes; corresponding angles are congruent and \( \frac{14}{26} = \frac{14}{26} = \frac{14}{26} \).

6. Yes; corresponding angles are congruent and \( \frac{6}{10} \) is the ratio for the lengths of all six sides.

If each pair of polygons is similar, find the values of \( x \) and \( y \).

7. \( x = 8, y = 10 \)

8. \( x = 30, y = 30 \)

9. \( x = 6, y = 24 \)

10. \( x = 8, y = 20 \)

11. \( x = 11, y = 11 \)

12. \( x = 15, y = 24 \)
9–3

Skills Practice

Similar Triangles

Determine whether each pair of triangles is similar. If so, tell which similarity test is used and complete the statement.

1. \( \triangle ABC \sim \triangle ? \)
   yes; ZYM; SAS

2. \( \triangle MNO \sim \triangle ? \)
   yes; YBA; SSS

3. \( \triangle BAC \sim \triangle ? \)
   yes; ZYR; AA

4. \( \triangle DEF \sim \triangle ? \)
   not similar

5. \( \triangle DYA \sim \triangle ? \)
   yes; RMZ; AA

6. \( \triangle FGI \sim \triangle ? \)
   not similar

Find the value of each variable.

7. \( x = 8 \)

8. \( x = 16, y = 24 \)

9. \( x = 3, y = 7 \)

10. \( x = 6, y = 18 \)

11. \( x = 16, y = 24 \)

12. \( x = 20, y = 28 \)
Skills Practice

Proportional Parts and Triangles

Complete each proportion.

1. \( \frac{MB}{BA} = \frac{MD}{?} \)  \( DC \)
2. \( \frac{MR}{RS} = \frac{MW}{?} \)  \( WT \)

3. \( \frac{BD}{AC} = \frac{MD}{?} \)  \( MC \)
4. \( \frac{MB}{MA} = \frac{?}{MC} \)  \( MD \)

5. \( \frac{CD}{DM} = \frac{AB}{?} \)  \( BM \)
6. \( \frac{MS}{RM} = \frac{MT}{?} \)  \( MW \)

7. \( \frac{ST}{RW} = \frac{SM}{?} \)  \( RM \)
8. \( \frac{MW}{WT} = \frac{?}{RS} \)  \( MR \)

9. \( \frac{RW}{ST} = \frac{MW}{?} \)  \( MT \)
10. \( \frac{TW}{WM} = \frac{SR}{?} \)  \( RM \)

11. \( \frac{CM}{MD} = \frac{?}{BM} \)  \( AM \)
12. \( \frac{SM}{SR} = \frac{TM}{?} \)  \( TW \)

Find the value of \( x \).

13. \( \frac{12}{8} = \frac{15}{x} \)  \( 10 \)
14. \( \frac{15}{15} = \frac{30}{x} \)  \( 6 \)
15. \( \frac{50}{38} = \frac{x}{18} \)  \( 25 \)

16. \( \frac{15}{25} = \frac{x}{15} \)
17. \( \frac{15}{x} = \frac{7}{8} \)  \( 7 \)
18. \( \frac{9}{12} = \frac{x}{21} \)  \( 9 \)

19. \( \frac{5}{10} = \frac{2x}{5} \)  \( 5 \)
20. \( \frac{x}{x + 8} = \frac{20}{15} \)  \( 4 \)
21. \( \frac{12}{18} = \frac{x}{30} \)  \( 7.2 \)
Triangles and Parallel Lines

In each figure, determine whether \( \overline{AB} \parallel \overline{RS} \).

1. yes
2. yes
3. no
4. no
5. no
6. yes

\[ M, O, \text{ and } R \text{ are the midpoints of the sides of } \triangle ABC. \]

Complete each statement.

7. \( \overline{OR} \parallel \overline{?AB} \)
8. \( \overline{BC} \parallel \overline{?MR} \)
9. If \( MO = 15 \), then \( AC = \overline{?30} \)
10. If \( BC = 62 \), then \( MR = \overline{?31} \)
11. If \( m\angle BMO = 75 \), then \( m\angle BAC = \overline{?75} \)
12. If \( m\angle BCA = 52 \), then \( m\angle BOM = \overline{?52} \)
13. \( \overline{AC} \parallel \overline{?MO} \)
14. If \( BM = 28 \), then \( AM = \overline{?28} \)
15. If \( AB = 50 \), then \( OR = \overline{?25} \)
16. If \( BC = 74 \), then \( BO = \overline{?37} \)
17. If \( m\angle COR = 60 \), then \( m\angle CBA = \overline{?60} \)
18. If \( BO = 19 \), then \( MR = \overline{?19} \)
Skills Practice

Proportional Parts and Parallel Lines

Complete each proportion.

1. \( \frac{TX}{XZ} = \frac{?}{YA} \quad \frac{WY}{?} = TX \)

2. \( \frac{WY}{WA} = \frac{TX}{TZ} \)

3. \( \frac{YA}{WY} = \frac{XZ}{?} \quad TX \)

4. \( \frac{WA}{?} = \frac{TZ}{TX} \quad WY \)

5. \( \frac{AY}{WY} = \frac{XZ}{TX} \)

6. \( \frac{TZ}{WY} = \frac{WA}{TX} \)

Find the value of \( x \).

7. \[
\begin{align*}
10 & \quad 10 \\
15 & \quad x \\
\end{align*}
\]

8. \[
\begin{align*}
9 & \quad 12 \\
15 & \quad x \\
\end{align*}
\]

9. \[
\begin{align*}
12 & \quad 10 \\
x & \quad 15 \\
\end{align*}
\]

10. \[
\begin{align*}
8 & \quad 18 \\
x & \quad 8 \\
\end{align*}
\]

11. \[
\begin{align*}
30 & \quad 30 \\
30 & \quad x \\
\end{align*}
\]

12. \[
\begin{align*}
4 & \quad 16 \\
5 & \quad x \\
\end{align*}
\]

13. \[
\begin{align*}
9 & \quad x \\
x & \quad 9 \\
\end{align*}
\]

14. \[
\begin{align*}
20 & \quad 88 \\
60 & \quad x \\
\end{align*}
\]

15. \[
\begin{align*}
5 & \quad 7 \\
x & \quad 21 \\
\end{align*}
\]
Skills Practice

Perimeters and Similarity

Find the value of each variable for each pair of similar triangles.

1. Perimeter of $\triangle RST = 30$
   $x = 8, y = 10, z = 12$

2. Perimeter of $\triangle ADE = 24$
   $x = 6, y = 8, z = 10$

3. Perimeter of $\triangle OPS = 9$
   $x = 3, y = 3, z = 3$

4. Perimeter of $\triangle MNO = 11$
   $x = 5, y = 3, z = 3$

5. Perimeter of $\triangle DEF = 51$
   $x = 16, y = 12, z = 23$

6. Perimeter of $\triangle QPZ = 168$
   $x = 49, y = 49, z = 70$

Determine the scale factor for each pair of similar triangles.

7. $\triangle XYZ$ to $\triangle MBA$ $\frac{2}{1}$

8. $\triangle ADX$ to $\triangle MYB$ $\frac{3}{1}$

9. $\triangle FHA$ to $\triangle BLN$ $\frac{2}{3}$

10. $\triangle MBA$ to $\triangle XYZ$ $\frac{1}{2}$

11. $\triangle MYB$ to $\triangle ADX$ $\frac{1}{3}$

12. $\triangle BLN$ to $\triangle FHA$ $\frac{3}{2}$

13. The perimeter of $\triangle BDE$ is 72 feet. If $\triangle BDE \sim \triangle FMR$ and the scale factor of $\triangle BDE$ to $\triangle FMR$ is $\frac{4}{5}$, find the perimeter of $\triangle FMR$. 90 ft
Naming Polygons

Identify each polygon by its sides. Then determine whether it appears to be regular or not regular. If not regular, explain why.

1. quadrilateral, not regular; sides are not all congruent

2. triangle, regular

3. quadrilateral, not regular; sides not all congruent

Name each part of hexagon ABCDEF.

4. two consecutive vertices
   Sample answer: A, B

5. two diagonals
   Sample answer: AC, AD

6. all nonconsecutive sides of AB
   Sample answer: CD, DE, EF

7. any three consecutive sides
   Sample answer: AB, BC, CD

8. any four consecutive vertices
   Sample answer: A, B, C, D

Classify each polygon as convex or concave.

9. convex

10. convex

11. concave

12. concave

13. convex

14. concave
Diagonals and Angle Measure

Find the sum of the measures of the interior angles in each figure.

1. \(\triangle XYZ\)
2. \(\hexagon ABCDE\)
3. \(\quad QRS\)
4. \(\pentagon ERMZL\)
5. \(\heptagon HIKJLDP\)
6. \(\triangle LDA\)
7. \(\triangle\) 60, 120
8. \(\octagon\) 135, 45
9. \(\decagon\) 144, 36
10. \(\nonagon\) 140, 40
11. \(\text{quadrilateral}\) 90, 90
12. \(\hexagon\) 120, 60

13. The sum of the measures of three interior angles of a quadrilateral is 245. What is the measure of the fourth interior angle? 115
14. The sum of the measures of six exterior angles of a heptagon is 310. What is the measure of the seventh exterior angle? 50
15. The sum of the measures of seven interior angles of an octagon is 1000. What is the measure of the eighth interior angle? 80
16. The sum of the measures of nine exterior angles of a decagon is 325. What is the measure of the tenth exterior angle? 35
Areas of Polygons

Find the area of each polygon in square units.

1. 5 units²
2. 5 units²
3. 8 units²
4. 4 units²
5. 10 units²
6. 14 units²
7. 9 units²
8. 5 units²
9. 10 units²

Estimate the area of each polygon in square units. 10–12. Sample answers given.

10. 16 units²
11. 17 units²
12. 23 units²

13. Sketch two polygons that both have a perimeter of 20 units, but that have different areas.

Sample answer:

14. Sketch a pentagon with an area of 20 square units.

Sample answer:
Areas of Triangles and Trapezoids

Find the area of each triangle or trapezoid.

1. \( \text{Area} = \frac{1}{2} \times \text{base} \times \text{height} = \frac{1}{2} \times 37 \text{ ft} \times 20 \text{ ft} = 370 \text{ ft}^2 \)

2. \( \text{Area} = \frac{1}{2} \times \text{base} \times \text{height} = \frac{1}{2} \times 14 \text{ cm} \times 20 \text{ cm} = 140 \text{ cm}^2 \)

3. \( \text{Area} = \frac{1}{2} \times \text{base} \times \text{height} = \frac{1}{2} \times 5 \text{ m} \times 8 \text{ m} = 35 \text{ m}^2 \)

4. \( \text{Area} = \frac{1}{2} \times \text{base} \times \text{height} = \frac{1}{2} \times 5 \text{ in} \times 12 \text{ in} = 30 \text{ in}^2 \)

5. \( \text{Area} = \frac{1}{2} \times \text{base} \times \text{height} = \frac{1}{2} \times 7 \text{ ft} \times 15 \text{ ft} = 70 \text{ ft}^2 \)

6. \( \text{Area} = \frac{1}{2} \times \text{base} \times \text{height} = \frac{1}{2} \times 19 \text{ cm} \times 26 \text{ cm} = 399 \text{ cm}^2 \)

7. \( \text{Area} = \frac{1}{2} \times \text{base} \times \text{height} = \frac{1}{2} \times 24 \text{ mm} \times 19 \text{ mm} = 228 \text{ mm}^2 \)

8. \( \text{Area} = \frac{1}{2} \times \text{base} \times \text{height} = \frac{1}{2} \times 11 \text{ m} \times 3 \text{ m} = 21 \text{ m}^2 \)

9. \( \text{Area} = \frac{1}{2} \times \text{base} \times \text{height} = \frac{1}{2} \times 27 \text{ in} \times 5 \text{ in} = 297 \text{ in}^2 \)

10. \( \text{Area} = \frac{1}{2} \times \text{base} \times \text{height} = \frac{1}{2} \times 28 \text{ cm} \times 22 \text{ cm} = 308 \text{ cm}^2 \)

11. \( \text{Area} = \frac{1}{2} \times \text{base} \times \text{height} = \frac{1}{2} \times 2 \text{ cm} \times 6 \text{ cm} = 12 \text{ cm}^2 \)

12. \( \text{Area} = \frac{1}{2} \times \text{base} \times \text{height} = \frac{1}{2} \times 25 \text{ m} \times 18 \text{ m} = 225 \text{ m}^2 \)

13. Find the area of a trapezoid whose altitude measures 8 feet and whose bases are 9 feet and 21 feet long. \( 120 \text{ ft}^2 \)

14. Find the area of a triangle whose base measures 17 inches and whose altitude is 10 inches. \( 85 \text{ in}^2 \)

15. Find the area of a trapezoid whose altitude measures 77 meters and whose bases are 200 meters and 300 meters long. \( 19,250 \text{ m}^2 \)

16. The area of a triangle is 500 square feet. The height of the altitude is 25 feet. What is the length of the base? \( 40 \text{ ft} \)
Areas of Regular Polygons

Find the area of each regular polygon.

1. \[ \text{12 cm} \times \text{18 cm} \]
   \[ 540 \text{ cm}^2 \]

2. \[ \text{4 ft} \times \text{5 ft} \]
   \[ 60 \text{ ft}^2 \]

3. \[ \text{9 in.} \times \text{10 in.} \]
   \[ 360 \text{ in}^2 \]

4. \[ \text{3 cm} \times \text{2.5 cm} \]
   \[ 22.5 \text{ cm}^2 \]

5. \[ \text{22 in.} \times \text{7 in.} \]
   \[ 231 \text{ in}^2 \]

6. \[ \text{8 m} \times \text{7 m} \]
   \[ 168 \text{ m}^2 \]

Find the area of the shaded region in each regular polygon.

7. \[ \text{38 in.} \times \text{24 in.} \]
   \[ 1824 \text{ in}^2 \]

8. \[ \text{15 ft} \times \text{12 ft} \]
   \[ 270 \text{ ft}^2 \]

9. \[ \text{5 m} \times \text{6 m} \]
   \[ 80 \text{ m}^2 \]

10. \[ \text{28 in.} \times \text{24 in.} \]
    \[ 1344 \text{ in}^2 \]

11. \[ \text{18 m} \times \text{13 m} \]
    \[ 351 \text{ m}^2 \]

12. \[ \text{30 cm} \times \text{18 cm} \]
    \[ 177 \text{ cm}^2 \]
Symmetry

Determine whether each figure has line symmetry. If it does, draw all lines of symmetry. If not, write no.

1. yes
2. no
3. yes
4. yes
5. no
6. yes
7. yes
8. no
9. yes
10. yes
11. no
12. no

Determine whether each figure has rotational symmetry. Write yes or no.

7. yes
8. no
9. yes
10. yes
11. no
12. no
Tessellations

Identify the figures used to create each tessellation. Then identify the tessellation as regular, semi-regular, or neither.

1. trapezoids; neither
2. rhombi; neither
3. equilateral triangles and right triangles; neither
4. regular hexagons; regular
5. squares and isosceles right triangles; neither
6. trapezoids and rectangles; neither

Create a tessellation using the given polygons.
7. right triangles
8. equilateral triangles and rhombi
11–1

Skills Practice

Parts of a Circle

Use \( \odot A \) at the right to determine whether each statement is true or false.

1. \( \overline{AT} \) is a radius of \( \odot A \). true
2. \( \overline{RB} \) is a chord of \( \odot A \). false
3. \( ZU = 2(ZA) \) true
4. \( SA = SW \) false
5. \( AT = BX \) false
6. \( SW \) is a diameter of \( \odot A \). true
7. \( SW \) is a chord of \( \odot A \). true
8. \( AT = AZ \) true
9. \( \overline{AT} \) is a chord of \( \odot A \). false
10. \( SU = RX \) false
11. \( SA = AU \) true
12. \( SY \) is a chord of \( \odot A \). true
13. \( SC = SA \) false
14. \( ZU \) is a chord of \( \odot A \). true
15. \( ZU \) is a radius of \( \odot A \). false
16. \( BU \) is a chord of \( \odot A \). false

Circle \( W \) has a radius of 15 units, and \( \odot Z \) has a radius of 10 units.

17. If \( XY = 7 \), find \( YZ \). 3
18. If \( XY = 7 \), find \( WX \). 8
19. If \( XY = 7 \), find \( TX \). 23
20. If \( XY = 7 \), find \( WR \). 28
11-2

Skills Practice

Arcs and Central Angles

Find each measure in \(\overparen{ACB} = 80\), \(\overparen{AF} = 45\), and \(\overparen{AE}\) and \(\overparen{FD}\) are diameters.

1. \(m\overparen{ACF} = 45\)
2. \(m\overparen{AB} = 80\)
3. \(m\overparen{FCE} = 135\)
4. \(m\overparen{EF} = 135\)
5. \(m\overparen{ABE} = 180\)
6. \(m\overparen{BCE} = 100\)
7. \(m\overparen{AFE} = 180\)
8. \(m\overparen{DCE} = 45\)
9. \(m\overparen{DE} = 45\)
10. \(m\overparen{BCD} = 55\)
11. \(m\overparen{BAE} = 260\)
12. \(m\overparen{ABF} = 315\)

In \(\overparen{A}\), \(BD\) is a diameter, \(m\overparen{BAE} = 85\), and \(m\overparen{CAD} = 120\). Determine whether each statement is true or false.

13. \(m\overparen{BAC} = 60\)  true
14. \(m\overparen{CD} = m\overparen{CAD}\)  true
15. \(\angle ABE\) is a central angle.  false
16. \(m\overparen{BAC} = m\overparen{DAE}\)  false
17. \(m\overparen{CED} = 220\)  false
18. \(m\overparen{BCD} = 180\)  true
19. \(m\overparen{CE} = 145\)  true
20. \(m\overparen{DAE} = m\overparen{DE}\)  true

Q is the center of two circles with radii \(\overparen{QD}\) and \(\overparen{QE}\). If \(m\overparen{AQE} = 90\) and \(m\overparen{RE} = 115\), find each measure.

21. \(m\overparen{AE} = 90\)
22. \(m\overparen{QRE} = 115\)
23. \(m\overparen{AR} = 155\)
24. \(m\overparen{RQA} = 155\)
25. \(m\overparen{AER} = 205\)
26. \(m\overparen{BSD} = 270\)
27. \(m\overparen{DS} = 115\)
28. \(m\overparen{BD} = 90\)
**Arcs and Chords**

**Skills Practice**

Complete each sentence.

1. If $SG \equiv RE$, then $SG \equiv \, ? \, RE$
2. If $ST \equiv ET$, then $\triangle SMT \equiv \, ? \, EMT$
3. If $TM \perp RG$, then $RT \equiv \, ? \, TG$
4. If $ST \equiv TE$, $ST \equiv \, ? \, TE$
5. If $RG \perp AS$, then $SB \equiv \, ? \, AB$
6. If $RE \equiv SG$, then $\triangle RME \equiv \, ? \, GMS$
7. If $RE \equiv SG$, then $RE \equiv \, ? \, SG$
8. If $TM \perp RG$, then $ST \equiv \, ? \, TE$
9. If $TM \perp RG$, then $SQ \equiv \, ? \, EQ$
10. If $TM \perp RG$ and $ST \equiv TE$, then $\triangle SQT \equiv \, ? \, EQT$
11. If $SQ \equiv EQ$, then $TM \perp \, ? \, RG$
12. If $SR \equiv AR$, then $RG \perp \, ? \, SA$

Use $\odot B$, where $BX \perp WY$, to complete each sentence.

13. If $BW = 23$, then $BY = \, ? \, 23$
14. If $WY = 38$, then $WZ = \, ? \, 19$
15. If $WZ = 15$, then $WY = \, ? \, 30$
16. If $BZ = 6$ and $WZ = 8$, then $WB = \, ? \, 10$
17. If $WB = 15$ and $BZ = 9$, then $WZ = \, ? \, 12$
18. If $WY = 40$ and $BZ = 15$, then $WB = \, ? \, 25$
19. If $BY = 30$ and $BZ = 18$, then $WY = \, ? \, 48$
20. If $m\overset{\frown}{WY} = 110$, then $m\overset{\frown}{WX} = \, ? \, 55$
Inscribed Polygons
Use $O$ to find $x$.

1. $WM = x + 8, ZN = 2x + 5$  
2. $WM = 3x + 10, ZN = 2x + 15$  
3. $WM = x - 6, ZN = 2x - 12$  
4. $WM = 2x - 5, ZN = x + 5$  
5. $WM = 5x - 1, ZN = 2x + 5$  
6. $WM = 4x + 15, ZN = 3x + 19$  
7. $WM = x + 8, ZN = 2x + 5$  
8. $WM = 4x, ZN = 3x + 1$  
9. $WM = x - 1, ZN = 2x - 7$  
10. $WM = 20x + 100, ZN = 30x + 80$

Square $SQUR$ is inscribed in $O$ with a radius of 20 meters.

11. Find $\angle SCQ$.  
12. Find $SQ$ to the nearest tenth.  
13. Find $CA$ to the nearest tenth.
Skills Practice

Circumference of a Circle

*Find the circumference of each object to the nearest tenth.*

1. a round swimming pool with radius 12 feet  
   75.4 ft

2. a circular top of a trampoline with diameter 16 feet  
   50.3 ft

3. the circular base of a paper weight with diameter 3 centimeters  
   9.4 cm

4. a CD with diameter 11 centimeters  
   34.6 cm

5. circular garden with radius 10 feet  
   62.8 ft

6. circular mirror with diameter 4 feet  
   12.6 ft

*Find the circumference of each circle to the nearest tenth.*

7. \( r = 7 \text{ cm} \)  
   44.0 cm

8. \( d = 20 \text{ yd} \)  
   62.8 yd

9. \( r = 1 \text{ m} \)  
   6.3 m

10. \( d = 6 \text{ ft} \)  
    18.8 ft

11. \( r = 200 \text{ ft} \)  
    1256.6 ft

12. \( d = 5 \text{ in.} \)  
    15.7 in.

13. \( r = 2 \text{ m} \)  
    12.6 m

14. \( d = 70 \text{ ft} \)  
    219.9 ft

15. \( r = 3 \text{ in.} \)  
    18.8 in.

16. \( d = 10 \text{ in.} \)  
    31.4 in.

17. \( r = 19 \text{ m} \)  
    119.4 m

18. \( d = 35 \text{ yd} \)  
    110.0 yd

*Find the radius of each circle to the nearest tenth for each circumference given.*

19. \( 100 \text{ m} \)  
    15.9 m

20. \( 32 \text{ ft} \)  
    5.1 ft

21. \( 18 \text{ mi} \)  
    2.9 mi

22. \( 28 \text{ cm} \)  
    4.5 cm

23. \( 80 \text{ in.} \)  
    12.7 in.

24. \( 25 \text{ m} \)  
    4.0 m

25. \( 75 \text{ yd} \)  
    11.9 yd

26. \( 14 \text{ cm} \)  
    2.2 cm

27. \( 250 \text{ ft} \)  
    39.8 ft

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Skills Practice

Area of a Circle

Find the area of each circle to the nearest hundredth.

1. \( r = 10 \text{ in.} \)
   
   \[ 314.16 \text{ in}^2 \]

2. \( r = 18 \text{ cm} \)

   \[ 1017.88 \text{ cm}^2 \]

3. \( r = 4 \text{ mm} \)

   \[ 50.27 \text{ mm}^2 \]

4. \( d = 50 \text{ ft} \)

   \[ 1963.50 \text{ ft}^2 \]

5. \( d = 6 \text{ in.} \)

   \[ 28.27 \text{ in}^2 \]

6. \( d = 30 \text{ m} \)

   \[ 706.86 \text{ m}^2 \]

7. \( C = 31.42 \text{ yd} \)

   \[ 78.56 \text{ yd}^2 \]

8. \( C = 131.95 \text{ m} \)

   \[ 1385.51 \text{ m}^2 \]

9. \( C = 232.48 \text{ ft} \)

   \[ 4300.92 \text{ ft}^2 \]

10. \( r = 1 \text{ mi} \)

    \[ 3.14 \text{ mi}^2 \]

11. \( d = 90 \text{ m} \)

    \[ 6361.73 \text{ m}^2 \]

12. \( C = 628.32 \text{ ft} \)

    \[ 31,416.07 \text{ ft}^2 \]

13. \( d = 300 \text{ ft} \)

    \[ 70,685.83 \text{ ft}^2 \]

14. \( r = 6 \text{ in.} \)

    \[ 113.10 \text{ in}^2 \]

15. \( C = 150.80 \text{ m} \)

    \[ 1809.64 \text{ m}^2 \]

A circle has a radius of 10 inches. Find the area of a sector whose central angle has the following measure. Round to the nearest hundredth.

16. \( 90^\circ \)

    \[ 78.54 \text{ in}^2 \]

17. \( 30^\circ \)

    \[ 26.18 \text{ in}^2 \]

18. \( 120^\circ \)

    \[ 104.72 \text{ in}^2 \]

19. \( 45^\circ \)

    \[ 39.27 \text{ in}^2 \]

20. \( 60^\circ \)

    \[ 52.36 \text{ in}^2 \]

21. \( 135^\circ \)

    \[ 117.81 \text{ in}^2 \]

22. \( 100^\circ \)

    \[ 87.27 \text{ in}^2 \]

23. \( 150^\circ \)

    \[ 130.90 \text{ in}^2 \]

24. \( 70^\circ \)

    \[ 61.09 \text{ in}^2 \]
Solid Figures

Name the faces, edges, and vertices of each polyhedron.

1. Faces: rectangles $ABED$, $BCFE$, $ACFD$, $\triangle ACB$, $\triangle DEF$ Edges: $AC$, $DF$, $AD$, $BE$, $CF$, $AB$, $BC$, $DE$, $EF$ Vertices: $A$, $B$, $C$, $D$, $E$, $F$


Name each solid.

4. cylinder

5. cube or rectangular prism

6. triangular prism

Determine whether each statement is true or false for the solid.

7. The figure is a prism. false

8. The base of the figure is a pentagon. true

9. There are five lateral faces. true

10. The figure has 6 edges. false
### Skills Practice

**Surface Areas of Prisms and Cylinders**

Find the lateral area and the surface area for each solid. Round to the nearest hundredth, if necessary.

1. 4 cm
   - Lateral Area: \(100.53 \text{ cm}^2\)
   - Surface Area: \(201.06 \text{ cm}^2\)

2. 30 ft, 8 ft
   - Lateral Area: \(760 \text{ ft}^2\)
   - Surface Area: \(1240 \text{ ft}^2\)

3. 3 m, 5 m, 4 m
   - Lateral Area: \(48 \text{ m}^2\)
   - Surface Area: \(60 \text{ m}^2\)

4. 18 in., 8 in.
   - Lateral Area: \(904.78 \text{ in}^2\)
   - Surface Area: \(1306.90 \text{ in}^2\)

5. 2 yd, 2 yd
   - Lateral Area: \(16 \text{ yd}^2\)
   - Surface Area: \(24 \text{ yd}^2\)

6. 8 in., 6 in.
   - Lateral Area: \(84 \text{ in}^2\)
   - Surface Area: \(180 \text{ in}^2\)

7. 20 cm, 12 cm, 16 cm, 15 cm
   - Lateral Area: \(720 \text{ cm}^2\)
   - Surface Area: \(912 \text{ cm}^2\)

8. 5 ft, 15 ft
   - Lateral Area: \(471.24 \text{ ft}^2\)
   - Surface Area: \(1884.96 \text{ ft}^2\)

9. 3 ft, 11 ft
   - Lateral Area: \(84 \text{ ft}^2\)
   - Surface Area: \(150 \text{ ft}^2\)

10. 28 m, 16 m
    - Lateral Area: \(1407.43 \text{ m}^2\)
    - Surface Area: \(1809.56 \text{ m}^2\)

11. 18 cm, 24 cm, 12 cm
    - Lateral Area: \(864 \text{ cm}^2\)
    - Surface Area: \(1296 \text{ cm}^2\)

12. 33 mm, 18 mm
    - Lateral Area: \(1866.11 \text{ mm}^2\)
    - Surface Area: \(2375.04 \text{ mm}^2\)
Skills Practice

Volumes of Prisms and Cylinders

Find the volume of each solid. Round to the nearest hundredth, if necessary.

1. \(10,618.58 \text{ in}^3\)
2. \(1000 \text{ ft}^3\)
3. \(30 \text{ in}^3\)
4. \(4750.09 \text{ ft}^3\)
5. \(1584 \text{ cm}^3\)
6. \(28 \text{ ft}^3\)
7. \(9025.80 \text{ in}^3\)
8. \(6000 \text{ in}^3\)
9. \(36 \text{ m}^3\)
10. \(21.99 \text{ ft}^3\)
11. \(165 \text{ m}^3\)
12. \(20,480 \text{ ft}^3\)
Skills Practice

Surface Areas of Pyramids and Cones

Find the lateral area and the surface area of each regular pyramid or cone. Round to the nearest hundredth, if necessary.

1. \(42 \text{ ft}^2; 51 \text{ ft}^2\)

2. \(898.50 \text{ cm}^2; 1278.63 \text{ cm}^2\)

3. \(575 \text{ m}^2; 675 \text{ m}^2\)

4. \(43.98 \text{ ft}^2; 56.55 \text{ ft}^2\)

5. \(3840 \text{ cm}^2; 4864 \text{ cm}^2\)

6. \(30,536.28 \text{ in}^2; 36,697.16 \text{ in}^2\)

7. \(672 \text{ ft}^2; 840 \text{ ft}^2\)

8. \(276.46 \text{ in}^2; 477.52 \text{ in}^2\)

9. \(18,750 \text{ cm}^2; 24,375 \text{ cm}^2\)

10. \(62.83 \text{ mi}^2; 75.40 \text{ mi}^2\)

11. \(324 \text{ cm}^2; 405 \text{ cm}^2\)

12. \(31.42 \text{ km}^2; 43.98 \text{ km}^2\)

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Skills Practice

Volumes of Pyramids and Cones

Find the volume of each solid. Round to the nearest hundredth, if necessary.

1. \(6 \text{ in}^3\)

2. \(4712.39 \text{ cm}^3\)

3. \(12,000 \text{ ft}^3\)

4. \(2120.58 \text{ mm}^3\)

5. \(80 \text{ yd}^3\)

6. \(7.33 \text{ mi}^3\)

7. \(2640 \text{ in}^3\)

8. \(1407.43 \text{ ft}^3\)

9. \(1680 \text{ cm}^3\)

10. \(41,054.33 \text{ in}^3\)

11. \(24 \text{ ft}^3\)

12. \(3.14 \text{ ft}^3\)
Skills Practice

Spheres

Find the surface area and volume of each sphere. Round to the nearest hundredth.

1. \(9 \text{ m}\)
   - Surface Area: 1017.88 m\(^2\)
   - Volume: 3053.63 m\(^3\)

2. \(15 \text{ in}\)
   - Surface Area: 2827.43 in\(^2\)
   - Volume: 14,137.17 in\(^3\)

3. \(40 \text{ ft}\)
   - Surface Area: 5026.55 ft\(^2\)
   - Volume: 33,510.32 ft\(^3\)

4. \(2 \text{ mi}\)
   - Surface Area: 12.57 mi\(^2\)
   - Volume: 4.19 mi\(^3\)

5. \(70 \text{ km}\)
   - Surface Area: 61,575.22 km\(^2\)
   - Volume: 50.27 in\(^2\)

6. \(2 \text{ in}\)
   - Surface Area: 50.27 in\(^2\)
   - Volume: 33.51 in\(^3\)

7. \(10 \text{ mm}\)
   - Surface Area: 1256.64 mm\(^2\)
   - Volume: 4188.79 mm\(^3\)

8. \(28 \text{ ft}\)
   - Surface Area: 2463.01 ft\(^2\)
   - Volume: 11,494.04 ft\(^3\)

9. \(100 \text{ mi}\)
   - Surface Area: 31,415.93 mi\(^2\)
   - Volume: 523,598.78 mi\(^3\)

10. \(60 \text{ ft}\)
    - Surface Area: 11,309.73 ft\(^2\)
    - Volume: 113,097.34 ft\(^3\)

11. \(5 \text{ cm}\)
    - Surface Area: 452.39 cm\(^2\)
    - Volume: 904.78 cm\(^3\)

12. \(400 \text{ m}\)
    - Surface Area: 502,654.82 m\(^2\)
    - Volume: 33,510,321.64 m\(^3\)
Skills Practice

12–7

Similarity of Solid Figures

Determine whether each pair of solids is similar.

1. yes

2. yes

3. yes

4. no

5. yes

6. no

Find the scale factor of the solid on the left to the solid on the right for each pair of similar solids. Then find the ratios of the surface areas and the volumes.

7. \[ \frac{2}{1} \cdot \frac{4}{1} \cdot \frac{8}{1} \]

8. \[ \frac{7}{8} \cdot \frac{49}{64} \cdot \frac{343}{512} \]
### Simplifying Square Roots

#### Simplify each expression.

<table>
<thead>
<tr>
<th>Expression</th>
<th>Simplified Form</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. (\sqrt{9})</td>
<td>3</td>
</tr>
<tr>
<td>2. (\sqrt{169})</td>
<td>13</td>
</tr>
<tr>
<td>3. (\sqrt{400})</td>
<td>20</td>
</tr>
<tr>
<td>4. (\sqrt{225})</td>
<td>15</td>
</tr>
<tr>
<td>5. (\sqrt{256})</td>
<td>16</td>
</tr>
<tr>
<td>6. (\sqrt{900})</td>
<td>30</td>
</tr>
<tr>
<td>7. (\sqrt{289})</td>
<td>17</td>
</tr>
<tr>
<td>8. (\sqrt{2500})</td>
<td>50</td>
</tr>
<tr>
<td>9. (\sqrt{44})</td>
<td>(2\sqrt{11})</td>
</tr>
<tr>
<td>10. (\sqrt{18})</td>
<td>(3\sqrt{2})</td>
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<tr>
<td>11. (\sqrt{75})</td>
<td>(5\sqrt{3})</td>
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<td>12. (\sqrt{300})</td>
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<td>15. (\sqrt{125})</td>
<td>(5\sqrt{5})</td>
</tr>
<tr>
<td>16. (\sqrt{80})</td>
<td>(4\sqrt{5})</td>
</tr>
<tr>
<td>17. (\sqrt{250})</td>
<td>(5\sqrt{10})</td>
</tr>
<tr>
<td>18. (\sqrt{12} \cdot \sqrt{5})</td>
<td>(2\sqrt{15})</td>
</tr>
<tr>
<td>19. (\sqrt{6} \cdot \sqrt{6})</td>
<td>6</td>
</tr>
<tr>
<td>20. (\sqrt{10} \cdot \sqrt{2})</td>
<td>(2\sqrt{5})</td>
</tr>
</tbody>
</table>

21. What is the square root of 625? **25**

22. Multiply \(\sqrt{17} \cdot \sqrt{3}\). **\(\sqrt{51}\)**

23. Write \(\sqrt{3} \cdot \sqrt{15}\) in simplest form. **\(3\sqrt{5}\)**
45°-45°-90° Triangles

Find the missing measures. Write all radicals in simplest form.

1. $x = 9, y = 9\sqrt{2}$
2. $x = 2, y = 2\sqrt{2}$
3. $x = 16, y = 16\sqrt{2}$
4. $x = \sqrt{2}, y = 1$
5. $x = 32\sqrt{2}, y = 32$
6. $x = 50\sqrt{2}, y = 50$
7. $x = 10, y = 10$
8. $x = 14, y = 14$
9. $x = 1, y = 1$
10. $x = 50, y = 50$
11. $x = 7\sqrt{2}, y = 14$
12. $x = 5, y = 5$
30°-60°-90° Triangles

Find the missing measures. Write all radicals in simplest form.

1. \( x = 10, \ y = 5\sqrt{3} \) 
2. \( x = 42, \ y = 21\sqrt{3} \) 
3. \( x = 18, \ y = 9\sqrt{3} \)

4. \( x = 17\sqrt{3}, \ y = 34 \)
5. \( x = 29\sqrt{3}, \ y = 58 \)
6. \( x = 15, \ y = 15\sqrt{3} \)

7. \( x = 21, \ y = 21\sqrt{3} \)
8. \( x = 22, \ y = 22\sqrt{3} \)
9. \( x = 13\sqrt{3}, \ y = 13 \)

10. \( x = 10, \ y = 20 \)
11. \( x = 19, \ y = 38 \)
12. \( x = 28, \ y = 14 \)

13. \( x = 4\sqrt{3}, \ y = 8\sqrt{3} \)
14. \( x = 11\sqrt{3}, \ y = 22\sqrt{3} \)
15. \( x = 16\sqrt{3}, \ y = 24 \)
13-4 Skills Practice

Tangent Ratio

Find each tangent. Round to four decimal places, if necessary.

1. \(\tan A\) \(1.3333\)
2. \(\tan Y\) \(0.5333\)
3. \(\tan S\) \(0.2917\)
4. \(\tan C\) \(0.75\)
5. \(\tan X\) \(1.875\)
6. \(\tan R\) \(3.4286\)

Find each missing measure. Round to the nearest tenth.

7. \(x\) cm
   
   26°

   30 cm

   14.6

8. \(x\) ft
   
   13 ft

   50°

   15.5

9. \(x\) in.
   
   20°

   19 in.

   6.9

10. \(x\) m
    
    48 m

    55°

    68.6

11. \(x\) ft
    
    30 ft

    60°

    26.6

12. \(x\)
    
    90 m

    30 m

    71.6

13. \(x\) yd
    
    5 yd

    5 yd

    45

14. \(x\) ft
    
    11 ft

    78°

    51.8

15. \(x\)
    
    12 m

    5 m

    22.6
Skills Practice

Sine and Cosine Ratios

Find each sine or cosine. Round to four decimal places, if necessary.

1. \( \sin B \) \( 0.3793 \)  
2. \( \cos C \) \( 0.3793 \)  
3. \( \cos B \) \( 0.8621 \)

4. \( \sin D \) \( 0.7143 \)  
5. \( \sin F \) \( 0.7143 \)  
6. \( \cos G \) \( 0.3500 \)

Find each missing measure. Round to the nearest tenth.

7. \( x \) ft \( 14.9 \)
8. \( x \) in. \( 71.6 \)
9. \( x \) cm \( 68.2 \)
10. \( x \) cm \( 3.1 \)
11. \( x \) m \( 52.0 \)
12. \( x \) in. \( 78.0 \)
13. \( x \) mm \( 55.7 \)
14. \( x \) km \( 35.5 \)
15. \( x \) ft \( 25.4 \)
14–1
Skills Practice

Inscribed Angles

Determine whether each angle is an inscribed angle. Name the intercepted arc for the angle.

1. \( \angle XMY \) no; \( XY \)
2. \( \angle RST \) yes; \( RT \)
3. \( \angle MCN \) no; \( MN \)

Find each measure.

4. \( m\angle EDA \) 55
5. \( m\overline{DE} \) 84
6. \( m\angle BDA \) 35
7. \( m\angle BDE \) 90
8. \( m\angle ZYW \) 35
9. \( m\overline{VZ} \) 90
10. \( m\angle XYV \) 25
11. \( m\overline{WY} \) 80
12. \( m\overline{XY} \) 70
13. \( m\angle XZY \) 35

Find the value of \( x \) in each circle.

14.

15.

16.

17.

18.

19.

Exercises 4–7
Exercises 8–13
Tangents to a Circle

Find each measure. Round to the nearest tenth if necessary. Assume segments that appear to be tangent are tangent.

1. $BC$

2. $DF$

3. $SR$

4. $m\angle BAC$

5. $m\angle ARC$

6. $EG$

7. $m\angle ZAY$

8. $FE$

9. $MR$

10. $BC$

11. $HG$

12. $m\angle XZY$
Secant Angles

Find each measure.

1. \(m \angle EFB\)
   \[
   \begin{array}{c}
   E \\
   F \\
   A \\
   D, 46^\circ \\
   C
   \end{array}
   \]
   \(E\) is 70°, \(B\) is 80°, \(A\) is 71°, \(C\) is 85°, \(P\) is 36°.
   \[m \angle EFB = 58\]

2. \(m \angle ABC\)
   \[
   \begin{array}{c}
   A \\
   C \quad P \\
   B
   \end{array}
   \]
   \(A\) is 28°, \(B\) is 110°, \(P\) is 36°.
   \[m \angle ABC = 22\]

3. \(m \angle LPM\)
   \[
   \begin{array}{c}
   K \quad O \\
   L \\
   P \quad M
   \end{array}
   \]
   \(L\) is 71°, \(P\) is 85°, \(O\) is 71°, \(N\) is 71°.
   \[m \angle LPM = 78\]

4. \(m \angle XYZ\)
   \[
   \begin{array}{c}
   X \\
   T \quad Y \\
   Z
   \end{array}
   \]
   \(X\) is 120°, \(T\) is 60°, \(Y\) is 110°.
   \[m \angle XYZ = 30\]

5. \(m \angle CED\)
   \[
   \begin{array}{c}
   A \quad E \quad C \\
   D \\
   B
   \end{array}
   \]
   \(A\) is 24°, \(E\) is 28°, \(C\) is 24°.
   \[m \angle CED = 26\]

6. \(m \overline{WZ}\)
   \[
   \begin{array}{c}
   X \\
   Y \\
   W \quad Z
   \end{array}
   \]
   \(X\) is 44°, \(Y\) is 45°, \(W\) is 45°.
   \[m \overline{WZ} = 36\]

7. \(m \overline{FE}\)
   \[
   \begin{array}{c}
   C \quad 90^\circ \\
   A \\
   D \quad 50^\circ \\
   E
   \end{array}
   \]
   \(C\) is 90°, \(A\) is 28°, \(D\) is 50°, \(E\) is 24°.
   \[m \overline{FE} = 10\]

8. \(m \overline{SQ}\)
   \[
   \begin{array}{c}
   R \quad 95^\circ \\
   S \\
   W \quad Q
   \end{array}
   \]
   \(R\) is 95°, \(S\) is 24°, \(W\) is 24°.
   \[m \overline{SQ} = 47\]

9. \(m \overline{AE}\)
   \[
   \begin{array}{c}
   C \quad 36^\circ \\
   A \\
   B \quad 70^\circ \\
   D \quad 36^\circ \\
   E
   \end{array}
   \]
   \(C\) is 36°, \(A\) is 70°, \(B\) is 70°.
   \[m \overline{AE} = 142\]

Find the value of \(x\) in each circle. Then find the given measure.

10. \(m \overline{BC}\)
   \[
   \begin{array}{c}
   A \quad 110^\circ \\
   E \\
   D \quad 9x^\circ \\
   C \quad 7x^\circ \\
   B
   \end{array}
   \]
   \(A\) is 110°, \(E\) is 9x°, \(C\) is 7x°, \(B\) is 7x°.
   \[10; 70\]

11. \(m \overline{HG}\)
   \[
   \begin{array}{c}
   E \quad 46^\circ \\
   F \\
   G
   \end{array}
   \]
   \(E\) is 46°, \(F\) is 7x°, \(G\) is (7x + 3)°.
   \[7; 52\]

12. \(m \overline{JL}\)
   \[
   \begin{array}{c}
   I \quad (4x + 2)^\circ \\
   J \quad 76^\circ \\
   K \quad (6x + 2)^\circ \\
   L \quad M
   \end{array}
   \]
   \(I\) is (4x + 2)°, \(J\) is 76°, \(K\) is (6x + 2)°.
   \[5; 32\]
Secant-Tangent Angles

Find the measure of each angle. Assume segments that appear to be tangent are tangent.

1. $\angle 1$

2. $\angle 2$

3. $\angle ABC$

4. $\angle 3$

5. $\angle 4$

6. $\angle XYZ$

7. $\angle 5$

8. $\angle 6$

9. $\angle CDE$

10. $\angle 7$

11. $\angle TUY$

12. $\angle 8$
Skills Practice

Segment Measures

Find the value of \( x \) in each circle. If necessary, round to the nearest tenth.

1. \[ \frac{3}{6} \quad \frac{7}{x} \]
2. \[ \frac{9}{6} \quad \frac{x}{9} \]
3. \[ \frac{15}{x} \quad \frac{x}{12} \quad \frac{18}{12} \]

4. \[ \frac{11}{4} \quad \frac{5}{x} \]
5. \[ \frac{6}{2} \quad \frac{x}{x} \]
6. \[ \frac{18}{x} \quad \frac{12}{10} \]

7. \[ \frac{12}{x} \quad \frac{x}{18} \]
8. \[ \frac{7}{9} \quad \frac{x}{x} \]
9. \[ \frac{6}{6} \quad \frac{24}{x} \]

Find each measure. If necessary, round to the nearest tenth.

10. \( DE \)

11. \( IH \)

12. \( WX \)
Skills Practice

Equations of Circles

Write an equation of a circle for each center and radius or diameter measure given.

1. \((1, 1), r = 2\)
   \((x - 1)^2 + (y - 1)^2 = 4\)

2. \((-3, 2), d = 2\)
   \((x + 3)^2 + (y - 2)^2 = 1\)

3. \((-1, -5), r = 3\)
   \((x + 1)^2 + (y + 5)^2 = 9\)

4. \((4, -3), d = 4\)
   \((x - 4)^2 + (y + 3)^2 = 4\)

5. \((0, 2), r = 4\)
   \(x^2 + (y - 2)^2 = 16\)

6. \((5, 0), r = 1\)
   \((x - 5)^2 + y^2 = 1\)

7. \((0, 0), r = 6\)
   \(x^2 + y^2 = 36\)

8. \((-1, 1), d = 6\)
   \((x + 1)^2 + (y - 1)^2 = 9\)

9. \((-5, 5), r = 5\)
   \((x + 5)^2 + (y - 5)^2 = 25\)

10. \((-3, 3), d = 20\)
   \((x + 3)^2 + (y - 3)^2 = 100\)

11. \((-6, -1), d = 10\)
    \((x + 6)^2 + (y + 1)^2 = 25\)

12. \((4, 4), d = 14\)
    \((x - 4)^2 + (y - 4)^2 = 49\)

13. \((3, 7), d = 2\sqrt{2}\)
    \((x - 3)^2 + (y - 7)^2 = 2\)

14. \((-5, 2), r = \sqrt{6}\)
    \((x - 5)^2 + (y - 2)^2 = 6\)

15. \((0, -2), r = \sqrt{10}\)
    \(x^2 + (y + 2)^2 = 10\)

16. \((7, 0), d = 2\sqrt{5}\)
    \((x - 7)^2 + y^2 = 5\)

Find the coordinates of the center and the measure of the radius for each circle whose equation is given.

17. \((x + 5)^2 + (y - 2)^2 = 49\)
    \((-5, 2), 7\)

18. \((x - 3)^2 + (y + 7)^2 = 100\)
    \((3, -7), 10\)

19. \((x + 1)^2 + (y + 8)^2 = 121\)
    \((-1, -8), 11\)

20. \(x^2 + y^2 = 64\)
    \((0, 0), 8\)

21. \(x^2 + (y + 9)^2 = 81\)
    \((0, -9), 9\)

22. \((x + 3)^2 + y^2 = 25\)
    \((-3, 0), 5\)

23. \((x - 6)^2 + (y + 6)^2 = 36\)
    \((6, -6), 6\)

24. \(x^2 + y^2 = 5\)
    \((0, 0), \sqrt{5}\)

25. \(x^2 + (y - 4)^2 = 7\)
    \((0, 4), \sqrt{7}\)

26. \((x - 1)^2 + (y + 1)^2 = 10\)
    \((1, -1), \sqrt{10}\)
Skills Practice

Logic and Truth Tables

For Exercises 1–16, use conditionals a, b, c and d.

\( a \): A triangle has three sides.
\( b \): January is a day of the week.
\( c \): \( 5 \times 5 = 20 \)
\( d \): Parallel lines do not intersect.

Write the statements for each negation.

1. \( \sim a \)
   A triangle does not have three sides.

2. \( \sim b \)
   January is not a day of the week.

3. \( \sim c \)
   \( 5 \times 5 \neq 20 \)

4. \( \sim d \)
   Parallel lines intersect.

Write a statement for each conjunction or disjunction. Then find the truth value.

5. \( a \lor b \) A triangle has three sides or January is a day of the week; true.
6. \( a \land b \) A triangle has three sides and January is a day of the week; false.
7. \( a \lor c \) A triangle has three sides or \( 5 \times 5 = 20 \); true.
8. \( a \land c \) A triangle has three sides and \( 5 \times 5 = 20 \); false.
9. \( a \lor d \) A triangle has three sides or parallel lines do not intersect; true.
10. \( a \land d \) A triangle has three sides and parallel lines do not intersect; true.
11. \( b \lor c \) January is a day of the week or \( 5 \times 5 = 20 \); false.
12. \( b \land c \) January is a day of the week and \( 5 \times 5 = 20 \); false.
13. \( b \lor d \) January is a day of the week or parallel lines do not intersect; true.
14. \( b \land d \) January is a day of the week and parallel lines do not intersect; false.
15. \( c \lor d \) \( 5 \times 5 = 20 \) or parallel lines do not intersect; true.
16. \( c \land d \) \( 5 \times 5 = 20 \) and parallel lines do not intersect; false.
Deductive Reasoning

Use the Law of Detachment to determine a conclusion that follows from statements (1) and (2). If a valid conclusion does not follow, write no valid conclusion.

1. (1) If a figure is a triangle, then it is a polygon.
(2) The figure is a triangle.
The figure is a polygon.

2. (1) If I sell my skis, then I will not be able to go skiing.
(2) I did not sell my skis.
no valid conclusion

3. (1) If two angles are complementary, then the sum of their measures is 90.
(2) Angle A and B are complementary.
The sum of the measures of angles A and B is 90.

4. (1) If the measures of the lengths of two sides of a triangle are equal, then the triangle is isosceles.
(2) Triangle ABC has two sides with lengths of equal measure.
Triangle ABC is isosceles.

5. (1) If it rains, we will not go on a picnic.
(2) We do not go on a picnic.
no valid conclusion

Use the Law of Syllogism to determine a conclusion that follows from statements (1) and (2). If a valid conclusion does not follow, write no valid conclusion.

6. (1) If my dog does not bark all night, I will give him a treat.
(2) If I give my dog a treat, then he will wag his tail.
If my dog does not bark all night, then he will wag his tail.

7. (1) If a polygon has three sides, then the figure is a triangle.
(2) If a figure is a triangle, then the sum of the measures of the interior angles is 180.
If a polygon has three sides, then the sum of the measures of the interior angles is 180.

8. (1) If the concert is postponed, then I will be out of town.
(2) If the concert is postponed, then it will be held in the gym.
no valid conclusion

9. (1) All whole numbers are rational numbers.
(2) All whole numbers are real numbers.
no valid conclusion

10. (1) If the temperature reaches 70°, then the swimming pool will open.
(2) If the swimming pool opens, then we will not go to the beach.
If the temperature reaches 70°, then we will not go to the beach.
Paragraph Proofs

Write a paragraph proof for each conjecture.

1. If \( \triangle ABD \) is an isosceles triangle with base \( \overline{BD} \) and \( C \) is the midpoint of \( \overline{BD} \), then \( \triangle ACD \cong \triangle ACB \).

If \( \triangle ABD \) is an isosceles triangle with base \( \overline{BD} \), then \( \overline{AD} \cong \overline{AB} \). If \( C \) is the midpoint of \( \overline{BD} \), then \( \overline{CD} \cong \overline{CB} \). \( AC \cong AC \) by the Reflexive Property, so \( \triangle ACD \cong \triangle ACB \) by SSS.

2. If lines \( a \) and \( b \) are parallel and \( WX \cong XY \), then \( \triangle WXS \cong \triangle YXZ \).

If lines \( a \) and \( b \) are parallel, then \( \angle SWX \cong \angle XYZ \) since they are alternate interior angles. \( \angle WXS \cong \angle YXZ \) since they are vertical angles. Then it is given that \( WX \cong XY \), so \( \triangle WXS \cong \triangle YXZ \) by ASA.

3. If \( ACDE \) is an isosceles trapezoid with bases \( \overline{AC} \) and \( \overline{ED} \), then \( \triangle AED \cong \triangle CDE \).

If \( ACDE \) is an isosceles trapezoid with bases \( \overline{AC} \) and \( \overline{ED} \), then the legs are congruent, so \( \overline{AE} \cong \overline{CD} \). Also, an isosceles trapezoid has congruent base angles, so \( \angle AED \cong \angle CDE \). Now, \( \overline{ED} \cong \overline{ED} \) by the Reflexive Property, so \( \triangle AED \cong \triangle CDE \) by SAS.

4. If \( RSTX \) is a rhombus, then \( \triangle RXT \cong \triangle RST \).

If \( RSTX \) is a rhombus, then \( RS \cong RX \) and \( XT \cong ST \). \( RT \cong RT \) by the Reflexive Property, so \( \triangle RXT \cong \triangle RST \) by SSS.
Preparing for Two-Column Proofs

Complete each proof.

1. If $m\angle 1 = m\angle 2$ and $m\angle 3 = m\angle 4$, then $m\angle ABC = m\angle ROD$.

   Given: $m\angle 1 = m\angle 2$, $m\angle 3 = m\angle 4$

   Prove: $m\angle ABC = m\angle ROD$

   Proof:

<table>
<thead>
<tr>
<th>Statements</th>
<th>Reasons</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. $m\angle 1 = m\angle 2$, $m\angle 3 = m\angle 4$</td>
<td>a. Given</td>
</tr>
<tr>
<td>b. $m\angle ABC = m\angle 1 + m\angle 3$</td>
<td>b. Angle Addition Postulate</td>
</tr>
<tr>
<td>$m\angle ROD = m\angle 2 + m\angle 4$</td>
<td></td>
</tr>
<tr>
<td>c. $m\angle 1 + m\angle 3 = m\angle 2 + m\angle 4$</td>
<td>c. Addition Property of Equality</td>
</tr>
<tr>
<td>d. $m\angle ABC = m\angle ROD$</td>
<td>d. Substitution Property of Equality</td>
</tr>
</tbody>
</table>

2. If $\frac{7x}{6} = 14$, then $x = 12$.

   Given: $\frac{7x}{6} = 14$

   Prove: $x = 12$

   Proof:

<table>
<thead>
<tr>
<th>Statements</th>
<th>Reasons</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. $\frac{7x}{6} = 14$</td>
<td>a. Given</td>
</tr>
<tr>
<td>b. $7x = 84$</td>
<td>b. Multiplication Property of Equality</td>
</tr>
<tr>
<td>c. $x = 12$</td>
<td>c. Division Property of Equality</td>
</tr>
</tbody>
</table>

3. If $\triangle ABC$ is a right triangle with $\angle C$ a right angle and $m\angle A = m\angle B$, then $m\angle A = 45$.

   Given: $\triangle ABC$ is a right triangle with $\angle C$ a right angle and $m\angle A = m\angle B$.

   Prove: $m\angle A = 45$

   Proof:

<table>
<thead>
<tr>
<th>Statements</th>
<th>Reasons</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. $\triangle ABC$ is a right triangle with $\angle C$ a right angle and $m\angle A = m\angle B$</td>
<td>a. Given</td>
</tr>
<tr>
<td>b. $m\angle A + m\angle B + m\angle C = 180$</td>
<td>b. Angle Sum Theorem</td>
</tr>
<tr>
<td>c. $m\angle C = 90$</td>
<td>c. Definition of Right Angle</td>
</tr>
<tr>
<td>d. $m\angle A + m\angle B = 90$</td>
<td>d. Subtraction Property of Equality</td>
</tr>
<tr>
<td>e. $m\angle A + m\angle A = 90$</td>
<td>e. Substitution Property of Equality</td>
</tr>
<tr>
<td>f. $2m\angle A = 90$</td>
<td>f. Substitution Property of Equality</td>
</tr>
<tr>
<td>g. $m\angle A = 45$</td>
<td>g. Division Property of Equality</td>
</tr>
</tbody>
</table>
### Two-Column Proofs

Write a two-column proof.

1. **Given:** $\triangle ITC$ is an isosceles triangle with base $IC$, $TS$ bisects $\angle ITC$  
   **Prove:** $IS \cong CS$  
   **Proof:**

<table>
<thead>
<tr>
<th>Statements</th>
<th>Sample Answer:</th>
<th>Reasons</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. $\triangle ITC$ is an isosceles triangle with base $IC$.</td>
<td>a. Given</td>
<td></td>
</tr>
<tr>
<td>b. $TS$ bisects $\angle ITC$</td>
<td>b. Given</td>
<td></td>
</tr>
<tr>
<td>c. $IT \cong CT$</td>
<td>c. Definition of isosceles triangle</td>
<td></td>
</tr>
<tr>
<td>d. $\angle ITS \cong \angle CTS$</td>
<td>d. Definition of angle bisector</td>
<td></td>
</tr>
<tr>
<td>e. $ST \cong ST$</td>
<td>e. Reflexive Property</td>
<td></td>
</tr>
<tr>
<td>f. $\triangle ITS \cong \triangle CTS$</td>
<td>f. SAS</td>
<td></td>
</tr>
<tr>
<td>g. $IS \cong CS$</td>
<td>g. CPCTC</td>
<td></td>
</tr>
</tbody>
</table>

2. **Given:** $ABCD$ is a square.  
   **Prove:** $AC \cong BD$  
   **Proof:**

<table>
<thead>
<tr>
<th>Statements</th>
<th>Sample Answer:</th>
<th>Reasons</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. $ABCD$ is a square.</td>
<td>a. Given</td>
<td></td>
</tr>
<tr>
<td>b. $AD \cong BC$</td>
<td>b. Definition of a square</td>
<td></td>
</tr>
<tr>
<td>c. $\angle ADC$ and $\angle BCD$ are right angles.</td>
<td>c. Definition of a square</td>
<td></td>
</tr>
<tr>
<td>d. $\angle ADC \cong \angle BCD$</td>
<td>d. Definition of congruent angles</td>
<td></td>
</tr>
<tr>
<td>e. $DC \cong DC$</td>
<td>e. Reflexive Property</td>
<td></td>
</tr>
<tr>
<td>f. $\triangle ADC \cong \triangle BCD$</td>
<td>f. SAS</td>
<td></td>
</tr>
<tr>
<td>g. $AC \cong BD$</td>
<td>g. CPCTC</td>
<td></td>
</tr>
</tbody>
</table>
Position and label each figure on a coordinate plane. 1–5. Sample answers given.

1. a square with sides $m$ units long

2. a right triangle with legs $p$ and $r$ units long

3. a rhombus with sides $c$ units long

4. an isosceles triangle with base $d$ units long and heights $s$ units long

5. a rectangle with length $x$ units and width $y$ units
Skills Practice

Solving Systems of Equations by Graphing

Solve each system of equations by graphing.

1. \( y = x \)
   \( y = -x + 2 \)  
   \((1, 1)\)

2. \( y = 2x + 4 \)
   \( y = -x + 1 \)  
   \((-1, 2)\)

3. \( y = x - 1 \)
   \( y = -x - 5 \)  
   \((-2, -3)\)

4. \( y = x - 5 \)
   \( y = -x + 1 \)  
   \((3, -2)\)

5. \( y = x + 4 \)
   \( y = -x - 2 \)  
   \((-3, 1)\)

6. \( y = -x \)
   \( y = -3x + 4 \)  
   \((2, -2)\)

7. \( y = 2x + 1 \)
   \( y = 3x + 2 \)  
   \((-1, -1)\)

8. \( y = x - 6 \)
   \( y = -2x + 6 \)  
   \((4, -2)\)

9. \( y = x - 1 \)
   \( y = -x + 5 \)  
   \((3, 2)\)

10. \( y = x + 5 \)
    \( y = -3x + 1 \)  
    \((-1, 4)\)

11. \( y = x + 1 \)
    \( y = 2x + 4 \)  
    \((-3, -2)\)

12. \( y = -x + 1 \)
    \( y = -2x + 5 \)  
    \((4, -3)\)
Skills Practice

Solving Systems of Equations by Using Algebra

Use substitution to solve each system of equations.

1. \( y = 7 \)
   \( x + 2y = 5 \)
   \((7, -1)\)

2. \( y = -3 \)
   \( x - y = 8 \)
   \((5, -3)\)

3. \( y = x \)
   \( 2x + y = 15 \)
   \((5, 5)\)

4. \( y = x - 7 \)
   \( 2x + 3y = 19 \)
   \((8, 1)\)

5. \( y = x + 2 \)
   \( 3x - 2y = -4 \)
   \((0, 2)\)

6. \( y = x - 1 \)
   \( 4x - 3y = 4 \)
   \((1, 0)\)

7. \( 3x + y = 2 \)
   \( 2x + 2y = 8 \)
   \((-1, 5)\)

8. \( -2x + y = 0 \)
   \( 3x - y = 4 \)
   \((4, 8)\)

9. \( 4x + y = -13 \)
   \( 2x - 3y = -11 \)
   \((-2, -5)\)

Use elimination to solve each system of equations.

10. \( x + y = 7 \)
    \( x - y = 1 \)
    \((4, 3)\)

11. \( x + y = 4 \)
    \( 2x - y = -13 \)
    \((-3, 7)\)

12. \( x + y = -3 \)
    \( 3x - y = -5 \)
    \((-2, -1)\)

13. \( x - y = 5 \)
    \( 2x + y = 4 \)
    \((3, -2)\)

14. \( x - y = -2 \)
    \( -2x + y = -1 \)
    \((3, 5)\)

15. \( x + y = 2 \)
    \( -3x - y = -4 \)
    \((1, 1)\)
Find the coordinates of the vertices of each figure after the given translation. Then graph the translation image.

1. (3, 4)  
2. (−2, 3)  
3. (1, 5)

4. (3, −2)  
5. (−3, −1)  
6. (4, 0)

7. (0, −3)  
8. (−2, −4)  
9. (−5, 0)

A′(0, 2), B′(2, 3), 
C′(1, 5)

Q′(−1, 4), U′(2, 2), 
A′(2, 0), D′(−1, 1)

D′(−2, 4), E′(0, 5), 
F′(−1, 1)

T′(0, 2), R′(2, 2), 
A′(2, −1), P′(0, 0)

G′(1, 3), H′(0, 0), 
A′(−3, 1)

A′(0, 2), B′(3, 4), 
C′(3, −4), D′(1, −3)

M′(−1, 1), N′(3, 0), 
P′(−3, −2)

R′(0, 1), S′(2, 0), 
T′(1, −3), V′(−2, −4)

X′(0, 4), Y′(0, 1), 
Z′(−4, 1)
Skills Practice

Reflections

Find the coordinates of the vertices of each figure after a reflection over the given axis. Then graph the reflection image.

1. \(x\)-axis
   \[A'(\text{-2}, \text{-3}), B'(3, \text{-4}), C'(2, \text{-1})\]

2. \(y\)-axis
   \[X'(\text{-3}, 4), Y'(\text{-4}, 1), Z'(\text{-1}, 1)\]

3. \(x\)-axis
   \[D'(\text{-2}, \text{-3}), E'(2, \text{-4}), F'(4, \text{-2}), G'(\text{-3}, \text{-1})\]

4. \(y\)-axis
   \[J'(\text{-4}, 4), K'(\text{-4}, \text{-4}), M'(\text{-2}, \text{-2}), I'(\text{-2}, 2)\]

5. \(x\)-axis
   \[P'(\text{-2}, \text{-1}), Q'(1, \text{-3}), R'(4, \text{-2})\]

6. \(y\)-axis
   \[R'(\text{-2}, 2), X'(\text{-4}, -1), T'(\text{-1}, -3)\]

7. \(x\)-axis
   \[W'(\text{-1}, \text{-3}), X'(3, \text{-4}), Y'(\text{4}, \text{-1}), Z'(\text{-2}, 0)\]

8. \(y\)-axis
   \[B'(\text{-1}, 4), C'(\text{-4}, 3), D'(\text{-3}, 1), E'(0, 2)\]

9. \(x\)-axis
   \[D'(3, \text{-4}), E'(2, 0), F'(\text{-2}, -3)\]
**Rotations**

Find the coordinates of the vertices of each figure after the given rotation about the origin. Then graph the rotation image.

1. 90° counterclockwise

![Diagram 1](image1)

**A**′(−1, 1), **B**′(−2, 4)

2. 90° clockwise

![Diagram 2](image2)

**S**′(1, 1), **R**′(4, 3)

3. 180° counterclockwise

![Diagram 3](image3)

**C**′(−1, −1), **D**′(−4, −3)

4. 180° clockwise

![Diagram 4](image4)

**E**′(−2, 1), **F**′(−3, 4)

5. 90° counterclockwise

![Diagram 5](image5)

**G**′(−2, 1), **H**′(−1, 3), **I**′(0, 0)

6. 90° clockwise

![Diagram 6](image6)

**J**′(4, −2), **K**′(1, −4), **M**′(0, 0)

7. 180° clockwise

![Diagram 7](image7)

**N**′(−2, −3), **P**′(−4, −1), **Q**′(0, 0)

8. 90° counterclockwise

![Diagram 8](image8)

**Q**′(−4, −2), **R**′(0, 0), **S**′(−2, −4)

9. 90° clockwise

![Diagram 9](image9)

**T**′(0, 0), **W**′(−3, −3), **X**′(−4, −1)
Dilations

Find the coordinates of the dilation image for the given scale factor \( k \), and graph the dilation image.

1. \( \frac{1}{2} \)

\[ A'(1, 1), B'(2, 3) \]

2. \( 2 \)

\[ Y'(2, 4), Z'(6, 8) \]

3. \( \frac{1}{3} \)

\[ C'(1, 2), D'(2, 3) \]

4. \( 4 \)

\[ A'(0, 8), C'(8, 8) \]

\[ E'(8, 0), G'(0, 0) \]

5. \( 2 \)

\[ T'(-2, 6), R'(0, 0), I'(-6, 2) \]

6. \( \frac{1}{4} \)

\[ A'(-2, 2), X'(0, 1), E'(-1, 0) \]

7. \( \frac{1}{2} \)

\[ F(1, -1), M(3, -2), T'(2, -3) \]

8. \( \frac{2}{3} \)

\[ A'(0, 6), B'(0, 0), C'(-2, 4) \]

9. \( 2 \)

\[ R'(-2, 4), S'(2, 6), T'(4, -2) \]