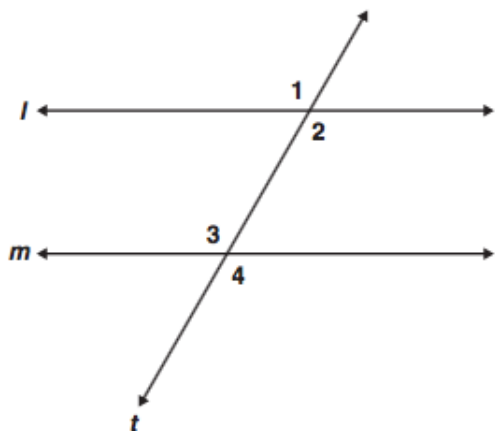In the diagram below, $\angle 1 \cong \angle 4$.

What conclusion(s) can be made?

Consider the arguments below.

I. Every multiple of 4 is even. 376 is a multiple of 4. Therefore, 376 is even.

II. A number can be written as a repeating decimal if it is rational. Pi cannot be written as a repeating decimal. Therefore, pi is not rational.
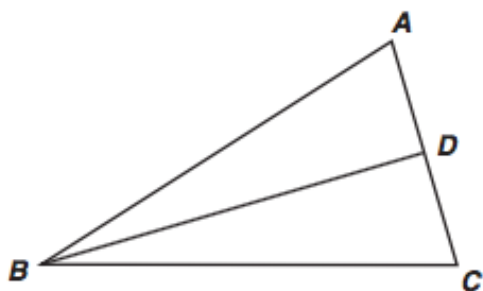
Which one(s), if any, use deductive reasoning?
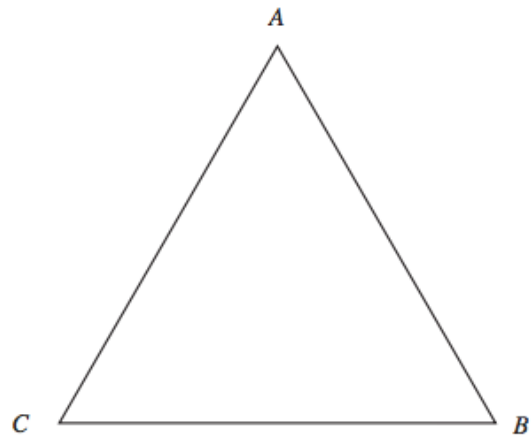
Theorem: A triangle has at most one obtuse angle.

Eduardo is proving the theorem above by contradiction. He began by assuming that in $\triangle ABC$, $\angle A$ and $\angle B$ are both obtuse. Which theorem will Eduardo use to reach a contradiction?

Given: $\overline{AB} \cong \overline{BC}$; D is the midpoint of $\overline{AC}$
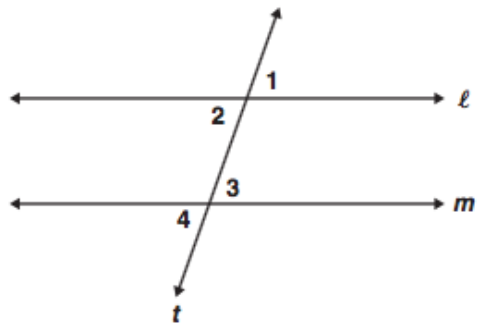Prove: $\triangle ABD \cong \triangle CBD$

In the figure below, $AB > BC$.

If we assume that $m\angle A = m\angle C$, it follows that $AB = BC$. This contradicts the given statement that $AB > BC$. What conclusion can be drawn from this contradiction?
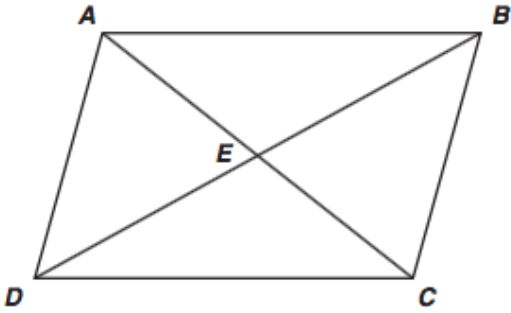
Given: $\angle 2 \cong \angle 3$

Prove: $\angle 1 \cong \angle 4$

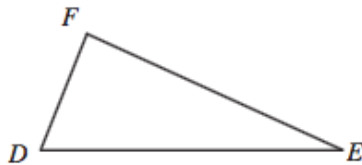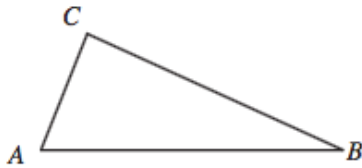Which figure can serve as a counterexample to the conjecture below?

If one pair of opposite sides of a quadrilateral is parallel, then the quadrilateral is a parallelogram.
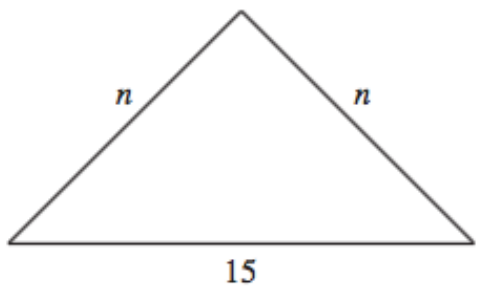
Parallelogram *ABCD* **is shown below.**

Which pair of triangles can be established to be congruent to prove that $\angle DAB \cong \angle BCD$ **?**

In the figure below, $\overline{AC} \cong \overline{DF}$ **and** $\angle A \cong \angle D.$
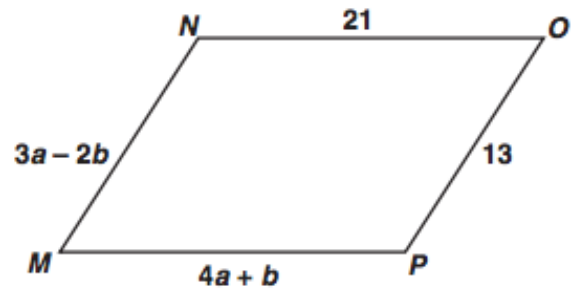

Which additional information would be enough to prove that $\triangle ABC \cong \triangle DEF$ **?**
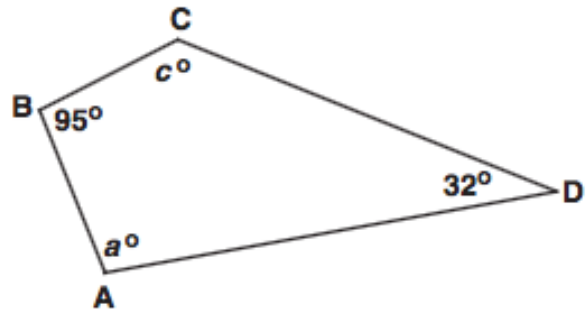
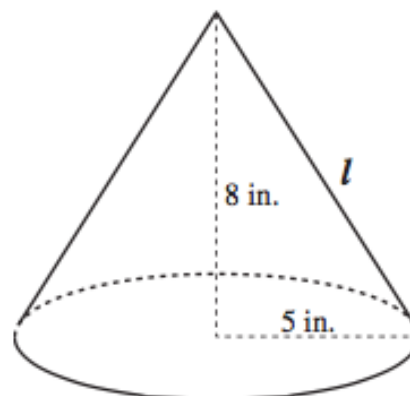**In the figure below,** *n* **is a whole number. What is the** *smallest* **possible value for** *n* **?**

What values of *a* and *b* make quadrilateral *MNOP* a parallelogram?

N ——— 21 ——— O

3a − 2b

M

4a + b

13

P

For the quadrilateral shown below, what is $m\angle a + m\angle c$?
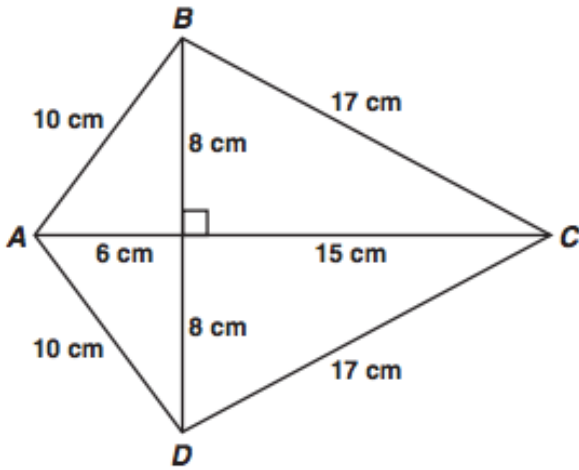
C

c°

B 95°

32° D

a°

A

A right circular cone has radius 5 inches and height 8 inches.

8 in.

l

5 in.

What is the lateral area of the cone? (Lateral area of cone = $\pi r l$, where l = slant height)
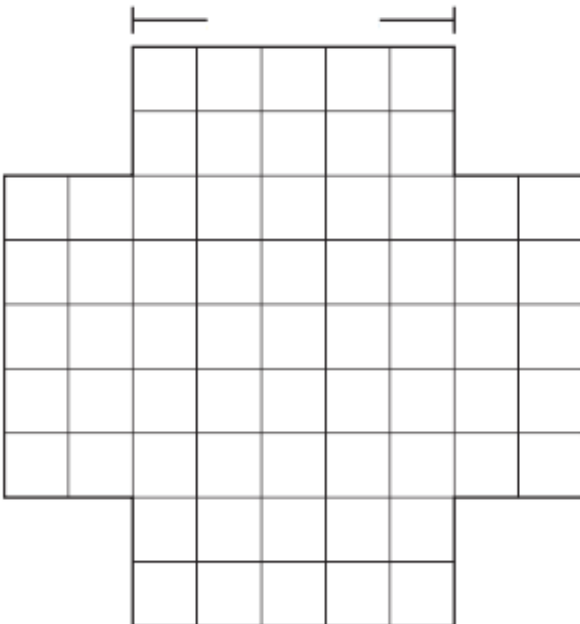
Figure *ABCD* is a kite.

What is the area of figure *ABCD*, in square centimeters?

If a cylindrical barrel measures 22 inches in diameter, how many inches will it roll in 8 revolutions along a smooth surface?

The four sides of this figure will be folded up and taped to make an open box.



What will be the volume of the box?

A sewing club is making a quilt consisting of 25 squares with each side of the square measuring 30 centimeters. If the quilt has five rows and five columns, what is the perimeter of the quilt?

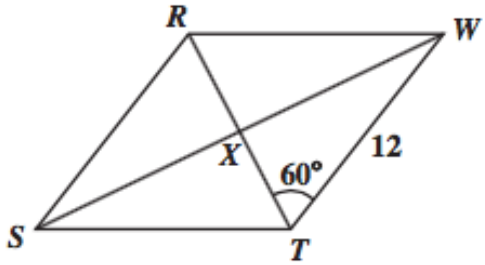A classroom globe has a diameter of 18 inches.

Which of the following is the approximate surface area, in square inches, of the globe? $\left(\text{Surface Area} = 4\pi r^2\right)$

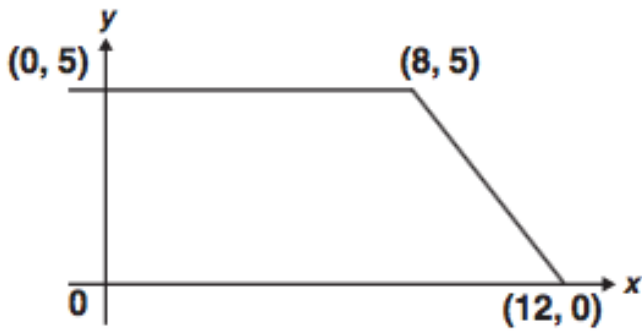The rectangle shown below has length 20 meters and width 10 meters.
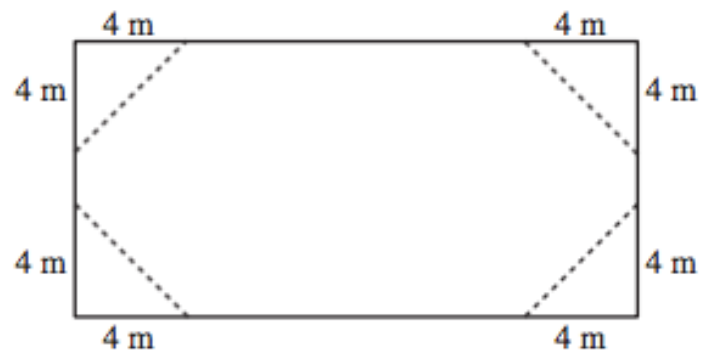
If four triangles are removed from the rectangle as shown, what will be the area of the remaining figure?

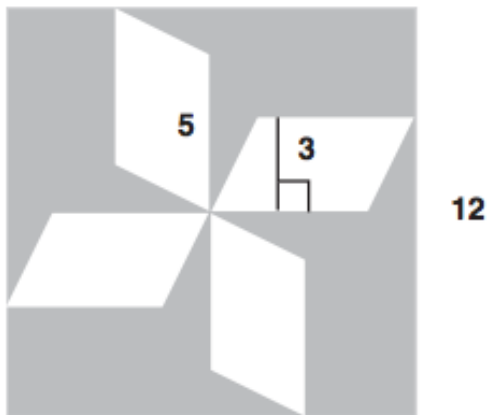If *RSTW* is a rhombus, what is the area of △*WXT*?

What is the area, in square units, of the trapezoid shown below?
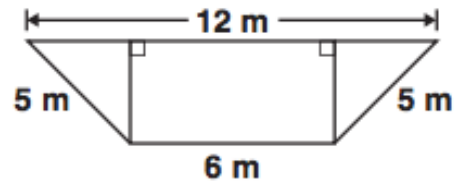

The figure below is a square with four congruent parallelograms inside.

What is the area, in square units, of the shaded portion?

The perimeters of two squares are in a ratio of 4 to 9. What is the ratio between the areas of the two squares?
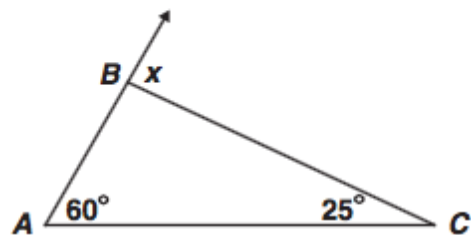
What is the area, in square meters (m), of the trapezoid shown below?

12 m

5 m   5 m

6 m

What is the area, in square inches (in.), of the triangle below?

10 in.   10 in.

10 in.

What is $m\angle x$?

B x

A 60°   25° C
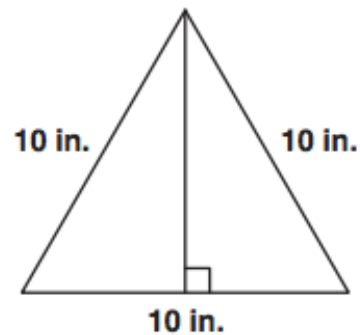
The sum of the interior angles of a polygon is the same as the sum of its exterior angles. What type of polygon is it?

If the measure of an exterior angle of a regular polygon is 120°, how many sides does the polygon have?

Two angles of a triangle have measures of 55° and 65°. Which of the following could *not* be a measure of an exterior angle of the triangle?

Trapezoid *ABCD* below is to be translated to trapezoid *A'B'C'D'* by the following motion rule.

$$(x, y) \rightarrow (x+3, y-4)$$
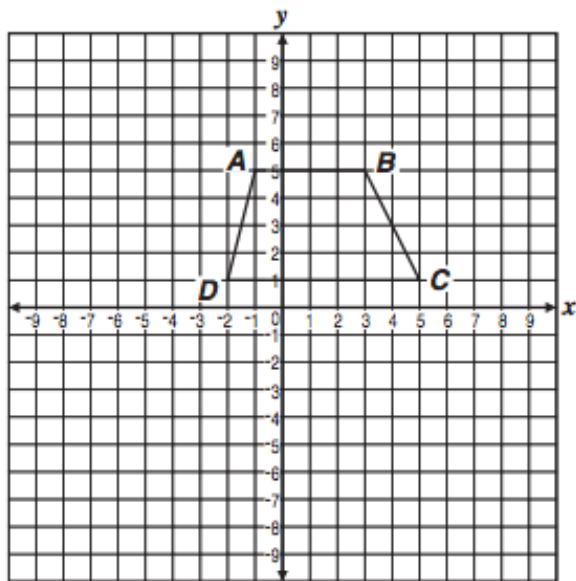
What will be the coordinates of vertex *C'*?

If triangle *ABC* is rotated 180 degrees about the origin, what are the coordinates of *A'*?
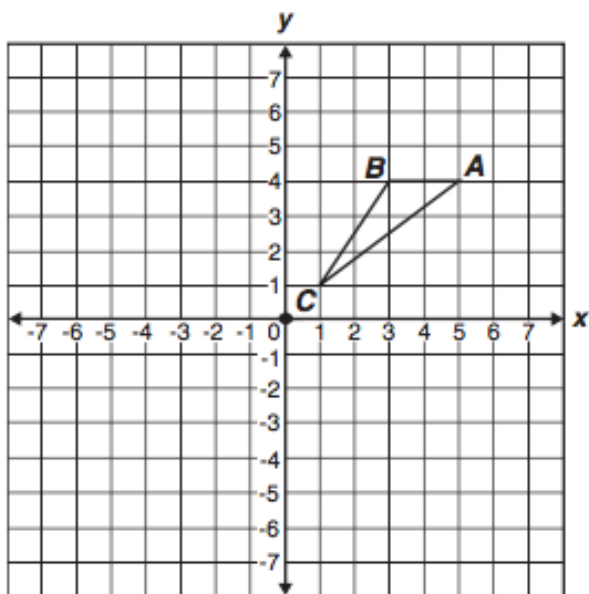
The vertices of △*ABC* are *A*(2, 1), *B*(3, 4), and *C*(1, 3). If △*ABC* is translated 1 unit down and 3 units to the left to create △*DEF*, what are the coordinates of the vertices of △*DEF*?

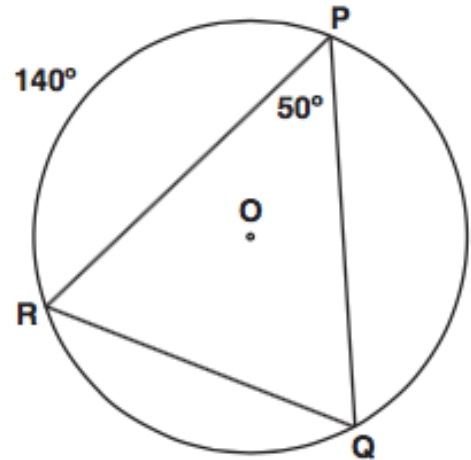In the circle shown below, the measure of $\overset{\frown}{PR} = 140°$ and the measure of $\angle RPQ = 50°$.

What is the measure of $\overset{\frown}{PQ}$?

Approximately how many feet tall is the streetlight?
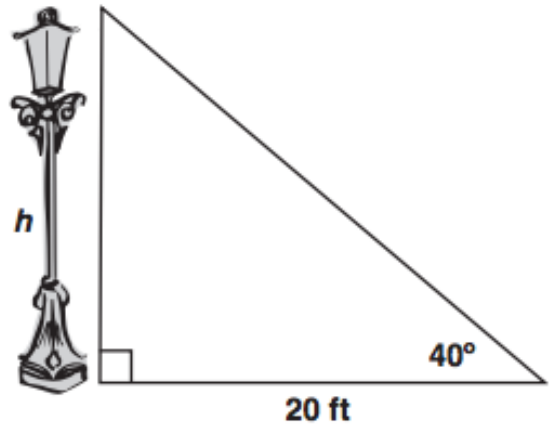
Right triangle ABC is pictured below.

Which equation gives the correct value for BC?

Triangle *JKL* is shown below.
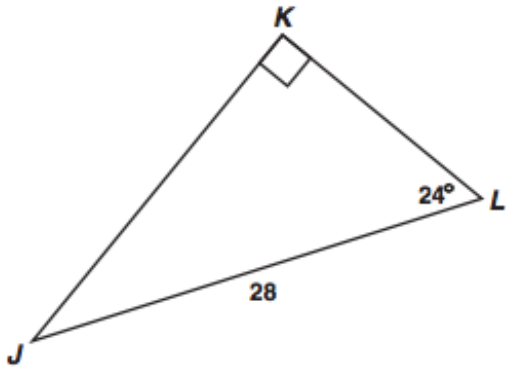
Which equation should be used to find the length of $\overline{JK}$?
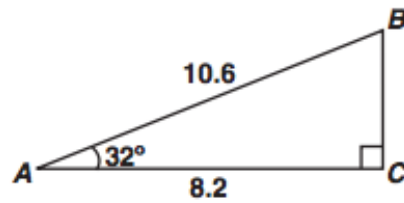
What is the approximate height, in feet, of the tree in the figure below?
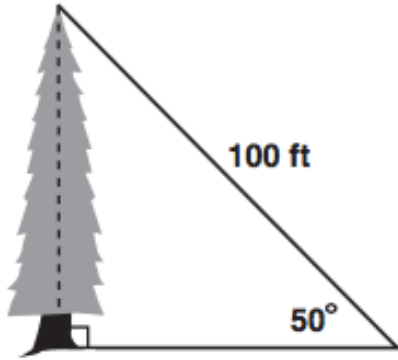
If $a = 3\sqrt{3}$ in the right triangle below, what is the value of b?
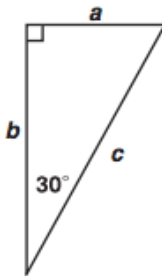
The measures of the interior angles of a pentagon are $2x, 6x, 4x - 6, 2x - 16$, and $6x + 2$. What is the measure, in degrees, of the largest angle?

A new pipeline is being constructed to re-route its oil flow around the exterior of a national wildlife preserve. The plan showing the old pipeline and the new route is shown below.
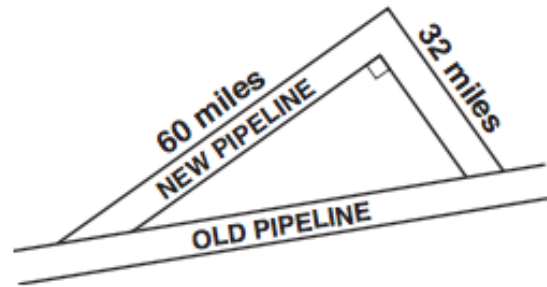
About how many extra miles will the oil flow once the new route is established?

What is $m\angle 1$?
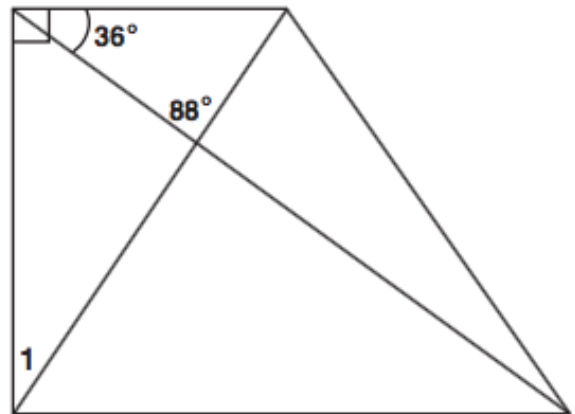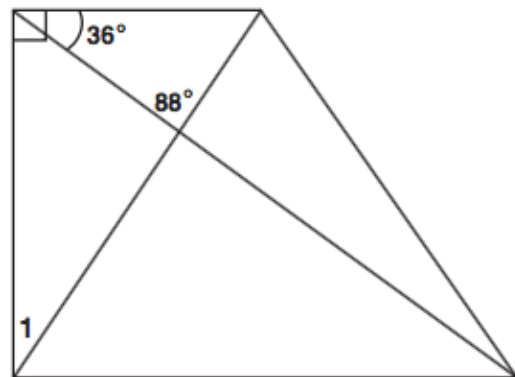
In the circle below, $\overline{AB}$ and $\overline{CD}$ are chords intersecting at E.
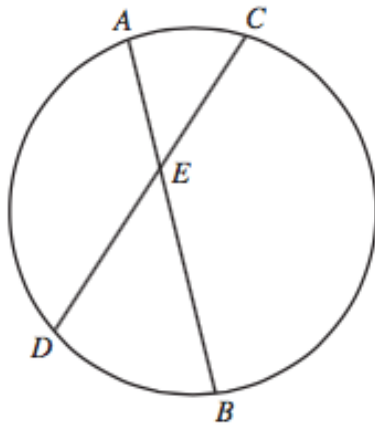
If $AE = 5$, $BE = 12$, and $CE = 6$, what is the length of $\overline{DE}$?

A square is circumscribed about a circle. What is the ratio of the area of the circle to the area of the square?

What is the value of x, in inches?

30°

7 in.

x
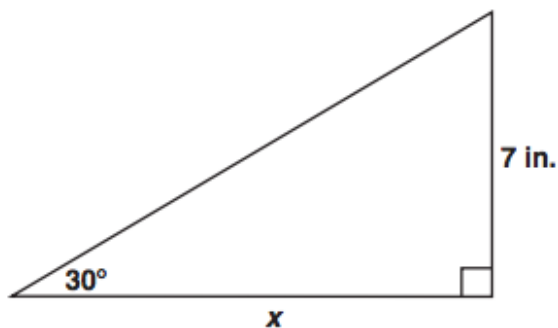
The point $(-3, 2)$ lies on a circle whose equation is $(x + 3)^2 + (y + 1)^2 = r^2$. Which of the following must be the radius of the circle?

What is the value of x in the triangle below?

```
        10
  B _____ C
    \         /
   x \       / x
      \  ◇  /
       \ / 
        A
```
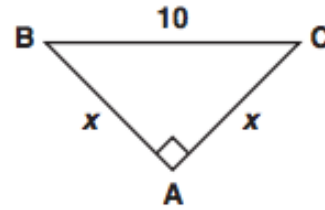
The diagram shows an 8-foot ladder leaning against a wall. The ladder makes a 53° angle with the wall. Which is closest to the distance up the wall the ladder reaches?

```
                  53°
          8 ft
                      ?
```
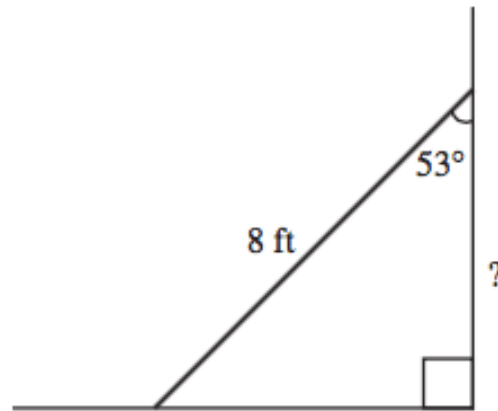
What type of triangle is formed by the points $A(4,2)$, $B(6,-1)$, and $C(-1,3)$?

```
  C
  |\
  | \
21|  \
  |   \
  |_____ A
  B
```
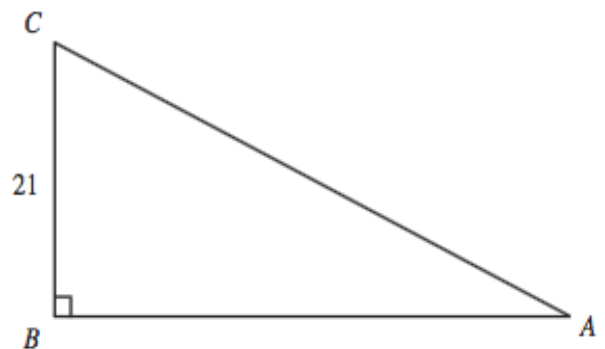
What is the length of $\overline{AC}$?

In the figure below, if $\sin x = \dfrac{5}{13}$, what are $\cos x$ and $\tan x$?

Figure *ABCO* is a parallelogram.

What are the coordinates of the point of intersection of the diagonals?

Scott is constructing a line perpendicular to line *l* from point *P*. Which of the following should be his first step?

What is the measure of an exterior angle of a regular hexagon?

Which triangle can be constructed using the following steps?

1. Put the tip of the compass on point A.

2. Open the compass so that the pencil tip is on point B.

3. Draw an arc above $\overline{AB}$.
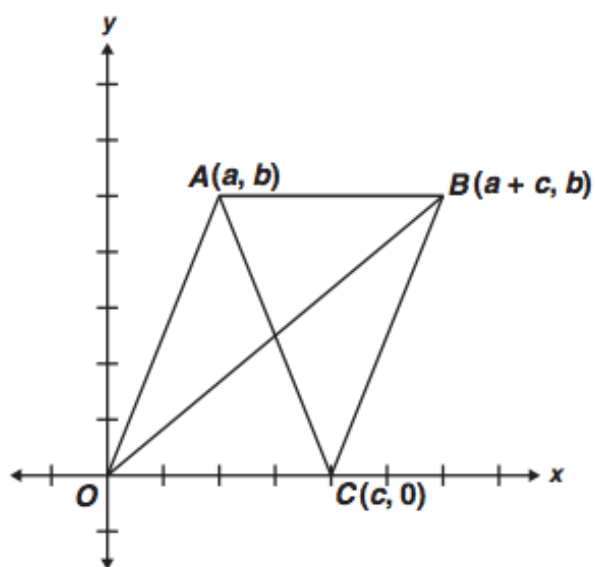
4. Without changing the opening, put the metal tip on point B and draw an arc intersecting the first arc at point C.

5. Draw $\overline{AC}$ and $\overline{BC}$.
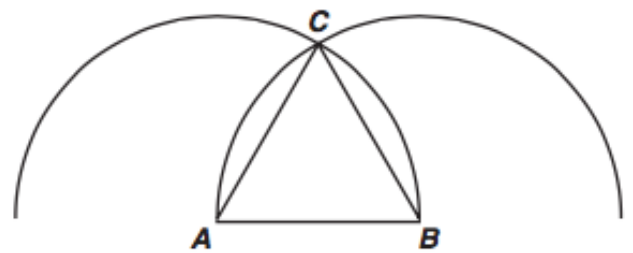
Given: angle A

What is the first step in constructing the angle bisector of angle A?
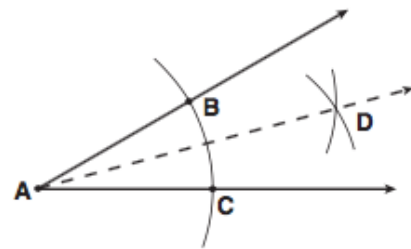
A right triangle's hypotenuse has length 5. If one leg has length 2, what is the length of the other leg?

1. Express the ratio $\frac{9}{12}$ in simplest form.

2. Find the value of x if: **a.** $\frac{7}{8} = \frac{x}{12}$ **b.** $\frac{9}{x+1} = \frac{6}{x}$

3. If $\triangle ABC \sim \triangle DEF$, then $\angle B \cong \underline{\ ?\ }$ and $\frac{AB}{DE} = \frac{?}{DF}$.

4. If $\frac{a}{b} = \frac{4}{9}$, then:

    a. $\frac{a}{4} = \frac{?}{?}$ **b.** $\frac{a+b}{b} = \frac{?}{?}$ **c.** $\frac{3a}{4} = \frac{?}{9}$

5. $ABCD$ and $EFGH$ are squares with $AB = 3$ and $EF = 5$. Find, in simplest form, the ratio of:
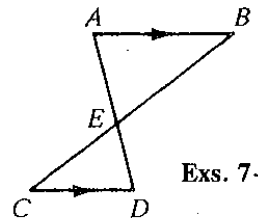   **a.** the length of a side of $ABCD$ to its perimeter
    b. the perimeter of $ABCD$ to the perimeter of $EFGH$

6. The ratio of the measures of the angles of a triangle is $1:4:7$. Find the measure of the largest angle.

7. What postulate or theorem justifies the statement $\triangle ABE \sim \triangle DCE$?

8. **a.** $\frac{AE}{DE} = \frac{BE}{?}$ **b.** $\frac{AE}{AB} = \frac{DE}{?}$

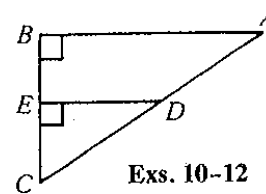9. The scale factor $\triangle AEB$ to $\triangle DEC$ is $5:2$. If $DE = 7$, then $AE = \underline{\ ?\ }$.

Exs. 7–9

10. What postulate or theorem justifies each statement?
    a. $\overleftrightarrow{AB} \parallel \overleftrightarrow{DE}$ **b.** $\frac{CD}{DA} = \frac{CE}{EB}$

11. If $CD = 4$, $DA = 3$, and $DE = 3$, then $AB = \underline{\ ?\ }$.

12. If $CB = 12$, $EB = 8$, and $CD = 6$, then $DA = \underline{\ ?\ }$.
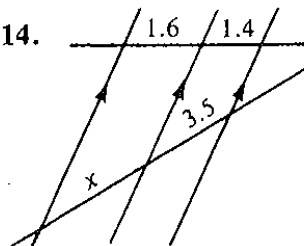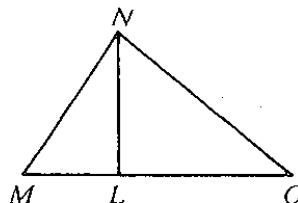

Exs. 10–12

Find the value of x.

13.
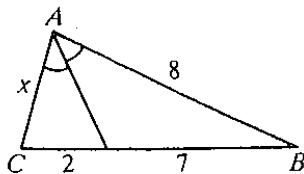
14.

15. Given: $\overline{MN} \perp \overline{NO}$; $\overline{MO} \perp \overline{LN}$
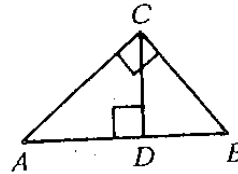   Prove: $MN \cdot LN = ML \cdot NO$

Find the geometric mean between the numbers.

1. 8 and 18

2. 9 and 80

3. Simplify the radical expressions.

    a. $\sqrt{75}$

    b. $\dfrac{2}{\sqrt{3}}$

In the diagram, $\angle ACB$ is a right angle and $\overline{CD} \perp \overline{AB}$.

4. $\triangle ADC \sim \triangle \underline{\ ?\ }$, and $\triangle ADC \sim \triangle \underline{\ ?\ }$.

5. CD is the geometric mean between $\underline{\ ?\ }$ and $\underline{\ ?\ }$.

6. CB is the geometric mean between $\underline{\ ?\ }$ and $\underline{\ ?\ }$.

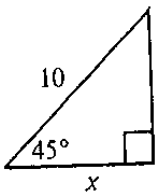**7.** If $AD = 9$ and $CD = 6$, then $DB = \underline{\ ?\ }$.

Exs. 4–7

Tell whether a triangle formed with sides having the lengths named is acute, obtuse, or right. If a triangle can't be formed, write *not possible*.

8. 2, 7, 10

9. 6, 6, 2

10. 5, 12, 13

11. 5, 8, 15
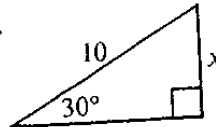
Find the value of x.

12.

13.
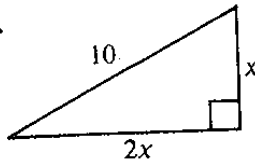
14.

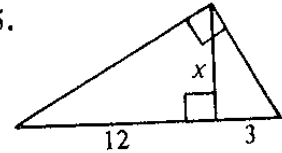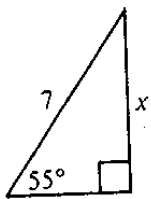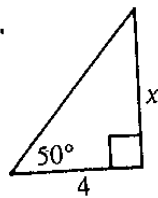**15.**

For Exercises 16–23 find angle measures and lengths correct to the nearest integer.

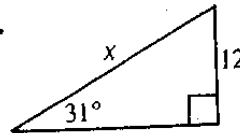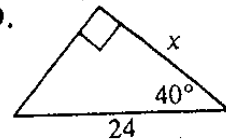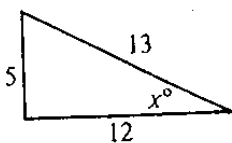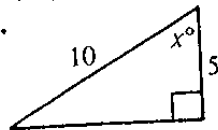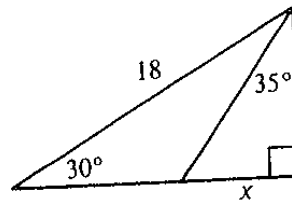**16.**

17.

18.

19.

20.

21.

22.

23. A building casts a shadow 40 ft long when the sun's angle of elevation is 58°. Find the height of the building.

In the diagram, $\overleftrightarrow{DA} \perp \overleftrightarrow{AB}$.

1. Name a chord that is not a diameter.
2. Name a diameter.
3. Name a radius.
4. Name a tangent.
5. Name a secant.
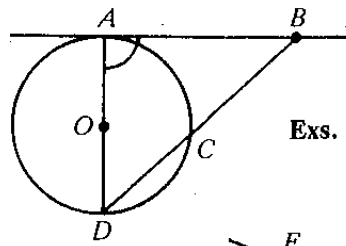
$\overrightarrow{CA}$ and $\overrightarrow{CB}$ are tangent to $\odot O$.

6. $m \angle AOB = \underline{\quad?\quad}$
7. $m \angle ADB = \underline{\quad?\quad}$
8. $m \angle ACB = \underline{\quad?\quad}$
9. $m \angle EAD = \underline{\quad?\quad}$
10. If $m \angle AEB = 20$, then $m \angle AFB = \underline{\quad?\quad}$.
11. If $m\overset{\frown}{AB} = 95$ and $m\overset{\frown}{EF} = 25$, then $m \angle AGB = \underline{\quad?\quad}$.
12. If $m\overset{\frown}{AB} = 70$ and $m\overset{\frown}{EF} = 30$, then $m \angle AHB = \underline{\quad?\quad}$.
13. If $m\overset{\frown}{AB} = 85$ and $m \angle EHF = 59$, then $m\overset{\frown}{EF} = \underline{\quad?\quad}$.

Exs. 1–5

Exs. 6–9
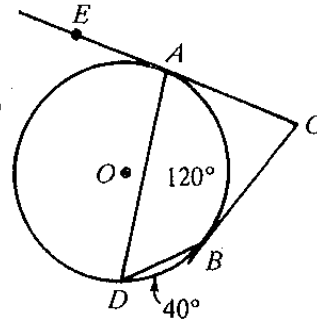
Exs. 10–13
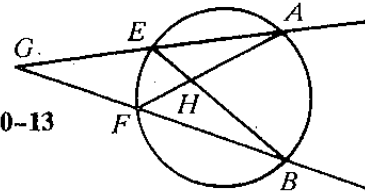
For Exercises 14–17 find the value of x.

14.

15.
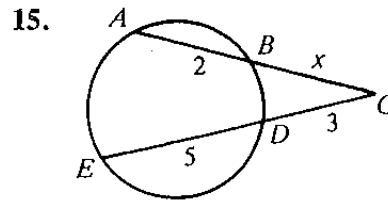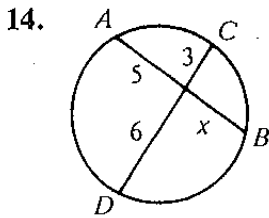
16. $\overline{BA}$ is tangent to the circle.
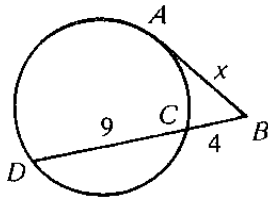
17. $\overline{CA}$ and $\overline{CB}$ are tangent to the circle.
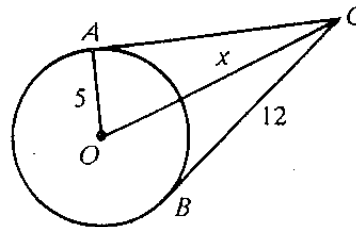
18. Given: $\overline{AD}$ and $\overline{BE}$ are chords
intersecting at C.
Prove: $\triangle BCA \sim \triangle DCE$
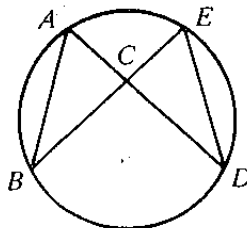
Begin by drawing segments and angles roughly like those shown.
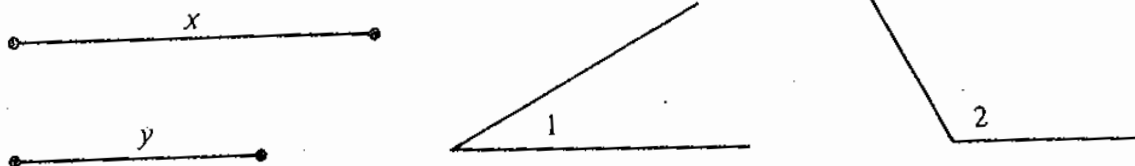
1. Construct an angle A such that $m\angle A = \frac{1}{2}m\angle 2$.
2. Construct a segment of length $x + 3y$.
3. Construct an isosceles right triangle with legs of length x.
4. Construct $\triangle ABC$ with $\angle A \cong \angle 1$, $\angle B \cong \angle 2$, and $AB = x$.
5. Construct $\triangle DEF$ so that $DE = x$, $EF = y$, and $\angle E \cong \angle 1$.
6. Construct an angle having measure $60°$.
7. Draw a line l, and select a point A on l. Construct a line perpendicular to l at point A.
8. Refer to Exercise 7, and select a point B not on l. Construct a line parallel to l through point B.
9. Draw a large circle and a point M not on the circle. From point M, construct a tangent to the circle.
10. Draw a large acute triangle. Construct a circle that circumscribes the triangle.
11. What is the locus of points in a plane at a given distance from a given line?
12. What is the locus of points in space at a given distance from a given point?
13. What is the locus of points in a plane equidistant from two intersecting lines?
14. What is the locus of all points in space equidistant from two points?

Find the area of each figure described.

1. A square with perimeter 28 cm
2. A rectangle with width 7 and diagonal 25
3. A parallelogram with sides 16 and 20 that form a 30° angle
4. A trapezoid with bases 6 and 10 and height 4
5. A rhombus with diagonals 8 and 5
6. A right triangle with legs 25 cm and 6 cm
7. A circle with diameter 18
8. A triangle with sides 5, 5, and 8
9. A circle with circumference 22π cm
10. A regular hexagon with radius 12
11. Sector AOB of $\odot O$ with radius 8 and $m\overarc{AB} = 40$
12. An equilateral triangle with radius $6\sqrt{3}$

Find the area of each shaded region.

13.
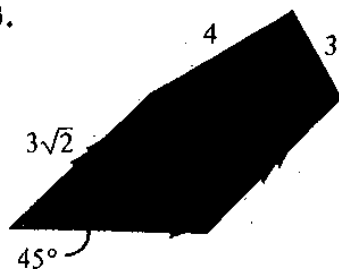
14.
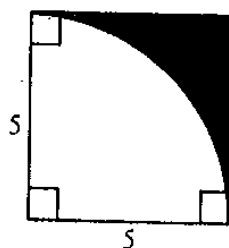
15. In $\odot O$, $m\overarc{AB} = 72$, and the area of sector AOB is 20π. Find the length of $\overarc{AB}$.
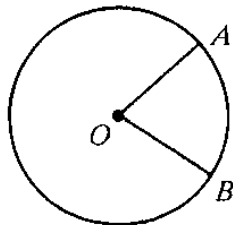
16. Two circles have radii 8 and 11. What is the ratio of the areas?

17. Two corresponding sides of two similar polygons have lengths 3 and 7. The perimeter of the larger polygon is 91 cm. What is the perimeter of the smaller polygon?

18. The dimensions of the small rectangle are one-third those of the large rectangle. A point is picked at random within the large rectangle. What is the probability that it is within the small rectangle?
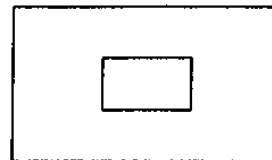
Chapter 12

1. Find the volume of a rectangular solid with length 6 cm, width 5 cm, and height 12 cm.

2. Find the volume and the total area of a cube with edge $5a$.

3. A right triangular prism has height 15 and base edges 5, 12, and 13. Find the volume and the total area.

4. Find the volume of a cone with radius 4 and height 7.

5. Find the lateral area and the total area of the cone in Exercise 4.

6. Find the lateral area of a cylinder with radius 4 cm and height 6 cm.

7. A regular square pyramid has base edge 8 and lateral edge 6. Find the lateral area and the total area.

8. Find the area and the volume of a sphere with radius 6 cm.

9. Two similar regular triangular pyramids have total areas of 20 cm^2 and 80 cm^2. Find the volume of the smaller pyramid if the volume of the larger one is 10 cm^3.

10. The volumes of two spheres have a ratio of 27:64. Find the area of the larger sphere if the area of the smaller is 18.

11. The radii of two similar cylinders are 2 and 5. Find the ratio of their volumes and of their lateral areas.

12. Find the area of a sphere with volume 36π.

13. A cone with radius 5 cm has total area 90π cm^2. Find its height.

14. The volumes of two similar rectangular solids are 125 cm^3 and 64 cm^3. Find the ratio of their base perimeters.

Given points $A(1, 3)$ and $B(4, -1)$, complete each statement.

1. The y-coordinate of point B is __?__.
2. The distance between A and B equals __?__.
3. The midpoint of $\overline{AB}$ is (__?__, __?__).
4. The slope of $\overleftrightarrow{AB}$ is __?__.
5. An equation of $\overleftrightarrow{AB}$ is __?__.
6. The circle with diameter $\overline{AB}$ has equation __?__.
7. An equation of the line through $G(3, -2)$ and perpendicular to $\overleftrightarrow{AB}$ is __?__.
8. An equation of the line that is parallel to $\overleftrightarrow{AB}$ and has y-intercept -3 is __?__.
9. If B is the midpoint of $\overline{AC}$, then C has coordinates (__?__, __?__).

10. Given points $L(3, 3)$, $M(6, 5)$, and $N(3, 8)$, find **(a)** $\overrightarrow{LM}$, **(b)** $|\overrightarrow{MN}|$, and **(c)** $\overrightarrow{LM} + 3\overrightarrow{MN}$.

11. Draw the graph of the equation $4x - 3y = 9$.

12. Find the point of intersection of the lines $3x + 2y = 17$ and $x - 3y = 2$.

13. Find the radius and the center of the circle with the equation $(x + 1)^2 + (y - 5)^2 = 49$.

14. Parallelogram $ORST$ is shown. Give the missing coordinates of point S without introducing any new letters.
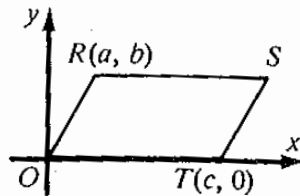
15. Consider points $D(3, 3)$, $E(-1, 2)$, and $F(0, -2)$. Show that $\triangle DEF$ is a right triangle by using slopes.

16. Use coordinate geometry to prove the statement: If a point lies on the perpendicular bisector of a segment, then the point is equidistant from the endpoints of the segment.
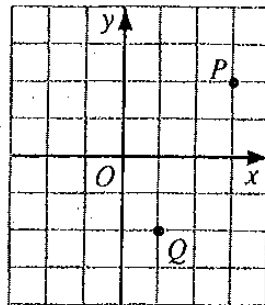
T is the transformation mapping (x, y) to $(x + 1, 3y)$.

1. The image of $(2, -2)$ is $(\underline{\quad?\quad}, \underline{\quad?\quad})$.
2. The preimage of $(6, -3)$ is $(\underline{\quad?\quad}, \underline{\quad?\quad})$.
3. Is T an isometry? Give a reason to justify your answer.

Give the coordinates of the image of P under reflection in the lines specified.

4. The x-axis
5. The y-axis
6. The line $y = x$

Give the coordinates of the image of point Q under the transformations specified. Use the diagram above.

7. R_y
8. $\mathcal{R}_{O, 90}$
9. $\mathcal{R}_{O, -90}$
10. H_O
11. $D_{O, \frac{1}{2}}$
12. $H_O \circ \mathcal{R}_{O, 90}$
13. $\mathcal{R}_{O, 180} \circ H_O$
14. $R_x \circ H_O$
15. $R_x \circ R_y$
16. $R_x \circ D_{O, 2}$

Give the inverse of each transformation.

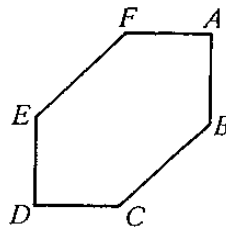17. $D_{O, 3}$
18. $\mathcal{R}_{O, 90}$
19. R_l

T is the translation mapping $(-1, 5)$ to $(2, 1)$. Find the coordinates of the origin under each mapping.

20. T
21. T^{-1}
22. T^2

Hexagon $ABCDEF$ is shown below. Does the hexagon have the symmetry named?

23. point symmetry
24. line symmetry
25. 90° rotational symmetry
26. 180° rotational symmetry

27. How many planes of symmetry does a square pyramid have?