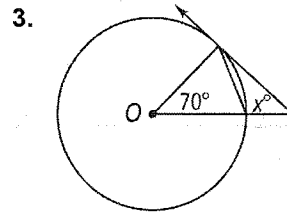
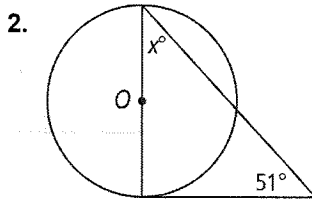
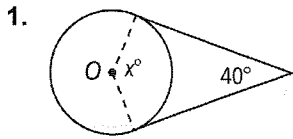


5-1

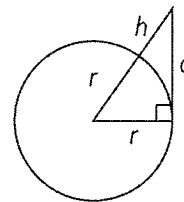
Tangent Lines

Form G

Algebra Assume that lines that appear to be tangent are tangent. O is the center of each circle. What is the value of x ?



The circle at the right represents Earth. The radius of the Earth is about 6400 km. Find the distance d that a person can see on a clear day from each of the following heights h above Earth. Round your answer to the nearest tenth of a kilometer.

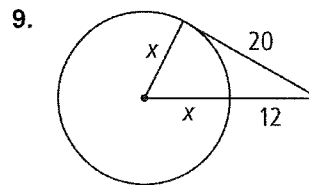
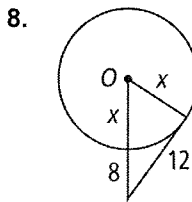
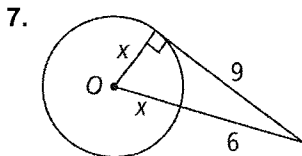


4. 12 km

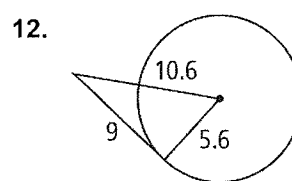
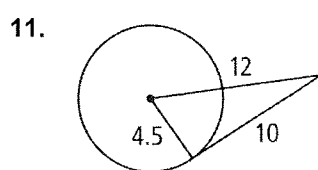
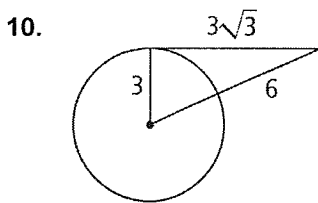
5. 20 km

6. 1300 km

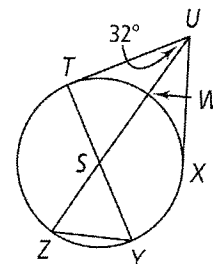
In each circle, what is the value of x to the nearest tenth?



Determine whether a tangent line is shown in each diagram. Explain.



13. \overline{TU} and \overline{ZW} are diameters of $\odot S$. \overline{TU} and \overline{UX} are tangents of $\odot S$. What is $m\angle SYZ$?



5-1

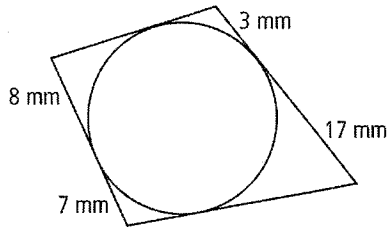
Practice (continued)

Form G

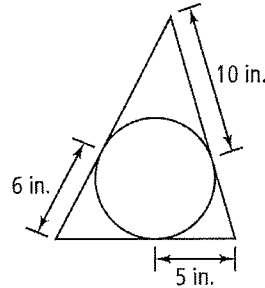
Tangent Lines

Each polygon circumscribes a circle. What is the perimeter of each polygon?

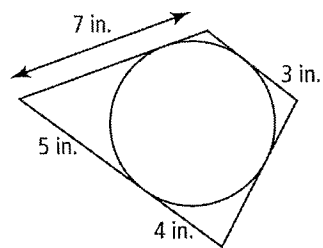
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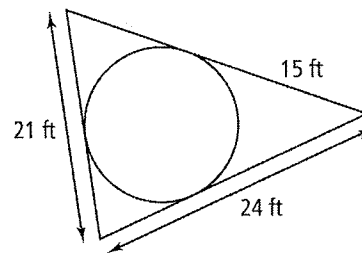
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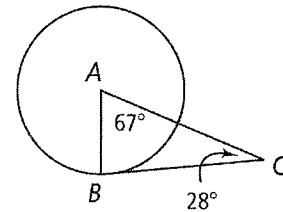
16.



17.

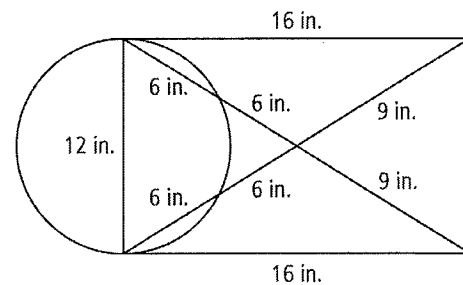


18. **Error Analysis** A classmate states that \overline{BC} is tangent to $\odot A$. Explain how to show that your classmate is wrong.



19. The peak of Mt. Everest is about 8850 m above sea level. About how many kilometers is it from the peak of Mt. Everest to the horizon if the Earth's radius is about 6400 km? Draw a diagram to help you solve the problem.

20. The design of the banner at the right includes a circle with a 12-in. diameter. Using the measurements given in the diagram, explain whether the lines shown are tangents to the circle.



5-2

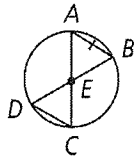
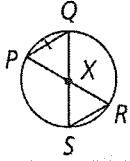
Practice

Form G

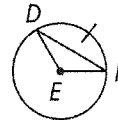
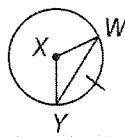
Chords and Arcs

In Exercises 1 and 2, the $\odot X \cong \odot E$. What can you conclude?

1.

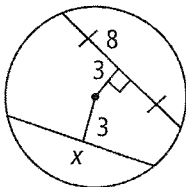


2.

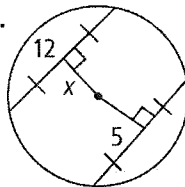


Find the value of x .

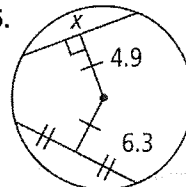
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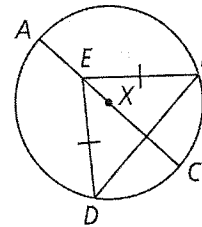
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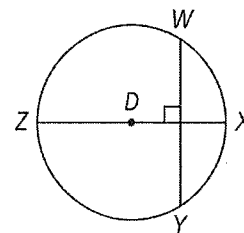
5.



6. In $\odot X$, \overline{AC} is a diameter and $\overline{ED} \cong \overline{EB}$. What can you conclude about \widehat{DC} and \widehat{CB} ? Explain.

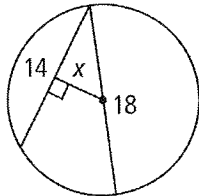


7. In $\odot D$, \overline{ZX} is the diameter of the circle and $\overline{ZX} \perp \overline{WY}$. What conclusions can you make? Justify your answer.

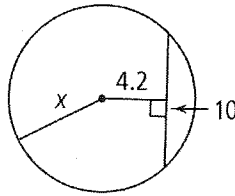


Find the value of x to the nearest tenth.

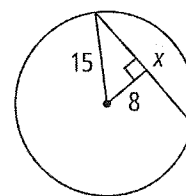
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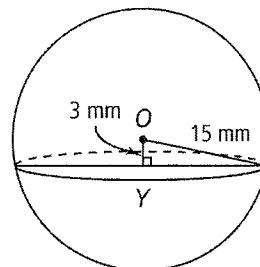
9.



10.



11. In the figure at the right, sphere O with radius 15 mm is intersected by a plane 3 mm from the center. To the nearest tenth, find the radius of the cross section $\odot Y$.

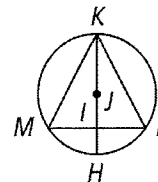


5-2 Practice (continued)

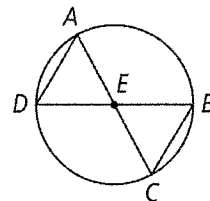
Form G

Chords and Arcs

12. **Given:** $\odot J$ with diameter \overline{HK} ; $\widehat{KL} \cong \widehat{LM} \cong \widehat{MK}$
Prove: $\triangle KIL \cong \triangle KIM$

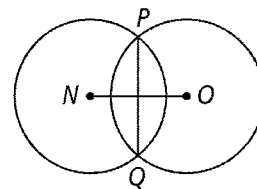


13. **Given:** \overline{AC} and \overline{DB} are diameters of $\odot E$.
Prove: $\triangle EAD \cong \triangle ECB$



$\odot N$ and $\odot O$ are congruent. \overline{PQ} is a chord of both circles.

14. If $NO = 12$ in. and $\overline{PQ} = 8$ in., how long is the radius to the nearest tenth of an inch?



15. If $NO = 30$ mm and radius = 16 mm, how long is \overline{PQ} to the nearest tenth of a millimeter?

16. If radius = 12 m and $\overline{PQ} = 9$ m, how long is \overline{NO} to the nearest tenth?

17. **Draw a Diagram** A student draws $\odot X$ with a diameter of 12 cm. Inside the circle she inscribes equilateral $\triangle ABC$ so that \overline{AB} , \overline{BC} , and \overline{CA} are all chords of the circle. The diameter of $\odot X$ bisects \overline{AB} . The section of the diameter from the center of the circle to where it bisects \overline{AB} is 3 cm. To the nearest whole number, what is the perimeter of the equilateral triangle inscribed in $\odot X$?

18. Two concentric circles have radii of 6 mm and 12 mm. A segment tangent to the smaller circle is a chord of the larger circle. What is the length of the segment to the nearest tenth.

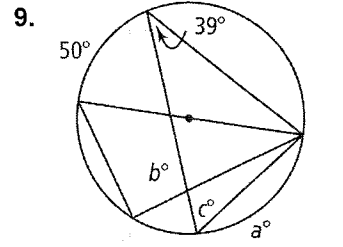
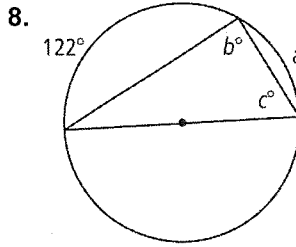
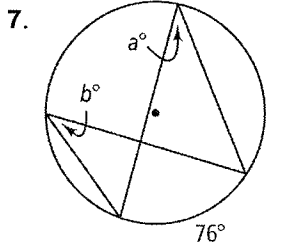
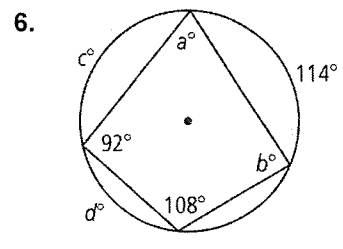
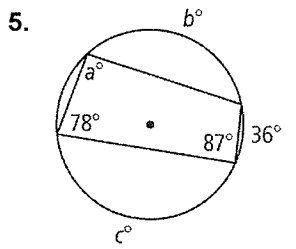
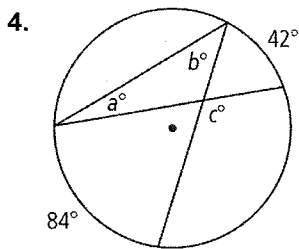
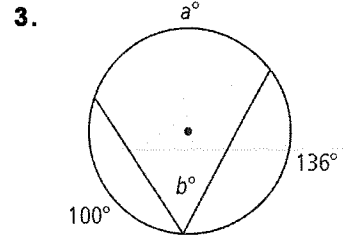
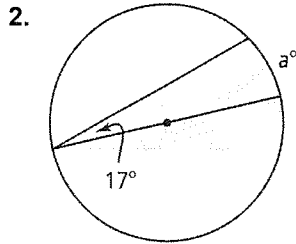
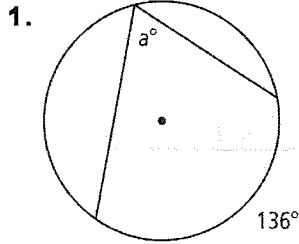
5-3

Practice

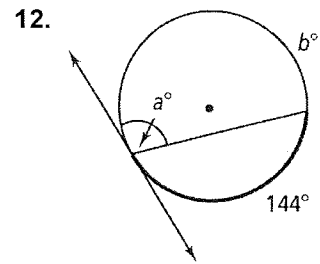
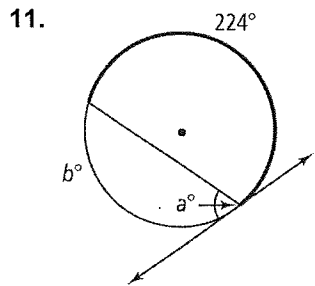
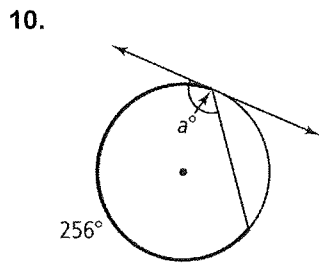
Form G

Inscribed Angles

Find the value of each variable. For each circle, the dot represents the center.



Find the value of each variable. Lines that appear to be tangent are tangent.



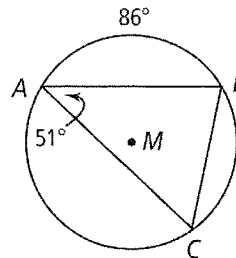
Find each indicated measure for $\odot M$.

13. a. $m\angle B$

b. $m\angle C$

c. $m\widehat{BC}$

d. $m\widehat{AC}$



5-3

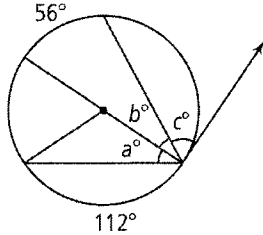
Practice (continued)

Form G

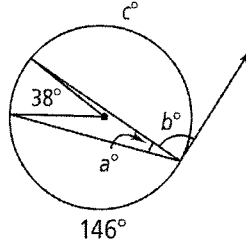
Inscribed Angles

Find the value of each variable. For each circle, the dot represents the center.

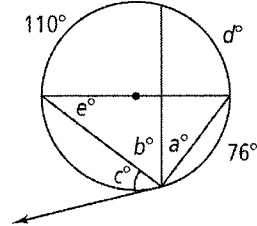
14.



15.



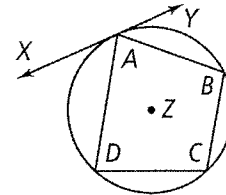
16.



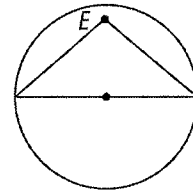
17. **Given:** Quadrilateral $ABCD$ is inscribed in $\odot Z$.

\overleftrightarrow{XY} is tangent to $\odot Z$.

Prove: $m\angle XAD + m\angle YAB = m\angle C$



18. **Error Analysis** A classmate says that $m\angle E = 90$. Explain why this is incorrect.



19. A student inscribes quadrilateral $ABCD$ inside a circle. The measures of angles A , B , and C are given below. Find the measure of each angle of quadrilateral $ABCD$.

$$m\angle A = 8x - 4$$

$$m\angle B = 5x + 4$$

$$m\angle C = 7x + 4$$

20. **Reasoning** Quadrilateral $WXYZ$ is inscribed in a circle. If $\angle W$ and $\angle Y$ are each inscribed in a semicircle, does this mean the quadrilateral is a rectangle? Explain.

21. **Writing** A student inscribes an angle inside a semicircle to form a triangle. The measures of the angles that are not the vertex of the inscribed angle are x and $2x - 9$. Find the measures of all three angles of the triangle. Explain how you got your answer.

5-4

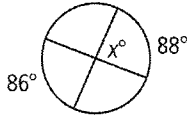
Practice

Form G

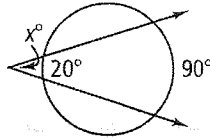
Angle Measures and Segment Lengths

Find the value of x .

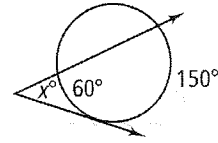
1.



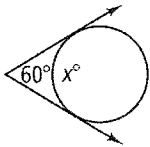
2.



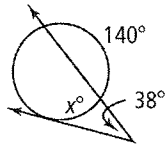
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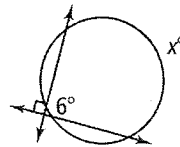
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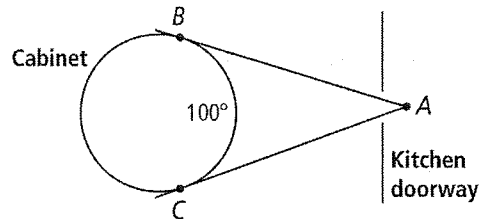
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6.

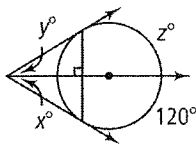


7. There is a circular cabinet in the dining room. Looking in from another room at point A , you estimate that you can see an arc of the cabinet of about 100° . What is the measure of $\angle A$ formed by the tangents to the cabinet?

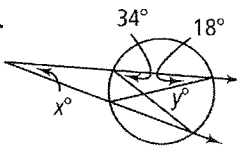


Algebra Find the value of each variable using the given chord, secant, and tangent lengths. If the answer is not a whole number, round to the nearest tenth.

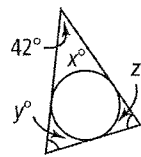
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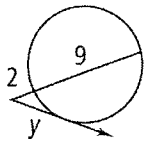
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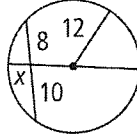
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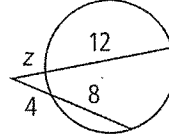
11.



12.



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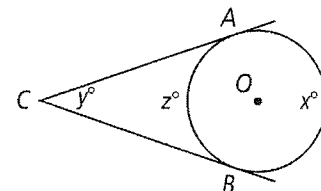


Algebra \overline{CA} and \overline{CB} are tangents to $\odot O$. Write an expression for each arc or angle in terms of the given variable.

14. $m\widehat{AB}$ using x

15. $m\widehat{AB}$ using y

16. $m\angle C$ using x



5-4

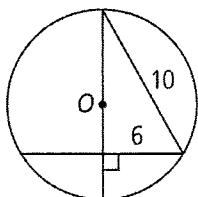
Practice (continued)

Form G

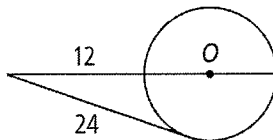
Angle Measures and Segment Lengths

Find the diameter of $\odot O$. A line that appears to be tangent is tangent. If your answer is not a whole number, round to the nearest tenth.

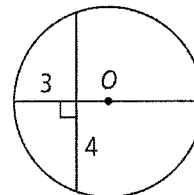
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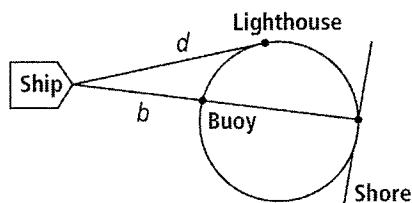
18.



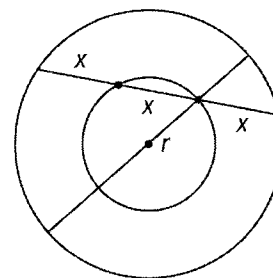
19.



20. The distance from your ship to a lighthouse is d , and the distance to the buoy is b . Express the distance to the shore in terms of d and b .



21. **Reasoning** The circles at the right are concentric. The radius of the larger circle is twice the radius, r , of the smaller circle. Explain how to find the ratio $x : r$, then find it.



22. A circle is inscribed in a parallelogram. One angle of the parallelogram measures 60° . What are the measures of the four arcs between consecutive points of tangency? Explain.
23. An isosceles triangle with height 10 and base 6 is inscribed in a circle. Create a plan to find the diameter of the circle. Find the diameter.
24. If three tangents to a circle form an equilateral triangle, prove that the tangent points form an equilateral triangle inscribed in the circle.
25. A circle is inscribed in a quadrilateral whose four angles have measures 86, 78, 99, and 97. Find the measures of the four arcs between consecutive points of tangency.

5-5

Practice

Form G

Circles in the Coordinate Plane

Find the center and radius of each circle.

1. $x^2 + y^2 = 36$

2. $(x - 2)^2 + (y - 7)^2 = 49$

3. $(x + 1)^2 + (y + 6)^2 = 16$

4. $(x + 3)^2 + (y - 11)^2 = 12$

Write the standard equation of each circle.

5. center $(0, 0)$; $r = 7$

6. center $(4, 3)$; $r = 8$

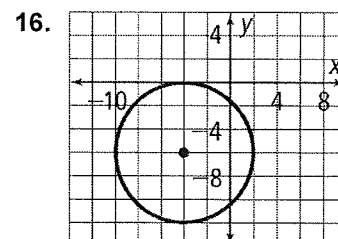
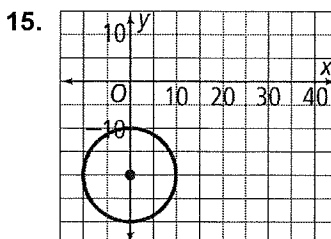
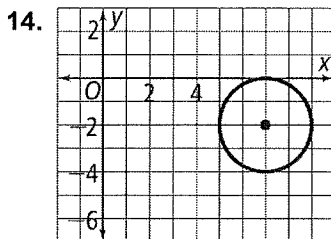
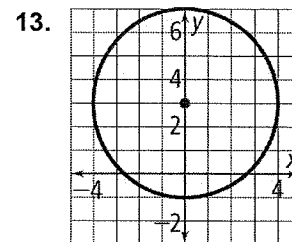
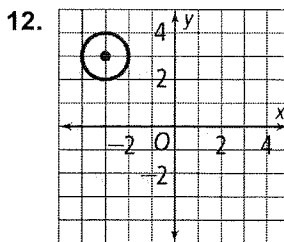
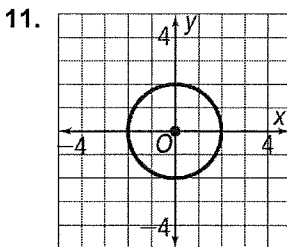
7. center $(5, 3)$; $r = 2$

8. center $(-5, 4)$; $r = \frac{1}{2}$

9. center $(-2, -5)$; $r = \sqrt{2}$

10. center $(-1, 6)$; $r = \sqrt{5}$

Write the standard equation of each circle.



Find the center and radius of each circle. Then graph the circle.

17. $x^2 + y^2 = 25$

18. $(x - 3)^2 + (y - 5)^2 = 9$

19. $(x + 2)^2 + (y + 4)^2 = 16$

20. $(x + 1)^2 + (y - 1)^2 = 36$

Write the standard equation of the circle with the given center that passes through the given point.

21. center $(0, 0)$; point $(3, 4)$

22. center $(5, 9)$; point $(2, 9)$

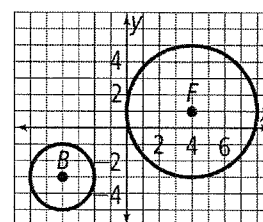
23. center $(-4, -3)$; point $(2, 2)$

24. center $(7, -2)$; point $(-1, -6)$

Write the standard equation of each circle in the diagram at the right.

25. $\odot B$

26. $\odot F$



5-5

Practice (continued)

Form G

Circles in the Coordinate Plane

Write an equation of a circle with diameter \overline{AB} .

27. $A(0, 0), B(-6, 8)$

28. $A(0, -1), B(2, 1)$

29. $A(7, 5), B(-1, -1)$

30. **Reasoning** Circles in the coordinate plane that have the same center and congruent radii are identical. Circles with congruent radii are congruent. In (a) through (g), circles lie in the coordinate plane.

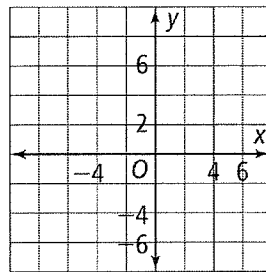
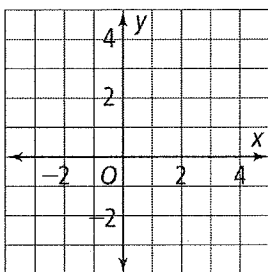
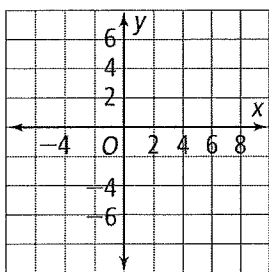
- a. Two circles have equal areas. Are the circles congruent?
- b. Two circles have circumferences that are equal in length. Are the circles congruent?
- c. How many circles have an area of $36\pi \text{ m}^2$?
- d. How many circles have a center of $(4, 7)$?
- e. How many circles have an area of $36\pi \text{ m}^2$ and center $(4, 7)$?
- f. How many circles have a circumference of $6\pi \text{ in.}$ and center $(4, 7)$?
- g. How many circles have a diameter with endpoints $A(0, 0)$ and $B(-6, 8)$?

Sketch the graph of each equation. Find all points of intersection of each pair of graphs.

31. $x^2 + y^2 = 65$
 $y = x - 3$

32. $x^2 + y^2 = 10$
 $y = 3$

33. $(x + 2)^2 + (y - 2)^2 = 16$
 $y = -x + 4$



34. **Writing** Two circles in the coordinate plane with congruent radii intersect in exactly two points. Why is it not possible for these circles to be concentric?

35. Find the circumference and area of the circle whose equation is $(x - 5)^2 + (y + 4)^2 = 49$. Leave your answer in terms of π .

36. What are the x - and y -intercepts of the line tangent to the circle $(x + 6)^2 + (y - 2)^2 = 100$ at the point $(2, -4)$?