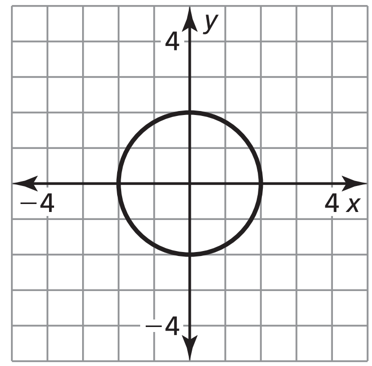
10.7 Start Thinking

The standard form of the equation of a circle centered at $(0, 0)$ is $x^2 + y^2 = r^2$, where r is the radius. Find the equation of the circle shown. Graph the circle $x^2 + y^2 = 9$.



10.7 Warm Up

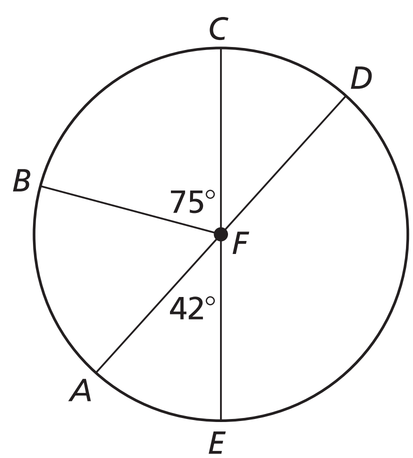
Find the measure of $\overline{PQ}$ and its midpoint.

1. $P = (2, 8)$
   $Q = (-2, 8)$
2. $P = (0, -5)$
   $Q = (7, -7)$
3. $P = (-4, -3)$
   $Q = (-6, 11)$
4. $P = \left(\frac{1}{2}, -3\right)$
   $Q = \left(-\frac{5}{2}, \frac{3}{2}\right)$

10.7 Cumulative Review Warm Up

Find the measure of the arc.

1. $\overset{\frown}{AB}$
2. $\overset{\frown}{CD}$
3. $\overset{\frown}{DE}$
4. $\overset{\frown}{BCD}$
5. $\overset{\frown}{AED}$

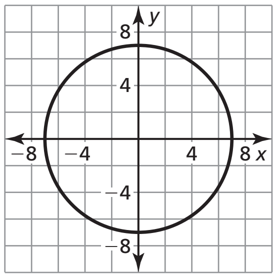


Name____________________ Date__________

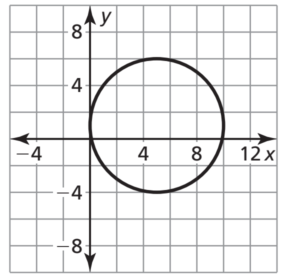
10.7 Practice A

In Exercises 1–4, write the standard equation of the circle with the given center and radius.

1.



2.



3. a circle with center $(0, 0)$ and radius 8

4. a circle with center $(0, -5)$ and radius 2

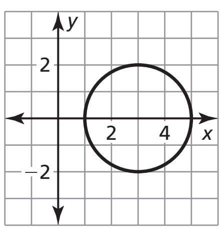
In Exercises 5 and 6, use the given information to write the standard equation of the circle.

5. The center is $(0, 0)$, and a point on the circle is $(3, -4)$.

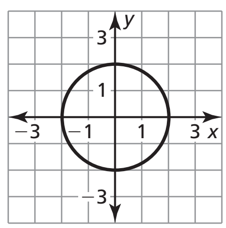
6. The center is $(3, -2)$, and a point on the circle is $(23, 19)$.

In Exercises 7–9, match each graph with its equation.

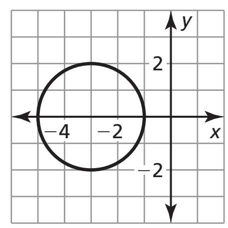
7.



8.



9.



A. $x^2 + y^2 = 4$

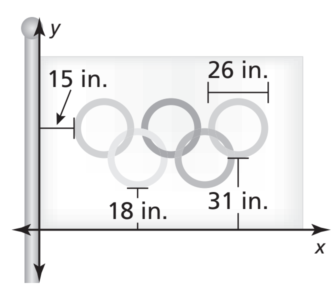
B. $(x - 3)^2 + y^2 = 4$

C. $(x + 3)^2 + y^2 = 4$

10. The equation of a circle is $x^2 + y^2 - 6y + 9 = 4$. Find the center and radius of the circle. Then graph the circle.

11. Prove or disprove that the point $(-3, 3)$ lies on the circle centered at the origin with radius 4.

12. You are using a math software program to design a pattern for an Olympic flag. In addition to the dimensions shown in the diagram, the distance between the outer edges any two adjacent rings in the same row is 3 inches.



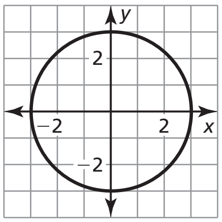
a. Use the given dimensions to write equations representing the outer circles of the five rings. Use inches as units in a coordinate plane with the lower left corner of the flag on the origin.

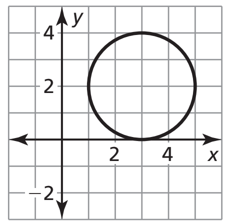
b. Each ring is 3 inches thick. Explain how you can adjust the equations of the outer circles to write equations representing the inner circles.

Name ____ Date __________

10.7 Practice B

In Exercises 1–4, write the standard equation of the circle with the given center and radius.

1. 

2. 

3. a circle with center $(4, -7)$ and radius 4

4. a circle with center $(-3, 0)$ and radius 5

In Exercises 5–7, use the given information to write the standard equation of the circle.

5. The center is $(0, 0)$, and a point on the circle is $(1, 0)$.

6. The center is $(4, -1)$, and a point on the circle is $(-1, -1)$.

7. The center is $(2, 4)$, and a point on the circle is $(-3, 16)$.

In Exercises 8–11, find the center and radius of the circle. Then graph the circle.

8. $x^2 + y^2 = 100$

9. $(x - 2)^2 + (y - 9)^2 = 4$

10. $x^2 + y^2 + 4y + 4 = 36$

11. $x^2 - 2x + 5 + y^2 = 8$

In Exercises 12 and 13, prove or disprove the statement.

12. The point $(-3, 4)$ lies on the circle centered at the origin with radius 5.

13. The point $(2, \sqrt{3})$ lies on the circle centered at the origin and containing the point $(-3, 0)$.

14. After an earthquake, you are given seismograph readings from three locations where the coordinates are miles.

The epicenter is 5 miles away from $A(2, 1)$.

The epicenter is 6 miles away from $B(-2, -2)$.

The epicenter is 4 miles away from $(-6, 4)$.

a. Graph three circles in one coordinate plane to represent the possible epicenter locations determined by each of the seismograph readings.

b. What are the coordinates of the epicenter?

c. People could feel the earthquake up to 9 miles from the epicenter. Could a person at $(4, -5)$ feel it? Explain.

Name____ Date__________

10.7 Enrichment and Extension

Circles in the Coordinate Plane

1. The x- and y-axis are tangent to a circle with radius 3 units. Write a standard equation of the circle.

2. A town wants to add a grocery store that is equidistant from the farthest houses in the community. Planners use a grid system to model the locations of the three houses as $C(4, 3)$, $D(2, -7)$, and $E(-2, -3)$. Determine the ideal location for the grocery store, and write an equation of the circle that models the situation.

3. Find the standard equation of the circle with its center on the y-axis that is tangent to $y = -2$ and $y = -17$.

4. Find the standard equation of the circle that has a diameter of 15 units and has a center at the intersection of $y = x + 7$ and $y = 2x - 5$.

5. Circle C_1 has equation $(x + 2)^2 + (y + 4)^2 = 64$, and circle C_2 has equation $(x - h)^2 + (y - 1)^2 = 81$. The distance between the centers of circles C_1 and C_2 is 13.

   a. Find all possible values of h.

   b. If a segment connecting the centers of the circles is drawn, let A be the intersection of the segment and circle C_1, and let B be the intersection of the segment and circle C_2. Find AB.

   c. For each possible value of h, find the standard equations of the circles that are concentric with circle C_1 and tangent to circle C_2.

The equation of a sphere is an extension of the equation of a circle. The standard equation of a sphere with center (i, j, k) and radius r units is $(x - i)^2 + (y - j)^2 + (z - k)^2 = r^2$.

6. Write an equation for each sphere described.

   a. center $(-5, 0, 4)$ and radius 11

   b. center $(10, -6, 2)$ and point $(10, -1, 10)$ on the sphere

   c. diameter with endpoints $(-8, 1, -7)$ and $(6, 3, -1)$

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10.7 Puzzle Time

What Should You Do When It Rains?

Write the letter of each answer in the box containing the exercise number.

Write the standard equation of the circle.

1. center $(5, 2)$ and radius 4
2. center $(-3, -4)$ and radius 3
3. The center is $(0, 0)$, and a point on the circle is $(0, 8)$.
4. The center is $(2, 3)$, and a point on the circle is $(6, 0)$.

Find the center and radius of the circle.

5. $x^2 + y^2 = 81$
6. $(x + 4)^2 + (y - 3)^2 = 64$
7. The point $(-4, 3)$ lies on a circle centered at the origin that contains the point $(3, 4)$. True or false?

Use the Black Box readings from locations *A*, *B*, and *C* to find the epicenter of the box.

- The epicenter is 3 miles away from $A(0, 0)$.
- The epicenter is 3 miles away from $B(3, 3)$.
- The epicenter is 3 miles away from $C(-3, 3)$.

8. What is the epicenter of the Black Box?

Answers

C. $(x + 3)^2 + (y + 4)^2 = 9$

M. $x^2 + y^2 = 8$

B. $(x - 2)^2 + (y + 3)^2 = 25$

C. $x^2 + y^2 = 64$

E. $(x - 2)^2 + (y - 3)^2 = 25$

G. $(x + 5)^2 + (y + 2)^2 = 16$

D. center $= (0, 0)$, $r = 9$

L. center $= (4, -3)$, $r = 8$

N. center $= (-4, 3)$, $r = 8$

K. false **I.** true

U. $(x + 4)^2 + (y + 3)^2 = 9$

O. $(0, 3)$

R. center $= (1, 1)$, $r = 3$

I. $(x - 5)^2 + (y - 2)^2 = 16$

S. $(3, 0)$

3	8	1	6	2	7	5	4