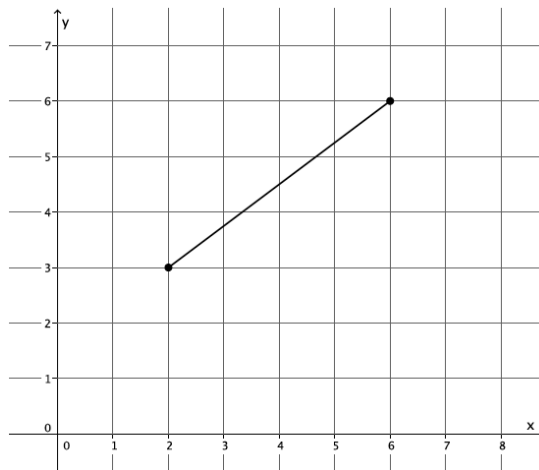# Lesson 17: Writing the Equation for a Circle
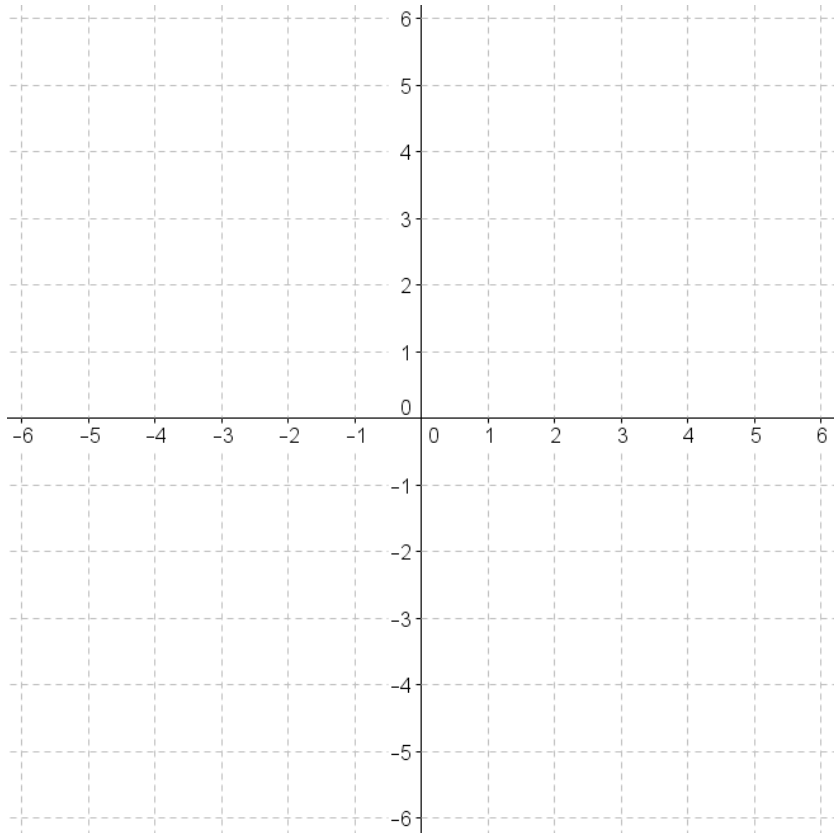
## Classwork

**Opening Exercise**

1. What is the length of the segment shown on the coordinate plane below?



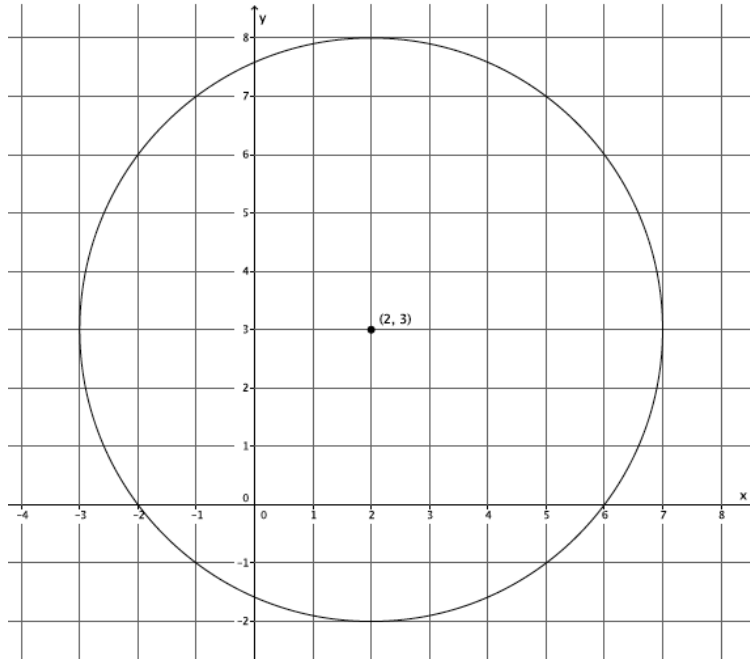2. Use the distance formula to determine the distance between points $(9, 15)$ and $(3, 7)$.

## Example 1

If we graph all of the points whose distance from the origin is equal to 5, what shape will be formed?
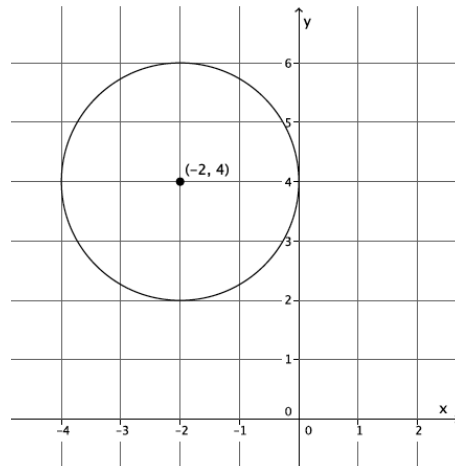
## Example 2

Shown below is a circle with center $(2, 3)$ with radius $5$.

**Exercises**

3.  Write an equation for the circle whose center is at $(9, 0)$ and has radius 7.

4.  Write an equation whose graph is the circle below.



5.  What is the radius and center of the circle given by the equation $(x + 12)^2 + (y - 4)^2 = 81$?

6.  Petra is given the equation $(x - 15)^2 + (y + 4)^2 = 100$ and identifies its graph as a circle whose center is $(-15, 4)$ and radius is 10. Has Petra made a mistake? Explain.

7.

a. What is the radius of the circle with center $(3, 10)$ that passes through $(12, 12)$?

b. What is the equation of this circle?

8. A circle with center $(2, -5)$ is tangent to the $x$-axis.
    a. What is the radius of the circle?

    b. What is the equation of the circle?

9. Two points in the plane, $A = (-3, 8)$ and $B = (17, 8)$, represent the endpoints of the diameter of a circle.
    a. What is the center of the circle? Explain.

    b. What is the radius of the circle? Explain.

    c. Write the equation of the circle.

10. Consider the circles with equations:

$$x^2 + y^2 = 25 \text{ and}$$
$$(x - 9)^2 + (y - 12)^2 = 100.$$

a.   What are the radii of the circles?

b.   What is the distance between the centers of the circles?

c.   Make a rough sketch of the two circles to explain why the circles must be tangent to one another.

11. A circle is given by the equation $(x^2 + 2x + 1) + (y^2 + 4y + 4) = 121$.

a.   What is the center of the circle?

b.   What is the radius of the circle?

c.   Describe what you had to do in order to determine the center and the radius of the circle.

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**Lesson Summary**

$(x - a)^2 + (y - b)^2 = r^2$ is the general equation for any circle with radius $r$ and center $(a, b)$.

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## Problem Set

1. Write the equation for a circle with center $\left(\frac{1}{2}, \frac{3}{7}\right)$ and radius $\sqrt{13}$.

2. What is the center and radius of the circle given by the equation $x^2 + (y - 11)^2 = 144$?

3. A circle is given by the equation $x^2 + y^2 = 100$. Which of the following points are on the circle?
   a. $(0, 10)$
   b. $(-8, 6)$
   c. $(-10, -10)$
   d. $(45, 55)$
   e. $(-10, 0)$

4. Determine the center and radius of each circle:
   a. $3x^2 + 3y^2 = 75$
   b. $2(x + 1)^2 + 2(y + 2)^2 = 10$
   c. $4(x - 2)^2 + 4(y - 9)^2 - 64 = 0$

5. A circle has center $(-13, \pi)$ and passes through the point $(2, \pi)$.
   a. What is the radius of the circle?
   b. Write the equation of the circle.

6. Two points in the plane, $A = (19, 4)$ and $B = (19, -6)$, represent the endpoints of the diameter of a circle.
   a. What is the center of the circle?
   b. What is the radius of the circle?
   c. Write the equation of the circle.

7. Write the equation of the circle shown below.
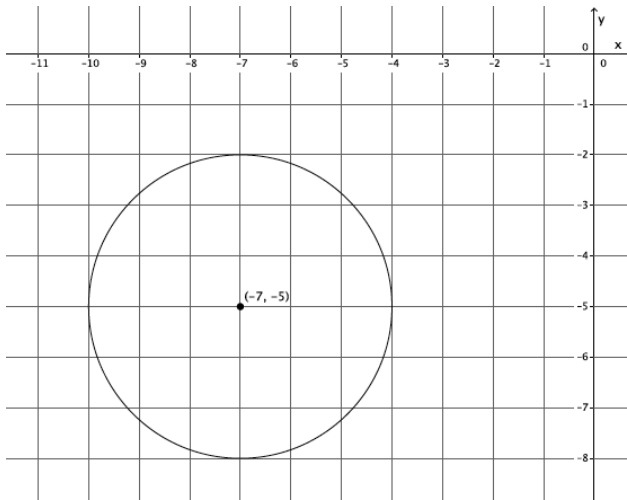


8. Write the equation of the circle shown below.
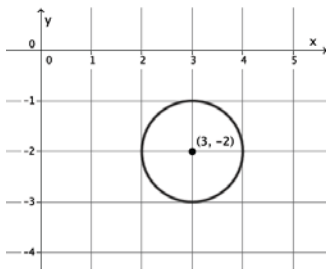


9. Consider the circles with equations:

$$x^2 + y^2 = 2 \text{ and}$$
$$(x - 3)^2 + (y - 3)^2 = 32.$$

a. What are the radii of the two circles?

b. What is the distance between their centers?

c. Make a rough sketch of the two circles to explain why the circles must be tangent to one another.