

MATHEMATICS

Quarter 2 - Module 8: Equation and Graph of a Circle



AIRs - LM

MATHEMATICS 10

Quarter 2 - Module 8: Equation and Graph of a Circle
Second Edition, 2021

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Region I

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Printed in the Philippines by: _____

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MATHEMATICS

Quarter 2 - Module 8: Equation and Graph of a Circle



Introductory Message

This Self-Learning Module (SLM) is prepared so that you, our dear learners, can continue your studies and learn while at home. Activities, questions, directions, exercises, and discussions are carefully stated for you to understand each lesson.

Each SLM is composed of different parts. Each part shall guide you step-by-step as you discover and understand the lesson prepared for you.

Pre-tests are provided to measure your prior knowledge on lessons in each SLM. This will tell you if you need to proceed on completing this module or if you need to ask your facilitator or your teacher's assistance for better understanding of the lesson. At the end of each module, you need to answer the post-test to self-check your learning. Answer keys are provided for each activity and test. We trust that you will be honest in using these.

In addition to the material in the main text, Notes to the Teacher are also provided to our facilitators and parents for strategies and reminders on how they can best help you on your home-based learning.

Please use this module with care. Do not put unnecessary marks on any part of this SLM. Use a separate sheet of paper in answering the exercises and tests. And read the instructions carefully before performing each task.

If you have any questions in using this SLM or any difficulty in answering the tasks in this module, do not hesitate to consult your teacher or facilitator.

Thank you.



Target

From the previous lesson, we have defined circle as a set of all points that are equidistant from a fixed point called center. When the circle is plotted on the Cartesian coordinate plane, the algebraic condition for a circle can be derived from the distance formula.

This module focuses on writing equation of a circle, determining its graph and solving word problems which involve circles. As you study how to write its equation, it is important to recall some basic concepts on simplifying algebraic expressions. In plotting graphs of circles, you will apply your knowledge on coordinate system and skills in sketching graphs. And on solving word problems, you have to exercise your analytical and critical thinking skills in applying accurate concepts to answer what is being asked for each problem.

In this module, you will learn to:

1. illustrate the center-radius form of the equation of a circle. **(M10GE-IIh-1)**
2. determine the center and radius of a circle given its equation and vice versa. **(M10GE-IIh-2)**
3. graph and solve problems involving circles and other geometric figures on the coordinate plane.

At the end of this module, you are expected to:

1. identify the center and radius of a circle given the equation and its graph;
2. write the equation of a circle in center-radius form and in general form;
3. graph circles on the coordinate plane; and
4. solve problems involving circles .

Let us find out how much you already know about this module. Answer the pre-assessment in a separate sheet of paper.

PRE-ASSESSMENT

Directions: Choose the letter of the correct answer. Write your answer on a separate sheet of paper. Take note of the items that you were not able to answer correctly and find the right answer as you go through this module.

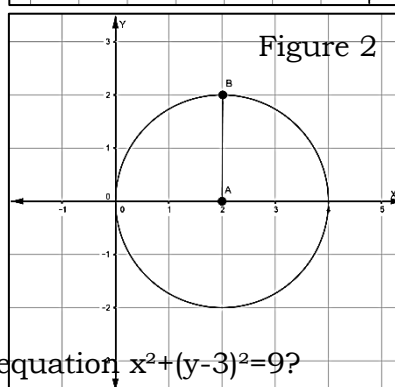
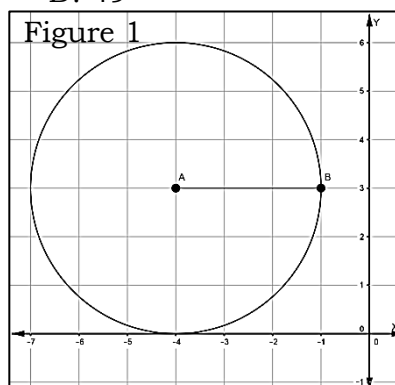
- The center-radius form of an equation of a circle is $(x-h)^2+(y-k)^2=r^2$. Which of the following represents the center of the circle?
A. (x,y) B. (h,k) C. $(0,r)$ D. $(r,0)$
- What is the center of the circle whose equation is given by $(x-4)^2+(y+2)^2=25$?
A. $(-4, 2)$ B. $(-4, -2)$ C. $(4, -2)$ D. $(4, 2)$
- What is the radius of the circle whose equation is given by $(x-4)^2+(y+2)^2=25$?
A. 2 B. 4 C. 5 D. 25
- What is the equation of the circle with center at the origin and with a radius of 9?
A. $x^2+y^2=9$ B. $x^2+y^2=9^2$ C. $x^2-y^2=9$ D. $x^2-y^2=9^2$
- What is the equation of the circle with center at $(-7,2)$ and radius of 6?
A. $(x-7)^2+(y-2)^2=36$ B. $(x+7)^2+(y-2)^2=36$
C. $(x+7)^2+(y+2)^2=36$ D. $(x-7)^2+(y+2)^2=36$
- A circle with a radius of 3 inches has its center at point $(2, -1)$. Which of the following illustrates its equation in general form?
A. $x^2+y^2-4x+2y-4=0$ B. $x^2+y^2-4=0$
C. $x^2+y^2-4x+2y+2=0$ D. $x^2+y^2+2=0$
- Which of the following equations describe a circle on the coordinate plane with a radius of 4 units?
A. $(x-4)^2+(y-4)^2=2^2$ B. $(x-2)^2+(y-2)^2=4^2$
C. $(x+2)^2-(y+2)^2=4^2$ D. $(x-4)^2+(y-4)^2=16^2$
- What is the center of the circle whose equation is given by $x^2+y^2+10x-6y-15=0$?
A. $(5, 3)$ B. $(-5, -3)$ C. $(5, -3)$ D. $(-5,3)$
- What is the radius of the circle whose equation is given by $x^2+y^2+10x-6y-15=0$?
A. 3 B. 5 C. 7 D. 49
- Given the graph in figure 1, what is the equation of the circle in center-radius form?

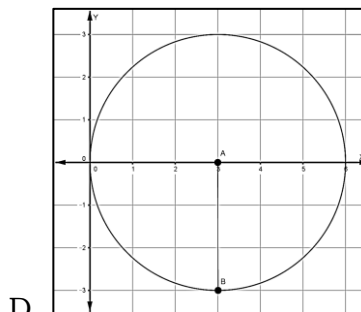
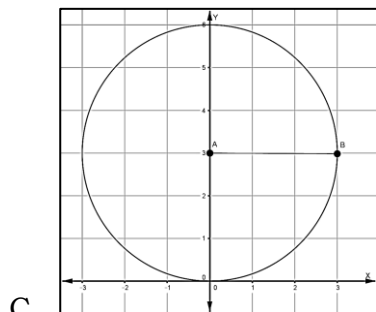
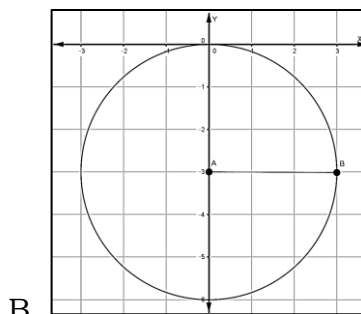
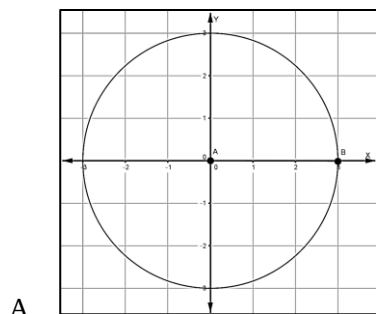
- A. $(x-4)^2+(y+3)^2=3$
B. $(x+4)^2+(y-3)^2=3$
C. $(x-4)^2+(y+3)^2=9$
D. $(x+4)^2+(y-3)^2=9$

- Given the graph in figure 2, what is the equation of the circle in its general form?

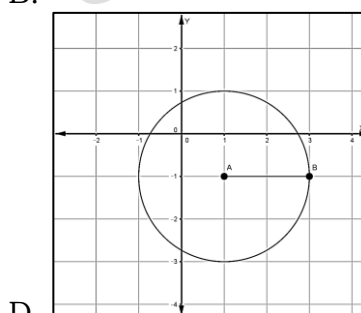
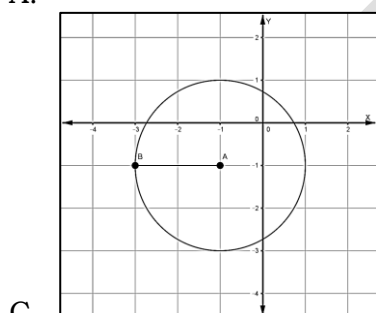
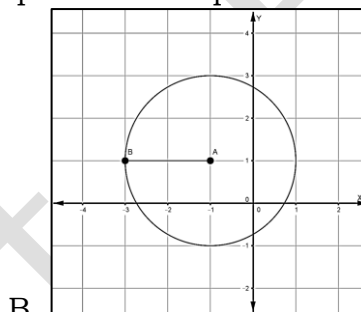
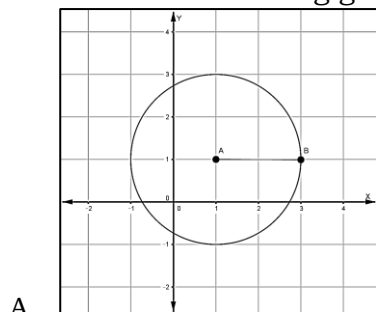
- A. $x^2+y^2-4x=0$
B. $x^2+y^2-4y=0$
C. $x^2-y^2-4x=0$
D. $x^2-y^2-4y=0$

- Which of the following graphs represent the equation $x^2+(y-3)^2=9$?





13. Which of the following graphs represent the equation $x^2 + y^2 + 2x - 2y - 2 = 0$?



14. A radius of a circle has endpoints $(3, -2)$ and $(-1, 1)$. What is the equation that defines the circle if its center is at the fourth quadrant?

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

B. $(x+1)^2 + (y-1)^2 = 5$

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

D. $(x+1)^2 + (y-1)^2 = 25$

15. On a grid map of La Union, the coordinates that correspond to the location of a telecommunication tower is $(-6, 4)$ and it can transmit signals up to 15 km radius. What is the equation that represents the transmission boundaries of the tower?

A. $x^2 + y^2 + 12x - 8y - 173 = 0$

B. $x^2 + y^2 + 12x - 8y + 173 = 0$

C. $x^2 + y^2 + 12x - 8y + 37 = 0$

D. $x^2 + y^2 + 12x - 8y + 37 = 0$

Lesson 1

Equation of a Circle

Previously, you studied about the basic concepts on circles. Likewise, you have honed the knowledge and skills of identifying parts of a circle and proving theorems on circles. In this section, you will need to apply the basic concepts you have learned about coordinate system and some skills in simplifying expressions.



Jumpstart

At this point, you are going to identify the center of the circle and its radius given the graph of the circle. This activity will enable you to write equation of a circle given its center and radius.

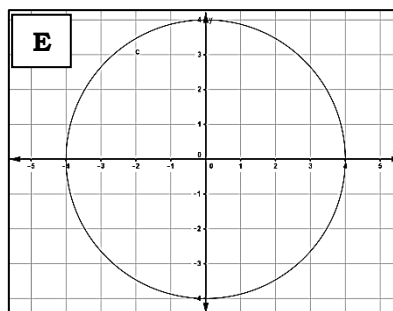
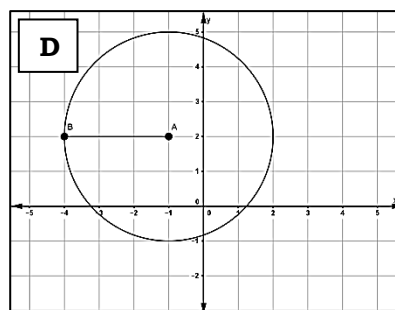
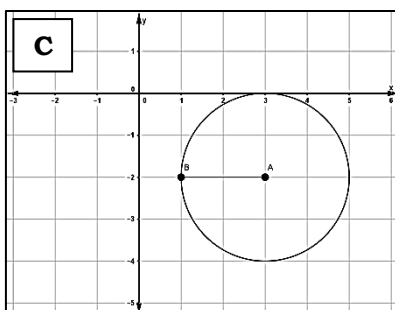
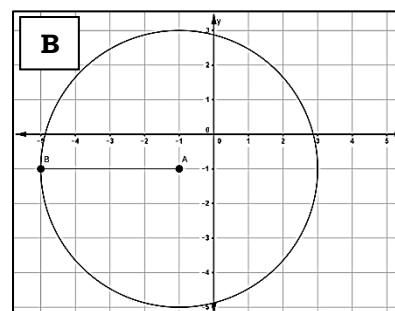
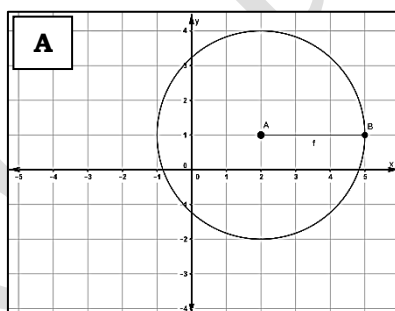
Activity 1: Find Your Partner

Match the given coordinates of the center of a circle and the length of its radius in column A with the corresponding graph of the circle in column B.

A

1. center: $(0, 0)$;
radius: 4 units
2. center: $(-1, 2)$;
radius: 3 units
3. center: $(-1, -1)$;
radius: 4 units
4. center: $(2, 1)$;
radius: 3 units
5. center: $(3, -2)$;
radius: 2 units

B



Activity 2: Complete Me

Write the missing part of equation of the circle in $(x-h)^2+(y-k)^2=r^2$ given its center (h,k) and radius (r) by filling the blanks with the correct answer.

- | | |
|---|--|
| 1. center: (0, 0);
radius: 4 units | $(x-0)^2 + (y-0)^2 = 4^2$
_____ + $y^2 = 16$ |
| 2. center: (-1, 2);
radius: 3 units | $(x+1)^2 + (y-2)^2 = \underline{\hspace{1cm}}^2$ |
| 3. center: (-1, -1);
radius: 4 units | $(x+\underline{\hspace{1cm}})^2 + (y+1)^2 = 4^2$ |
| 4. center: (2, 1);
radius: 3 units | $(x-2)^2 + (y-\underline{\hspace{1cm}})^2 = \underline{\hspace{1cm}}^2$ |
| 5. center: (3, -2);
radius: 2 units | $(x-\underline{\hspace{1cm}})^2 + (y+\underline{\hspace{1cm}})^2 = \underline{\hspace{1cm}}^2$ |

Activity 3: Choose Right

Given the equation of the circle, identify the coordinates of its center and the length of its radius. Choose the letter of the correct answer.

- | | | |
|------------------------------|------------------|------------------|
| 1. $x^2 + y^2 = 7^2$ | A. C(0,0), r=7 | B. C(0,0), r=-7 |
| 2. $(x+2)^2 + y^2 = 5^2$ | A. C(2,0), r=5 | B. C(-2,0), r=5 |
| 3. $(x-3)^2 + (y-4)^2 = 2^2$ | A. C(-3,4), r= 2 | B. C(3,4), r= 2 |
| 4. $(x+2)^2 + (y-6)^2 = 3^2$ | A. C(-2,6), r=3 | B. C(-2,-6), r=3 |
| 5. $(x-7)^2 + (y+5)^2 = 4^2$ | A. C(7,5), r=4 | B. C(7,-5), r=4 |

Questions:

1. In writing equation of a circle, what are its properties that we need to identify first?
2. What is our guide in writing the equation of a circle?



Discover

The activities above show how to determine an equation of a circle. In writing, we first identify the coordinates of the center of the circle and the length of its radius. This section will discuss this further.

Center-Radius Form and General Form of the Equation of a Circle

The equation of a circle with center at (h, k) and a radius of r in *center-radius form* is $(x-h)^2 + (y-k)^2 = r^2$. The equation can be written in its general form by expanding the given equation. Thus, the *general form* of the equation of a circle is written as $x^2 + y^2 + Dx + Ex + F = 0$, where D , E , and F are real numbers.

Examples

- Write the equation of the circle, in center-radius form, whose center is at $(5, -8)$ and has radius of 6.

Given:

center $(h, k) = (5, -8)$ where $h=5$ and $k=-8$

radius $(r) = 6$

Solution:

substitute the values of h , k , and r to $(x-h)^2 + (y-k)^2 = r^2$

$$\rightarrow (x-5)^2 + (y+8)^2 = 6^2$$

Simplify

$$\rightarrow (x-5)^2 + (y+8)^2 = 36$$

Answer: $(x-5)^2 + (y+8)^2 = 36$

- Write the equation of the circle, in center-radius form, whose center is at $(-2, 0)$ and has radius of 9.

Given:

center $(h, k) = (-2, 0)$ where $h=-2$ and $k=0$

radius $(r) = 9$

Solution:

substitute the values of h , k , and r to $(x-h)^2 + (y-k)^2 = r^2$

$$\rightarrow (x+2)^2 + (y-0)^2 = 9^2$$

Simplify

$$\rightarrow (x+2)^2 + y^2 = 81$$

Answer: $(x+2)^2 + y^2 = 81$

- Determine the center and radius of the circle given by the equation $(x-4)^2 + (y-1)^2 = 49$.

Given:

$$(x-4)^2 + (y-1)^2 = 49$$

$$\begin{array}{ccc} \uparrow & \uparrow & \uparrow \\ h & k & r^2 \end{array}$$

Solution:

$$\begin{array}{lll} h=4 & k=1 & r^2=49 \\ & & r=\sqrt{49} \end{array}$$

$$r = 7$$

Answer: center $= (4, 1)$ and radius $= 7$

4. Determine the center and radius of the circle given by the equation $x^2+(y+5)^2=100$.

Given:

$$\begin{array}{ccccc} (x-0)^2+(y+5)^2=100 \\ \uparrow \quad \quad \uparrow \quad \quad \uparrow \\ h \quad \quad k \quad \quad r^2 \end{array}$$

Solution:

$$\begin{array}{lcl} h=0 & k=-5 & r^2=100 \\ & & r=\sqrt{100} \\ & & r=10 \end{array}$$

Answer: center=(0,-5) and radius=10

5. Write the general form of the equation of the circle whose center is at (2, 6) and has radius of 5.

Given:

center (h,k) =(2, 6) where h=2 and k=6
radius (r)= 5

Solution:

Write the equation in center-radius form first.

$$\text{➤ } (x-2)^2 + (y-6)^2 = 5^2$$

Expand the equation.

$$\text{➤ } (x-2)^2 + (y-6)^2 = 25$$

$$\text{➤ } x^2 - 4x + 4 + y^2 - 12y + 36 = 25$$

Arrange and simplify.

$$\text{➤ } x^2 + y^2 - 4x - 12y + 4 + 36 - 25 = 0$$

$$\text{➤ } x^2 + y^2 - 4x - 12y + 15 = 0$$

Answer: $x^2 + y^2 - 4x - 12y + 15 = 0$

6. Write the general form of the equation of the circle whose center is at (0, -9) and has radius of 11.

Given:

center (h,k) =(0, -9) where h=0 and k=-9
radius (r)= 11

Solution:

Write the equation in center-radius form first.

$$\text{➤ } (x-0)^2 + (y+9)^2 = 11^2$$

Expand the equation.

$$\text{➤ } (x-0)^2 + (y+9)^2 = 121$$

$$\text{➤ } x^2 + y^2 + 18y + 81 = 121$$

Arrange and simplify.

$$\text{➤ } x^2 + y^2 + 18y + 81 - 121 = 0$$

$$\text{➤ } x^2 + y^2 + 18y - 40 = 0$$

Answer: $x^2 + y^2 + 18y - 40 = 0$

7. Determine the center and the radius of the circle given by the equation $x^2+y^2+2x+4y-20=0$.

Solution:

Write the equation $x^2+y^2+2x+4y-20=0$ in the form $(x-h)^2+(y-k)^2=r^2$.

Step 1: Rearrange the terms. Group the terms having the same variables. Isolate the constant term at the right side of the equal sign.	➤ $(x^2 + 2x) + (y^2 + 4y) = 20$
Step 2: Complete each group by completing the square. Add the third term of the trinomial. Note that what you added to each group should also be added to the right side of the equation.	➤ $(x^2 + 2x + \underline{\quad}) + (y^2 + 4y + \underline{\quad}) = 20 + \underline{\quad} + \underline{\quad}$ a. To complete $(x^2 + 2x + \underline{\quad})$, solve for $\left(\frac{b}{2}\right)^2$. The coefficient of x is b, which is equal to 2. Therefore, $\left(\frac{b}{2}\right)^2 = \left(\frac{2}{2}\right)^2 = 1^2 = 1$. b. To complete $(y^2 + 4y + \underline{\quad})$, solve for $\left(\frac{b}{2}\right)^2$. The coefficient of y is b, which is equal to 4. Therefore, $\left(\frac{b}{2}\right)^2 = \left(\frac{4}{2}\right)^2 = 2^2 = 4$. ➤ $(x^2 + 2x + \underline{1}) + (y^2 + 4y + \underline{4}) = 20 + \underline{1} + \underline{4}$
Step 3: Simplify and write each perfect trinomial square into binomial factors.	➤ $(x^2 + 2x + \underline{1}) + (y^2 + 4y + \underline{4}) = 25$ ➤ $(x+1)^2 + (y+2)^2 = 25$
Step 4: Rewrite the equation in center-radius form. Then identify the center and the radius.	➤ $(x+1)^2 + (y+2)^2 = 5^2$ <u>Center (h,k) = (-1,-2)</u> <u>Radius (r) = 5</u>

8. Determine the center and the radius of the circle given by the equation $x^2 + y^2 - 6x - 55 = 0$.

Solution:

Write the equation $x^2 + y^2 - 6x - 55 = 0$ in the form $(x-h)^2 + (y-k)^2 = r^2$.

Step 1: Rearrange the terms. Group the terms having the same variables. Isolate the constant term at the right side of the equal sign.	➤ $(x^2 - 6x) + y^2 = 55$
Step 2: Complete each group by completing the square. Add the third term of the trinomial. Note that what you added to each group should also be added to the right side of the equation.	➤ $(x^2 - 6x + \underline{\quad}) + y^2 = 55 + \underline{\quad}$ a. To complete $(x^2 - 6x + \underline{\quad})$, solve for $\left(\frac{b}{2}\right)^2$. The coefficient of x is b, which is equal to -6. Therefore, $\left(\frac{b}{2}\right)^2 = \left(\frac{-6}{2}\right)^2 = (-3)^2 = 9$. ➤ $(x^2 - 6x + \underline{9}) + y^2 = 55 + \underline{9}$
Step 3: Simplify and write each perfect trinomial square into binomial factors.	➤ $(x^2 - 6x + \underline{9}) + y^2 = 64$ ➤ $(x-3)^2 + y^2 = 64$
Step 4: Rewrite the equation in center-radius form. Then identify the center and the radius.	➤ $(x-3)^2 + y^2 = 8^2$ <u>Center (h,k) = (3,0)</u> <u>Radius (r) = 8</u>



Explore

Activity 4: Tell the Truth

Tell whether the given statement is valid or not. Write TRUE if the statement is valid, if not, change the underlined term/value to make it accurate. Write your answers on your answer sheets.

1. The coordinates of the center of the circle with equation $x^2+(y-2)^2=16$ is (0,2).
2. The length of the radius of the circle with equation $(x-3)^2+(y+5)^2=25$ is 25.
3. The center of the circle with equation $(x-3)^2+(y+5)^2=25$ is (3,5).
4. The equation of the circle whose center is at $(-6,2)$ and whose radius is 9 is $(x+6)^2+(y-2)^2=9$.
5. The equation of the circle in general form whose center is at $(-2,5)$ and whose radius is 2 is $x^2+y^2+4x-10y+25=0$.
6. The coordinates of the center of the circle with equation $(x+9)^2+(y+1)^2=36$ is $(-9,-1)$.
7. The equation of the circle whose center is at $(7,-5)$ and whose radius is 8 is $(x-7)^2+(y+5)^2=64$.
8. The general form of the equation of the circle $(x-1)^2+(y-4)^2=16$ is $x^2+y^2-2x-8y+33=0$.
9. The length of the radius of the circle with equation $(x+12)^2+(y+7)^2=121$ is 11.
10. The center of the circle with equation $x^2+y^2+2x-2y-34=0$ is $(1,-1)$.

Now that you know the important ideas about the topic, let's go deeper by moving on to the next section.



Deepen

Activity 5: Equation Generator

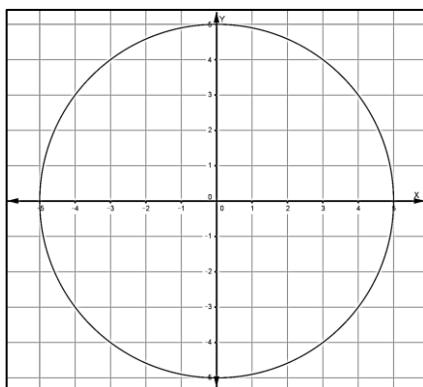
In this activity, you need to apply all the concepts you have learned in this module by completing the table below. Supply the necessary information for each item.

Center of the Circle	Length of the Radius	Equation of the Circle in Center-Radius Form	Equation of the Circle in General Form
$(-8, 0)$	5	1.	2.
$(5, 2)$	7	3.	4.
5.	6.	$(x+3)^2+(y-6)^2=16$	7.
8.	9.	10.	$x^2+y^2-2x+4y-4=0$

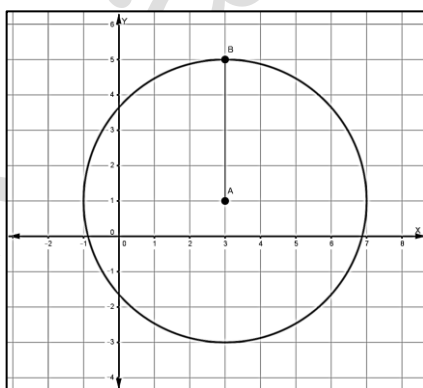
Graph of a Circle

Jumpstart

Determine the coordinates of the center of the circle and the length of its radius based from the graph. Then, write the equation of the circle in center-radius form.


$$C(h,k) = \underline{\hspace{2cm}}$$
$$\mathbf{r} =$$

Equation in Center-Radius Form


$$C(h,k) = \underline{\hspace{2cm}}$$
$$\mathbf{r} =$$

Equation in Center-Radius Form

Activity 7: Do you have signal?

Use the situation below to answer the questions that follow.

On a grid map of La Union, the coordinates that correspond to the location of a telecommunication tower is $(-6, 4)$ and it can transmit signals up to 15 km radius.

1. What is the equation in general form that represents the transmission boundaries of the tower?
2. If your house is located 6 kilometers away from the communication tower, will you be able to maximize the signal strength of the telecommunication company in case you will avail their service? Why?
3. If a person's location is at $(10, -6)$, can he benefit from the signal transmitted by the said telecommunication tower? Why?

Were you able to determine the equation of the transmission boundaries of the tower? Were you able to describe whether the signal is strong or not given a particular location? Were you able to apply the concepts you have learned about equations of the circle accurately?



Discover

The previous activities enabled you to identify some properties of the circle given its graph and apply concepts on equations of circles to solve a related problem. This section will guide you in sketching graphs of circles on the Cartesian plane when the equation is given. This will also present some word problems which involve circles.

Graphing Circles

In sketching graphs of circles, the first thing that you need to determine is the location of the center and the length of its radius. From the equation of the circle in center-radius form, $(x-h)^2 + (y-k)^2 = r^2$, you know that (h, k) represents the coordinates of its center and r represents its radius.

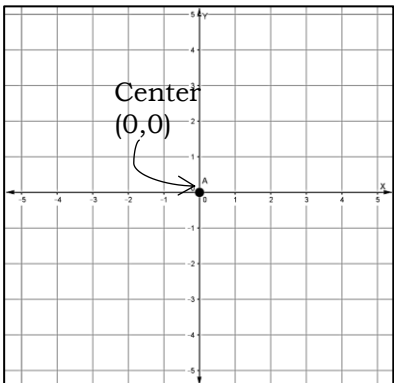
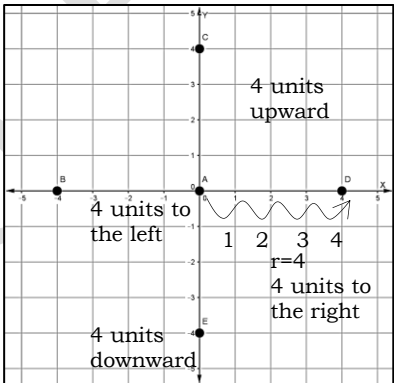
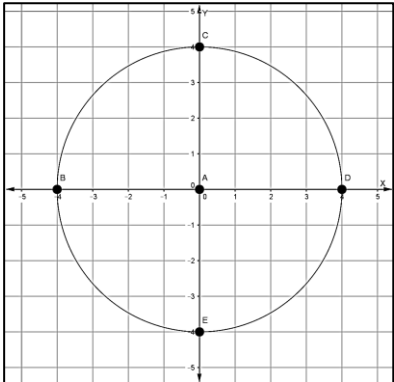
Here are some simple steps that you may follow in sketching the graph of a circle.

1. Identify the center (h, k) and radius r .
2. Plot the center (h, k) in the Cartesian coordinate plane.
3. Using radius r , plot the radius points. You can do this by counting r units from the center, horizontally and vertically in both directions to get four different points on the circle.
4. Sketch the graph by connecting the four radius points with a smooth round curve forming a circle.

For more accurate graphs of circles, you may use graphing calculators and graphing applications such as Geogebra, Graphmatica, Microsoft Math, Desmos and the like.

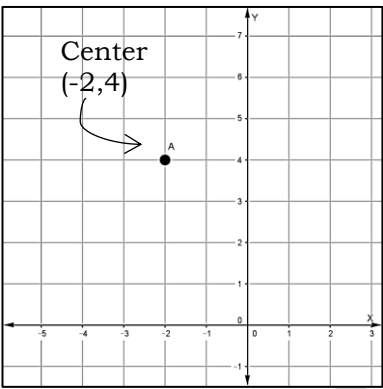
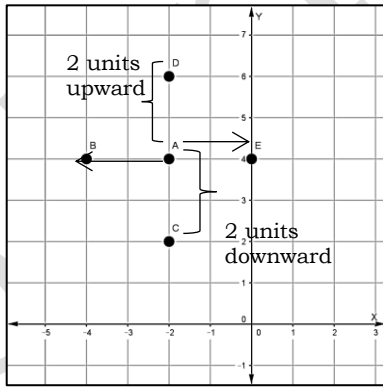
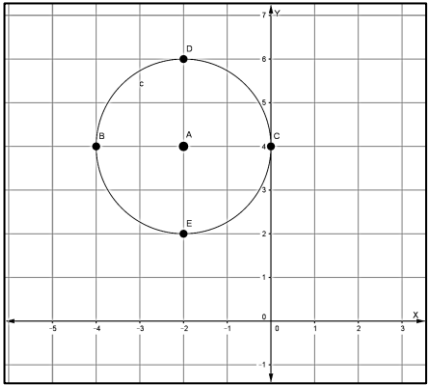
Examples

1. Sketch the graph of the circle with equation $x^2+y^2=16$.

Step 1: Identify the center (h,k) and radius r .	Center $(h,k) = (0,0)$ $r=\sqrt{16}=4$
Step 2: Plot the center (h,k) in the Cartesian coordinate plane.	
Step 3: Using radius r , plot the radius points by counting r units horizontally and vertically on both sides.	
Step 4: Sketch the graph by connecting the four radius points with a smooth round curve forming a circle.	 Graph of $x^2+y^2=16$

2. Sketch the graph of the circle with equation $x^2+y^2+4x-8y+16=0$.

Step 1: Identify the center (h,k) and radius r .	Rewrite the equation in center-radius form: $(x+2)^2+(y-4)^2=4$
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<p>Step 2: Plot the center (h,k) in the Cartesian coordinate plane.</p>	<p>Center $(h,k) = (-2,4)$ $r=\sqrt{4}=2$</p> 
<p>Step 3: Using radius r, plot the radius points by counting r units horizontally and vertically on both sides.</p>	 <p>$r=2$, from the center, count 2 units to the right, left, upward and downward</p>
<p>Step 4: Sketch the graph by connecting the four radius points with a smooth round curve forming a circle.</p>	 <p>Graph of $x^2+y^2+4x-8y+16=0$</p>

Word Problems Involving Circles

The following are some worded problems on circles. Remember that in solving, you need to identify the given, the question and the formula you will be using for you to get the correct answer.

Example 1. Determine the equation of the circle in center-radius form if its center is at $(-3, 4)$ and the circle passes through $(2, 6)$.

Given:

center $(h,k) = (-3, 4)$

point on the circle $(x, y) = (2, 6)$

Solution:

Solve for the radius by using the center-radius form of the equation of a circle $(x-h)^2 + (y-k)^2 = r^2$.

Substitute $(h,k) = (-3, 4)$ and $(x,y) = (2,6)$ in $(x-h)^2 + (y-k)^2 = r^2$. Solve for r .

$$(x - h)^2 + (y - k)^2 = r^2$$

$$(2 - (-3))^2 + (6 - 4)^2 = r^2$$

$$(5)^2 + (2)^2 = r^2$$

$$25 + 4 = r^2$$

$$29 = r^2$$

$$\sqrt{29} = r$$

Write the equation of the circle in center-radius form.

$$(x + 3)^2 + (y - 4)^2 = (\sqrt{29})^2$$

$$(x + 3)^2 + (y - 4)^2 = 29$$

Answer:

The equation of the circle is $(x + 3)^2 + (y - 4)^2 = 29$.

Example 2. On a grid map of La Union, the coordinates that correspond to the location of a telecommunication tower is $(-6, 4)$ and it can transmit signals up to 15 km radius. What is the equation that represents the transmission boundaries of the tower? Write the answer in general form.

Given:

Location of the tower corresponds to the center $(h,k) = (-6, 4)$

Signal can be transmitted within 15 km radius r

Solution:

Substitute the values to the center-radius form of the equation of the circle $(x-h)^2 + (y-k)^2 = r^2$, then expand to get the general form.

$$(x - h)^2 + (y - k)^2 = r^2$$

$$(x + 6)^2 + (y - 4)^2 = 15^2$$

$$x^2 + 12x + 36 + y^2 - 8y + 16 = 225$$

$$x^2 + y^2 + 12x - 8y + 36 + 16 - 225 = 0$$

$$x^2 + y^2 + 12x - 8y - 173 = 0$$

Answer:

The equation that represents the transmission boundaries of the tower is $x^2 + y^2 + 12x - 8y - 173 = 0$.



Explore

Let's have some practice on the things that you have learned about graphs of circles.

Activity 8: Match Up!

Match the equation of the circle in column A with its corresponding graph in column B. Write the letter of your answer on your answer sheet.

Set No. 1

Column A

1. $x^2 + (y+1)^2 = 4$

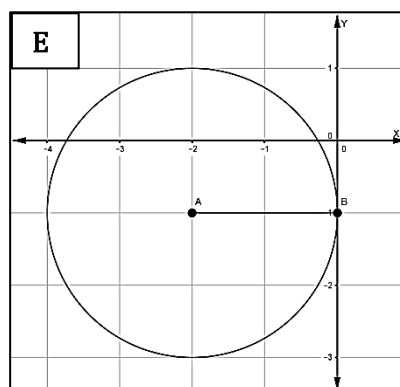
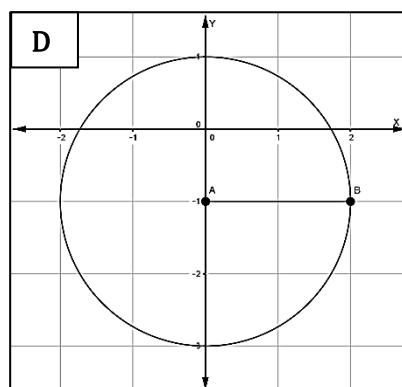
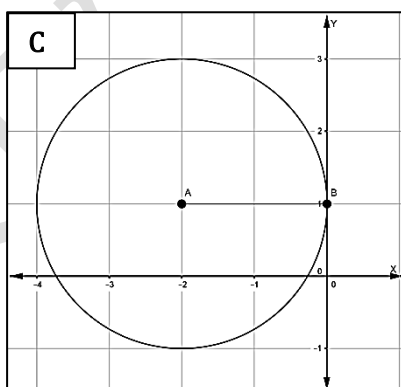
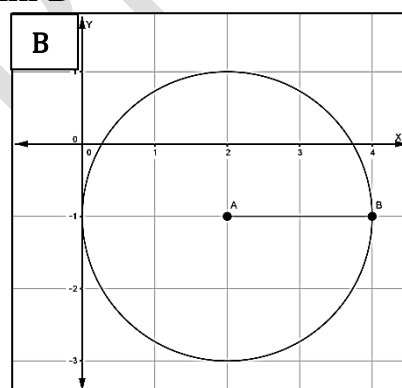
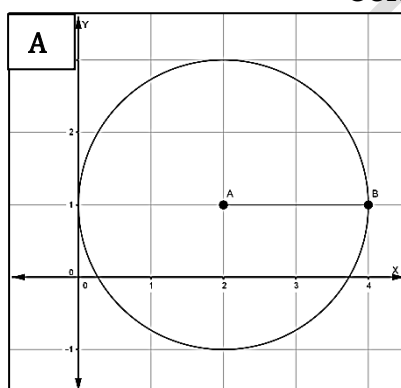
2. $(x-2)^2 + (y-1)^2 = 4$

3. $(x+2)^2 + (y+1)^2 = 4$

4. $(x-2)^2 + (y+1)^2 = 4$

5. $(x+2)^2 + (y-1)^2 = 4$

Column B



Set No. 2

Column A

6. $x^2 + y^2 = 9$

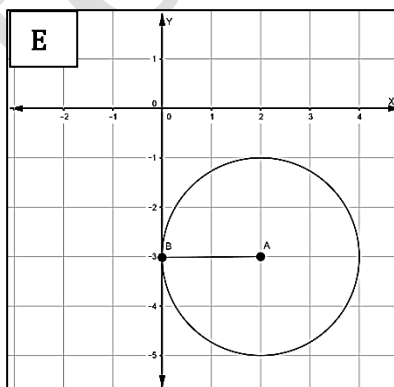
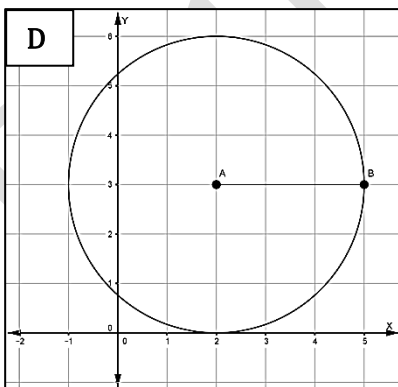
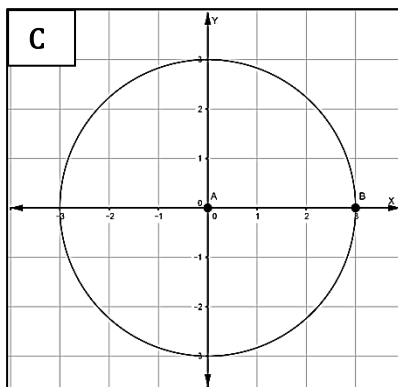
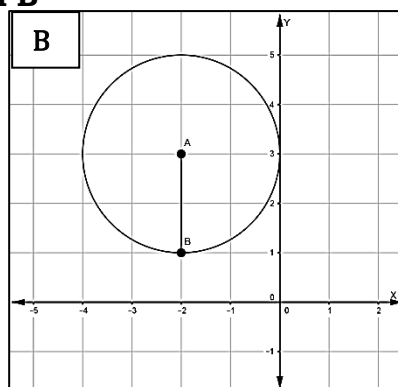
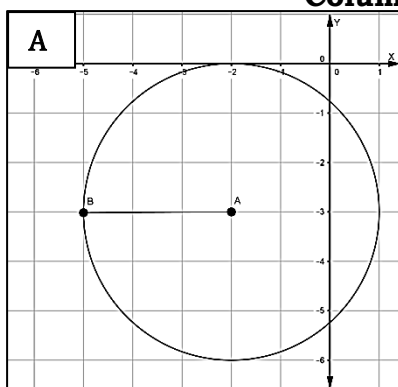
7. $(x-2)^2 + (y-3)^2 = 9$

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

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

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

Column B



Now that you know the important ideas about the topic, let's go deeper by moving on to the next section.



Deepen

Activity 9: Wrap Around

In solving the following worded problems, you need to apply the concepts you have learned about distance and midpoint formula and equation of circles.

1. The endpoints of the diameter of a circle have coordinates $(-11, 5)$ and $(3, 5)$.
 - A. Where is center of the circle located?
 - B. How long is its radius?
 - C. Write the equation of the circle in center-radius form.
2. Determine the equation of the circle in center-radius form if its center is at $(-3, -6)$ and it passes through $(-7, -3)$.
 - A. What is the length of the radius of the circle?
 - B. Write the equation of the circle in general form
3. The area covered by a typhoon on a particular time was represented the equation $x^2 + y^2 + 160x - 240y + 20400 = 0$. If the location of the eye of the typhoon has coordinates $(-80, 120)$, how long is the diameter of the typhoon?
4. Tell whether the equation $x^2 + y^2 - 4x + 8y + 24 = 0$ determines a circle. Support your answer
5. Sketch the graph of the circle given by the equation $x^2 + y^2 - 14x + 10y + 58 = 0$.



Gauge

Assessment: Post-Test

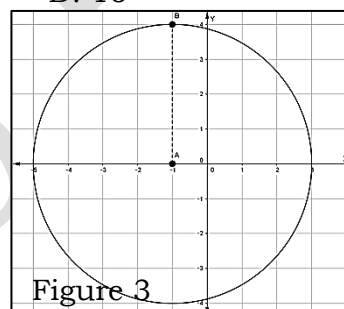
Direction: Find out how much have you learned from the lesson. Choose the letter of the correct answer to the question. Write your answer in a separate sheet of paper.

1. The center-radius form of an equation of a circle is $x^2 + y^2 = r^2$. Where is the center of the circle located?
 - A. Quadrant 1
 - B. on the negative x-axis
 - C. origin
 - D. on the positive y-axis
2. What is the center of the circle whose equation is given by $(x+4)^2 + (y-5)^2 = 81$?
 - A. $(4, 5)$
 - B. $(4, -5)$
 - C. $(-4, -5)$
 - D. $(-4, 5)$

3. What is the radius of the circle whose equation is given by $(x+4)^2+(y-5)^2=81$?
A. 4 B. 5 C. 9 D. 81
4. What is the equation of the circle with center at the origin and with a radius of 6?
A. $x^2+y^2=6$ B. $x^2+y^2=6^2$ C. $x^2-y^2=36$ D. $x^2-y^2=36^2$
5. What is the equation of the circle with center at (8,-1) and radius of 4?
A. $(x+8)^2+(y-1)^2=16$ B. $(x-8)^2+(y-1)^2=16$
C. $(x-8)^2+(y+1)^2=16$ D. $(x+8)^2+(y+1)^2=16$
6. A circle with a radius of 5 inches has its center at point (-3, 7). Which of the following illustrates its equation in general form?
A. $x^2+y^2+6x-14y+33=0$ B. $x^2+y^2+6x-14y-33=0$
C. $x^2+y^2+6x-14y+83=0$ D. $x^2+y^2+6x-14y-83=0$
7. Which of the following equations describe a circle on the coordinate plane with a radius of 16 units?
A. $(x-4)^2+(y-4)^2=4^2$ B. $(x-2)^2-(y-2)^2=4^2$
C. $(x+2)^2-(y+2)^2=16^2$ D. $(x-4)^2+(y-4)^2=16^2$
8. What is the center of the circle whose equation is given by $x^2+y^2+4x+8y-16=0$?
A. (2, 4) B. (-2, -4) C. (2, -4) D. (-2, 4)
9. What is the radius of the circle whose equation is given by $x^2+y^2+4x+8y-16=0$?
A. 4 B. 6 C. 8 D. 16

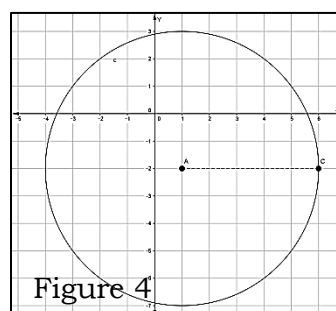
10. Given the graph in figure 3, what is the equation of the circle in center-radius form?

- A. $(x+1)^2+y^2=4^2$
- B. $(x-1)^2+y^2=4^2$
- C. $x^2+(y+1)^2=4^2$
- D. $x^2+(y-1)^2=4^2$

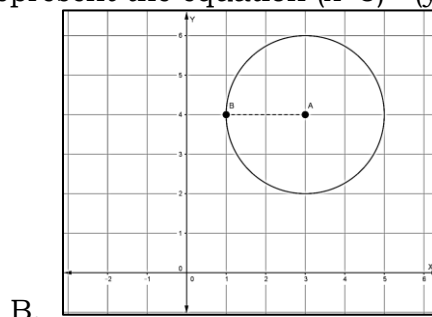
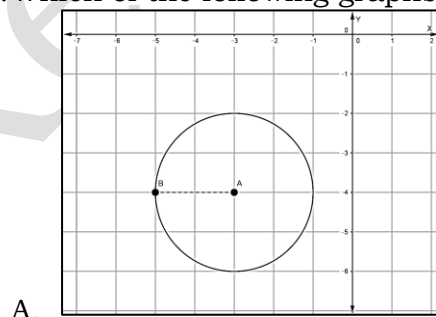


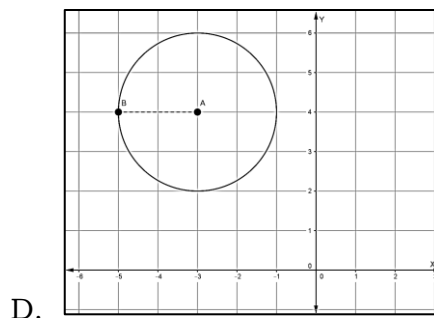
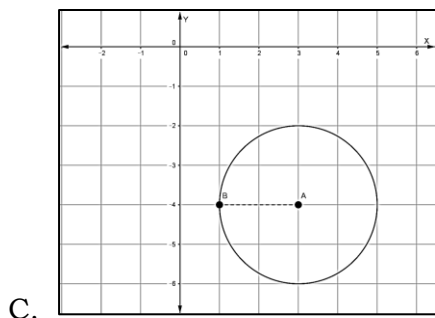
11. Given the graph in figure 4, what is the equation of the circle in its general form?

- A. $x^2+y^2+2x+4y-20=0$
- B. $x^2+y^2+2x+4y+20=0$
- C. $x^2+y^2-2x+4y-20=0$
- D. $x^2+y^2-2x+4y+20=0$

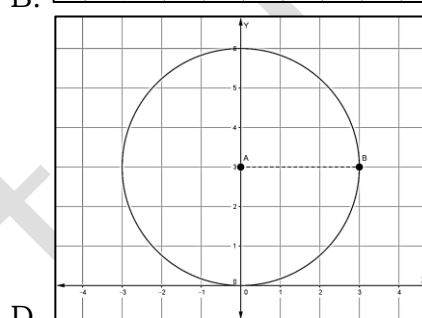
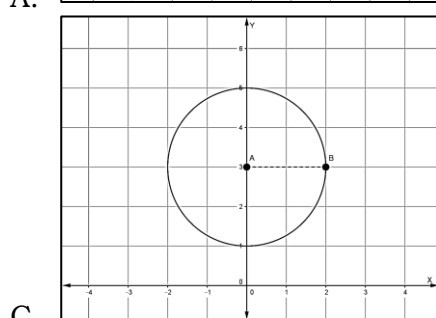
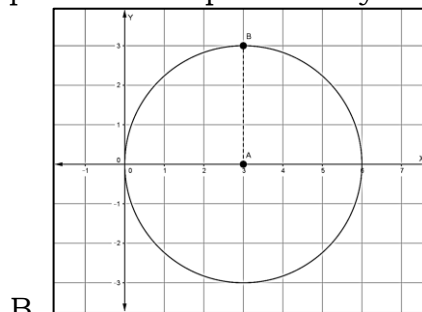
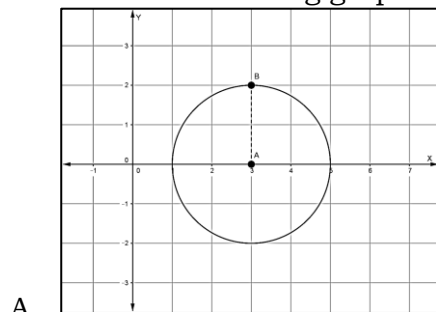


12. Which of the following graphs represent the equation $(x+3)^2+(y-4)^2=4$?





13. Which of the following graphs represent the equation $x^2 + y^2 - 6x = 0$?



14. A radius of a circle has endpoints $(0, 3)$ and $(-3, 3)$. What is the equation that defines the circle if its center is on the y -axis?

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

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

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

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

15. An errand service delivery area in Bacnotan is represented by a circle, and extends to the points $(0, 18)$ and $(-6, 8)$, these points are on the diameter of the circular area. Write an equation for the circle that models this delivery area.

A. $(x+3)^2 + (y-13)^2 = 34$

B. $(x-3)^2 + (y-13)^2 = 34$

C. $(x+3)^2 + (y+13)^2 = 34$

D. $(x-3)^2 + (y+13)^2 = 34$

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