

Circle Equation Lab

Build and decode circle equations with center and radius.

HIGH SCHOOL • HSG-GPE.A.1

CCSS.Math.Content.HSG-GPE.A.1 "Derive the equation of a circle of given center and radius using the Pythagorean Theorem; complete the square to find the center and radius of a circle given by an equation."

NAME _____

DATE _____

CENTER, RADIUS, EQUATION

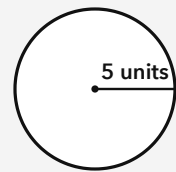
A circle with center (h, k) and radius r has equation $(x - h)^2 + (y - k)^2 = r^2$. This comes from the Pythagorean Theorem because every point on the circle is r units from the center. To decode an equation, group the x -terms and y -terms, then complete the square.

WORKED EXAMPLE

The circle shown has center $(1, -2)$. Use the labeled radius to write its equation in standard form.

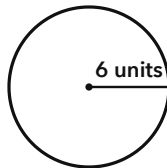
1. Start with $(x - h)^2 + (y - k)^2 = r^2$.
2. Substitute $h = 1$, $k = -2$, and $r = 5$.
3. Simplify the subtraction of a negative and square the radius.

Answer: $(x - 1)^2 + (y + 2)^2 = 25$



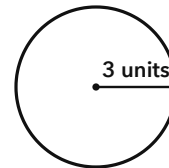
PRACTICE 6 problems

- 1** The circle shown has center $(-3, 4)$. Use the labeled radius to write its equation in standard form.



ANSWER _____

- 2** The circle shown has center $(7, -4)$. Use the labeled radius to write its equation in standard form.



ANSWER _____

- 3** Write the equation of a circle with center $(-8, 6)$ and radius 4.

ANSWER _____

- 4** Complete the square to find the center and radius of $x^2 + y^2 - 12x + 8y - 20 = 0$.

ANSWER _____

- 5** Complete the square to find the center and radius of $x^2 + y^2 + 14x - 18y + 114 = 0$.

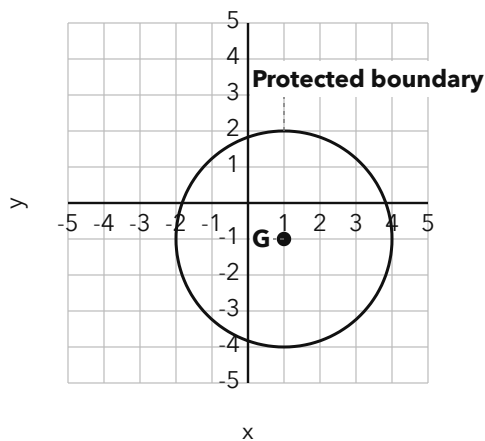
ANSWER _____

- 6** Complete the square to find the center and radius of $x^2 + y^2 - 6x - 16y + 57 = 0$.

ANSWER _____

APPLY IT Show your work

- 1** A game designer uses the circular boundary shown on the coordinate grid for a protected zone. Point G is the center of the zone. Write an equation for the boundary.



ANSWER _____

2

For a drone-light-show design, a circular formation is modeled by $x^2 + y^2 + 4x - 10y + 13 = 0$. Find the center and radius of the formation.

WORK SPACE

ANSWER _____**CHALLENGE** One step up

A circle has equation $x^2 + y^2 + ax - 10y + 9 = 0$ and passes through $(4, 3)$. Find a , then find the circle's center and radius. Show how the point determines a .

WORK SPACE AND ANSWER

PART 1 • PRACTICE

#	PROBLEM	ANSWER
1	The circle shown has center $(-3, 4)$. Use the labeled radius to write its equation in standard form.	$(x + 3)^2 + (y - 4)^2 = 36$
2	The circle shown has center $(7, -4)$. Use the labeled radius to write its equation in standard form.	$(x - 7)^2 + (y + 4)^2 = 9$
3	Write the equation of a circle with center $(-8, 6)$ and radius 4.	$(x + 8)^2 + (y - 6)^2 = 16$
4	Complete the square to find the center and radius of $x^2 + y^2 - 12x + 8y - 20 = 0$.	Center: $(6, -4)$; radius: $6\sqrt{2}$
5	Complete the square to find the center and radius of $x^2 + y^2 + 14x - 18y + 114 = 0$.	Center: $(-7, 9)$; radius: 4
6	Complete the square to find the center and radius of $x^2 + y^2 - 6x - 16y + 57 = 0$.	Center: $(3, 8)$; radius: 4

PART 2 • APPLY IT

1. $(x - 1)^2 + (y + 1)^2 = 9$ The grid shows center $(1, -1)$. The boundary is 3 units from the center, so $r^2 = 9$.
2. **Center: $(-2, 5)$; radius: 4** Complete the square to get $(x + 2)^2 + (y - 5)^2 = 16$. Read the center from the signs inside the parentheses and take the square root of 16.

CHALLENGE

$a = -1$; center: $(1/2, 5)$; radius: $\sqrt{65}/2$

Accept equivalent standard-form equations and equivalent radical notation, such as $(\sqrt{65})/2$. For completed-square items, accept correct work that identifies the same center and positive radius.