

# Circle Code

Build circle equations from centers, radii, and points.

HIGH SCHOOL • MA.912.GR.7.2

**MA.912.GR.7.2** "Given a mathematical or real-world context, derive and create the equation of a circle using key features."

NAME \_\_\_\_\_

DATE \_\_\_\_\_

## CIRCLE EQUATION

A circle with center  $(h,k)$  and radius  $r$  has the equation  $(x-h)^2 + (y-k)^2 = r^2$ . Substitute the center coordinates and radius, then simplify the signs inside the parentheses. The signs in the equation are opposite the signs of the center coordinates.

## WORKED EXAMPLE

Write the equation of a circle with center  $(-11,13)$  and radius 12.

1. Start with  $(x-h)^2 + (y-k)^2 = r^2$ .
2. Substitute  $h=-11$ ,  $k=13$ , and  $r=12$ :  $(x-(-11))^2 + (y-13)^2 = 12^2$ .
3. Simplify the signs and square the radius:  $(x+11)^2 + (y-13)^2 = 144$ .

**Answer:  $(x+11)^2 + (y-13)^2 = 144$**

## PRACTICE 6 problems

- 1** Write the equation of a circle with center  $(2,-7)$  and radius 5.

ANSWER \_\_\_\_\_

- 2** Write the equation of a circle with center  $(-6,4)$  and diameter 18.

ANSWER \_\_\_\_\_

- 3** A circle has center  $(8,-3)$  and passes through  $(8,7)$ . Write its equation.

ANSWER \_\_\_\_\_

- 4** A circle has center  $(-2,6)$  and passes through  $(1,10)$ . Write its equation.

ANSWER \_\_\_\_\_

- 5** The endpoints of a circle's diameter are  $(2,4)$  and  $(10,4)$ . Write the equation of the circle.

ANSWER \_\_\_\_\_

- 6** Write the equation of a circle with center  $(0,-8)$  and radius 15.

ANSWER \_\_\_\_\_

## APPLY IT Show your work

- 1** On a coordinate map of a school concert, a charging station is at  $(3,-4)$ . Its Wi-Fi signal reaches the point  $(3,5)$  in every direction. Write the equation of the circular signal boundary.

WORK SPACE

ANSWER \_\_\_\_\_

- 2** A robotics team marks a circular practice zone on a coordinate grid. The endpoints of the zone's diameter are  $(-8,2)$  and  $(6,2)$ . Write the equation of the boundary.

WORK SPACE

ANSWER \_\_\_\_\_

## CHALLENGE One step up

### CHALLENGE

A circle passes through  $(4,0)$ ,  $(7,1)$ , and  $(0,2)$ . Find its equation and explain how you found its key features.

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## PART 1 • PRACTICE

| # | PROBLEM                                                                                      | ANSWER                    |
|---|----------------------------------------------------------------------------------------------|---------------------------|
| 1 | Write the equation of a circle with center (2,-7) and radius 5.                              | $(x-2)^2 + (y+7)^2 = 25$  |
| 2 | Write the equation of a circle with center (-6,4) and diameter 18.                           | $(x+6)^2 + (y-4)^2 = 81$  |
| 3 | A circle has center (8,-3) and passes through (8,7). Write its equation.                     | $(x-8)^2 + (y+3)^2 = 100$ |
| 4 | A circle has center (-2,6) and passes through (1,10). Write its equation.                    | $(x+2)^2 + (y-6)^2 = 25$  |
| 5 | The endpoints of a circle's diameter are (2,4) and (10,4). Write the equation of the circle. | $(x-6)^2 + (y-4)^2 = 16$  |
| 6 | Write the equation of a circle with center (0,-8) and radius 15.                             | $x^2 + (y+8)^2 = 225$     |

## PART 2 • APPLY IT

1.  $(x-3)^2 + (y+4)^2 = 81$  The center is (3,-4). The distance from (3,-4) to (3,5) is 9, so the radius squared is 81.
2.  $(x+1)^2 + (y-2)^2 = 49$  The midpoint of the diameter is (-1,2), so it is the center. The diameter is 14 units, so the radius is 7.

## CHALLENGE

The perpendicular bisectors of the chords meet at (4,5), so the center is (4,5). Each given point is 5 units from that center, so the equation is  $(x-4)^2 + (y-5)^2 = 25$ .

Accept equivalent equations with the two squared terms in either order. Accept unsimplified forms such as  $(x-0)^2$ , but the radius must be squared correctly.