

Geometry · Equation of a Circle · Worksheet Answer Key

Common Core G-GPE.A.1 · mathovore.fr

Each solution shows the substitution or the completing-the-square steps, then the final answer in bold. Check that the signs in the parentheses are opposite to the center coordinates and that the right side is the square of the radius.

GeometryCommon Core: G-GPE.A.1

Problem 1: Center at the origin

With the center at the origin, $x^2 + y^2 = r^2$ and $r^2 = 25$.

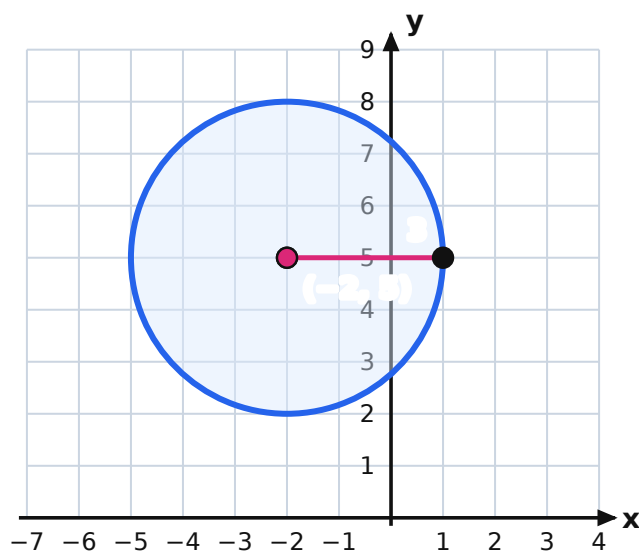
$$x^2 + y^2 = 25$$

Problem 2: Center and radius given

Use $(x-h)^2 + (y-k)^2 = r^2$ with $h = 3$, $k = 2$ and $r^2 = 16$. Since $r^2 = 4^2 = 16$:

$$(x-3)^2 + (y-2)^2 = 16$$

Problem 3: Negative x-coordinate



The circle $(x + 2)^2 + (y - 5)^2 = 9$.

Here $h = -2$ and $k = 5$, so $x - h = x + 2$ and $y - k = y - 5$. Also $r^2 = 9$.

$$(x+2)^2+(y-5)^2=9$$

Problem 4: Radius is a square root

$$r^2=(\sqrt{7})^2=7.$$

$$(x-4)^2+(y+1)^2=7$$

Problem 5: Given the diameter length

The radius is half the diameter: $r=10$, so $r^2=100$.

$$(x+6)^2+(y+3)^2=100$$

Problem 6: Read the center and radius

Compare with $(x-h)^2+(y-k)^2=r^2$: $x-5$ gives $h=5$; $y+2=y-(-2)$ gives $k=-2$; $r^2=49$ gives $r=7$.

Center $(5,-2)$, **radius** 7

Problem 7: Circle at the origin

There are no shifts, so the center is the origin. $r^2=36$ gives $r=6$.

Center $(0,0)$, **radius** 6

Problem 8: Radius that is not a whole number

$x+1=x-(-1)$ gives $h=-1$, and $k=4$. The radius is $r=\sqrt{20}=\sqrt{4\cdot 5}=2\sqrt{5}$.

Center $(-1,4)$, **radius** $2\sqrt{5}$

Problem 9: Unit circle shifted

Both signs flip: $h=-8$ and $k=-8$. $r^2=1$ gives $r=1$.

Center $(-8,-8)$, **radius** 1

Problem 10: Is the point on the circle?

Substitute: $(6-2)^2+(6-3)^2=4^2+3^2=16+9=25$.

This equals $r^2=25$, so **the point lies on the circle**.

Problem 11: Inside, on or outside

A: $(4-1)^2+(2+2)^2=9+16=25$, and 25 is less than 36, so A is **inside**.

B: $(7-1)^2+(-2+2)^2=36+0=36$, which equals 36, so B is **on** the circle.

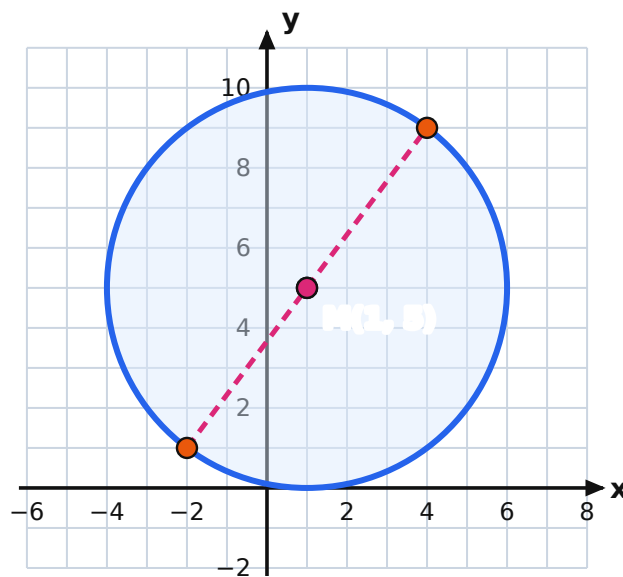
C: $(6-1)^2+(5+2)^2=25+49=74$, and 74 is greater than 36, so C is **outside**.

Problem 12: Center and a point on the circle

The radius is the distance from the center to the point: $r^2=(4-1)^2+(6-2)^2=9+16=25$.

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

Problem 13: Endpoints of a diameter



Center M(1, 5), radius 5.

The center is the midpoint: $\left(\frac{-2+4}{2}, \frac{1+9}{2}\right)=(1,5)$.

The radius is the distance from the center to B: $r^2=(4-1)^2+(9-5)^2=9+16=25$.

$$(x-1)^2+(y-5)^2=25$$

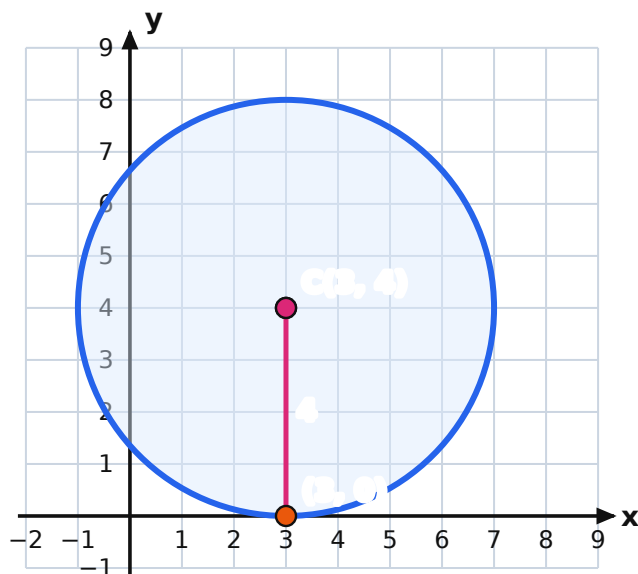
Problem 14: Find a missing coordinate

The equation is $(x-2)^2+(y+3)^2=25$. Substitute $x=5$: $9+(k+3)^2=25$.

So $(k+3)^2=16$ and $k+3=4$ or $k+3=-4$.

$k=1$ or $k=-7$

Problem 15: Tangent to the x-axis



Radius 4 reaches the x-axis at (3, 0).

A circle tangent to the x-axis touches it where the radius is perpendicular to the axis, so the radius equals the distance from the center to the axis: the y-coordinate, $r=4$.

$$(x-3)^2+(y-4)^2=16$$

Problem 16: Tangent to the y-axis

The distance from the center to the y-axis is the absolute value of the x-coordinate: $r=|-5|=5$, so $r^2=25$.

$$(x+5)^2+(y-2)^2=25$$

Problem 17: Complete the square, case 1

Group the terms and move the constant: $(x^2+8x)+(y^2-2y)=-8$.

Add $\left(\frac{8}{2}\right)^2=16$ for the x-terms and $\left(\frac{-2}{2}\right)^2=1$ for the y-terms to both sides:
 $(x^2+8x+16)+(y^2-2y+1)=-8+16+1=9$.

Factor each perfect square: $(x+4)^2+(y-1)^2=9$.

Center $(-4,1)$, **radius** 3

Problem 18: Complete the square, case 2

Group the terms and move the constant: $(x^2-10x)+(y^2-4y)=-4$.

Add $\left(\frac{-10}{2}\right)^2 = 25$ for the x-terms and $\left(\frac{-4}{2}\right)^2 = 4$ for the y-terms to both sides:
 $(x^2 - 10x + 25) + (y^2 - 4y + 4) = -4 + 25 + 4 = 25$.

Factor each perfect square: $(x-5)^2 + (y-2)^2 = 25$.

Center (5,2), radius 5

Problem 19: Complete the square, case 3

Group the terms and move the constant: $(x^2 + 2x) + (y^2 + 6y) = 15$.

Add $\left(\frac{2}{2}\right)^2 = 1$ for the x-terms and $\left(\frac{6}{2}\right)^2 = 9$ for the y-terms to both sides:
 $(x^2 + 2x + 1) + (y^2 + 6y + 9) = 15 + 1 + 9 = 25$.

Factor each perfect square: $(x+1)^2 + (y+3)^2 = 25$.

Center (-1,-3), radius 5

Problem 20: Only one variable shifted

Group the terms and move the constant: $x^2 + (y^2 - 12y) = -20$.

Add $\left(\frac{-12}{2}\right)^2 = 36$ for the y-terms to both sides: $x^2 + (y^2 - 12y + 36) = -20 + 36 = 16$.

Factor each perfect square: $x^2 + (y-6)^2 = 16$.

Center (0,6), radius 4

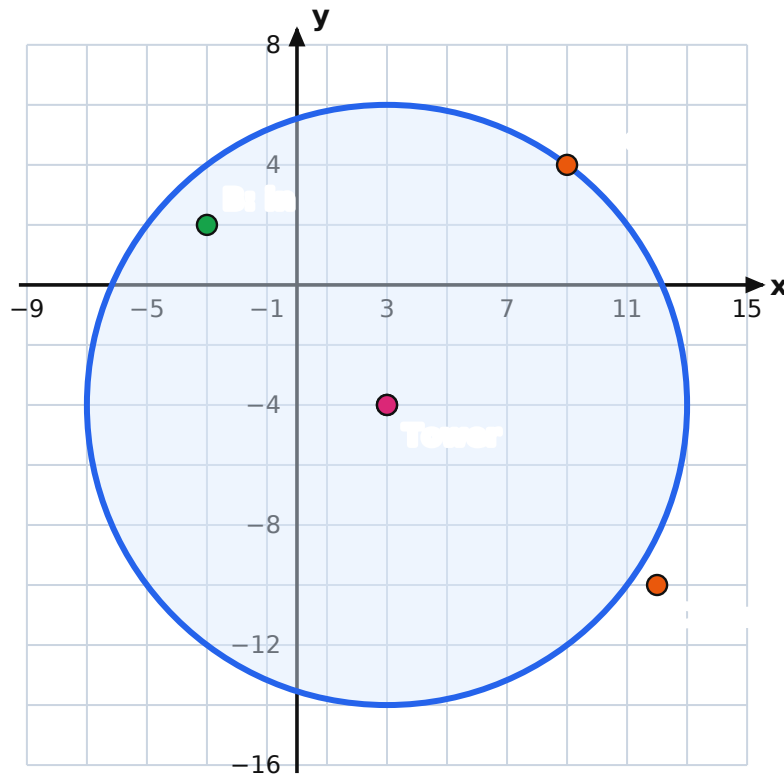
Problem 21: Points with a given x-coordinate

Substitute $x = 8$: $(8-2)^2 + (y+1)^2 = 100$, so $36 + (y+1)^2 = 100$.

$(y+1)^2 = 64$, so $y+1 = 8$ or $y+1 = -8$.

$y = 7$ or $y = -9$

Problem 22: Cell tower coverage



Coverage edge: $(x - 3)^2 + (y + 4)^2 = 100$.

Edge of coverage: $(x-3)^2+(y+4)^2=100$.

Town A: $(9-3)^2+(4+4)^2=36+64=100$, exactly on the edge.

Town B: $(-3-3)^2+(2+4)^2=36+36=72$, less than 100, so inside.

Town C: $(12-3)^2+(-10+4)^2=81+36=117$, more than 100, so outside.

A is on the boundary (signal at the limit), B has a signal, C has none.

Problem 23: Wi-Fi router

Boundary: $(x-2)^2+(y-1)^2=625$, since $25^2=625$.

Laptop at (20, 18): $(20-2)^2+(18-1)^2=324+289=613$, less than 625, so **inside the range**.

Laptop at (20, 20): $(20-2)^2+(20-1)^2=324+361=685$, more than 625, so **outside the range**.

Problem 24: Pond on a map

Group and complete the square: $(x^2-8x+16)+(y^2+6y+9)=16+9$, so $(x-4)^2+(y+3)^2=25$.

Center $(4, -3)$, radius 5 yd.

Origin: $(0-4)^2+(0+3)^2=16+9=25$, which equals 25, so **the entrance is on the edge of the pond.**

Problem 25: Earthquake zone

Boundary: $(x+6)^2+(y-8)^2=225$.

Point (6, -1): $(6+6)^2+(-1-8)^2=144+81=225$, exactly on the boundary, so it is felt right at the limit.

Origin: $(0+6)^2+(0-8)^2=36+64=100$, less than 225, so **felt.**