

Writing and Graphing Circle Equations

Grade 10 – Geometry math · Worksheet Answer Key · Standards: G-GPE.A.1

Each solution shows the substitution, the added constants when completing the square and a check of the final radius. Verify the signs of the center by reversing the signs inside the parentheses.

Standards: G-GPE.A.1 · **Level:** Grade 10 Geometry

Problem 1 Write the Equation

$$(x - 4)^2 + (y - (-5))^2 = 6^2 = 36.$$

$$(x - 4)^2 + (y + 5)^2 = 36$$

Problem 2 Centered at the Origin

$$x^2 + y^2 = 11^2 = 121.$$

$$x^2 + y^2 = 121$$

Problem 3 Read Center and Radius

$(x + 2) = (x - (-2))$ and $(y + 8) = (y - (-8))$, so $h = -2$ and $k = -8$. The radius is $\sqrt{64} = 8$.

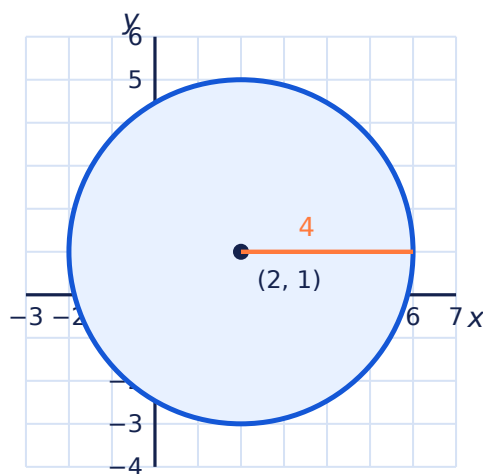
Center $(-2, -8)$, radius 8

Problem 4 Center on the x-Axis

$$(x + 5)^2 + (y - 0)^2 = (\sqrt{10})^2 = 10.$$

$$(x + 5)^2 + y^2 = 10$$

Problem 5 Equation from a Graph



Center $(2, 1)$, radius 4.

The center is $(2, 1)$. The point $(6, 1)$ is 4 units to the right, so $r = 4$.

$$(x - 2)^2 + (y - 1)^2 = 16$$

Problem 6 Radius from a Point

$$r^2 = (1 - (-3))^2 + (7 - 2)^2 = 16 + 25 = 41.$$

$$(x + 3)^2 + (y - 2)^2 = 41$$

Problem 7 Equation from a Diameter

$$\text{Center} = \text{midpoint} = \left(\frac{-4 + 6}{2}, \frac{3 + (-1)}{2} \right) = (1, 1).$$

$$r^2 = (6 - 1)^2 + (-1 - 1)^2 = 25 + 4 = 29.$$

$$(x - 1)^2 + (y - 1)^2 = 29$$

Problem 8 Inside, On or Outside

$$(a) (7 - 1)^2 + (0 + 2)^2 = 36 + 4 = 40: \text{ on the circle.}$$

$$(b) (-2 - 1)^2 + (3 + 2)^2 = 9 + 25 = 34 \text{ is less than } 40: \text{ inside.}$$

$$(c) (5 - 1)^2 + (4 + 2)^2 = 16 + 36 = 52 \text{ is greater than } 40: \text{ outside.}$$

(a) on (b) inside (c) outside

Problem 9 Another Point on the Circle

Radius squared: $(6 + 2)^2 + (-1 + 4)^2 = 64 + 9 = 73$.

For $(1, 4)$: $(1 + 2)^2 + (4 + 4)^2 = 9 + 64 = 73$.

Both points give $r^2 = 73$, so $(1, 4)$ is on the circle.

Problem 10 Complete the Square: Basic

$$(x^2 - 6x + 9) + (y^2 + 10y + 25) = -18 + 9 + 25 = 16.$$

$$(x - 3)^2 + (y + 5)^2 = 16.$$

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

Problem 11 Complete the Square: Irrational Radius

$$(x^2 + 8x + 16) + (y^2 - 2y + 1) = 4 + 16 + 1 = 21.$$

$$(x + 4)^2 + (y - 1)^2 = 21.$$

Center $(-4, 1)$, radius $\sqrt{21} \approx 4.58$

Problem 12 Completing the Square with Large Terms

$$(x^2 - 12x + 36) + (y^2 - 4y + 4) = -20 + 36 + 4 = 20.$$

$$(x - 6)^2 + (y - 2)^2 = 20.$$

Center $(6, 2)$, radius $2\sqrt{5}$

Problem 13 Divide First

Divide by 2: $x^2 + y^2 + 2x - 8y - 5 = 0$.

$$(x^2 + 2x + 1) + (y^2 - 8y + 16) = 5 + 1 + 16 = 22.$$

$$(x + 1)^2 + (y - 4)^2 = 22.$$

Center $(-1, 4)$, radius $\sqrt{22} \approx 4.69$

Problem 14 Circle, Point or Nothing?

(a) $(x - 2)^2 + (y + 3)^2 = -13 + 4 + 9 = 0$. Only $(2, -3)$ satisfies it.

(b) $(x - 2)^2 + (y + 3)^2 = -20 + 13 = -7$. A sum of squares cannot be negative.

(a) the single point (2, -3) (b) no graph

Problem 15 Cell Tower Coverage

(a) $(x + 3)^2 + (y - 5)^2 = 144$.

(b) $(6 + 3)^2 + (-3 - 5)^2 = 81 + 64 = 145$, which is greater than 144, so the town is just outside.

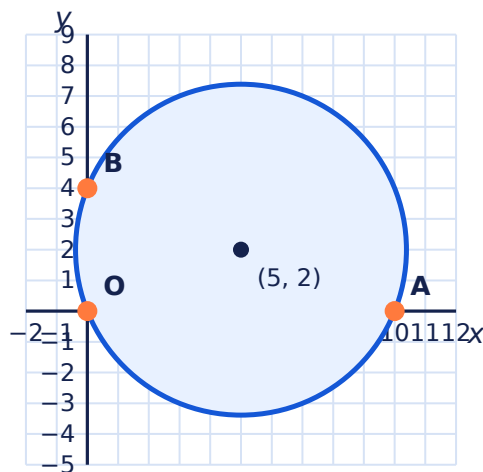
(a) $(x + 3)^2 + (y - 5)^2 = 144$ (b) Not covered

Problem 16 Flower Bed in a Corner

The circle is tangent to both axes, so its center is 4 units from each: (4, 4).

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

Problem 17 Circle Through Three Points



The circle has center (5, 2).

The angle at (0, 0) is 90° , so it is inscribed in a semicircle and the segment from (10, 0) to (0, 4) is a diameter.

Center = (5, 2). $r^2 = 5^2 + 2^2 = 29$.

Check (0, 0): $25 + 4 = 29$.

$(x - 5)^2 + (y - 2)^2 = 29$

Problem 18 Ferris Wheel Heights

(a) $x^2 + (y - 12)^2 = 100$.

(b) $25 + (y - 12)^2 = 100$, so $(y - 12)^2 = 75$ and $y = 12 \pm 5\sqrt{3} \approx 20.66$ or 3.34 .

(a) $x^2 + (y - 12)^2 = 100$ (b) ≈ 20.7 ft or ≈ 3.3 ft

Problem 19 Bike Path Through a Plaza

Substitute $y = x + 1$: $(x - 1)^2 + (x + 1 - 2)^2 = 8$, so $2(x - 1)^2 = 8$ and $(x - 1)^2 = 4$.

$x - 1 = \pm 2$, so $x = 3$ or $x = -1$. Then $y = 4$ or $y = 0$.

(3, 4) and (-1, 0)

Problem 20 Tangent Line to a Circle

(a) $(3 + 1)^2 + (4 - 2)^2 = 16 + 4 = 20$. ✓

(b) The center is $(-1, 2)$. The radius to $(3, 4)$ has slope $\frac{4 - 2}{3 - (-1)} = \frac{1}{2}$. The tangent is perpendicular, so its slope is -2 .

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

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