MATHEMATICS · GRADES 10-12

Circle equations

Difficulty level: Advanced

Mathematics: Grades 10-12

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Overview of the concept

This is how you describe a circle exactly by its centre and radius. A designer positions a round logo with it, and an engineer maps the reach of a sprinkler the same way. The equation is just the circle written in numbers, so anyone reading it knows exactly where the circle sits and how big it is.



Rule

Circle equation: $(x - h)^2 + (y - k)^2 = r^2$.

A circle with centre (h, k) and radius r is all the points at distance r from the centre. The centre tells you h and k, and the radius tells you r.

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Worked examples

EXAMPLE 1

Q Write the equation of the circle with centre (0, 0) and radius 5.

SOLUTION

The form is $x^2 + y^2 = r^2$.

Here r = 5, so $r^2 = 5 \times 5 = 25$.

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

EXAMPLE 2

Q Write the equation of the circle with centre (2, 3) and radius 4.

SOLUTION

The form is $(x - h)^2 + (y - k)^2 = r^2$.

Here h = 2 and k = 3, and r = 4, so $r^2 = 4 \times 4 = 16$.

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

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Practice questions

1 Write the equation of the circle with centre (0, 0) and radius 3 m.

- **A** $x^2 + y^2 = 3$
- **B** $x^2 + y^2 = 9$
- **C** $x^2 + y^2 = 81$
- **D** $(x - 3)^2 + (y - 3)^2 = 9$

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2 Write the equation of the circle with centre (1, 2) and radius 2 m.

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

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3 What are the centre and radius of the circle $x^2 + y^2 = 49$?

- **A** Centre (0, 0), radius 49
- **B** Centre (7, 0), radius 7
- **C** Centre (0, 0), radius 7
- **D** Centre (0, 0), radius 14

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4 What are the centre and radius of the circle $(x - 4)^2 + (y - 1)^2 = 9$?

- **A** Centre (-4, -1), radius 3
- **B** Centre (4, 1), radius 9
- **C** Centre (4, 1), radius 3
- **D** Centre (1, 4), radius 3

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5 Does the point $(3, 4)$ lie on the circle $x^2 + y^2 = 25$?

- **A** Yes
- **B** No

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6 Write the equation of the circle with centre $(0, 0)$ and radius 10 m.

- **A** $x^2 + y^2 = 10$
- **B** $x^2 + y^2 = 100$
- **C** $(x - 10)^2 + (y - 10)^2 = 100$
- **D** $x^2 + y^2 = 20$

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7 What are the centre and radius of the circle $(x + 2)^2 + y^2 = 4$?

- **A** Centre (2, 0), radius 2
- **B** Centre (-2, 0), radius 4
- **C** Centre (-2, 0), radius 2
- **D** Centre (0, -2), radius 2

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8 What does the letter r stand for in a circle equation?

- **A** Diameter
- **B** Radius
- **C** Circumference
- **D** Centre

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9 **Write the equation of the circle with centre (5, 5) and radius 1 m.**

- **A** $(x + 5)^2 + (y + 5)^2 = 1$
- **B** $(x - 5)^2 + (y - 5)^2 = 1$
- **C** $(x - 5)^2 + (y - 5)^2 = 5$
- **D** $x^2 + y^2 = 1$

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10 **What is the diameter of the circle $x^2 + y^2 = 25$?**

- **A** 10
- **B** 5
- **C** 25
- **D** 50

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ANSWER KEY

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

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

3. Centre (0, 0), radius 7

4. Centre (4, 1), radius 3

5. Yes

6. $x^2 + y^2 = 100$

7. Centre (-2, 0), radius 2

8. Radius

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

10. 10

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