

PART 1: Circles

Identify the center and radius of each.

1. $(x + 5)^2 + (y - 13)^2 = 9$

$C: (-5, 13) \quad r = 3$

3. $x^2 + y^2 - 8x + 28y + 187 = 0$

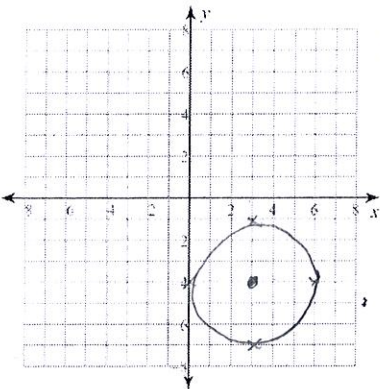
$x^2 - 8x + 16 + y^2 + 28y + 196 = -187 + 16 + 196$

$(x - 4)^2 + (y + 14)^2 = 25$

$C: (4, -14) \quad r = 5$

Identify the center and radius of each. Then sketch the graph.

5. $(x - 3)^2 + (y + 4)^2 = 9$



$C: (3, -4)$
 $r = 3$

2. $(x - 14)^2 + (y - 12)^2 = 4$

$C: (14, 12) \quad r = 2$

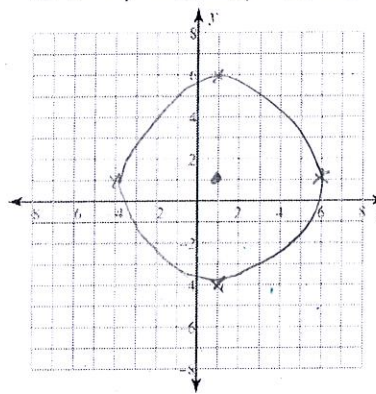
4. $x^2 + y^2 + 28x - 16y + 259 = 0$

$x^2 + 28x + 196 + y^2 - 16y + 64 = -259 + 196 + 64$

$(x + 14)^2 + (y - 8)^2 = 1$

$C: (-14, 8) \quad r = 1$

6. $x^2 + y^2 - 2x - 2y - 23 = 0$



$x^2 - 2x + 1 + y^2 - 2y + 1 = 23 + 1 + 1$
 $(x - 1)^2 + (y - 1)^2 = 25$

$C: (1, 1)$
 $r = 5$

Use the information provided to write the standard form equation of each circle.

7. Center: (10, 6) $(x - 10)^2 + (y - 6)^2 = 1$
Radius: 1

8. Center: (13, 12) $(x - 13)^2 + (y - 12)^2 = 16$
Radius: 4

9. Center: (15, 5)
Point on Circle: (13, 6)

$(x - 15)^2 + (y - 5)^2 = 5^2$

$d = \sqrt{(13 - 15)^2 + (6 - 5)^2} = \sqrt{4 + 1} = \sqrt{5}$

$(x - 15)^2 + (y - 5)^2 = 5$

10. Center: (-4, 3)

Point on Circle: (1, 13)

$(x + 4)^2 + (y - 3)^2 = \sqrt{125}^2$
 $(x + 4)^2 + (y - 3)^2 = 125$

$d = \sqrt{(1 - (-4))^2 + (13 - 3)^2} = \sqrt{25 + 100} = \sqrt{125}$

11. Ends of a diameter: (8, -12) and (10, -14)

$m = \left(\frac{8 + 10}{2}, \frac{-12 + (-14)}{2}\right)$

$\sqrt{(9 - 8)^2 + (-13 - 12)^2} = \sqrt{2}$

$= (9, -13) \Rightarrow \text{Center}$

$(x - 9)^2 + (y + 13)^2 = 2$

12. Ends of a diameter: (1, -9) and (-9, -5)

$m = \left(\frac{1 + (-9)}{2}, \frac{-9 + (-5)}{2}\right) = (-4, -7)$ Center

$\sqrt{(-4 - 1)^2 + (-7 - (-9))^2} = \sqrt{29}$

$(x + 4)^2 + (y + 7)^2 = 29$

Use the information provided to write the general form equation of each circle.

13. $(x - 12)^2 + (y - 16)^2 = 4$

$(x - 12)(x - 12) + (y - 16)(y - 16) = 4$

$x^2 - 12x - 12x + 144 + y^2 - 16y - 16y + 256 - 4 = 0$

$x^2 + y^2 - 24x - 32y + 396 = 0$

14. $(x - 15)^2 + (y - 9)^2 = 9$

$(x - 15)(x - 15) + (y - 9)(y - 9) = 9$

$x^2 - 15x - 15x + 225 + y^2 - 9y - 9y + 81 - 9 = 0$

$x^2 + y^2 - 30x - 18y + 297 = 0$

Use the information provided to write the standard form equation of each circle.

15. $x^2 + y^2 - 12x + 6y + 21 = 0$

$x^2 - 12x + 36 + y^2 + 6y + 9 = -21 + 36 + 9$

$(x - 6)^2 + (y + 3)^2 = 24$

16. $x^2 + y^2 + 20x - 20y + 184 = 0$

$x^2 + 20x + 100 + y^2 - 20y + 100 = -184 + 100 + 100$

$(x + 10)^2 + (y - 10)^2 = 16$

State if the following points are inside, outside, or on the circle $(x - 5)^2 + y^2 = 36$.

17. (6, -5)

$(6 - 5)^2 + (-5)^2 = 36$

$1 + 25 = 36$

$26 < 36$

Inside

18. (5, -6)

$(5 - 5)^2 + (-6)^2 = 36$

$0 + 36 = 36$

$36 = 36$

ON the circle

19. (-2, 3)

$(-2 - 5)^2 + 3^2 = 36$

$49 + 9 = 36$

$58 > 36$

outside

PART 2: Parallel & Perpendicular Lines

Remember

- Two lines are **PARALLEL** if and only if their slopes are **EQUAL**.
 - Any two **horizontal** lines ($y = \#$) are parallel. (Slopes are both **0**.)
 - Any two **vertical** lines ($x = \#$) are parallel. (Slopes are both **undefined**.)
- Two lines are **PERPENDICULAR** if and only if their slopes are **NEGATIVE/OPPOSITE RECIPROCALLS**.
 - Two lines are perpendicular if and only if the product of their slopes is **-1**.
 - A **horizontal** and a **vertical** line are always **perpendicular** to each other.

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Determine if the lines are **parallel, perpendicular, or neither**.

1. Line p contains points (2, 6) & (-2, 8)
Line b contains points (1, 5) & (3, 9)

p: $m = \frac{8-6}{-2-2} = \frac{2}{-4} = -\frac{1}{2}$ $m_{\text{line p}} = -\frac{1}{2}$

b: $m = \frac{9-5}{3-1} = \frac{4}{2} = 2$ $m_{\text{line b}} = 2$

Circle one: **PARALLEL** **PERPENDICULAR** **NEITHER**

2. Line k: $y = 2x + 4$
Line h: $8x - 4y = 12$

$-4y = -8x + 12$
 $-4y = -8x + 12$
 $y = 2x - 3$

$m_{\text{line k}} = 2$

$m_{\text{line h}} = 2$

Circle one: **PARALLEL** **PERPENDICULAR** **NEITHER**

Find the slope of a line parallel and perpendicular to each given line.

3. $x = 3$ Vertical Line

$m_{\parallel} = \text{undefined}$

$m_{\perp} = 0$

4. $2y + 3x = 6$

$\frac{2y}{2} = \frac{-3x+6}{2}$

$m_{\parallel} = -\frac{3}{2}$

$y = -\frac{3}{2}x + 3$

$m_{\perp} = \frac{2}{3}$

Write the equation for a line that is **parallel** to the given line and contains the following points.

5. $y = 4$ Contains the point (3, 8)

Horizontal Line
Use y value from ordered pair for parallel line.

equation: $y = 8$

6. $2x = 3 - 4y$ Contains the point (-4, 3)

$\frac{4y}{4} = \frac{-2x+3}{4}$

$y = -\frac{1}{2}x + \frac{3}{4}$

$m = -\frac{1}{2}$

equation: $y = -\frac{1}{2}x + 1$

$3 = -\frac{1}{2}(-4) + b$
 $3 = 2 + b$
 $1 = b$

Write the equation for a line that is **perpendicular** to the given line and contains the following points.

7. $5x - 3y = 6$ Contains the point (10, -6)

$-\frac{3y}{-3} = \frac{-5x+6}{-3}$

$y = \frac{5}{3}x - 2$

$m = \frac{5}{3}$

equation: $y = -\frac{3}{5}x$

$\perp m = -\frac{3}{5}$

$-b = -\frac{3}{5}(10) + b$

$-b = -6 + b$

$b = 0$

8. $x = -11$ Contains the point (-5, -7)

Vertical line $m = \text{und}$.
Use y value from ordered pair for perpendicular line.

equation: $y = -7$

Consider the graph to the right.

9. Write the equation of the line that is **parallel** to the graphed line and contains the point (1, -3).

$-3 = \frac{5}{2}(1) + b$

$-5.5 = b$

$y = \frac{5}{2}x - 5.5$

$-3 = 2.5 + b$

10. Write the equation of the line that is **perpendicular** to the graphed line and contains the point (5, 3).

$3 = -\frac{2}{5}(5) + b$

$\perp m = -\frac{2}{5}$

$3 = -2 + b$

$5 = b$

$y = -\frac{2}{5}x + 5$

