In problems 1-10, find the center and radius of the circle described by the given unexpanded equation. Your answers should be exact.

1. Find the center and radius of the circle described by: $x^2 + y^2 = 9$

2. Find the center and radius of the circle described by: $x^2 + y^2 = 11$

3. Find the center and radius of the circle described by: $(x - 2)^2 + (y - 5)^2 = 4$

4. Find the center and radius of the circle described by: $(x + 10)^2 + (y - 6)^2 = 25$

5. Find the center and radius of the circle described by: $(x - 5)^2 + y^2 = 5$

6. Find the center and radius of the circle described by: $(x - 3)^2 + (y + 7)^2 = 8$

7. Find the center and radius of the circle described by: $4x^2 + 4y^2 = 9$

8. Find the center and radius of the circle described by: $3x^2 + 3y^2 = 6$

9. Find the center and radius of the circle described by: $(2x - 10)^2 + (2y - 6)^2 = 16$

10. Find the center and radius of the circle described by: $(3x + 4)^2 + (3y - 1)^2 = 5$

In problems 11-20, find the center and radius of the circle described by the given expanded equation. Your answers should be exact.

11. Find the center and radius of the circle described by: $x^2 - 4x + y^2 + 6x - 3 = 0$

12. Find the center and radius of the circle described by: $x^2 - 10x + y^2 + 2x + 1 = 0$

13. Find the center and radius of the circle described by: $x^2 + 14x + y^2 - 4x - 11 = 0$

14. Find the center and radius of the circle described by: $x^2 - 6x + y^2 - 12y + 2 = 0$

15. Find the center and radius of the circle described by: $x^2 + 10x + y^2 + 7 = 0$

16. Find the center and radius of the circle described by: $x^2 - 4x + y^2 + 4y = 0$

17. Find the center and radius of the circle described by: $2x^2 - 4x + 2y^2 + 12y + 16 = 0$
18. Find the center and radius of the circle described by: $5x^2 - 10x + 5y^2 = 0$

19. Find the center and radius of the circle described by: $3x^2 + 12x + 3y^2 - 18y + 6 = 0$

20. Find the center and radius of the circle described by: $4x^2 + 160x + 4y^2 + 32y + 16 = 0$

**In problems 21-26, write the equation for the circle with the given center and radius. Do not expand your equation.**

21. Find the equation for a circle with center (0, 0) and radius 3
22. Find the equation for a circle with center (0, 2) and radius 2
23. Find the equation for a circle with center (3, 5) and radius 1
24. Find the equation for a circle with center (−3, 2) and radius 5
25. Find the equation for a circle with center (−4, −7) and radius 7
26. Find the equation for a circle with center (−5, 0) and radius 10

**In problems 27-30, write the equation for the circle in the graph. Do not expand your equation.**

27.
In problems 31-43, your answers should be exact. Simplify fractions and radicals, and rationalize all denominators.

31. The point \((2, y)\) lies on the circle \(x^2 + y^2 = 9\). What are the possible values for \(y\)?

32. The point \((x, 4)\) lies on the circle \(x^2 + y^2 = 36\). What are the possible values for \(x\)?

33. The point \((-3, y)\) lies on the circle \(x^2 + y^2 = 11\). What are the possible values for \(y\)?

34. The point \((x, 5)\) lies on the circle \(x^2 - 4x + y^2 = 32\). What are the possible values for \(x\)?

35. The point \((3, y)\) lies on the circle \(x^2 - 6x + y^2 + 2y = 2\). What are the possible values for \(y\)?

36. The point \((x, -1)\) lies on the circle \(x^2 + 2x + y^2 - 6y = 5\). What are the possible values for \(x\)?

37. The point \((8, y)\) lies on the circle \((x - 6)^2 + (y + 1)^2 = 25\). What are the possible values for \(y\)?

38. The point \((x, -2)\) lies on the circle \((x + 15)^2 + (y - 1)^2 = 49\). What are the possible values for \(x\)?

39. The point \((a, a)\) lies on the circle \((x - 2)^2 + (y + 2)^2 = 81\). What are the possible values for \(a\)?

40. The point \((x, 2)\) lies on the circle with center \((1, 4)\) and radius 5. What are the possible values for \(x\)?

41. The point \((-3, y)\) lies on the circle with center \((2, -3)\) and radius 10. What are the possible values for \(y\)?

42. The point \((x, 4)\) lies on the circle with center \((-1, -1)\) and radius 3. What are the possible values for \(x\)?

43. The point \((a, a)\) lies on the circle with center \((2, 0)\) and radius 4. What are the possible values for \(a\)?