A circle with center \((h, k)\) and radius \(r > 0\) is the set of all points \((x, y)\) in the plane whose distance to \((h, k)\) is \(r\).

The Standard Equation of a Circle: The equation of a circle with center \((h, k)\) and radius \(r > 0\) is

\[
(x - h)^2 + (y - k)^2 = r^2
\]

- From the Standard Eqn of a circle, it’s easy to read off the center and radius (and hence, easy to graph the circle)
- If the equation of a circle isn’t given in standard form, group the \((ax^2 + bx)\) terms and complete the square. Then do the same to \((ay^2 + by)\).

Examples:

1. Write the equation of a circle with center \((-3, 2)\) and radius 2, and graph the circle.

2. Write the equation of the circle below:
3. Write the equation of the circle below:

\[
\begin{align*}
2 \cdot & \quad \quad y \\
\end{align*}
\]

4. Use complete the square to put the equation in standard form. If it represents a circle, identify the center and radius (optional, graph the circle). If it doesn’t represent the equation of a circle, explain why not.

(a) \( x^2 + y^2 + 2x - 6y + 5 = 11 \)
(b) \( 4x^2 + 4y^2 - 4y + 2 = 0 \)
(c) (Optional) \(-2x^2 - 8x - 2y^2 + 4y - 3 = 0\)

5. (Optional) Write the equation of a circle with center \((5, -4)\) and radius \(\pi\), then graph the circle.