

$$x^2 + y^2 = 16$$

This equation is in standard form:

$$(x-h)^2 + (y-k)^2 = r^2$$

\uparrow \uparrow $\leftarrow r=4$
 $(h, k) = (0, 0)$

center $(0, 0)$
 $r = 4$

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

$h = 4$

$y = -7$ ← note $y - (-7) = y + 7$

$(h, k) = (4, -7)$; $r = \sqrt{7}$

$$x^2 - 2x + y^2 - 6y = 9$$

$$x^2 - 2x + 1^2 + y^2 - 6y + 3^2 = 9 + 1^2 + 3^2$$

square of $\frac{1}{2}$ the coefficient of x

square of $\frac{1}{2}$ the coefficient of y .

add to the right to balance the equation

These are now perfect squares \Rightarrow

$$(x-1)^2 + (y-3)^2 = 19 \quad \text{so center} = (1, 3) \quad r = \sqrt{19}$$

$$x^2 + y^2 - 4x + 6y + 4 = 0$$

$$x^2 - 4x + 2^2 + y^2 + 6y + 3^2 = -4 + 4 + 9$$

$$(x-2)^2 + (y+3)^2 = 9 \quad \rightarrow \text{center} = (2, -3) \quad r = 3$$