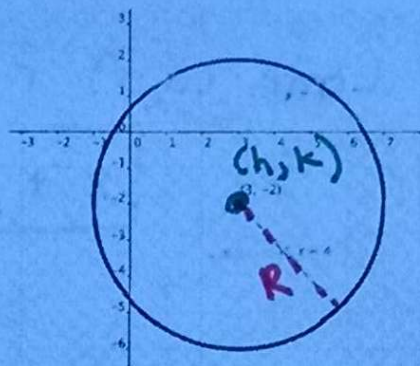


CIRCLES

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

Center (h, k)

Radius r



Example 2: Write the equation of each circle.

a. circle with center $(0, -4)$ and radius 3
 (h, k)

$$(x - \underline{h})^2 + (y - \underline{k})^2 = \underline{r}^2$$

$$(x - 0)^2 + (y - (-4)) = 3^2$$

$$\boxed{x^2 + (y + 4)^2 = 9}$$

b. circle with center $(-3, 5)$ and containing the point $(9, -2)$

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

$$(9 - (-3))^2 + (-2 - 5)^2 = r^2$$

$$(12)^2 + (-7)^2 = r^2$$

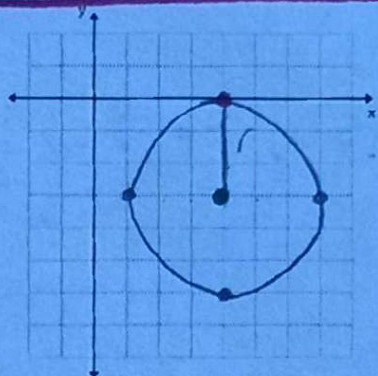
$$144 + 49 = r^2$$

$$193 = r^2$$

$$\boxed{(x + 3)^2 + (y - 5)^2 = 193}$$

Tangent: a line that *touches* the circle at ONE point.

c. circle with the center $(4, -3)$ and tangent to the x -axis
 (h, k)



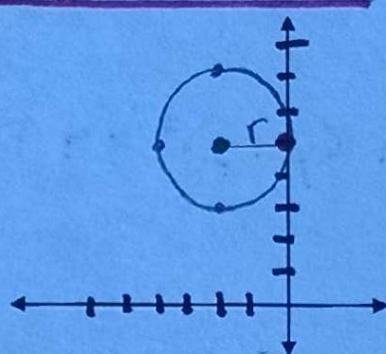
$$r = 3$$

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

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

$$\boxed{(x - 4)^2 + (y + 3)^2 = 9}$$

d. circle with the center $(-2, 5)$ and tangent to the y -axis
 (h, k)



$$r = 2$$

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

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

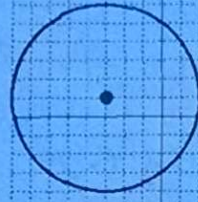
$$\boxed{(x + 2)^2 + (y - 5)^2 = 4}$$

e. Center $(0,0)$ $r = 4$



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

f. Center $(-3,1)$ $r = 5$



$$(x - (-3))^2 + (y - 1)^2 = 5^2$$

$$(x + 3)^2 + (y - 1)^2 = 25$$

Rewrite each circle in standard form by completing the square for x^2 and y^2 .

a. $x^2 + y^2 - 2x = 8$

$$x^2 - 2x + \frac{1}{(-1)^2} + y^2 + \frac{0}{(0)^2} = 8 + \frac{1}{1} + \frac{0}{1}$$

$$(x - 1)^2 + (y - 0)^2 = 9$$

$$(x - 1)^2 + y^2 = 9 \quad \text{center } (1, 0), \text{ radius} = 3$$

b. $x^2 - 4x + y^2 + 6y = 12$

$$x^2 - 4x + \frac{4}{(-2)^2} + y^2 + 6y + \frac{9}{(3)^2} = 12 + \frac{4}{1} + \frac{9}{1}$$

$$(x - 2)^2 + (y + 3)^2 = 25$$

$$(x - 2)^2 + (y + 3)^2 = 25 \quad \text{center } (2, -3), r = 5$$

c. $x^2 + y^2 - 10y - 24 = 0$

$$x^2 + (y - 5)^2 = 49 \quad \text{center } (0, 5), r = 7$$

d. $x^2 + y^2 + 4x + 2y - 11 = 0$

$$(x + 2)^2 + (y + 1)^2 = 16 \quad \text{center } (-2, -1), r = 4$$

- Move constants to the other side of equation
- Rearrange so like variables are together
- Complete the Square (once or twice)