

Section 2.4 circles

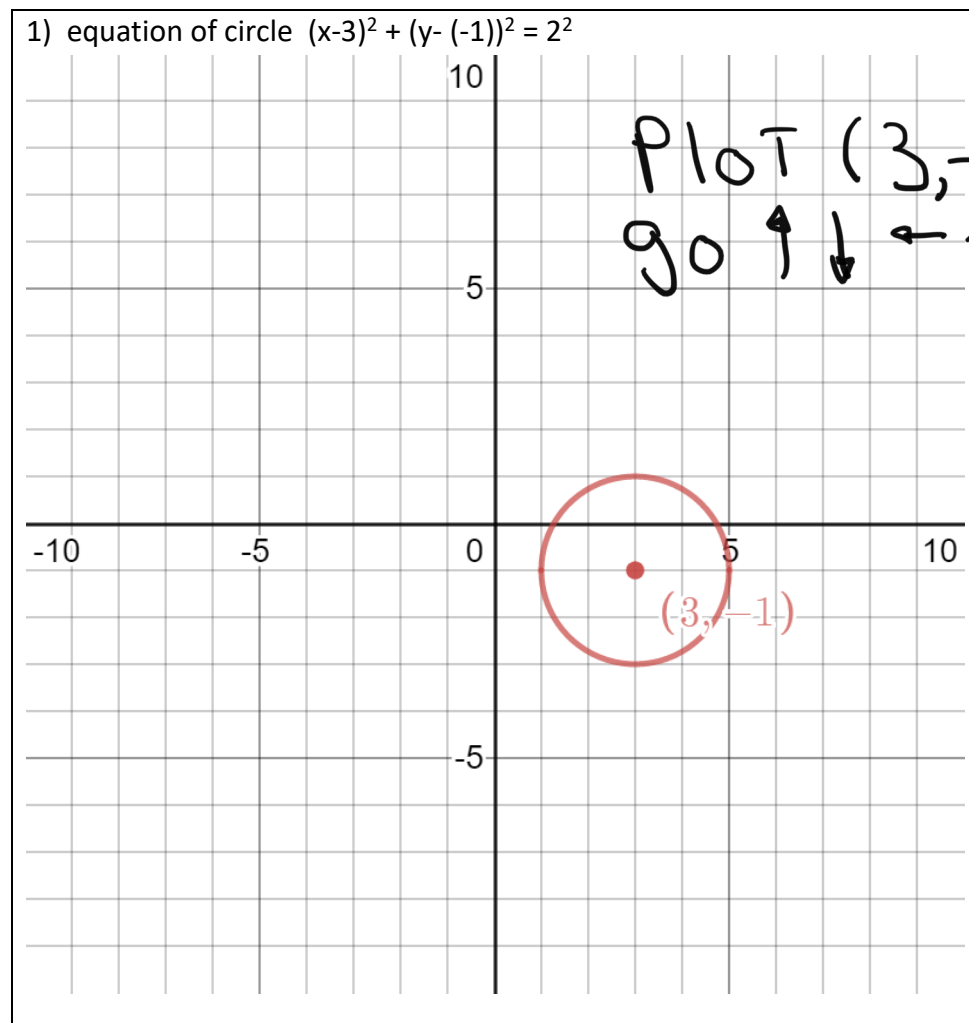
#1-8: Write the standard form of the equation of the circle with the given radius (r) and center (h,k) then sketch a graph of the circle.

1) $r = 2$ $(h,k) = (3, -1)$

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

$h = 3$ $k = -1$ $r = 2$

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



3) $r=3$ $(h,k) = (-4,1)$

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

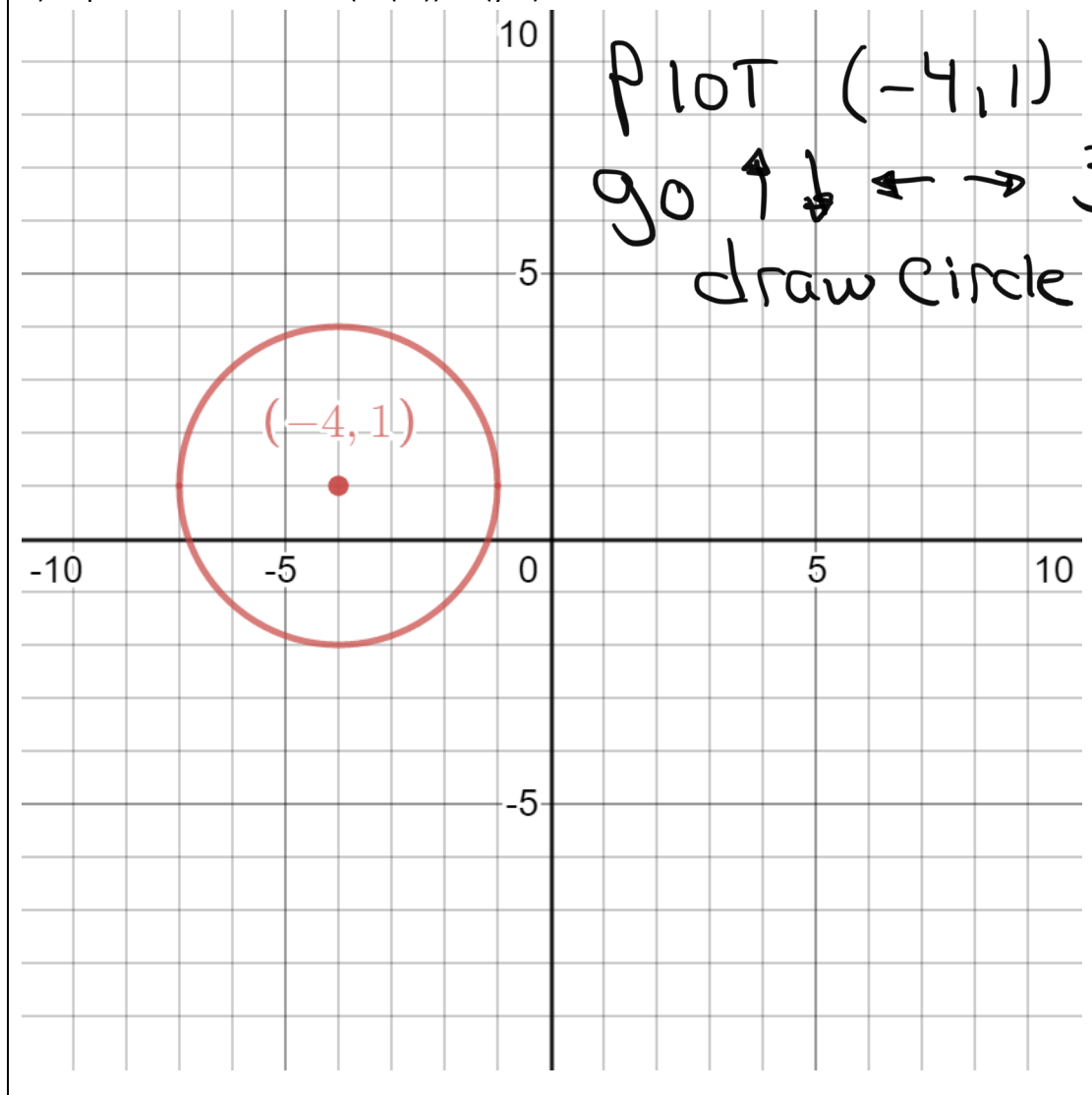
$$h = -4$$

$$k = 1$$

$$r = 3$$

$$(x - (-4))^2 + (y - 1)^2 = 3^2$$

3) equation of the circle $(x - (-4))^2 + (y - 1)^2 = 3^2$



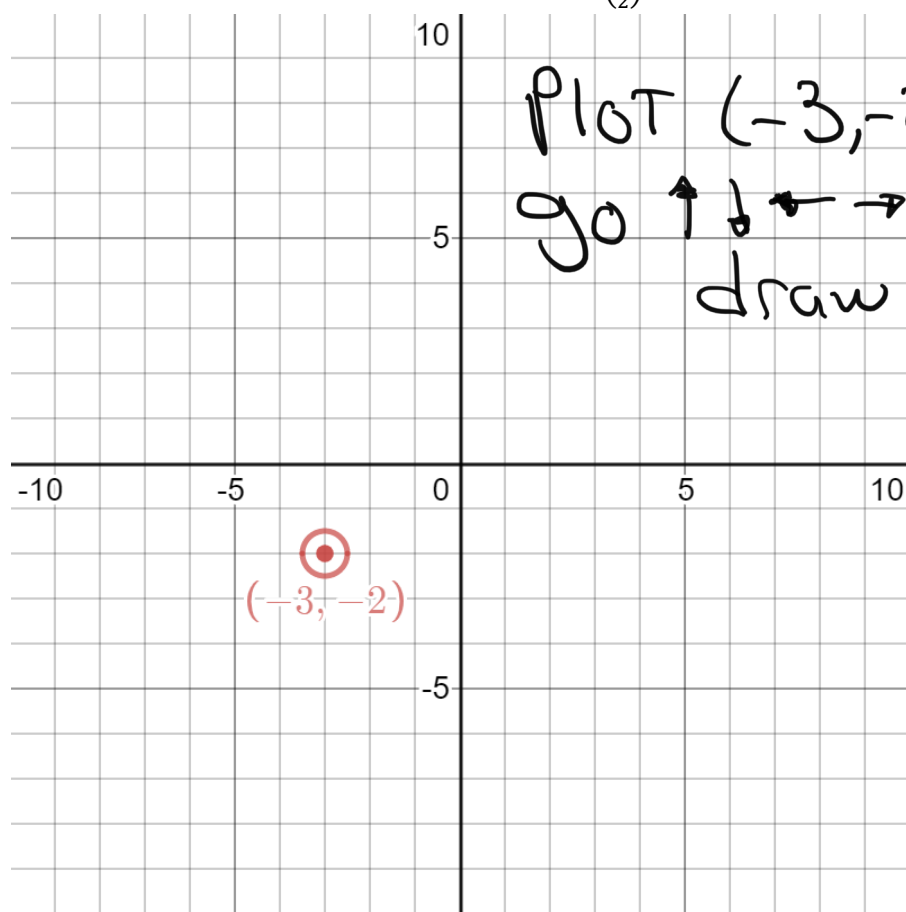
5) $r = \frac{1}{2}$ $(h,k) = (-3,-2)$

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

$$h = -3 \quad k = -2 \quad r = \frac{1}{2}$$

$$(x - (-3))^2 + (y - (-2))^2 = \left(\frac{1}{2}\right)^2$$

equation of circle $(x - (-3))^2 + (y - (-2))^2 = \left(\frac{1}{2}\right)^2$



7) $r=5$ $(h,k) = (0,2)$

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

$$h=0 \quad k=2 \quad r=5$$

equation of circle $x^2 + (y-2)^2 = 5^2$

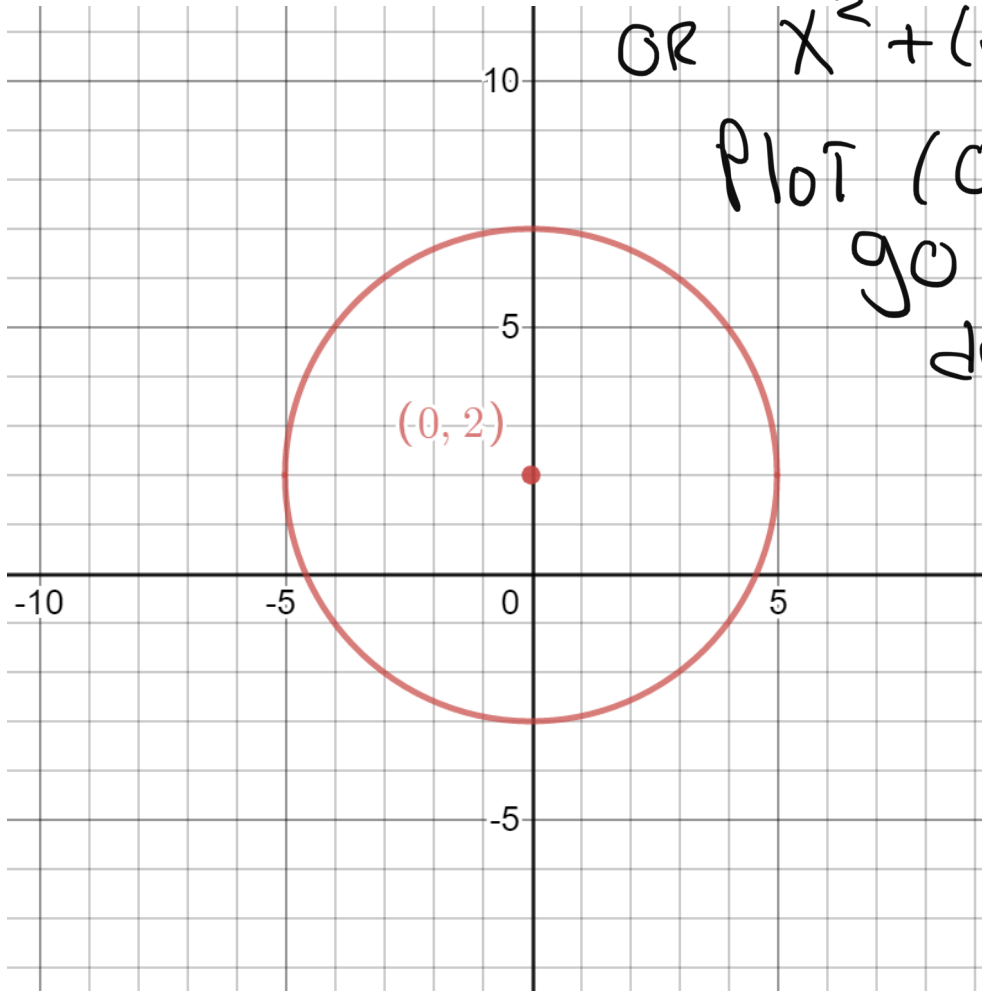
$$(x-0)^2 + (y-2)^2 = 5^2$$

$$\text{OR } x^2 + (y-2)^2 = 5^2$$

Plot $(0,2)$

go $\uparrow \downarrow \leftarrow \rightarrow 5$

draw
circle



#9-18: rewrite so that the equation is written in the standard form of a circle. Identify the radius and the center. Then sketch a graph.

9) $x^2 + y^2 - 6x + 2y + 9 = 0$
 $-9-9$

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

$$x^2 - 6x + C_1 + y^2 + 2y + C_2 = -9 + C_1 + C_2$$

$$C_1 = \left(-\frac{-6}{2}\right)^2 \quad C_2 = \left(\frac{2}{2}\right)^2$$

$$C_1 = (-3)^2 \quad C_2 = (1)^2$$

$$C_1 = 9 \quad C_2 = 1$$

$$(x^2 - 6x + 9) + (y^2 + 2y + 1) = -9 + 9 + 1$$

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

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

Center (3, -1)

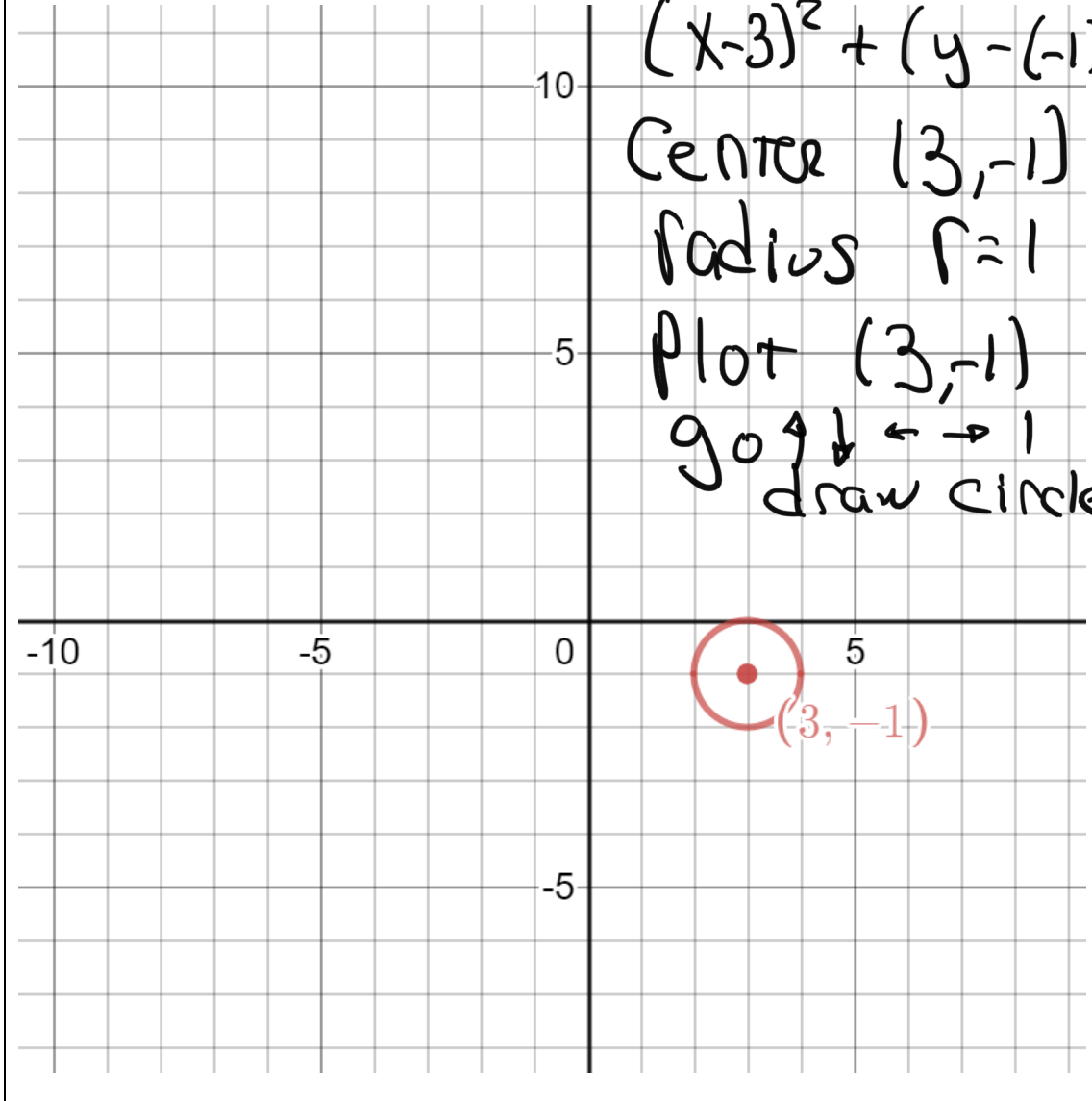
radius r=1

Plot (3, -1)

go \uparrow \downarrow \leftarrow \rightarrow 1
draw circle

equation of circle $(x-3)^2 + (y-(-1))^2 = 1^2$

Center (3, -1) radius 1



11) $x^2 + y^2 - 4x - 6y = -4$

$$x^2 - 4x + C_1 + y^2 - 6y + C_2 = -4 + C_1 + C_2$$

$$C_1 = \left(-\frac{-4}{2}\right)^2 \quad C_2 = \left(-\frac{-6}{2}\right)^2$$

$$C_1 = (-2)^2 \quad C_2 = (-3)^2$$

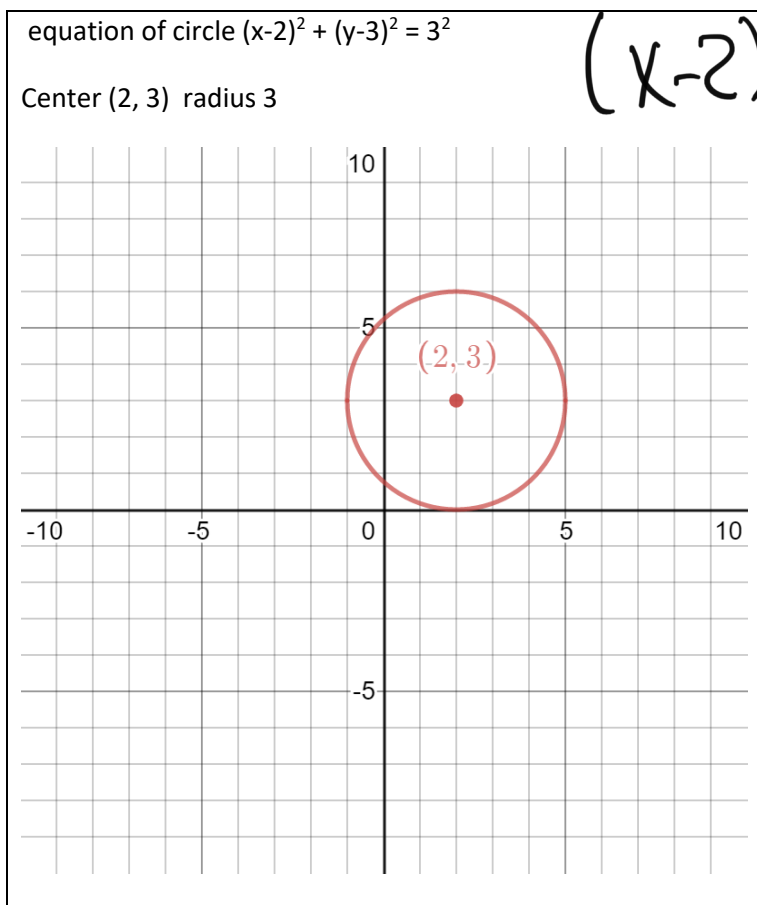
$$C_1 = 4$$

$$C_2 = 9$$

$$(x^2 - 4x + 4) + (y^2 - 6y + 9) = -4 + 4 + 9$$

equation of circle $(x-2)^2 + (y-3)^2 = 3^2$

Center (2, 3) radius 3



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

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

Center (2, 3)

radius 3

go $\uparrow \downarrow \leftarrow \rightarrow 3$

draw
circle

13) $x^2 + y^2 - 6y = 16$

x^2

$$+ y^2 - 6y + C_1 = 16 + C_1$$

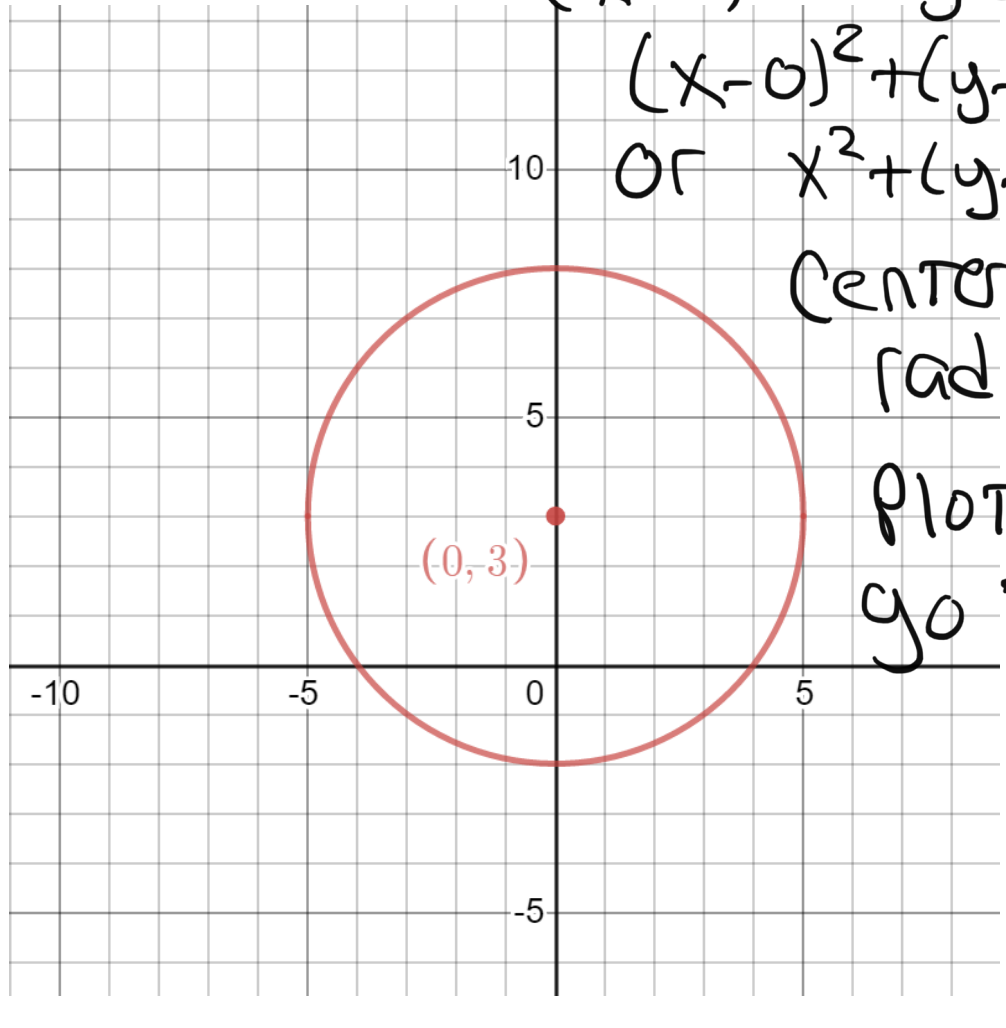
$$C_1 = (-6/2)^2$$

$$C_1 = (-3)^2$$

$$C_1 = 9$$

equation of circle $x^2 + (y-3)^2 = 5^2$

Center (0, 3) radius 5



$$(x-0)^2 + (y-3)^2 = 16+9$$

$$(x-0)^2 + (y-3)^2 = 25$$

$$(x-0)^2 + (y-3)^2 = 5^2$$

$$\text{OR } x^2 + (y-3)^2 = 5^2$$

Center (0, -3)

radius 5

Plot (0, -3)

go $\uparrow \downarrow \leftarrow \rightarrow 5$

draw circle

15) $x^2 - 6x + y^2 = 40$

$$x^2 - 6x + C_1 + y^2 = 40 + C_1$$

$$C_1 = \left(-\frac{-6}{2}\right)^2$$

$$C_1 = (-3)^2$$

$$C_1 = 9$$

$$x^2 - 6x + 9 + y^2 = 40 + 9$$

$$(x-3)^2 + (y-0)^2 = 49$$

$$(x-3)^2 + (y-0)^2 = 7^2$$

OR

$$(x-3)^2 + y^2 = 7^2$$

Center (3,0)

radius 7

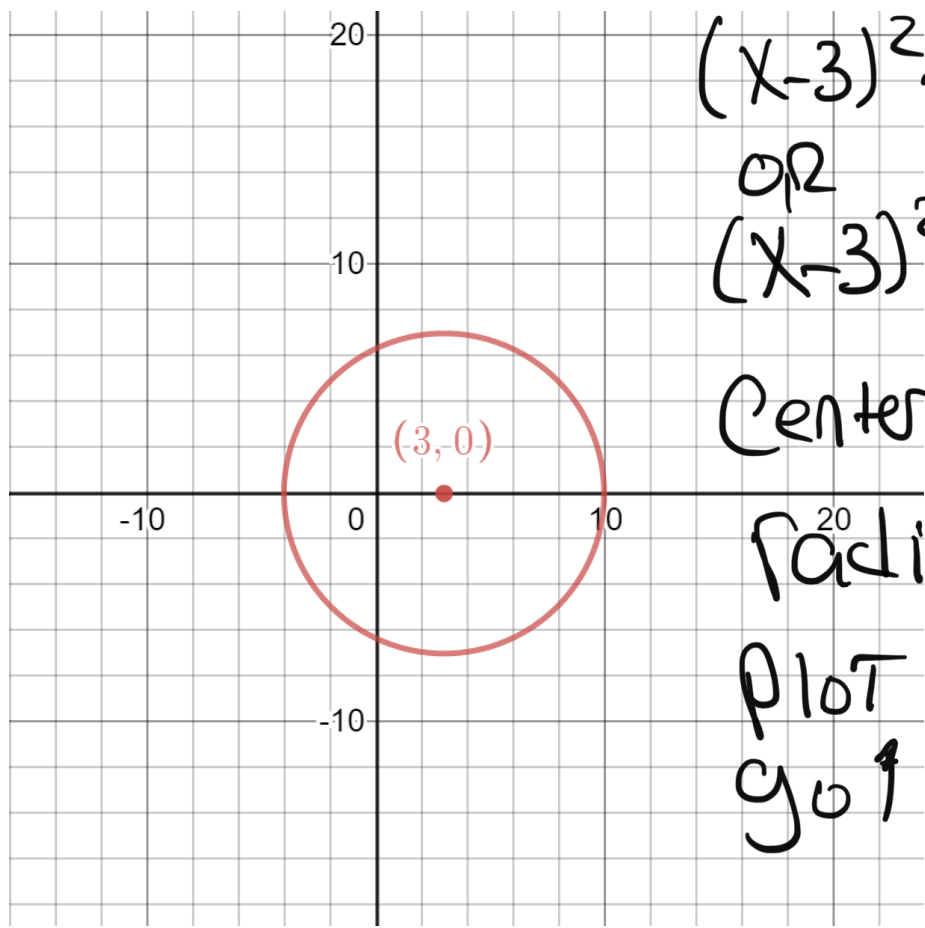
Plot (3,0)

go 7

draw circle

equation of circle $(x-3)^2 + y^2 = 7^2$

Center (3,0) radius 7



17) $x^2 + y^2 - 4 = 0$

$\frac{+4+4}{}$

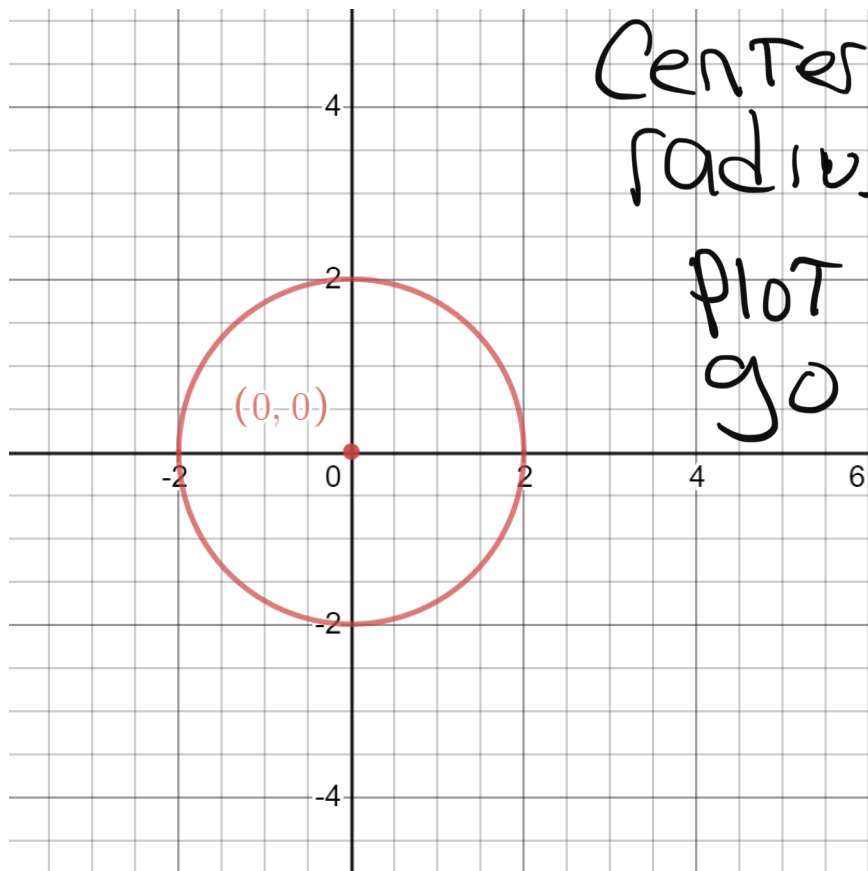
$x^2 + y^2 = 4$

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

or $x^2 + y^2 = 2^2$

equation of circle $x^2 + y^2 = 2^2$

Center (0,0) radius 2



Center (0,0)
radius 2

Plot (0,0)
go

↑ ↓ ← → 2

draw
circle

#19 - 22: Find the standard form of the equation of each circle. Identify the radius.

19) Center (-2, 3) contains the point (1, 7)

Solve for r

$$h = -2 \quad x = 1$$

$$k = 3 \quad y = 7$$

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

$$(1 - (-2))^2 + (7 - 3)^2 = r^2$$

$$(3)^2 + (4)^2 = r^2$$

$$9 + 16 = r^2$$

*No \pm
Since positive* $\sqrt{25} = \sqrt{r^2}$

$$5 = r$$

equation of circle $(x - (-2))^2 + (y - 3)^2 = 5^2$ radius 5

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

$$h = -2 \quad k = 3 \quad r = 5$$

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

radius 5

21) Center (5, 2) contains the point (5, 9)

$$h = 5$$

$$x = 5$$

$$k = 2$$

$$y = 9$$

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

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

$$(0)^2 + (7)^2 = r^2$$

$$0 + 49 = r^2$$

equation of circle $(x-5)^2 + (y-2)^2 = 7^2$ radius 7

*not
since
r is
positive*

$$\sqrt{49} = \sqrt{r^2}$$

$$7 = r$$

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

$$h = 5$$

$$k = 2 \quad r = 7$$

$$(x-5)^2 + (y-2)^2 = 7^2$$

radius 7