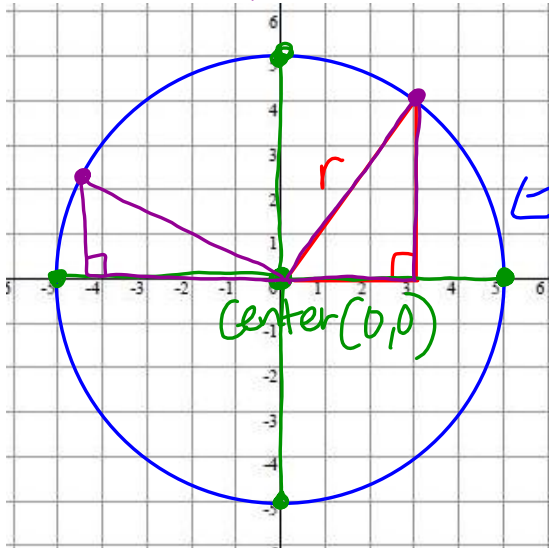


12.5 Graphing Circles \*Center

Equation if the center is at  $(0,0)$

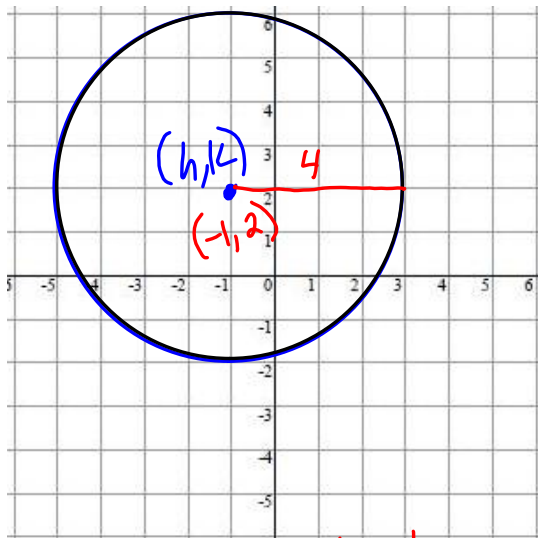
\* radius

$$x^2 + y^2 = r^2 \rightarrow r = \text{radius}$$



$x^2 + y^2 = 25$   
 $r^2 = 25$   
 $r = 5$   
 $c: (0,0)$

When center is NOT at  $(0,0)$ , but at  $(h,k)$



\* any point.  
 $(x+1)^2 + (y-2)^2 = 16$   
 $(x-h)^2 + (y-k)^2 = r^2$

\* must change the signs of  $h$  &  $k$  from eq  $\rightarrow$  point.

Center =  $(-1, 2)$   
 radius = 4

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

plug-into equation

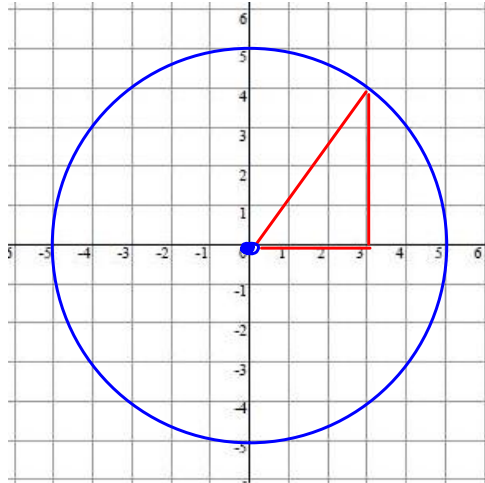
$$(x+1)^2 + (y-2)^2 = 16$$

## 12.5 Graphing Circles

If your center is  
at  $(0,0)$

equation  $x^2 + y^2 = r^2$

\* Center  
\* radius



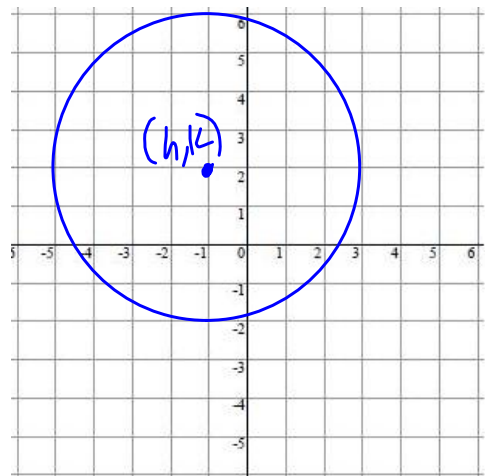
Center  
 $(0,0)$

radius  
 $r = 5$

$$x^2 + y^2 = 25$$

When center is NOT at  $(0,0)$ , but at  $(h,k)$

\* any  
point.



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

\* must change  
the signs of  $h$  &  $k$   
from eq  $\rightarrow$  point.

center  $(-1, 2)$   
radius  $r = 4$

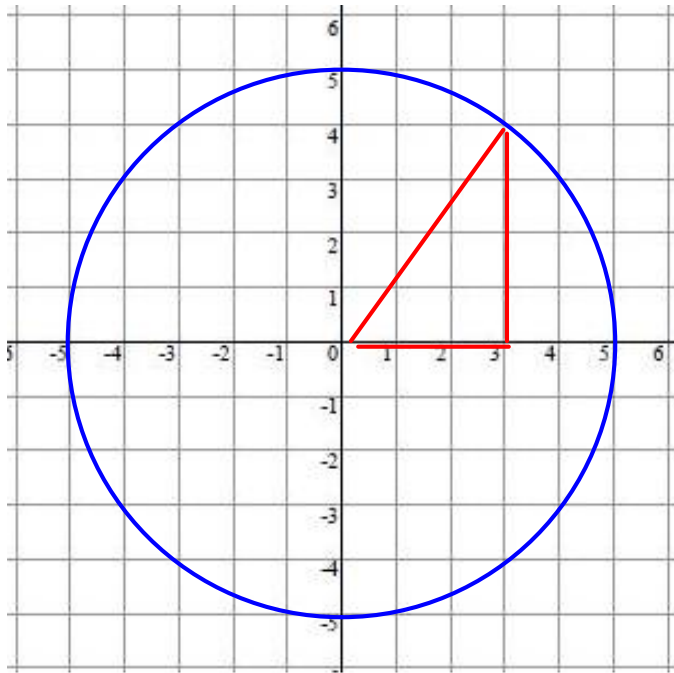
plug into equation

$$(x+1)^2 + (y-2)^2 = 16$$

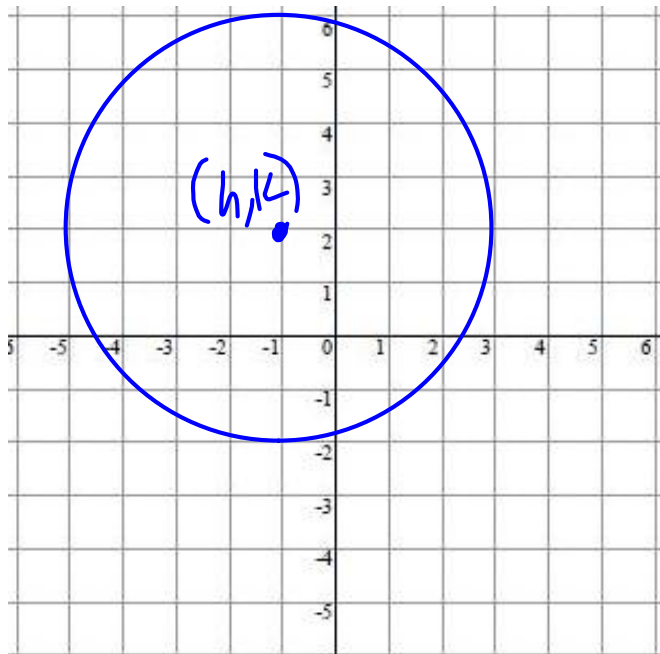
Info  
for the center

Info  
for radius

# 12.5 Graphing Circles



When center is NOT at  $(0,0)$ , but at  $(h,k)$   
 \* any point.



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

\* must change the signs of  $h$  &  $k$  from eq  $\rightarrow$  point.

Ex 1 | What is standard form for the equation of a circle with center  $(5, -2)$  and radius 7?   
  $h, k$

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

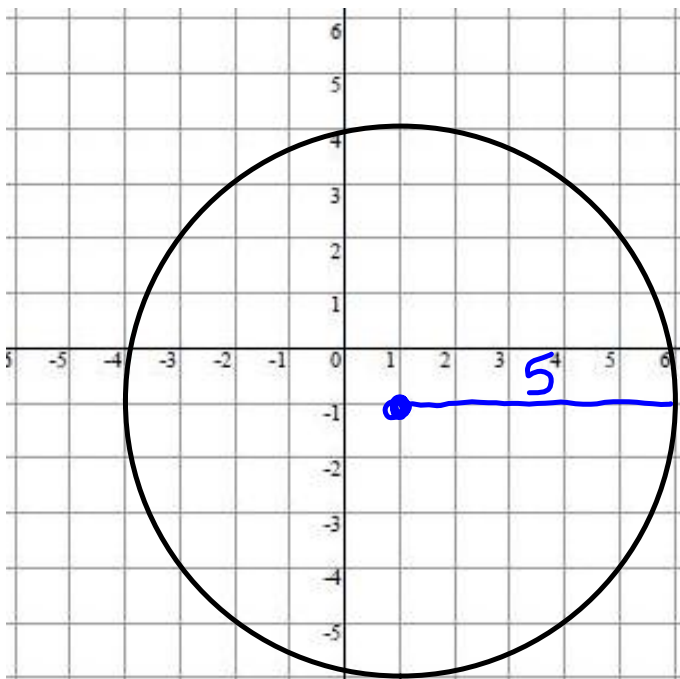
$$(x-5)^2 + (y+2)^2 = 49$$

$$y = 2x - 5$$

$$y + 5 = 2x$$

Ex 2 | Write an equation in standard form for the given circle.  $x^2 + y^2 = r^2$

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



$h, k$   
center:  $(1, -1)$   
radius: 5

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

Ex 1 | What is standard form for the equation of a circle with center  $(5, -2)$  and radius 7?  $(x-h)^2 + (y-k)^2 = r^2$

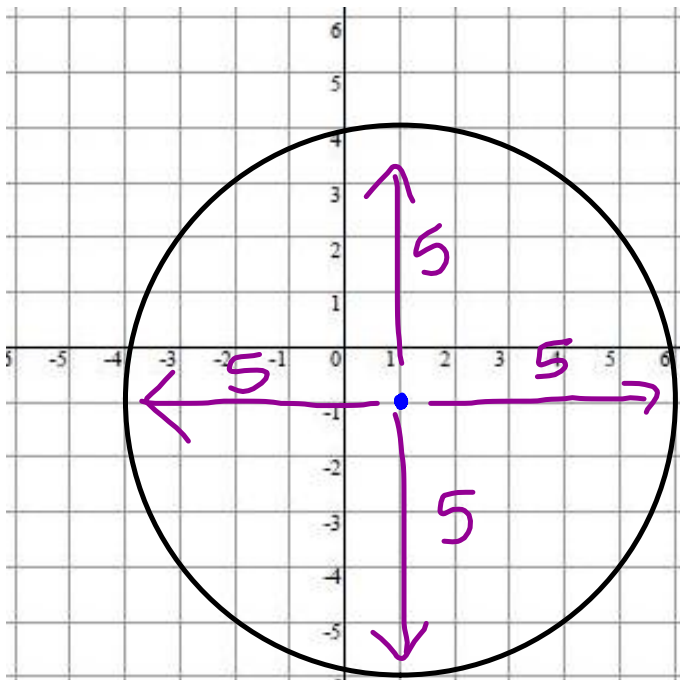
$$r = 7$$

$$h = 5$$

$$k = -2$$

$$(x-5)^2 + (y+2)^2 = 49$$

Ex 2 | Write an equation in standard form for the given circle.



$$r = 5$$

$$\text{center} = (1, -1)$$

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

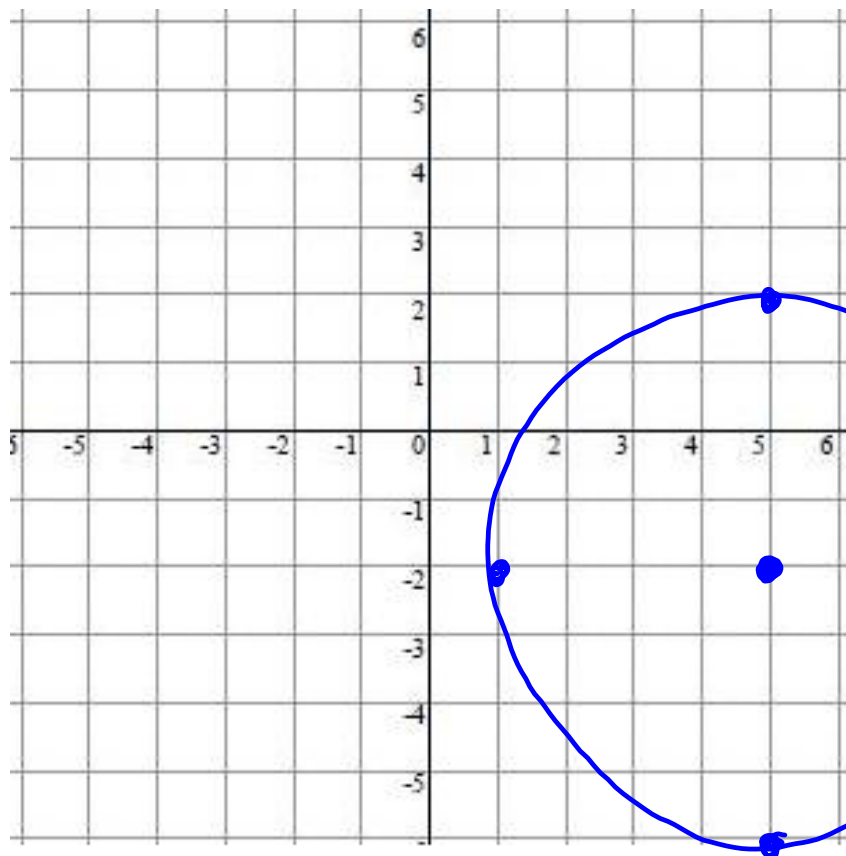
Ex 3 Find the center and radius for each circle.

a)  $x^2 + y^2 = 36$        $c: (0, 0)$   
 $r^2 = 6$        $r: 6$

b)  $(x+4)^2 + (y-1)^2 = 25$        $c: (-4, 1)$   
 $r = 5$

c)  $x^2 + (y+8)^2 = 100$   
 $c: (0, -8)$        $r = 10$

Ex 4 Graph  $(x-5)^2 + (y+2)^2 = 16$



$c: (5, -2)$

$r = 4$

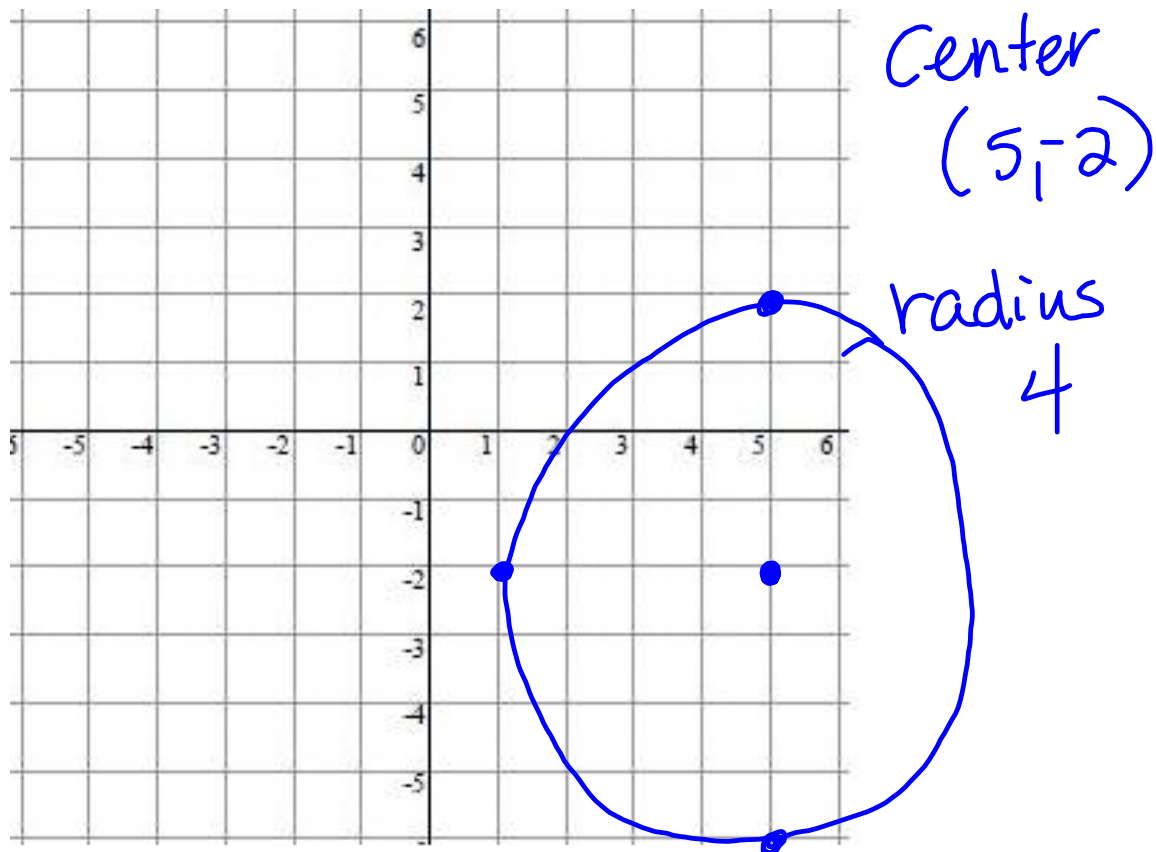
Ex 3 | Find the center and radius for each circle.

a)  $x^2 + y^2 = 36$       Center  $(0,0)$   
 $r = 6$

b)  $(x+4)^2 + (y-1)^2 = 25$       Center  $(-4,1)$   
 $r = 5$

c)  $x^2 + (y+8)^2 = 100$       Center  $(0,-8)$   
 $r = 10$

Ex 4 | Graph  $(x-5)^2 + (y+2)^2 = 16$



Ex 5 | Write an equation of a circle with the center at  $(h, k)$  and passes through the point  $(x, y)$ .

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

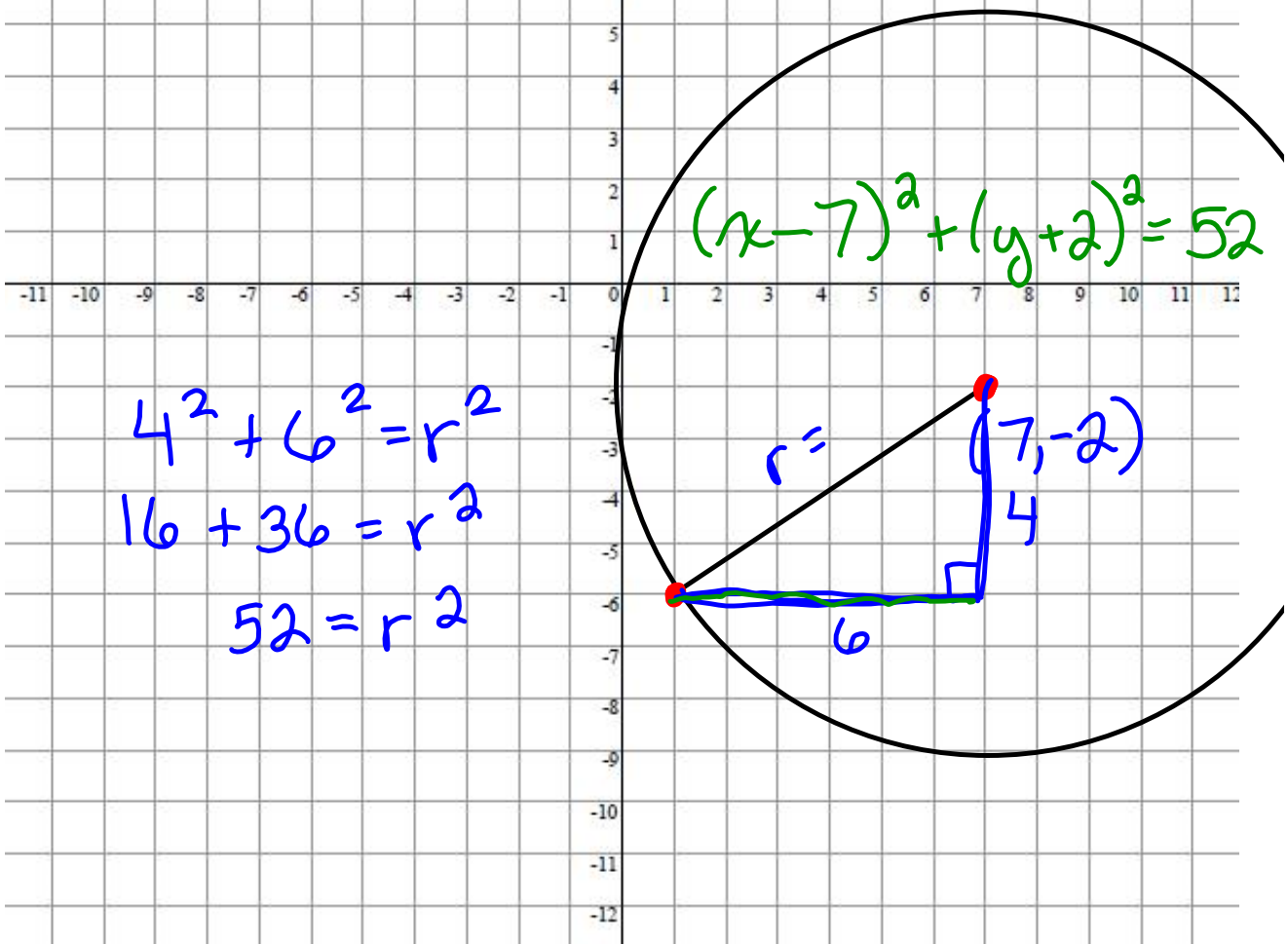
$$(x-7)^2 + (y+2)^2 = 52$$

$$(1-7)^2 + (-6+2)^2 = r^2$$

$$(-6)^2 + (-4)^2 = r^2$$

$$36 + 16 = r^2$$

$$52 = r^2$$



$$4^2 + 6^2 = r^2$$

$$16 + 36 = r^2$$

$$52 = r^2$$



Ex 5 | Write an equation of a circle with the center at  $(7, -2)$  and passes through the point  $(1, -6)$ .

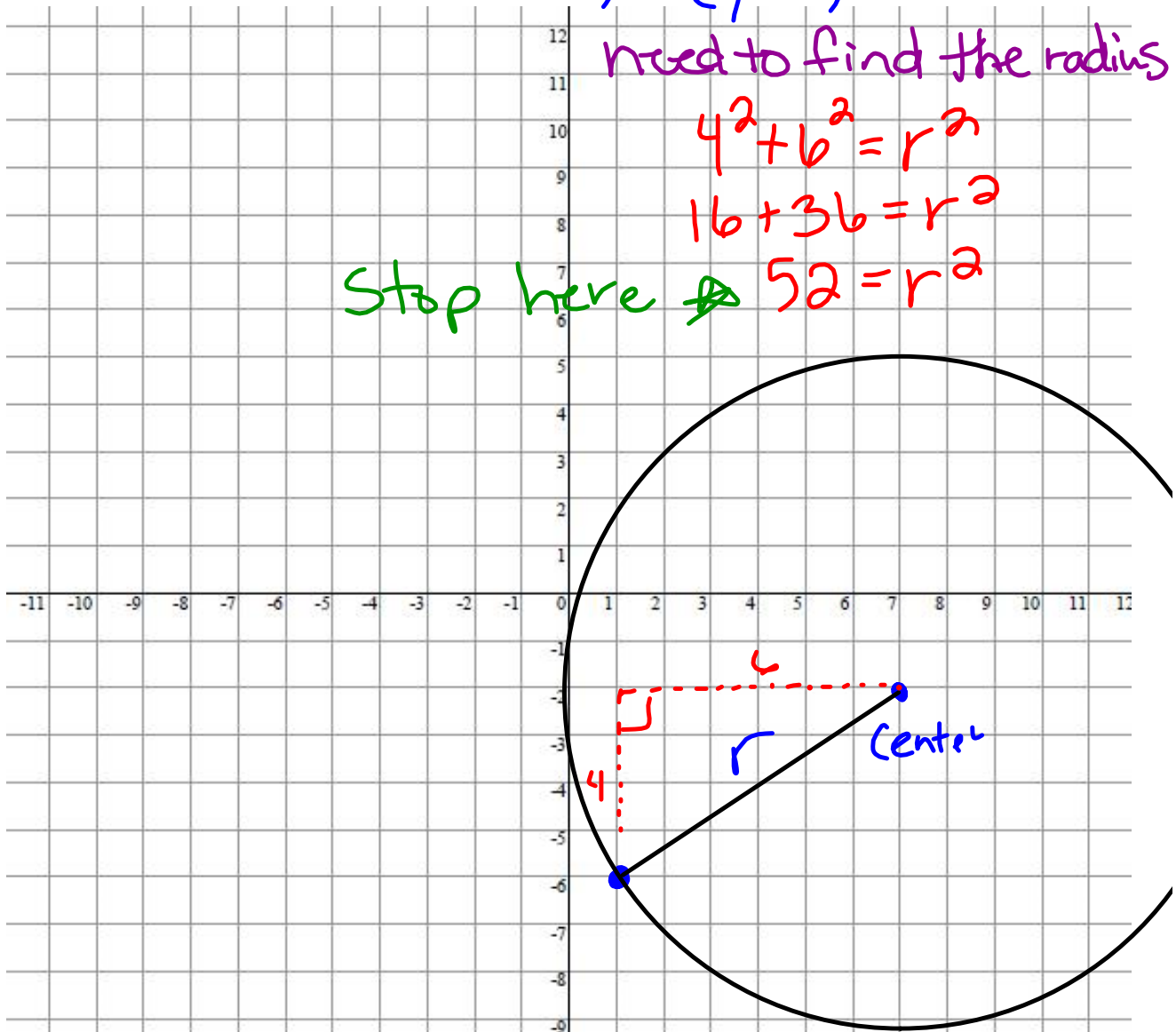
$$(x-7)^2 + (y+2)^2 = r^2$$

need to find the radius

$$4^2 + 6^2 = r^2$$

$$16 + 36 = r^2$$

Stop here  $\rightarrow 52 = r^2$



$$(x-7)^2 + (y+2)^2 = 52$$

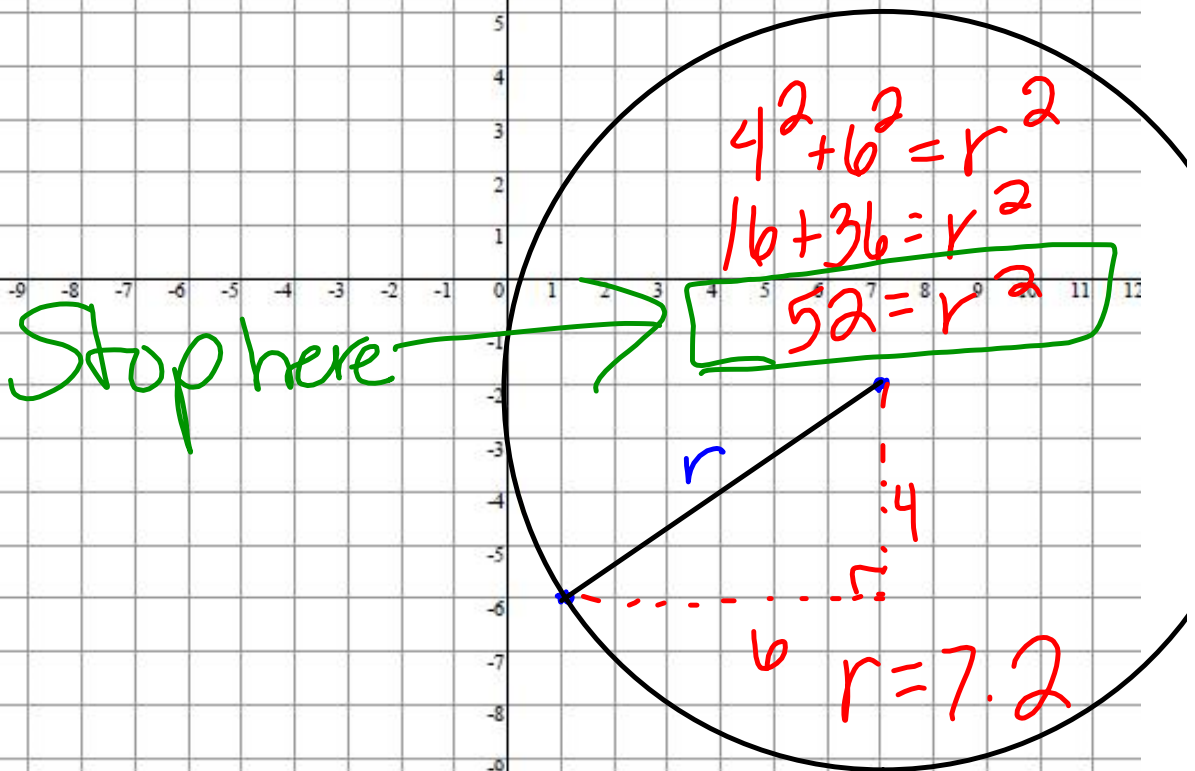
Ex 5 | Write an equation of a circle with the center at  $(7, -2)$  and passes through the point  $(1, -6)$ .

center  $(7, -2)$

find

radius  $r = 7.2$

$$(x-7)^2 + (y+2)^2 = 52$$



Ex 6

a) What is standard form for the equation of a circle with center  $(4, -3)$  and radius 3?

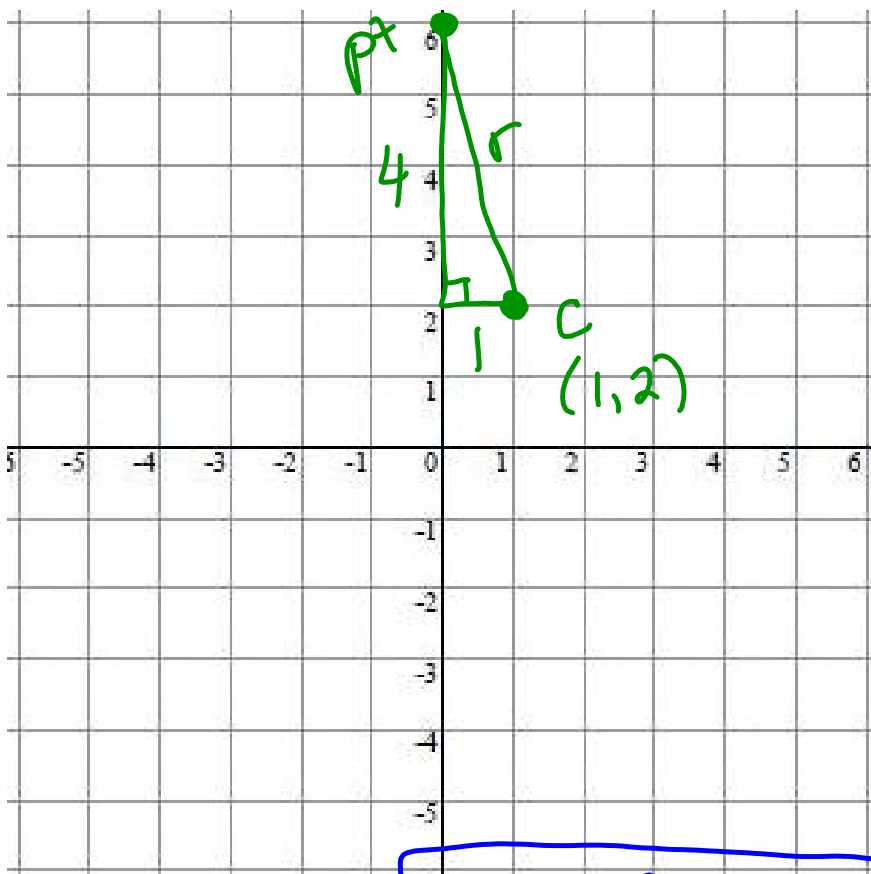
$$(x-4)^2 + (y+3)^2 = 9$$

b) State the center and radius for

$$(x+3)^2 + y^2 = 121 \quad c: (-3, 0)$$

$$r = 11$$

Ex 7 Write an equation of a circle with center at  $(1, 2)$  and passes through  $(0, 6)$ .



$$r^2 = 1^2 + 4^2$$

$$r^2 = 1 + 16$$

$$r^2 = 17$$

$$(x-1)^2 + (y-2)^2 = 17$$

$$C: \begin{pmatrix} h \\ k \end{pmatrix}$$

$$pt: \begin{pmatrix} x \\ y \end{pmatrix}$$

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

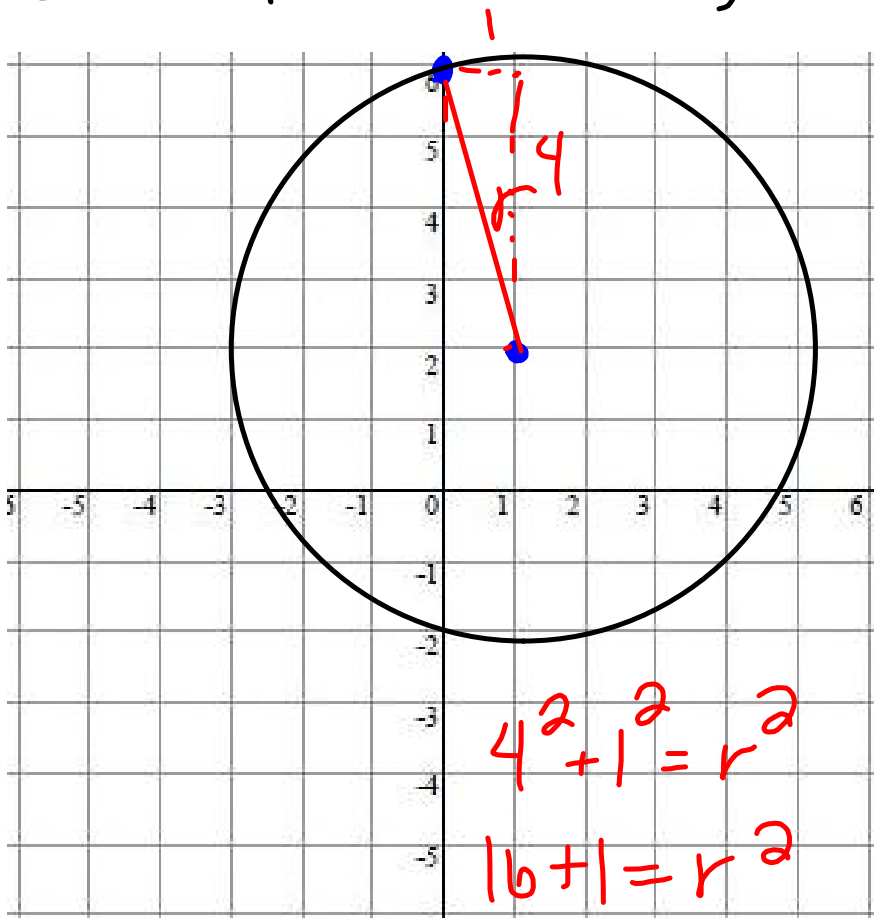
$$(0-1)^2 + (6-2)^2 = r^2$$

$$1 + 16 = r^2$$

$$17 = r^2$$

$$(x-1)^2 + (y-2)^2 = 17$$

Ex 7 Write an equation of a circle with center at  $(1, 2)$  and passes through  $(0, 6)$ .



$$4^2 + 1^2 = r^2$$

$$16 + 1 = r^2$$

$$17 = r^2$$

$(1, 2)$  center

$$(x-1)^2 + (y-2)^2 = 17$$

Ex 8 | Rewrite the equation of a circle in standard form

$$8x + \underset{+y^2}{x^2} - 2y = 64 - \underset{+y^2}{y^2}$$

Standard form $(x-h)^2 + (y-k)^2 = r^2$	Complete the Square of a quadratic function $ax^2 + bx + c$
--	---

ex:  $(x-2)^2 + (y+1)^2 = 20$

$$x^2 + \boxed{5}x + \left(\frac{b}{2}\right)^2$$

① re-order equation

$$x^2 + 10x + 25$$

$$\rightarrow x^2 + \boxed{5x + 5x} + 25$$

$$(x+5)(x+5)$$

$$(x+5)^2$$

$$x^2 + 8x + y^2 - 2y = 64$$

$$x^2 + 8x + \underline{\quad} + y^2 - 2y + \underline{\quad} = 64 + \underline{\quad} + \underline{\quad}$$

$$(x+4)^2 + (y-1)^2 = 81$$

Center  $(-4, 1)$

$$r = 9$$

$$8x + x^2 - 2y = 64 - y^2$$

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

$$x^2 + 8x + y^2 - 2y = 64$$

$$\left(x^2 + 8x + \frac{(b/2)^2}{2}\right) + \left(y^2 - 2y + \frac{1}{2}\right) = 64 + 16 + 1$$

$$(x+4)^2 + (y-1)^2 = 81$$

$$(x+4)^2 + (y-1)^2 = 81$$

$$c: (-4, 1)$$

$$r = 9$$

Ex 8 | Rewrite the equation of a circle in standard form

$$8x + x^2 - 2y = 64 - y^2$$

Standard form $(x-h)^2 + (y-k)^2 = r^2$	Complete the Square of a quadratic function $ax^2 + bx + c$
ex: $(x-2)^2 + (y+1)^2 = 20$	$x^2 + bx + \left(\frac{b}{2}\right)^2$

① re-group

$$x^2 + 8x + y^2 - 2y = 64$$

$$x^2 + 8x + \left(\frac{8}{2}\right)^2 + y^2 - 2y + \left(\frac{-2}{2}\right)^2 = 64 + 16 + 1$$

② Simplify

$$x^2 + 8x + 16 + y^2 - 2y + 1 = 81$$

$$(x+4)^2 + (y-1)^2 = 81$$



Ex 9 | Rewrite the equation of a circle in standard form

$$x^2 + 8x + 32y + y^2 = -263 - x^2 + x^2$$


---

$$(x^2 + 8x + 16) + (y^2 + 32y + 256) = -263 + 16 + 256$$

$$(x + 4)^2 + (y + 16)^2 = 9$$

$$(x + 4)^2 + (y + 16)^2 = 9$$

$$c: (-4, -16) \quad r = 3$$