$d=\sqrt{(x_2-x_1)^2+(y_2-y_1)^2}$

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

Pre-Calculus

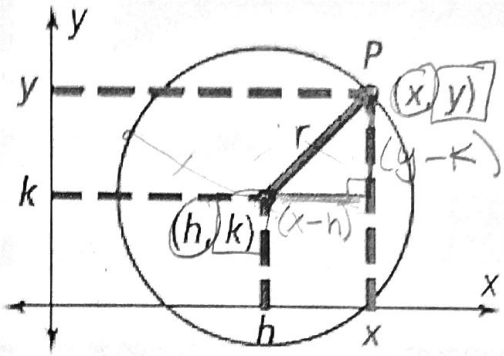
7.2 Equations of Circles

SWBAT graph circles on the coordinate plane and write the equations of circles in standard form.

Standard Form of Circles

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

Center:	Radius:	Point on the circle:
(h,k)	r	(x,y)



Example 1: Write the equation of a circle with the given information.

a) Center (0,0), Radius=10

h = 0 k = 0 r = 10

$x^2+y^2=100$

b) Center (2, 3), Diameter=12

h = 2 k = 3 r = 6.

$(x-2)^2+(y-3)^2=36$

Example 2: Determine the center and radius of a circle the given equation.

a) $x^2+y^2=\frac{9}{4}$

Center $(0,0)$

$r=3/2$

b) $(x+3)^2+(y-5)^2=81$

center $(-3,5)$

$r=9$

c) $(x+4)^2+(y+6)^2=1$

center $(-4,-6)$

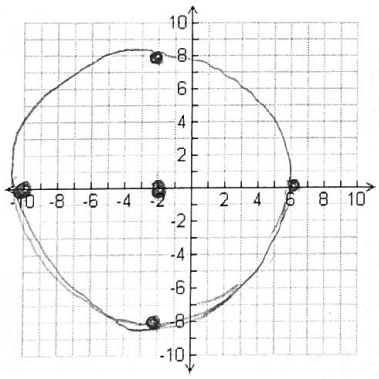
$r=1$

Example 3: Use the center and the radius to graph each circle.

a) $(x+2)^2+y^2=64$

Center: $(-2,0)$

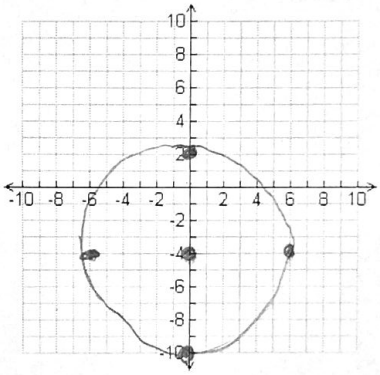
Radius: $r=8$



b) $x^2+(y+4)^2=36$

Center: $(0,-4)$

Radius: $r=6$



Writing an Equation with a Pass-Thru Point
Step 1: Substitute the center (h, k) into the equation
Step 2: Substitute the "pass through point (x, y)" into the equation for x and y.
Step 3: Simplify and solve for r^2.
Step 4: Substitute r^2 back into the equation from Step 1.

Example 4: Write the equation of a circle with a given center (2, 5) that passes through the point (5 ,-1).

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

$(5-2)^2+(-1-5)^2=r^2$

$9+36=r^2$

$45=r^2$

$(x-2)^2+(y-5)^2=45$

Writing an Equation with Two Points on the Circle	Midpoint Formula
Find the midpoint (center) between the two endpoints, and then follow steps 1-4.	$\left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}\right)$

Example 5: Write the equation of a circle with endpoints of diameter at (-6, 5) and (4, -3).

$(-6+1)^2 + (5-1)^2 = r^2$

$25 + 16 = r^2$

$41 = r^2$

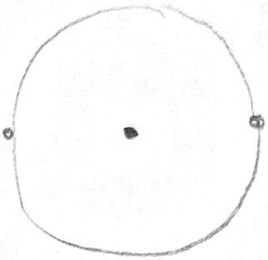
$\boxed{(x+1)^2 + (y-1)^2 = 41}$

midpoint

$\left(\frac{-6+4}{2}, \frac{5+-3}{2}\right)$

$(-1, 1)$

center



Writing the Equation of a Circle in Standard Form	
Step 1:	Group x's and group y's together.
Step 2:	Move any constants to the right side of the equation.
Step 3:	Use complete the square to make a perfect square trinomial for the x's and then again for the y's. **Remember, whatever you do to one side of the equation, you must do to the other!*
Step 4:	Simplify factors into standard form of a circle!

Example 5: Write the equation of a circle in standard form. Then, state the center and the radius.

a) $x^2 + y^2 + 4x - 8y + 16 = 0$

$x^2+4x+\underline{4}\ y^2-8y+\underline{16} = -\cancel{16}+4+\cancel{16}$

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

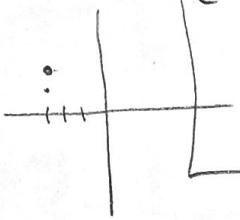
b) $x^2 + y^2 + 6x - 4y = 0$

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

$\boxed{(x+3)^2 + (y-2)^2 = 13}$

Center $(-3, 2)$

$r = \sqrt{13} \approx 3.\ldots$



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

$x^2-6x+9+y^2-2y+1 = -4+9+1$

$\boxed{(x-3)^2 + (y-1)^2 = 6}$

Center $(3, 1)$

radius $= \sqrt{6}$

d) $x^2 + y^2 + 8x - 10y - 4 = 0$

$x^2+8x+16+y^2-10y+25 = 4+16+25$

$\boxed{(x+4)^2 + (y-5)^2 = 45}$

center $(-4, 5)$

radius $= \sqrt{45}$

$= \boxed{3\sqrt{5}}$