Advanced Geometry Starter

Find the value of c that completes the square.

1. $x^2 - 18x + c$ 81

$\dfrac{18}{2}$ $(x-9)^2$

2. $x^2 + 10x + c$ 25

$(x+5)^2$

Solve by completing the square.

3. $x^2 - 8x = 20$

$x^2 - 8x + 16 = 20 + 16$

$\dfrac{8}{2}$

4. $x^2 + 2x - 89 = 10$

$x^2 + 2x = 99$

$x^2 + 2x + 1 = 99 + 1$

Fill in the blanks.

5. $x^2 - 6x + y^2 + 8y = 24$

$x^2 - 6x + \underline{9} + y^2 + 8y + \underline{16} = 24 + \underline{9} + \underline{16}$

$(x - \underline{3})^2 + (y + \underline{4})^2 = \underline{49}$

$(x-4)^2 = \sqrt{36}$

$x - 4 = \pm 6$

$+4 \quad +4$

$x = \pm 6 + 4$

$\boxed{x = 10} \quad \boxed{x = -2}$

$\sqrt{(x+1)^2} = \sqrt{100}$

$x + 1 = \pm 10$

$-1 \quad\quad -1$

$x = \pm 10 - 1$

$x = 9 \quad\quad x = -11$

<u>The Equation of a Circle</u>

The standard form of the equation of a circle with its center at the origin is

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

r is the radius of the circle so if we take the square root of the right hand side, we'll know how big the radius is.

Notice that both the *x* and *y* terms are squared. Linear equations don't have either the *x* or *y* terms squared. Parabolas have only the *x* term was squared (or only the *y* term, but NOT both).

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Let's look at the equation $x^2 + y^2 = 9$

This is r^2 so $r = 3$

The center of the circle is at the origin and the radius is 3.
Let's graph this circle.
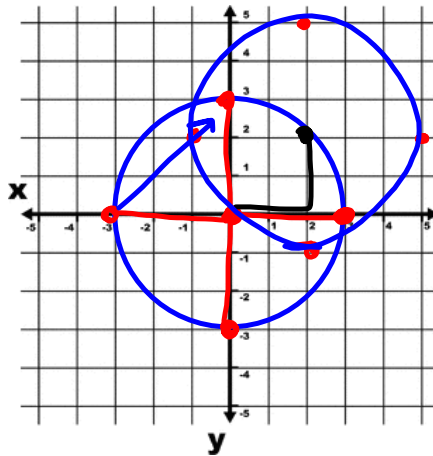
Center at (0, 0)

Count out 3 in all
directions since
that is the radius

If the center of the circle is NOT at the origin then the equation for the standard form of a circle looks like this:
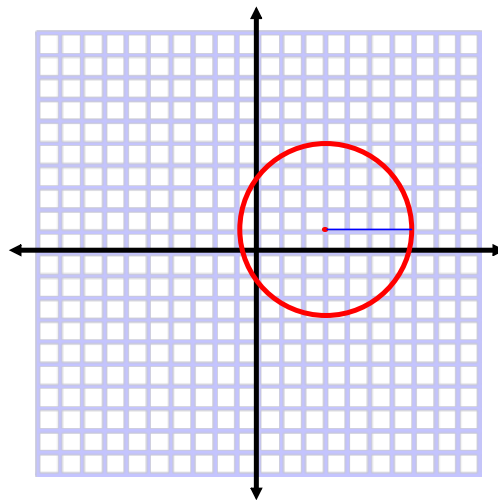
$$(x-h)^2 + (y-k)^2 = r^2$$

The center of the circle is at (h, k).

Example 1: Find the center and radius and graph this circle.

$$(x-3)^2 + (y-1)^2 = 16$$

Center: $(3, 1)$ Radius $= \sqrt{16} = 4$

Example 2: Find the center and the radius of the circle.

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

C: (-2, 4)

$\mathfrak{R} : \sqrt{4} = 2$

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Example 3: Find the center and the radius of the circle.

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

$-16 \quad -16$

$$x^2 + 4x + 4 \quad y^2 - 8y + 16 = -16 + 4 + 16$$

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

$$C: (-2, 4) \quad R: 2$$

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Drag the steps to complete the problems. Then identify the center and radius for each circle.

1. $x^2 + 2x + y^2 + 10y + 22 = 0$

$x^2 + 2x + y^2 + 10y = -22$

$x^2 + 2x + 1 + y^2 + 10y + 25 = -22 + 1 + 25$

$(x + 1)^2 + (y + 5)^2 = 4$

2. $x^2 + y^2 - 14y + 38 = 0$

$x^2 + y^2 - 14y = -38$

$x^2 + y^2 - 14y + 49 = -38 + 49$

$x^2 + (y - 7)^2 = 11$

3. $x^2 - 10x + y^2 + 8y + 33 = 0$

$x^2 - 10x + y^2 + 8y = -33$

$x^2 - 10x + 25 + y^2 + 8y + 16 = -33 + 25 + 16$

$(x - 5)^2 + (y + 4)^2 = 8$

Example 4:

Find an equation of the circle with center at (0, 0) and radius 7.

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

$$\underline{x^2 + y^2 = 49}$$

$$0^2 + 0^2 \neq 49$$

Example 5: Find an equation of the circle with center at (0, 0) that passes through the point (-1, -4).

$$\sqrt{(-1+0)^2 + (-4+0)^2} = \sqrt{r^2}$$

$$d = \sqrt{17} = r$$

$$(x+0)^2 + (y+0)^2 = (\sqrt{17})^2$$

$$x^2 + y^2 = 17$$

Homework

p.635 # 1a,c, 3a,b, 4a,c, 7, 11c

Easy ?'s

Hard?

Medium?

Example 6:

Find an equation of the circle with center at (-2, 5) and radius 6

$$(x+2)^2 + (y-5)^2 = 36$$

Example 7: Find an equation of the circle with center at (8, 2) and passes through the point (8, 0).

Subbing in the center values in standard form we have:

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

(x − 8)² + (y − 2)² = r²

Since it passes through the point (8, 0) we can plug this point in for x and y to find r²

$$\left(8-8\right)^2 + \left(0-2\right)^2 = r^2$$

$$4 = r^2$$

Solution: $\left(x-8\right)^2 + \left(y-2\right)^2 = 4$

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<u>Example 8</u>: Identify the center and radius and sketch the graph:

$$(x+4)^2 + (y-3)^2 = 25$$

Remember the center values end up being the opposite sign of what is with the x and y and the right hand side is the radius squared. So the center is at (-4, 3) and the radius is 5.

<u>Example 9</u>: Find the center and radius of the circle:

$$x^2 + y^2 + 6x - 4y - 3 = 0$$

We have to complete the square on both the x's and y's to get in standard form.

$$x^2 + 6x + \underline{\quad\quad} + y^2 - 4y + \underline{\quad\quad} = +3 + \underline{\quad\quad} + \underline{\quad\quad}$$

$$x^2 + 6x + \underline{\ 9\ } + y^2 - 4y + \underline{\ 4\ } = +3 + \underline{\ 9\ } + \underline{\ 4\ }$$

$$\left(x + 3\right)^2 + \left(y - 2\right)^2 = 16$$

So the center is at (-3, 2) and the radius is 4.

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Where is the center of the circle?

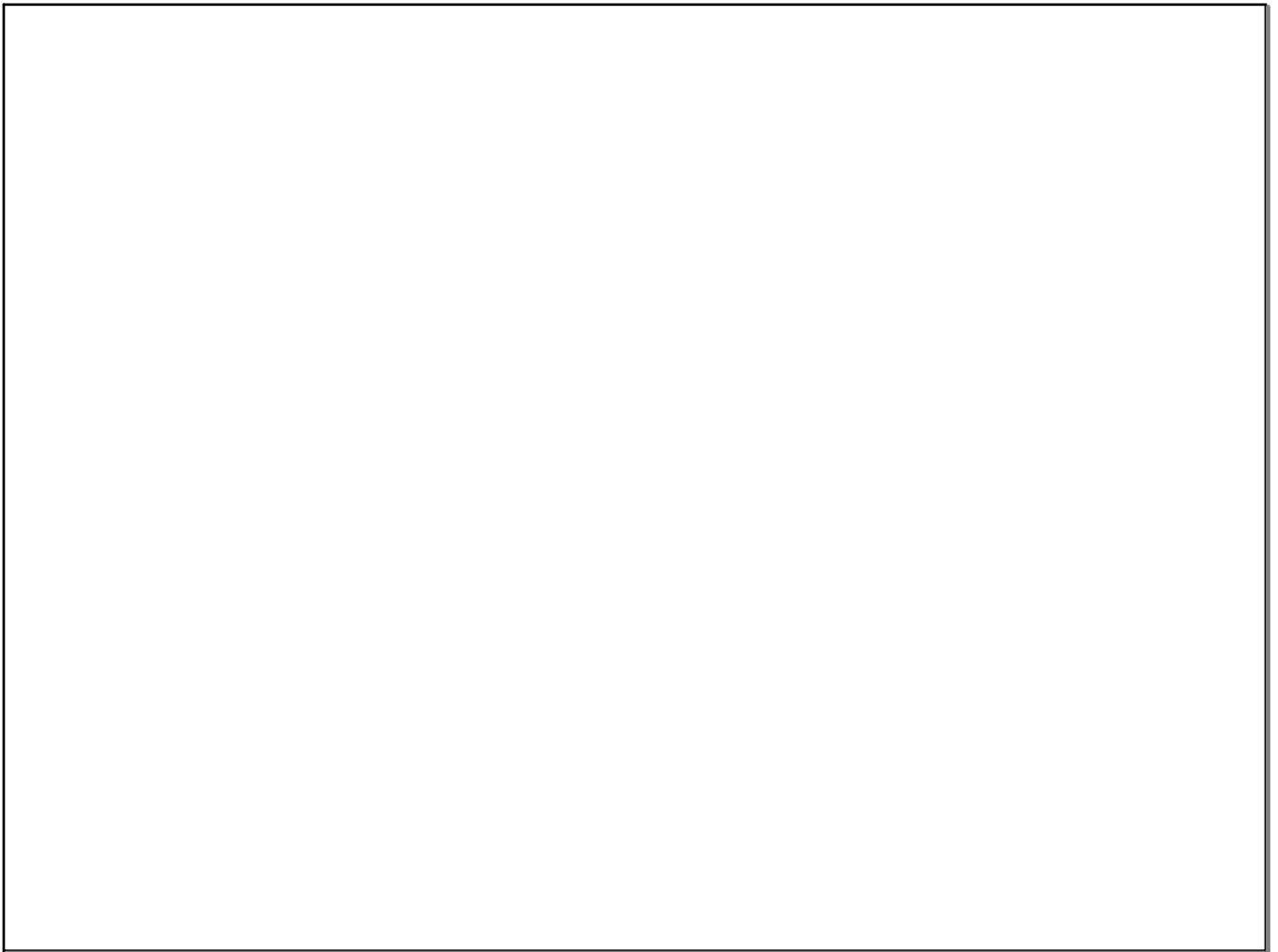# Classwork:

Complete "Notes: Circles in the Coordinate Plane" with your partner

Homework:

- p. 635 #1 - 8, 11
- 10.4 Index Cards
- Watch "Walk Around Example" video

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EXIT SLIP
1. Write the equation of a circle with center
    (-3, 0) and radius 7

2. Given the circle with equation
    $(x - 4)^2 + (y + 9)^2 = 25$
    a) What is the center?
    b) What is the radius?

3. Write the equation of a circle given:
    center is (-1, 5)
    (-6, 17) is a point on the circle