

Name _____

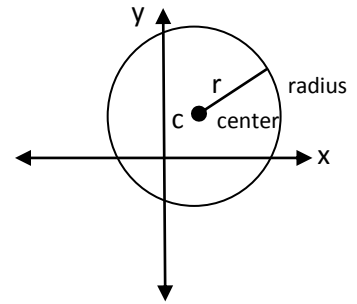
Algebra II
Lesson 10-3
Circles

A circle is a set of points in a plane that are a distance r or radius from a fixed point (called **center** with coordinates (h,k)).

A circle's formula is derived from the distance formula:

$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$. Our distance is in fact the radius. Squaring both sides and setting the center at the origin, $(0,0)$, we get: $x^2 + y^2 = r^2$.

When the circle is not centered at the origin the equation takes on the form: $(x - h)^2 + (y - k)^2 = r^2$, where the center is at the point, (h,k) .



Circles have a myriad of applications like computing lumber volume of trees, finding the epicenter of earthquakes, optimizing gear sizes and ratios for maximum engine horse power. If you want the best deal, take a ratio of area to price to see which pizza really is the best price!

Example: Write an equation for a circle with center at $(3, -4)$ and has a radius of 5 inches.

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

$$(x - 3)^2 + (y - (-4))^2 = 5^2,$$

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

1. Write the standard equation form.
2. Plug in values
3. Do any simplification and there you go!

Example: state the center and radius:

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

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

center is at $(3,0)$, and a radius = 3

1. Write in the standard form
2. Pull the coordinates and radius off equation.

As with all our other equations involving the point, (h,k) , these values may be used in conjunction with the standard form of a circle to perform translations. Here we look at the values of h and k . So to write an equation for the following translation we would get??

$$x^2 + y^2 = 1 \text{ Shift left 5 and down 3}$$

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

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

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

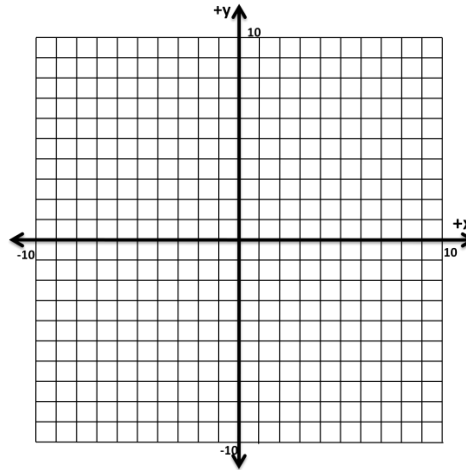
1. Write the equation in standard form and plug in the point (h,k)
2. a shift left of 5 makes $h =$ _____
3. a shift down of 3 makes $k =$ _____
4. Simplify

You try: Write an equation for the translation of $x^2 + y^2 = 25$; shift right 2 and down 4

To graph a circle use the center point (h,k) and radius to form the graph:

Graph: $(x + 9)^2 + (y + 2)^2 = 49$

1. Identify the center, (h,k)
2. Identify the radius, r.
3. Change the scale on the graph to accommodate.



You can also find the equation to a circle when given the center and a point on the circumference. How do you suppose you can do this?

The above information gives you the 2 points needed to find the length of the radius: the center and one on the circumference. You can use the distance formula to find the radius:

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

Example: You are given a point on a circle of (1,-5) and the center is at the origin, find the equation of the circle.

1. The points are (0,0) and (1,-5)
2. Put these points into the distance formula and solve for d, where d is in fact our radius r.

$$r = \sqrt{(1_2 - 0_1)^2 + ((-5)_2 - 0_1)^2}$$

$$r = \sqrt{1^2 + (-5)^2}$$

$$r = \sqrt{1 + 25} = \sqrt{26} \approx 5.1$$

$$\therefore x^2 + y^2 = 26$$

