

**Warm-Up:**

Are You Smarter Than an 8<sup>th</sup> Grader?

a = center

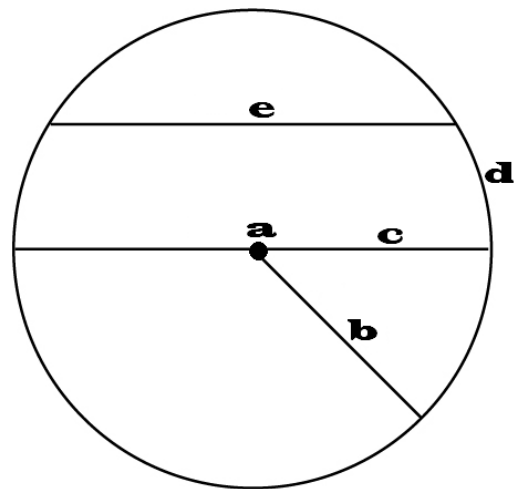
b = radius


c = diameter

d = circumference

e = chord

- The **radius** (r) is the distance from the centre of a circle to a point on the circle.
- All points on the **circumference** of the circle are equidistant (r units) from the centre.





Log in to **Gizmos!**  
 Open: Circles  
 Click on "Gizmo"

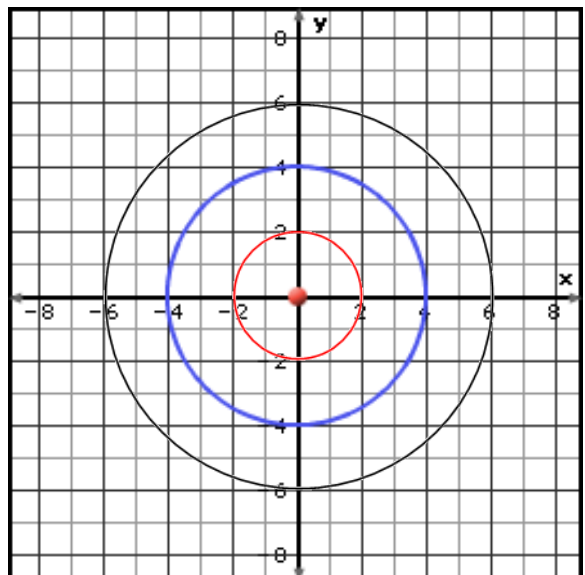
**Task 1: The Circle Formula**

On the screen, you should see the following circle.

1. What are the coordinates of the centre of the circle?

( 0 , 0 )

In the equation at the top:  $(x-h)^2 + (y-k)^2 = r^2$ , the value of  $h$  and  $k$  are the coordinates of the centre of the circle. In this exercise, our centre will always be  $(0, 0)$ , so the equation will be in the form:  $x^2 + y^2 = r^2$ .



2. Write down the equation of this blue circle shown on the screen. The equation is found in the blue highlighted box.

$$\underline{x^2 + y^2 = 4^2}$$

- Using the slider, change the value of 'r' to 6.

3. Sketch this circle on the same grid and write the equation here.

$$\underline{x^2 + y^2 = 6^2}$$

- Using the slider, change the value of 'r' to 2.

4. Sketch this circle on the same grid and write the equation here.

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

5. What does the 'r' value stand for in the equation?

radius

- Click **Explore geometric definition** box to confirm.

6. What is the radius of a circle with the equation  $x^2 + y^2 = 7^2$ ?  
Use the Gizmo to check your answer.

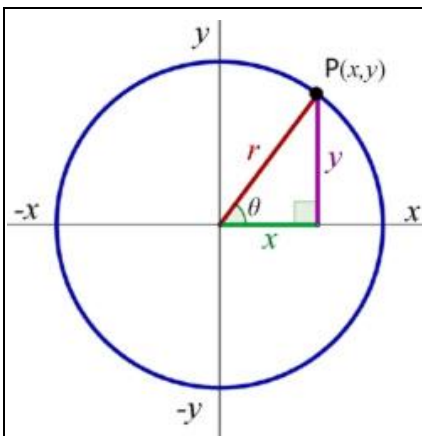
$$\underline{r = 7}$$

7. What would be the equation of a circle with centre (0, 0) and radius of 5? Use the Gizmo to check your answer.

$$\underline{x^2 + y^2 = 5^2}$$

8. What would happen to the graph of the circle if  $r = 0$ ?

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**Summary:** fill in the missing information

Due to the Pythagorean Theorem (and thus the length of a line segment formula as well!), the equation of a circle with centre at (0, 0) and radius  $r$  is:

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

**Task 2: Applications**

A point lies on the circumference of a circle if the distance between the point and the center of the circle is equal to the radius.

9. Use the formula to determine the equation of a circle with centre (0, 0) if the point (5, 2) is on the circumference.

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

Substitute the point (5, 2) into the equation for x and y.

$$(5-0)^2 + (2-0)^2 = r^2$$

Solve the equation for r.

$$25 + 4 = r^2$$

$$29 = r^2$$

$$\sqrt{29} = r$$

$r = 5.4$

Substitute the r back into the formula.

$$x^2 + y^2 = 5.4^2 \quad \text{or} \quad x^2 + y^2 = \sqrt{29}^2$$

- Use the slider to change the radius (r) in the Gizmo until the circle passes through the point (5, 2). Verify that your equation was correct.

$$x^2 + y^2 = 5.4^2 \quad \text{or} \quad x^2 + y^2 = \sqrt{29}^2$$

10. Point A(2, 4) is on a grid.

< less than      > greater than

- a. If a circle is drawn and point A is INSIDE the circle, what could the equation be? How could you show this by using the circle formula?

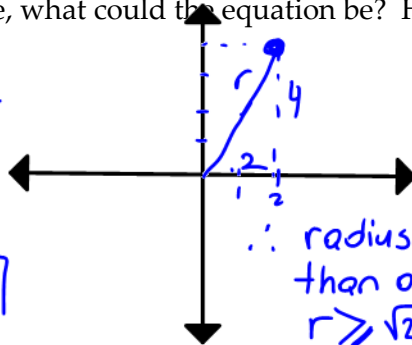
In order for point A to be inside the circle the radius must be minimum.

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

$$4 + 16 = r^2$$

$$20 = r^2$$

$r = \sqrt{20}$



$2^2 + 4^2$  is less than  $r^2$

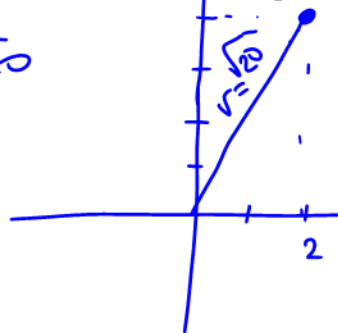
$\therefore$  radius must be greater than or equal to  $\sqrt{20}$   
 $r \geq \sqrt{20} \quad x^2 + y^2 \geq (\sqrt{20})^2$

- b. If a circle is drawn and point A is OUTSIDE the circle, what could the equation be? How could you show this by using the circle formula?

The radius must be less than  $\sqrt{20}$

$$x^2 + y^2 < r^2$$

$$x^2 + y^2 < (\sqrt{20})^2$$



- Verify if your equations above satisfied the required conditions by using the Gizmo.