

EQUATIONS OF A CIRCLE

- Remember that a circle is a locus of points. A circle is all of the points that are a fixed distance, known as the radius, from a given point, known as the center of the circle.

The standard form equation of a circle is the rule that relates the x and y values that result in a circle when graphed.

The CIRCLE with CENTER at (0, 0)

← origin

The equation of a circle centered at the origin $(0, 0)$ with a radius of r , is given by:

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

This equation of a circle is said to be expressed in standard form.

Example 1

Find the equation of a circle centered at the origin and having a radius of 3 cm. $r=3$

Solution

Using the equation above, $x^2 + y^2 = r^2$, the equation of the circle is: $x^2 + y^2 = (3)^2$

$$x^2 + y^2 = 9$$

Example 2

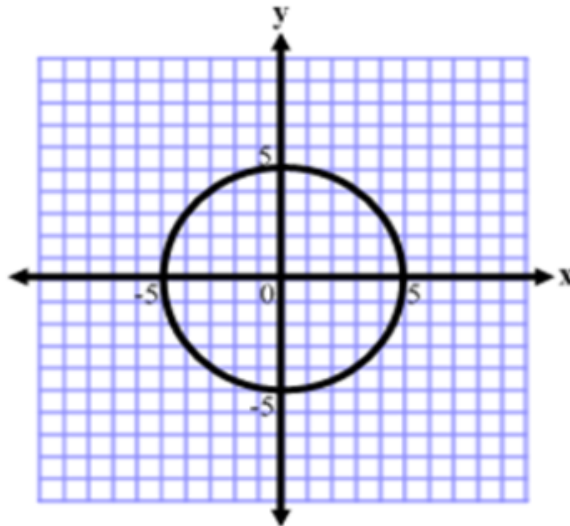
Given the equation, $x^2 + y^2 = 25$, find the radius of the circle and sketch the graph.

$$r^2 = 25$$
$$r = 5$$

Solution

We know that the radius, $r = \sqrt{25} = 5$ units and, the center is at the origin $(0, 0)$.

This is enough information for us to sketch the graph of this circle.



②

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

$$r^2 = 25$$
$$r = 5 \text{ units}$$

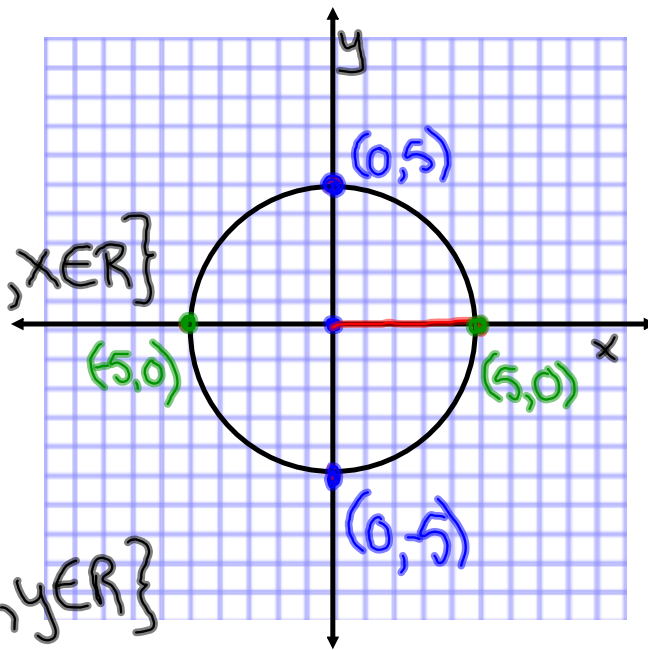
Center: $(0,0)$

Domain:

$$\{x \mid -5 \leq x \leq 5, x \in \mathbb{R}\}$$

Range:

$$\{y \mid -5 \leq y \leq 5, y \in \mathbb{R}\}$$



x intercepts:

$$x = \pm 5$$

y intercepts

$$y = \pm 5$$

For the circle with a defining equation of $x^2 + y^2 = r^2$, you can see that

- x-intercepts are $\pm r$.
- y-intercepts are $\pm r$.
- Domain – the set of all x values.
- Range – the set of all y values.

$$\{x \mid -r \leq x \leq r, x \in \mathbb{R}\}.$$

$$\{y \mid -r \leq y \leq r, y \in \mathbb{R}\}.$$

Example 3 / Solution

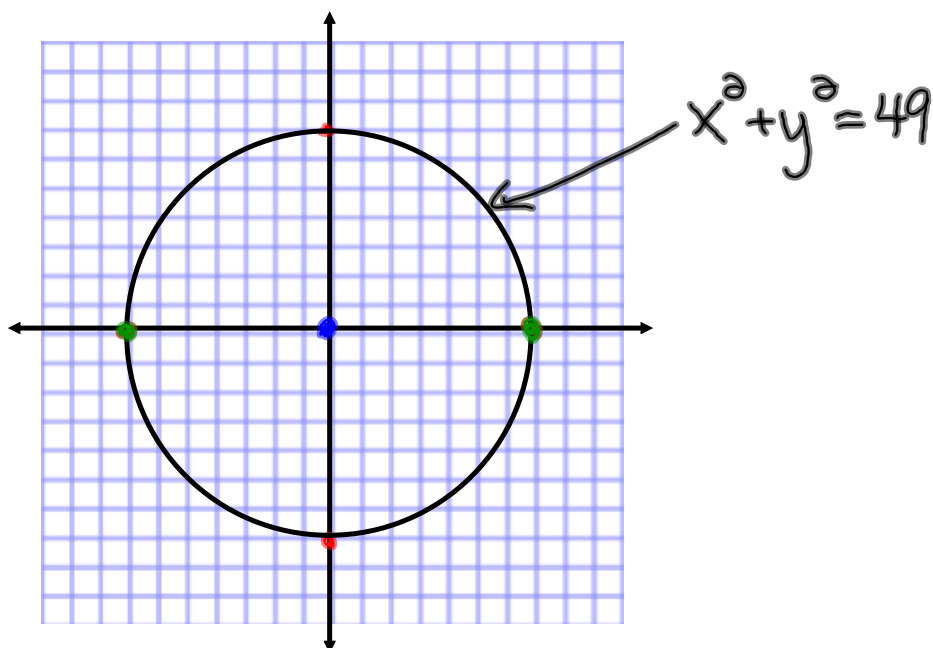
Complete the following chart.

<u>Equation</u>	<u>Center</u>	<u>Domain</u>
$x^2 + y^2 = 49$	$(0, 0)$	$\{x \mid -7 \leq x \leq 7, x \in \mathbb{R}\}$

<u>Range</u>	<u>x-intercepts</u>	<u>y-intercepts</u>
$\{y \mid -7 \leq y \leq 7, y \in \mathbb{R}\}$	-7 and 7	-7 and 7

$(-7, 0) + (7, 0)$

$(0, -7) + (0, 7)$



Homework

Do # 1-5

① b) $r = \underline{\sqrt{3}}$

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

$$x^2 + y^2 = (\sqrt{3})^2$$

$$x^2 + y^2 = 3$$

c) $r = \underline{2\sqrt{5}}$

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

$$x^2 + y^2 = (2\sqrt{5})^2$$

$$x^2 + y^2 = 20$$

d) $r = \underline{2r}$

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

$$x^2 + y^2 = 4r^2$$

② B: $x^2 + y^2 = 50 \leftarrow r^2 = 50$

$$r = \sqrt{50}$$

$$r = \sqrt{25 \times 2}$$

$$r = 5\sqrt{2}$$