Warm Up:

Graph each equation on a graphing calculator. Identify each conic section. Then describe the center and intercepts for circles and ellipses, or the vertices and direction that the graph opens for parabolas and hyperbolas.

1. $x^2 - 16y^2 = 16$

$-16y^2 = 16 - x^2$

$y^2 = -1 + \frac{x^2}{16}$

$y = \pm\sqrt{-1 + \frac{x^2}{16}}$

2. $4x^2 + 49y^2 = 196$

3. $x = 6y^2$

4. $x^2 + y^2 = 0.25$

10-2 Circles

Objectives

Write an equation for a circle.

Graph a circle, and identify its center and radius.

10-2 Circles

Vocabulary

circle
tangent

10-2 Circles

A **circle** is the set of points in a plane that are a fixed distance, called the radius, from a fixed point, called the center. Because all of the points on a circle are the same distance from the center of the circle, you can use the Distance Formula to find the equation of a circle.

Plug your values into the distance formula and then solve so there is no square root sign. Keep both x and y on the same side of the equation. This tells you the center of the circle and what the radius is too.

Write the equation of a circle with center (–3, 4) and radius *r* = 6.

Use the Distance Formula with $(x_2, y_2) = (x, y)$, $(x_1, y_1) = (-3, 4)$, and distance equal to the radius, 6.

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

$$6 = \sqrt{(x+3)^2 + (y-4)^2}$$

$$36 = (x+3)^2 + (y-4)^2$$

Write the equation of a circle with center (4, 2) and radius r = 7.

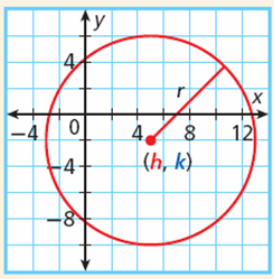
$7 = \sqrt{(x-4)^2 + (y-2)^2}$

$49 = (x-4)^2 + (y-2)^2$

10-2 Circles

Notice that r^2 and the center are visible in the equation of a circle. This leads to a general formula for a circle with center (h, k) and radius r.

Equation of a Circle

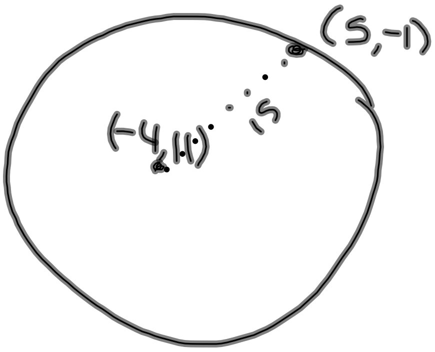
EQUATION	EXAMPLE	GRAPH
The equation of a circle with center (h, k) and radius r is $(x-h)^2 + (y-k)^2 = r^2$.	The equation of the circle with center $(5, -2)$ and radius $r = 8$ is $(x-5)^2 + (y-(-2))^2 = 8^2$ or $(x-5)^2 + (y+2)^2 = 64$.	

Write the equation of the circle.

the circle with center (0, 6) and radius $r = 1$

Write the equation of the circle.

the circle with center (–4, 11) and containing the point (5, –1)



$$r = \sqrt{(5+4)^2 + (-1-11)^2}$$

$$= \sqrt{9^2 + (-12)^2}$$

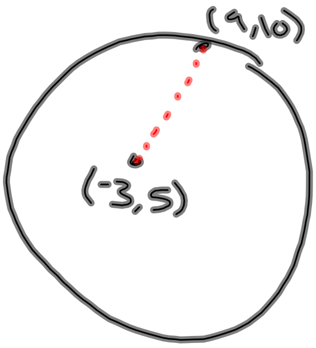
$$= \sqrt{81+144}$$

$$= \sqrt{225}$$

$$= 15$$

$$(x+4)^2 + (y-11)^2 = 225$$

Find the equation of the circle with center (–3, 5) and containing the point (9, 10).



$\sqrt{(10-5)^2+(9--3)^2}$

$\sqrt{5^2+12^2}$

$\sqrt{25+144}$

$\sqrt{169}$

$=13$

$(x+3)^2+(y-5)^2=169$

The location of points in relation to a circle can be described by inequalities. The points inside the circle satisfy the inequality $(x - h)^2 + (x - k)^2 < r^2$. The points outside the circle satisfy the inequality $(x - h)^2 + (x - k)^2 > r^2$.

10-2 Circles

A **tangent** is a line in the same plane as the circle that intersects the circle at exactly one point. Recall from geometry that a tangent to a circle is perpendicular to the radius at the point of tangency.

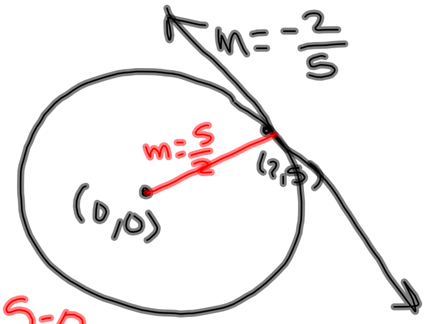
Remember!

To review linear functions, see Lesson 2-4.

To find tangent lines there are a few steps to take:

1) Find the center and radius of the circle.
2) Find the slope of the line from the center of the circle to the point of tangency.
3) The slope of the tangent line is perpendicular to your previous slope, so use the opposite reciprocal.
4) Use the point of tangency and opposite reciprocal slope to find the equation of the line.

Write the equation of the line tangent to the circle $x^2 + y^2 = 29$ at the point (2, 5).



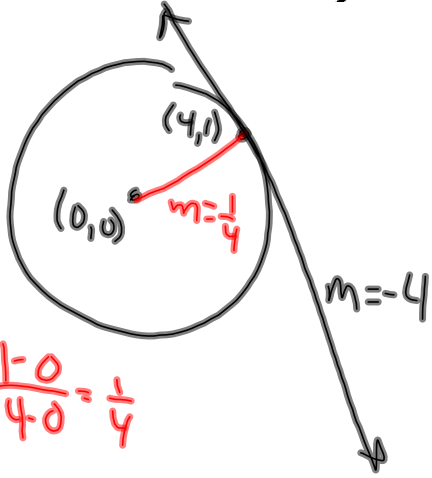
$$\frac{5-0}{2-0} = \frac{5}{2}$$

$$y - 5 = -\frac{2}{5}(x-2)$$

$$y - 5 = -\frac{2}{5}x + \frac{4}{5}$$

$$y = -\frac{2}{5}x + \frac{29}{5}$$

Write an equation for the line tangent to the circle $x^2 + y^2 = 17$ at the point (4, 1).



$$\frac{1-0}{4-0} = \frac{1}{4}$$

$$y - 1 = -4(x-4)$$

$$y - 1 = -4x + 16$$

$$y = -4x + 17$$

Write an equation of a circle. Find any line that lies tangent to your circle.

Homework:

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