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.

Standard Form of a Circle: $(x - h)^2 + (y - k)^2 = r^2$

Example #1:
Write the equation of a circle with center (–3, 4) and radius _r_ = 6.

Example #2:
Write the equation of a circle with center (0, 0) and radius _r_ = 7.

You try: Write the equation of the circle centered at (1,2) with r = 3.

Example #3:
Write the equation of the circle with center (–4, 11) that contains the point (5, –1)

A <u>tangent</u> is a line 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.

Example #4:

Write the equation of the circle that is tangent to the x-axis when x = 4 and tangent to the y-axis when y = -6.

Example #5:

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

You try:

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

Ellipses

An **ellipse** is the set of points such that the sum of the distances from any point on the ellipse to two other fixed points is constant.

➤ The two fixed points are called the **foci** (plural of **focus**) of the ellipse.
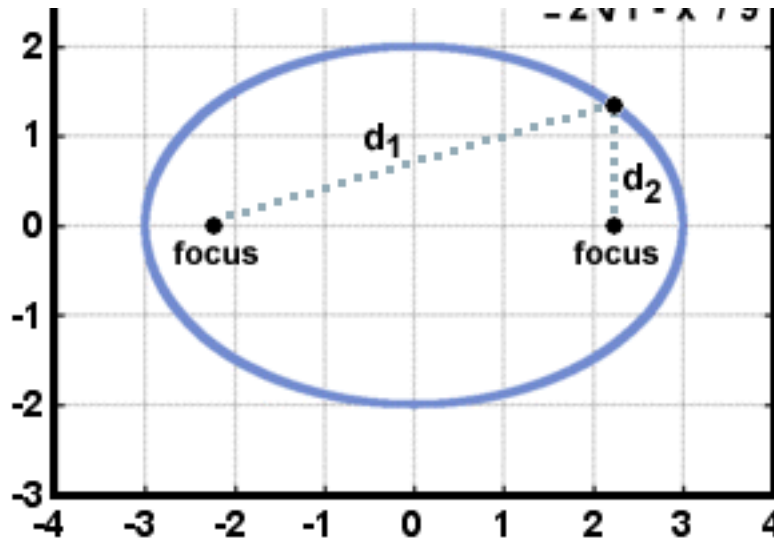
➤ The point halfway between the foci is the **center** of the ellipse.
➤ The line segment containing the foci of an ellipse with both endpoints on the ellipse is called the **major axis**.
➤ The line segment perpendicular to the major axis and passing through the center, with both endpoints on the ellipse, is the **minor axis**.
➤ The **vertices** are the endpoints on the major axis and the **co-vertices** are the endpoints on the minor axis.

Standard Form for the Equation of an Ellipse (Center at (0, 0))

MAJOR AXIS	HORIZONTAL	VERTICAL
Equation	$\dfrac{x^2}{a^2} + \dfrac{y^2}{b^2} = 1$	$\dfrac{y^2}{a^2} + \dfrac{x^2}{b^2} = 1$
Vertices	$(a, 0), (-a, 0)$	$(0, a), (0, -a)$
Foci	$(c, 0), (-c, 0)$	$(0, c), (0, -c)$
Co-vertices	$(0, b), (0, -b)$	$(b, 0), (-b, 0)$

Example #1:

Write an equation in standard form for each ellipse with center (0, 0) and Vertex at (6, 0); co-vertex at (0, 4)

Now let's graph it.

You try:

Write an equation in standard form for each ellipse with center (0, 0) and Co-Vertex at (5, 0); Vertex at (0,-9).

Example #2:

An ellipse has its center at the origin. A vertex is at (-13,0) and a co-vertex is at (0,5). What are the coordinates of the foci?

Foci Formula: $c = \sqrt{a^2 - b^2}$

Example #3: Write an equation in standard form for the ellipse with the center at the origin.

Vertex at (5, 0); focus at (–2, 0).

Now find the length of the minor axis.

You try: **Write the equation of the ellipse centered at the origin with co-vertex at (-3, 0) and focus at (0, 1).**