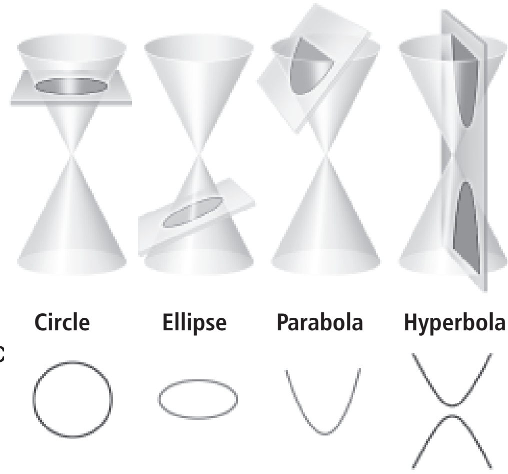
Date ______________

Dear Family,

In Chapter 10, your child will study the family of curves called *conic sections*.

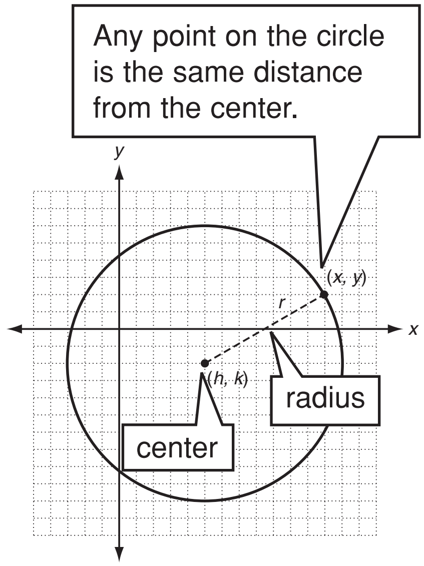


Geometrically, **conic sections** are formed when a double-cone is intersected by a plane. Depending upon the angle of intersection, one of four conic sections is created.

You may recognize the parabola, which was studied in Chapter 5. Although parabolas are functions, other conic sections are not. (Try the vertical line test on the graphs that follow.)

Every conic section can be defined in terms of distances. Hence, the Distance Formula is essential to this chapter.

Distance Formula: The distance d between the points with coordinates (x_1, y_1) and (x_2, y_2) is $d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$.

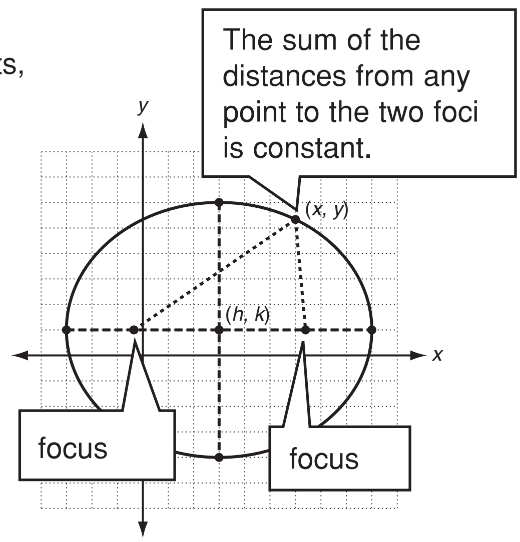


A **circle** is the set of points in a plane that are a fixed distance, called the **radius**, from a fixed point, called the **center**. Using the Distance Formula for any circle with radius r and center (h, k), and squaring both sides, gives:

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

For example, the equation of the circle with radius 8 and center $(5, -2)$ is $(x - 5)^2 + (y + 2)^2 = 64$.

An **ellipse** is the set of points in a plane such that the distances from any point on the ellipse to two fixed points, called **foci** (plural of *focus*), create a constant sum. An ellipse looks like a stretched circle.

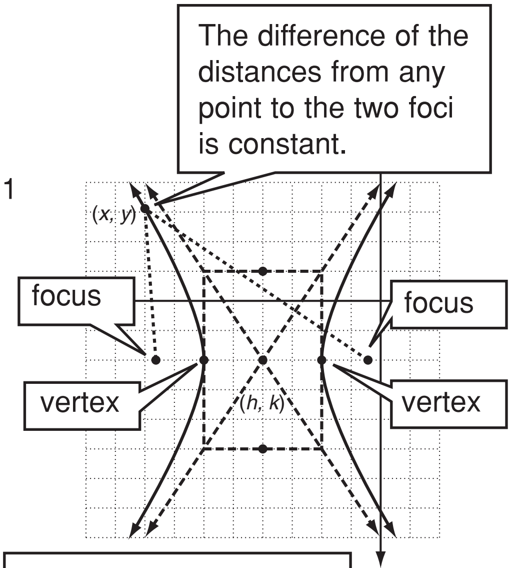


Equation of an Ellipse: $\dfrac{(x - h)^2}{a^2} + \dfrac{(y - k)^2}{b^2} = 1$

An ellipse has two axes. The longer axis is the **major axis**, with length $2a$. The shorter axis is the **minor axis**, with length $2b$. If the ellipse is taller than it is wide, the denominators a^2 and b^2 switch places in the equation.

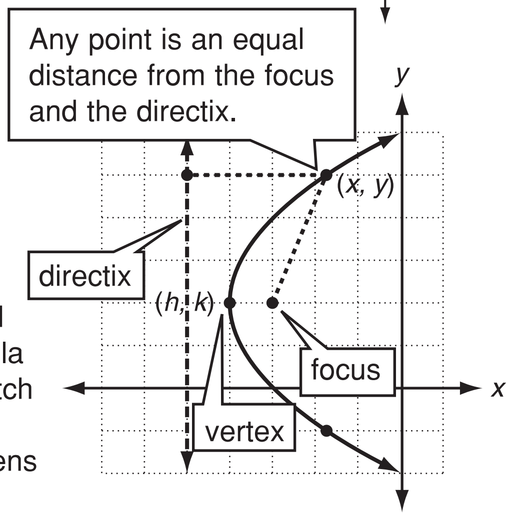
A **hyperbola** is the set of points in a plane such that the distances from any point on the hyperbola to two fixed points, called **foci**, create a constant difference.

Equation of a Hyperbola: $\frac{(x-h)^2}{a^2} - \frac{(y-k)^2}{b^2} = 1$



Every hyperbola has two symmetrical parts called **branches**. The **transverse axis** connects the **vertices** of each branch and has length $2a$. The **conjugate axis** lies between the two branches and has length $2b$. If the branches of the hyperbola open up and down, rather than left and right, the numerators $(x-h)^2$ and $(y-k)^2$ switch places in the equation.

A **parabola** is the set of points in a plane that are an equal distance from a fixed point, called the **focus**, and a fixed line, called the **directrix**.



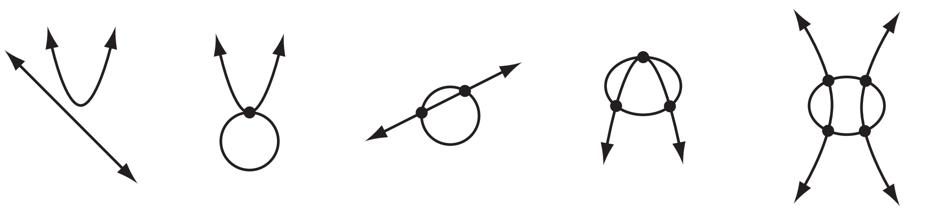
Equation of a Parabola: $x - h = \frac{1}{4p}(y-k)^2$

For a parabola, the vertex is at (h, k), and the focus and directrix are each $|p|$ units from the vertex. If the parabola opens up or down, the expressions $x - h$ and $y - k$ switch places in the equation. When p is positive, the parabola opens right (or up); when p is negative, the parabola opens left (or down).

The equation of any conic section can be written in general form: $Ax^2 + Bxy + Cy^2 + Dx + Ey + F = 0$. When an equation is in general form, you use the coefficients A, B, and C to classify the conic section.

Conic	Coefficients
Circle	$B^2 - 4AC < 0$, $B = 0$, and $A = C$
Ellipse	$B^2 - 4AC < 0$ and $B \neq 0$, or $A \neq C$
Hyperbola	$B^2 - 4AC > 0$
Parabola	$B^2 - 4AC = 0$

A **nonlinear system of equations** has at least one equation that is not linear. As with all systems, the solution is the set of points that make all of the equations true, or where the graphs intersect. With conic sections, there may be up to four possible solutions.



No Solution One Solution Two Solutions Three Solutions Four Solutions

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