Name ____Date__________________

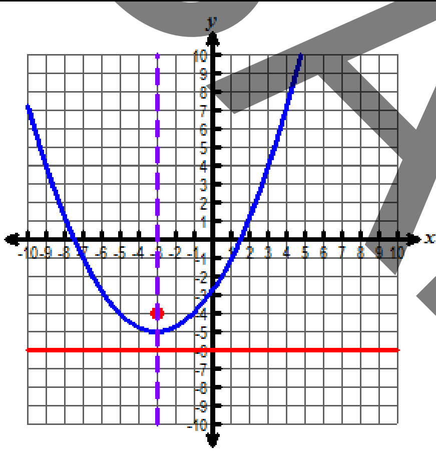
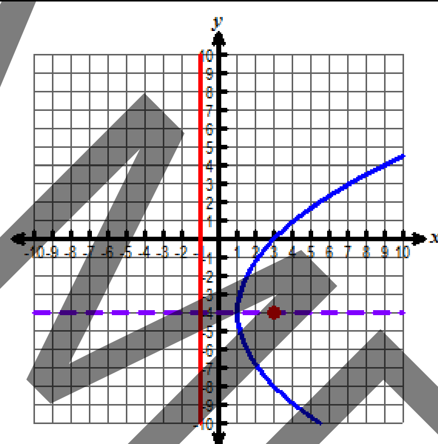
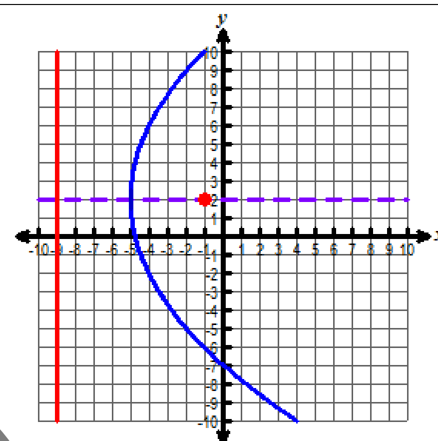
Conic Sections

Explore – Answer Key

Directions: For each of the sets of conic sections below, study the graphs and equations. Use the information provided to answer the debriefing questions that follow.

Part 1: Parabolas

The standard form of a parabola that opens upward or downward is $y - k = a(x - h)^2$.
The standard form of a parabola that opens to the right or left is $x - h = a(y - k)^2$.

$y+5=\frac{1}{4}(x+3)^2$	$x-1=\frac{1}{8}(y+4)^2$	$x+5=\frac{1}{16}(y-2)^2$
		

Debriefing Questions:

1. How do the coordinates of the **vertex** relate to the standard form equations of a parabola?
   The coordinates of the vertex, (h, k), have the opposite signs of the addends to x and y in the equation.

2. The purple dashed line represents the **axis of symmetry**. What do you notice about the location of the axis of symmetry? How would you write the equation of the axis of symmetry?
   The axis of symmetry passes through the vertex. For parabolas that open upward or downward, the equation would be y = k. For parabolas that open left or right, the equation would be x = h.

3. The red solid line represents the **directrix**. What do you notice about the location and distance of the directrix from the vertex? How does this location compare to the denominator of *a*?
   The directrix is located outside the parabola, and the distance between the directrix and vertex is the denominator of a divided by 4.

4. The red point represents the **focus** of the parabola. What do you notice about the location of the focus, vertex, and directrix?
   The focus and directrix are the same distance from the vertex.

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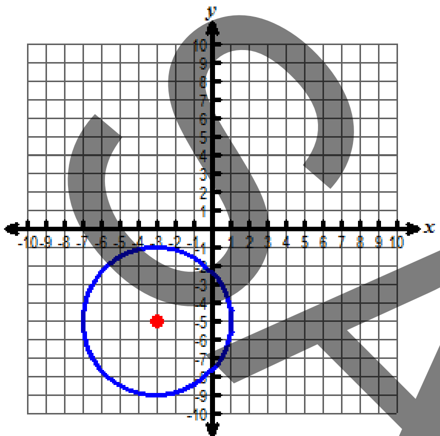
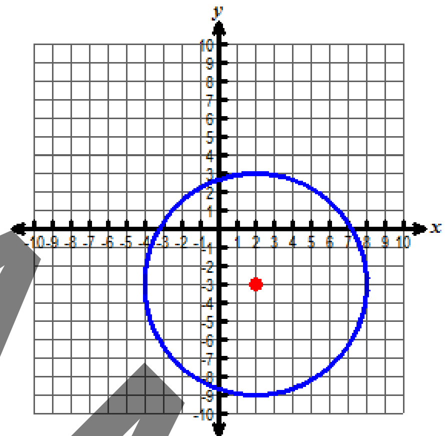
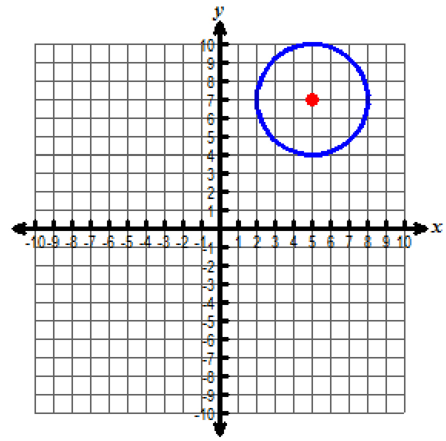
Part 2: Circles

The standard form of a circle is $(x - h)^2 + (y - k)^2 = r^2$.

$(x+3)^2 + (y+5)^2 = 16$	$(x-2)^2 + (y+3)^2 = 36$	$(x-5)^2 + (y-7)^2 = 9$
		

Debriefing Questions:

5. The red point inside the circle is the **center**. How do the coordinates of the center relate to the standard form equation of a circle?
   The coordinates of the center, (h, k), have the opposite signs of the addends to x and y in the equation.

6. How does the radius of the circle compare to the value of *r*?
   The radius is equal to the value of r in the equation.

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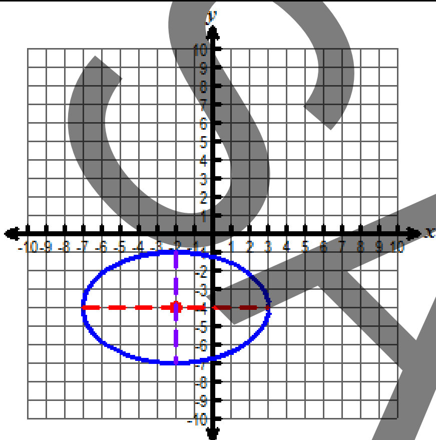
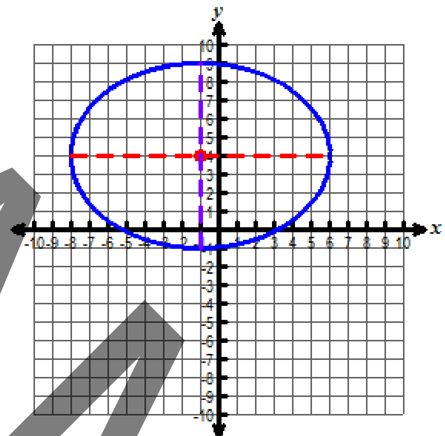
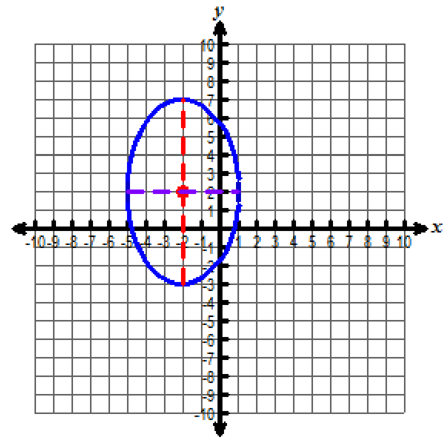
Part 3: Ellipses

The standard form of an ellipse is $\frac{(x-h)^2}{a^2}+\frac{(y-k)^2}{b^2}=1$.

$\frac{(x+2)^2}{25}+\frac{(y+4)^2}{9}=1$	$\frac{(x+1)^2}{49}+\frac{(y-4)^2}{25}=1$	$\frac{(x+2)^2}{9}+\frac{(y-2)^2}{25}=1$
		

Debriefing Questions:

7. The red point inside the ellipse is the **center**. How do the coordinates of the center relate to the standard form equation of an ellipse?
The coordinates of the center, (h, k), have the opposite signs of the addends to x and y in the equation.

8. The red dashed line is the **major axis** of the ellipse. The purple dashed line is the **minor axis** of the ellipse. How does the length of each axis compare to the value of *a* or *b* in the standard form equation of an ellipse?
The length of the major axis is twice the value of the greater of a or b. The length of the minor axis is twice the value of the lesser of a or b.

9. How is the direction of the major axis related to the parameters in the standard form equation of an ellipse?
If a > b, then the major axis will be horizontal (in the x direction). If a < b, then the major axis will be vertical (in the y direction).

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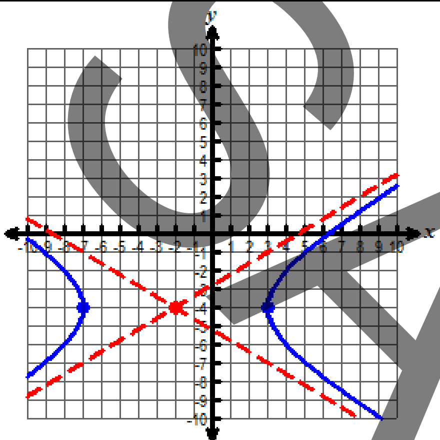
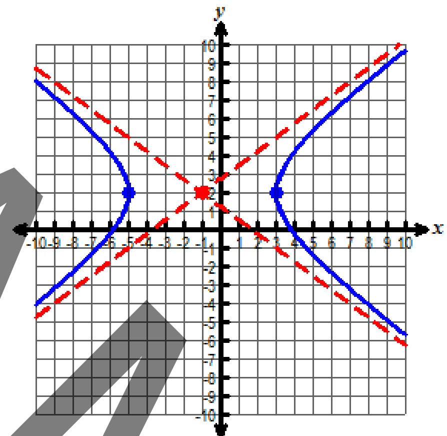
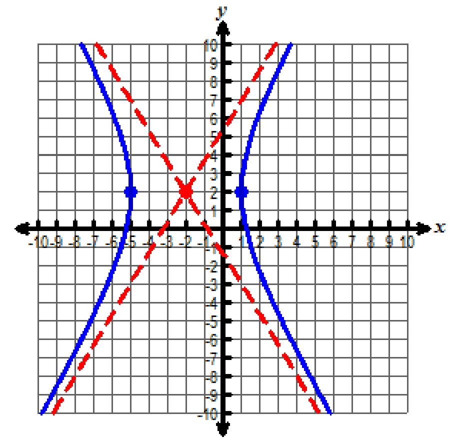
Part 4: Hyperbolas

The standard form of a hyperbola is $\frac{(x-h)^2}{a^2}-\frac{(y-k)^2}{b^2}=1$.

$\frac{(x+2)^2}{25}-\frac{(y+4)^2}{9}=1$	$\frac{(x+1)^2}{16}-\frac{(y-2)^2}{9}=1$	$\frac{(y-2)^2}{9}-\frac{(x+2)^2}{25}=1$
		

Debriefing Questions:

10. The red point inside the hyperbola is the **center**. How do the coordinates of the center relate to the standard form equation of a hyperbola?
The coordinates of the center, (h, k), have the opposite signs of the addends to x and y in the equation.

11. The red dashed lines are the **asymptotes** of the hyperbola. How does the slope of each asymptote compare to the values of *a* and *b*?
The slope of one asymptote is $\frac{b}{a}$ ***and the slope of the other asymptote is*** $-\frac{b}{a}$.

12. How does the direction in which the hyperbola opens compare to the standard form equation of a hyperbola?
The term in front of the minus sign determines the direction in which the hyperbola opens.

13. The blue points are the **vertices** of each branch of the hyperbola. How does the distance of these points from the center relate to the values of *a* and *b*?
If the hyperbola opens left and right, the vertices of each branch of the hyperbola are located a units from the center.

If the hyperbola opens upward and downward, the vertices of each branch of the hyperbola are located b units from the center.