Definition of a Hyperbola
A Hyperbola is a smooth curve graph in which the difference of the distance from a single point "P" to the two Foci, $F_1$ & $F_2$, is a constant $k$.

Foci of a Hyperbola are $F_1$ & $F_2$.

$PF_1$ minus $PF_2$ equals the constant $k$.

Hyperbola - consists of two smooth branches
- turning point of each branch is a vertex

Traverse axis - segment connecting the two vertices
- also the axis of symmetry

$F_1$ & $F_2$ lie on the axis of symmetry

Center of the hyperbola
- midpoint of the two vertices
- midpoint of the two foci

Horizontal Parabola

Standard Equation
\[ \frac{x^2}{a^2} - \frac{y^2}{b^2} = 1 \]

Traverse Axis: Horizontal

Vertices: $(a,0)$, $(-a,0)$

Foci: $(\pm c,0)$, where $c^2 = a^2 + b^2$

Asymptotes $y = \pm \frac{b}{a}x$
Write the standard equation for a hyperbola with vertices (0,4) (0,-4) and a focus at (0,5)?

Sketch the graph.

step 1) Traverse axis: __________

step 2) Identify a, b and c.

step 3) Use $c^2 = a^2 + b^2$ to find the missing part.

step 4) Write the equation

Write the standard equation for a hyperbola with vertices (2,0) (-2,0) and a focus at (3,0)?

Sketch the graph.

step 1) Traverse axis: __________

step 2) Identify a, b and c.

step 3) Use $c^2 = a^2 + b^2$ to find the missing part.

step 4) Write the equation
Given the following equation find the vertices, foci, and asymptotes.  

$$9y^2 - 7x^2 = 63$$

1) **Rewrite the equation**

2) **Vertical or horizontal hyperbola**

3) Use $c^2 = a^2 + b^2$ to find the missing part.

4) **Vertices:** 
   Foci: 
   Asymptotes:

Given the following equation find the vertices, foci, and asymptotes.  

$$9x^2 - 4y^2 = 36$$

1) **Rewrite the equation**

2) **Vertical or horizontal hyperbola**

3) Use $c^2 = a^2 + b^2$ to find the missing part.

4) **Vertices:** 
   Foci: 
   Asymptotes:

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**Translating Horizontal Hyperbolas**

<table>
<thead>
<tr>
<th>Center $(0,0)$</th>
<th>Center $(h,k)$</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Standard Equation</strong></td>
<td>$\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$</td>
</tr>
<tr>
<td><strong>Vertices</strong></td>
<td>$(\pm a,0)$</td>
</tr>
<tr>
<td><strong>Foci</strong></td>
<td>$(\pm c,0)$</td>
</tr>
<tr>
<td><strong>Asymptotes</strong></td>
<td>$y = \pm \frac{b}{a} x$</td>
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<tr>
<td>$c^2 = a^2 + b^2$</td>
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**Translating Vertical Hyperbolas**

<table>
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<th>Center $(h,k)$</th>
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<tbody>
<tr>
<td><strong>Standard Equation</strong></td>
<td>$\frac{y^2}{a^2} - \frac{x^2}{b^2} = 1$</td>
</tr>
<tr>
<td><strong>Vertices</strong></td>
<td>$(0,\pm a)$</td>
</tr>
<tr>
<td><strong>Foci</strong></td>
<td>$(0,\pm c)$</td>
</tr>
<tr>
<td><strong>Asymptotes</strong></td>
<td>$y = \pm \frac{a}{b} x$</td>
</tr>
<tr>
<td>$c^2 = a^2 + b^2$</td>
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Write the following equations in Standard Form.

\[
\frac{(y - 1)^2}{25} - \frac{(x - 3)^2}{144} = 1
\]

Sketch the graph.

What are the center, vertices, foci, and asymptotes of the hyperbola with equation:

\[
\frac{(x - 2)^2}{36} - \frac{(y + 2)^2}{64} = 1
\]

Sketch the graph.

Homework

Practice Workbook page

271 9-16, 24,25

275 1,2, 5-7, 15,16