

Trig/Precalculus  
Hyperbolas  
Mr. Roy

Name Key  
Date \_\_\_\_\_  
Period 3<sup>rd</sup>

For each problem, state the equation in standard form, determine the center, vertices, foci, and graph the equation including its asymptotes.

1.  $y^2 - 4x^2 - 2y - 16x + 1 = 0$

$$(y^2 - 2y + 1) - 4(x^2 + 4x + 4) = -1 + 1^2 - 16$$

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

$$\frac{(x+2)^2}{4} - \frac{(y-1)^2}{16} = 1 \quad \text{horizontal}$$

$h = -2$

$k = 1$

$a^2 = 4, a = 2$

$b^2 = 16, b = 4$

$c^2 = 20$

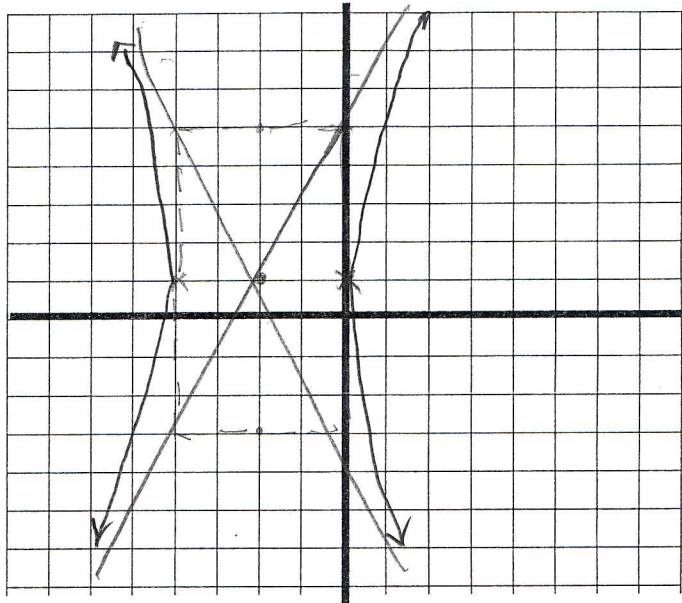
$c = \sqrt{20}$

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

Center  $(-2, 1)$

Vertices  $(0, 1), (-4, 1)$

Foci  $(-2 + \sqrt{20}, 1), (-2 - \sqrt{20}, 1)$



2.  $3x^2 - y^2 + 6x + 6y = 18$

$$3(x^2 + 2x + 1) - (y^2 - 6y + 3^2) = 18 + 3(1^2) - 3^2$$

$$\frac{3(x+1)^2}{12} - \frac{(y-3)^2}{12} = \frac{12}{12}$$

$$\frac{(x+1)^2}{4} - \frac{(y-3)^2}{12} = 1 \quad \text{horizontal}$$

$h = -1$

$k = 3$

$a^2 = 4, a = 2$

$b^2 = 12, b = \sqrt{12}$

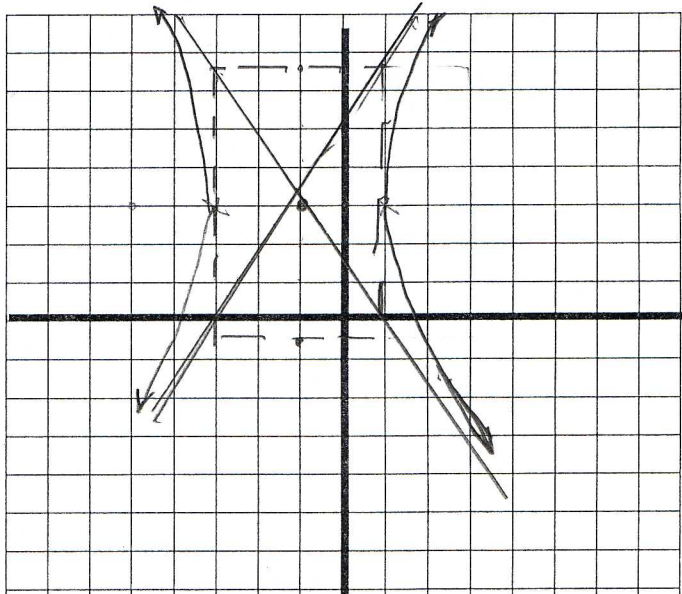
$c^2 = 16, c = 4$

Equation  $\frac{(x+1)^2}{4} - \frac{(y-3)^2}{12} = 1$

Center  $(-1, 3)$

Vertices  $(1, 3), (-3, 3)$

Foci  $(3, 3), (-5, 3)$

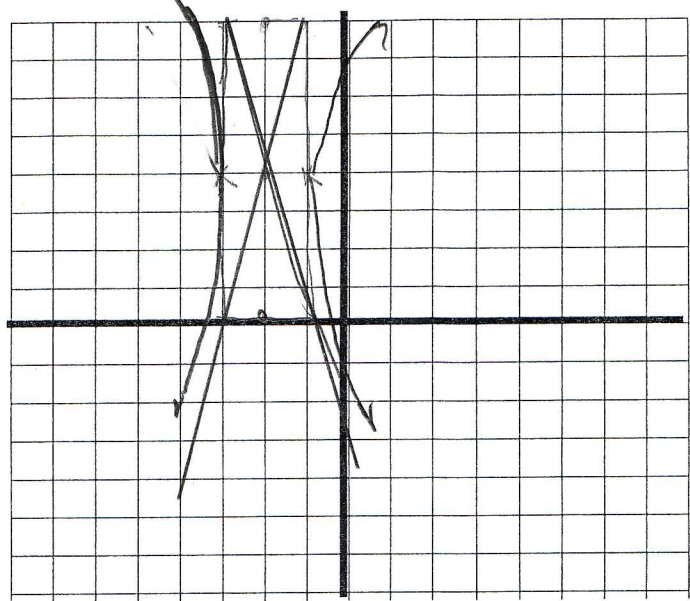


3. A hyperbola is centered at  $(-2, 4)$  with a horizontal transverse axis. The value of  $a = 1$  and  $b = 4$ . State the equation in standard form, determine the center, vertices, foci, and graph the equation including its asymptotes.

$h = -2$   
 $k = 4$   
 $a = 1$   
 $b = 4$   
 $c^2 = 17$   
 $c = \sqrt{17}$   
 $a^2 = 1$   
 $b^2 = 16$

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

horizontal



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

Center  $(-2, 4)$

Vertices  $(-1, 4)$   $(-3, 4)$

Foci  $(-2 + \sqrt{17}, 4)$   $(-2 - \sqrt{17}, 4)$

4. Solve for the equation in standard form of a hyperbola that has a center of  $(4, -1)$  and a focus of  $(9, -1)$  and  $(-1, -1)$ . The transverse axis is 8 units long.

$h = 4$   
 $k = -1$   
 $h + c = 9$   
 $h - c = -1$   
 $c^2 = 25$   
 $a^2 = 16$   
 $b^2 = 9$   
 $c = 5$   
 $a = 4$   
 $b = 3$

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

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

5. Solve for the equation in standard form of a hyperbola that has vertices of  $(-3, 11)$  and  $(-3, 1)$  and foci  $(-3, 19)$  and  $(-3, -7)$ .

$h = -3$   
 $k + a = 11$   
 $k - a = 1$   
 $2k = 12$   
 $k = 6$   
 $a = 5$   
 $h + c = 19$   
 $c = 13$   
 $b^2 = c^2 - a^2$   
 $b^2 = 169 - 25$   
 $b = 12$

vertical

Equation  $\frac{(y-6)^2}{25} - \frac{(x+3)^2}{144} = 1$