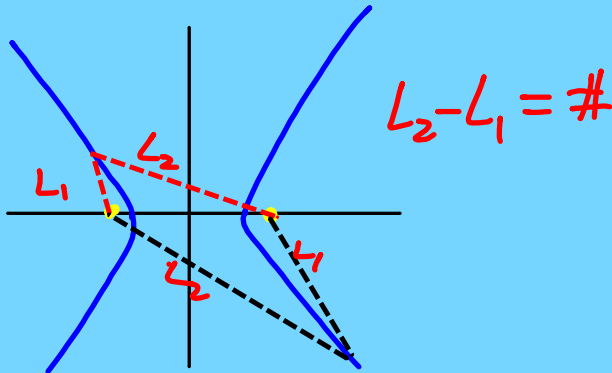
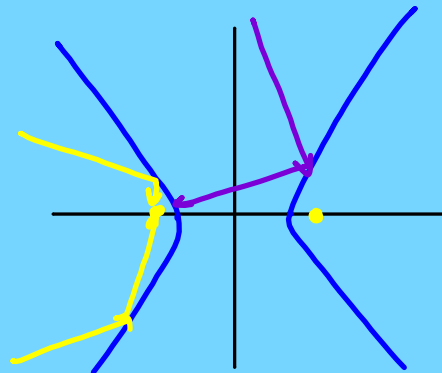


# HYPERBOLAS

- the set of points in which the difference of the distances from 2 given points is constant



Reflective Property



Applications

architecture

transmission tower

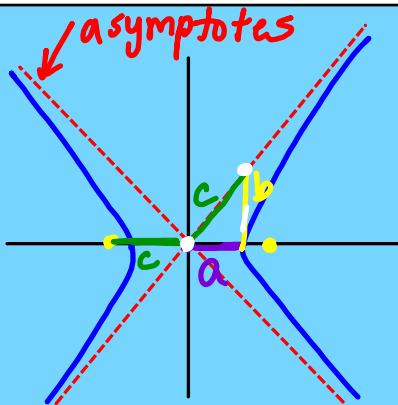
light from lamp shade

sonic boom

nuclear power plant towers

pringles chips





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

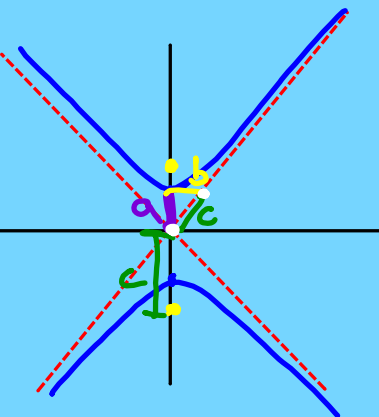
Center:  $(h, k)$   
 Vertices:  $(h \pm a, k)$   
 Foci:  $(h \pm c, k)$

Slopes of asymptotes:  $\pm \frac{b}{a}$

$a$  = center to vertex  
 $b$  = vertex to asymptote  
 $c$  = center to focus

$$c^2 = a^2 + b^2$$

$a$  is 1st number



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

Center:  $(h, k)$   
 Vertices:  $(h, k \pm a)$   
 Foci:  $(h, k \pm c)$

Slopes:  $\pm \frac{a}{b}$

$$25y^2 - 16x^2 - 150y - 32x - 191 = 0$$
$$25y^2 - 150y \quad -16x^2 - 32x \quad = 191$$
$$25(y^2 - 6y + 9) - 16(x^2 + 2x + 1) = 191$$

Diagram illustrating the completion of the square for the quadratic equation  $25y^2 - 16x^2 - 150y - 32x - 191 = 0$ .

The equation is rearranged to isolate the quadratic terms on the left and the constant term on the right:

$$25y^2 - 150y \quad -16x^2 - 32x \quad = 191$$

The quadratic terms are grouped, and constants are added to complete the squares:

$$25(y^2 - 6y + 9) - 16(x^2 + 2x + 1) = 191$$

The diagram shows the following steps:

- For the  $y$ -terms:  $25y^2 - 150y$  is grouped. A blue arc connects the coefficient of  $y$  ( $-150$ ) to the constant term added ( $+9$ ), with a label  $-3$  below the arc. Another blue arc connects the coefficient of  $y^2$  ( $25$ ) to the constant term added ( $+9$ ), with a label  $+225$  below the arc.
- For the  $x$ -terms:  $-16x^2 - 32x$  is grouped. A green arc connects the coefficient of  $x$  ( $-32$ ) to the constant term added ( $+1$ ), with a label  $+1$  below the arc. Another green arc connects the coefficient of  $x^2$  ( $-16$ ) to the constant term added ( $+1$ ), with a label  $-16$  below the arc.

$$\frac{25(y-3)^2}{16} - \frac{(x+1)^2}{25} = \frac{400}{400}$$

Center:  $(-1, 3)$

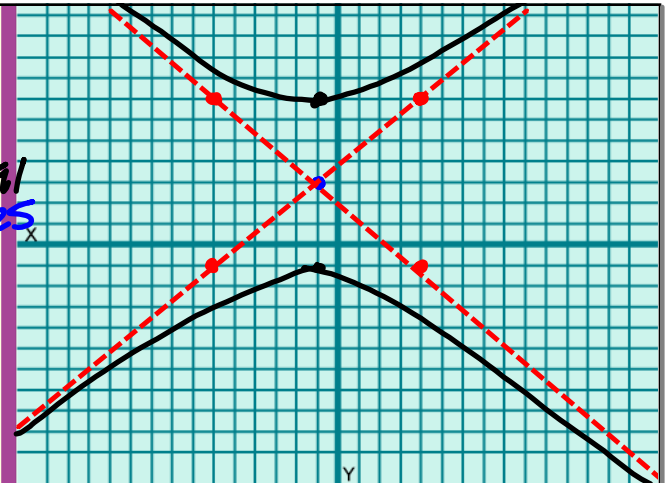
$$a = \sqrt{16} = 4 \quad \text{slopes: } \pm \frac{4}{5}$$

$$b = \sqrt{25} = 5$$

## Vertical

Vertical  
Vertices  $(-1, 3 \pm 4) < \begin{pmatrix} -1, 7 \\ -1, -1 \end{pmatrix}$

Foci (



To graph:

- 1) Plot center
- 2) Plot asymptotes
- 3) Plot vertices
- 4) Draw Curves toward asymptotes

$$c^2 = a^2 + b^2$$

$$c^2 = 16 + 25$$

$$\sqrt{k^2} = \sqrt{41}$$