

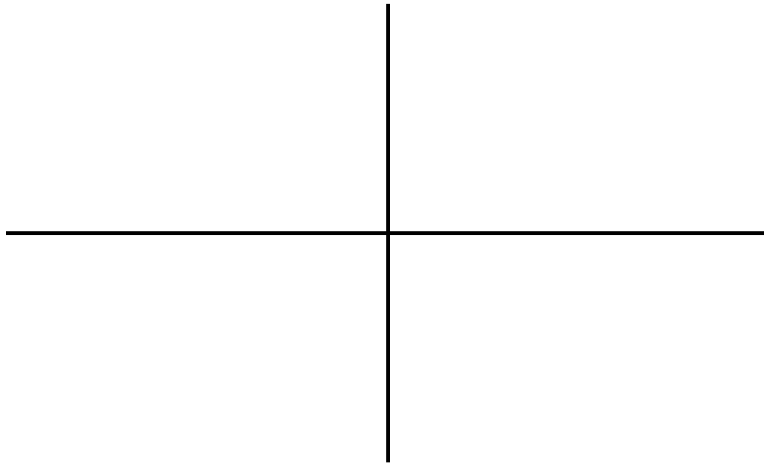
## 10.2/3 The Ellipse and the Hyperbola

### The Ellipse

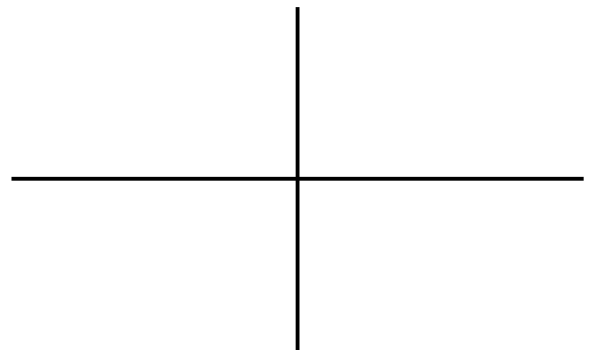
⚡ An **ellipse** is the set of all points  $(x, y)$  whose sum of distance from two fixed points is constant. The fixed points are called the *foci* (plural of focus). The equation of an ellipse is:

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$$

**Example 1** Plot the  $x$  and  $y$  intercepts of the ellipse given above, along with the two foci points  $(c, 0)$  and  $(-c, 0)$ . Find the constant sum length, and the relation between  $a$ ,  $b$ , and  $c$ .



**Example 2** Graph the ellipse given by  $25x^2 + 64y^2 - 1600 = 0$ . Plot the intercepts, and foci.



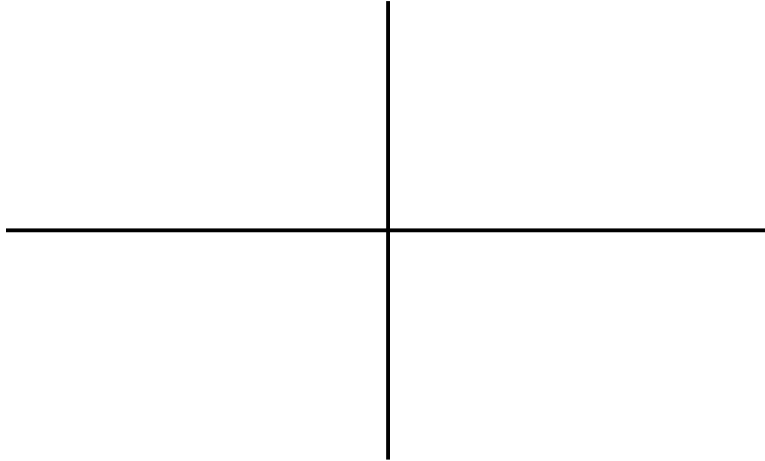
**Example 3** Find where the foci should be located to sketch the largest ellipse on a standard 8.5in by 11in sheet of paper. How long should the string be using the "string method".

## The Hyperbola

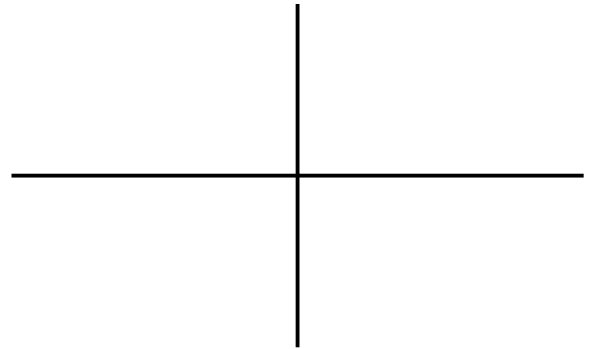
⚡ A **hyperbola** is the set of all points  $(x, y)$  whose *difference* of distances from two fixed points is constant. The fixed points are called the *foci* (plural of focus). The equation of an ellipse is:

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1 \quad \text{or} \quad \frac{y^2}{b^2} - \frac{x^2}{a^2} = 1$$

**Example 4** Plot the “intercepts”  $(\pm a, 0)$  and  $(0, \pm b)$ , the “helpful rectangle”, and the two foci points  $(c, 0)$  and  $(-c, 0)$ . Find the equation of the asymptotes and the relation between  $a$ ,  $b$ , and  $c$ .



**Example 5** Make a sketch of the hyperbola  $16x^2 - 9y^2 = 144$ . Find the coordinates of the foci, and the equations of the asymptotes.



**Example 6** Make a sketch of the hyperbola  $3y^2 - 8x^2 = 48$ . Find the asymptotes, and foci. Round coordinates to 2 decimal places.

