

Section 10.4 Hyperbolas

Objective: In this lesson you learned how to write the standard form of the equation of a hyperbola.

Course Number

Instructor

Date

Important Vocabulary

Define each term or concept.

Branches The two disconnected parts of the graph of a hyperbola.

Transverse axis The line segment connecting the vertices of a hyperbola.

Conjugate axis The line segment in a hyperbola of length $2b$ joining $(0, b)$ and $(0, -b)$ [or $(-b, 0)$ and $(b, 0)$].

I. Introduction (Pages 751–752)

A hyperbola is the set of all points (x, y) in a plane, the difference of whose distances from two distinct fixed points (foci) is a positive constant.

What you should learn
How to write equations of hyperbolas in standard form

The line through a hyperbola's two foci intersects the hyperbola at two points called vertices.

The midpoint of a hyperbola's transverse axis is the center of the hyperbola.

The standard form of the equation of a hyperbola centered at (h, k) and having a horizontal transverse axis is

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

The standard form of the equation of a hyperbola centered at (h, k) and having a vertical transverse axis is

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

In each case, the vertices and foci are, respectively, a and c units from the center. Moreover, a , b , and c are related by the equation

$$\underline{c^2 = a^2 + b^2}$$

If the center of the hyperbola is at the origin $(0, 0)$, the equation takes one of the following forms: $x^2/a^2 - y^2/b^2 = 1$ or $y^2/a^2 - x^2/b^2 = 1$.

II. Asymptotes of a Hyperbola (Pages 753–755)

The equations of the **asymptotes** of a hyperbola with a horizontal transverse axis are $y = k \pm b/a(x - h)$.

The equations of the **asymptotes** of a hyperbola with a vertical transverse axis are $y = k \pm a/b(x - h)$.

Example 1: Sketch the graph of the hyperbola given by $y^2 - 9x^2 = 9$.

The **eccentricity** of a hyperbola is $e = c/a$, where the values of e are **greater than 1**.

III. Applications of Hyperbolas (Page 756)

Describe a real-life application in which hyperbolas occur or are used.

Answers will vary.

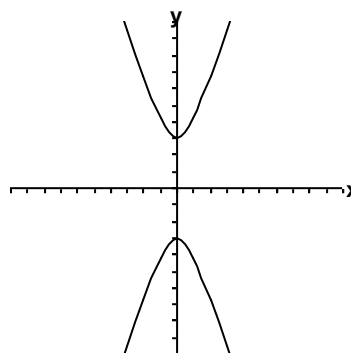
IV. General Equations of Conics (Page 757)

The graph of $Ax^2 + Cy^2 + Dx + Ey + F = 0$ is one of the following:

- 1) Circle if $A = C$
- 2) Parabola if $AC = 0$
- 3) Ellipse if $AC > 0$
- 4) Hyperbola if $AC < 0$

Example 2: Classify the equation $9x^2 + y^2 - 18x - 4y + 4 = 0$ as a circle, a parabola, an ellipse, or a hyperbola.
Ellipse

What you should learn
How to find asymptotes of and graph hyperbolas



What you should learn
How to use properties of hyperbolas to solve real-life problems

What you should learn
How to classify conics from their general equations

Homework Assignment

Page(s)

Exercises