LESSON 4: THE CONICS

Objectives:	1. To recognize the equation of a parabola, ellipse, or hyperbola 2. To put an equation of a parabola, ellipse, or hyperbola in standard form and sketch

Definitions

Parabola: The set of points in a plane equidistant from a fixed point, the focus; and a fixed line, the directrix.

Ellipse: The set of points in a plane such that the sum of the distances from any point on the ellipse to two fixed points, called the foci, is constant.

Hyperbola: The set of points in a plane such that the differences of the distances from a point to two fixed points, called the foci, is constant.

Examples

Put each of the following equations in standard form and graph:

1. $4y^2 - x = 0$
2. $x^2 + 12x - y + 39 = 0$
3. $\frac{x^2}{16} + \frac{y^2}{4} = 1$

4. $9x^2 - 18x + 4y^2 = 27$
5. $9y^2 - x^2 = 9$
6. $2y^2 - 3x^2 - 4y + 12x + 8 = 0$

Problems

In problems 1-3, put each equation in standard form and graph:

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

2. $4x^2 + 16x - 16y + 32 = 0$

3. $9x^2 - 16y^2 + 54x + 64y - 127 = 0$

4. The receiver in a parabolic television dish antenna is 3 feet from the vertex and is located at the focus. Find an equation of a cross-section of the reflector. (Assume that the dish is directed upward and the vertex is at the origin.)

5. A fireplace arch is to be constructed in the shape of a semi-ellipse. The opening is to be 2 feet high at the center and 5 feet wide at the base. To sketch the outline of the fireplace, the contractor uses a 5-foot string tied to two thumbtacks. Where should the thumbtacks be placed?

6. LORAN (Long Distance Radio Navigation) for aircraft and ships uses synchronized pulses transmitted by widely separated transmitting stations. These pulses travel at the speed of light (186,000 mi/sec). The differences in the times of arrival of these pulses at an aircraft or ship is constant on a hyperbola having the two transmitting stations as foci. Assume that two stations, 300 miles apart, are positioned on a rectangular coordinate system at points with coordinates (-150,0) and (150,0) and that a ship is traveling on a path with coordinates (x, 75). Find the x-coordinate of the position of the ship if the time difference between the pulses from the transmitting stations is 1000 microseconds (0.001 sec.).