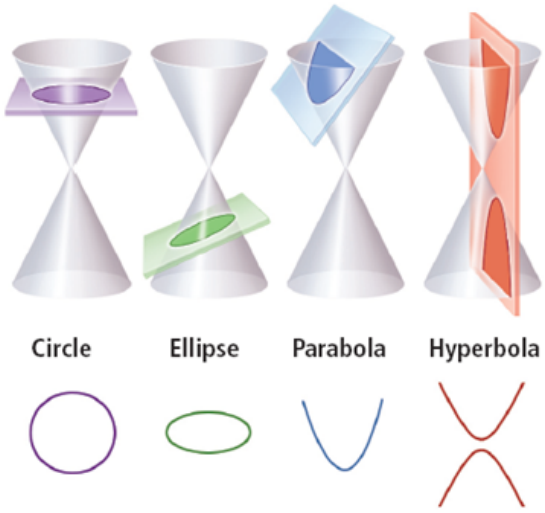
Bell Ringer

Write the equation in standard form for the hyperbola with a Center (0,0), Vertices (0,±4), and foci (0,±7).

10.6 Identify Conic Sections

Learning Target: Identify and transform conic sections.



Conic sections are formed by the intersection of a double right cone and a plane. There are four types of conic sections: circles, ellipses, hyperbolas, and parabolas.

The equation of a conic section can be written in the form:
$Ax^2 + By^2 + Dx + Ey + F = 0$ where A & B are not both zero.

Conic Sections	Standard Form of Equations	Characteristics
Circle	$\frac{(x-h)^2}{r^2} + \frac{(y-k)^2}{r^2} = \frac{r^2}{r^2}$	← same denom → circle plus circle or ellipse
Parabola	$y = a(x-h)^2 + k$ $x = a(y-k)^2 + h$	one variable squared, not both
Ellipse	$\frac{(x-h)^2}{a^2} + \frac{(y-k)^2}{b^2} = 1$ $\frac{(x-h)^2}{b^2} + \frac{(y-k)^2}{a^2} = 1$	← different denominators plus circle or ellipse ellipse
Hyperbola	$\frac{(x-h)^2}{a^2} - \frac{(y-k)^2}{b^2} = 1$ $\frac{(y-k)^2}{a^2} - \frac{(x-h)^2}{b^2} = 1$	minus hyperbola

How to Identify Conic Equations

1. How many variables are squared?
   * One - Parabola
   * Two - Rewrite equation so both variables are on same side.

2. Are both squared terms positive?
   * No - Hyperbola
   * Yes - Question 3

3. Are the coefficients of the squared terms the same?
   * Yes - Circle
   * No - Ellipse

Classify and write equation in standard form.

1) $y^2 - 2x^2 + 4y + 8x - 20 = 0$ hyperbola

2) $16x^2 + 9y^2 - 64x + 18y - 71 = 0$ ellipse

3) $x^2 - 8x + 8y + 32 = 0$ parabola

4) $y^2 - 5x^2 - 20y + 30x = 0$ hyperbola

5) $x^2 + y^2 - 6x + 16y - 152 = 0$

6) $x^2 + 2x + y^2 - 15 = 0$

same coefficients on x^2 & y^2 circle

7) $4x^2 + 3y^2 - 32x + 18y - 5 = 0$ ellipse

8) $x^2 - 2x - 12y + 49 = 0$ parabola

Circle

Parabola

Ellipse

Hyperbola

*1) $y^2 - 2x^2 + 4y + 8x - 20 = 0$

2) $16y^2 + 9x^2 - 64y + 18x - 71 = 0$

*3) $y^2 - 8y + 8x + 32 = 0$

4) $x^2 - 5y^2 - 20y + 30x = 0$

*5) $x^2 + y^2 - 6x + 16y - 152 = 0$

6) $x^2 + 2x + y^2 - 15 = 0$

*7) $4x^2 + 3y^2 - 32x + 18y - 5 = 0$

8) $x^2 - 2x - 12y + 49 = 0$

*1) $y^2 - 2x^2 + 4y + 8x - 20 = 0$

$y^2+4y+4 \quad -2(x^2-4x+4) = 20+4-8$

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

$\frac{(y+2)^2}{16} - \frac{(x-2)^2}{8} = 1$

*3) $x^2 - 8x + 8y + 32 = 0$

$x^2-8x+16 \quad +8y = -32+16$

$(x-4)^2 \quad +8y = -16$

$\frac{(x-4)^2}{-8} \quad \frac{+16}{-8} = \frac{-8y}{-8}$

$-\frac{1}{8}(x-4)^2 - 2 = y$

*5) $x^2 + y^2 - 6x + 16y - 152 = 0$

$x^2-6x+9 \quad +y^2+16y+64 = 152+9+64$

$(x-3)^2 + (y+8)^2 = 225$

*7) $4x^2 + 3y^2 - 32x + 18y - 5 = 0$

$4(x^2-8x+16) + 3(y^2+6y+9) = 5+64+27$

$\frac{4(x-4)^2}{96} \quad +\frac{3(y+3)^2}{96} = \frac{96}{96}$

$\frac{(x-4)^2}{24} + \frac{(y+3)^2}{32} = 1$