

CONICS HOMEWORK – SAMPLE TEST: CONICS 2 (ELLIPSES AND HYPERBOLAS)*

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Abstract

This module provides a sample test over conics concepts, especially emphasizing the equations of ellipses and hyperbolas.

	Horizontal	Vertical	Equations
Ellipse	$\frac{(x-h)^2}{a^2} + \frac{(y-k)^2}{b^2} = 1$	$\frac{(x-h)^2}{b^2} + \frac{(y-k)^2}{a^2} = 1$	$a^2 = b^2 + c^2, (a > b)$
Hyperbola	$\frac{(x-h)^2}{a^2} - \frac{(y-k)^2}{b^2} = 1$	$\frac{(y-k)^2}{a^2} - \frac{(x-h)^2}{b^2} = 1$	$c^2 = a^2 + b^2$

Table 1

Exercise 1

Identify each equation as a **line**, **parabola**, **circle**, **ellipse**, or **hyperbola**.

- $y = \frac{x}{3}$
- $y = \frac{2}{x}$
- $4y^2 = 7x + 7y + 7$
- $5(x+3)^2 - 5(y+3)^2 = 9$
- $3x^2 + 3x + 6y + 3y^2 = 4x + 7$
- $4x^2 + 5y^2 = 4$

Exercise 2

For each shape, is it a function or not? (Just answer yes or no.)

- Vertical line
- Horizontal line
- Vertical parabola
- Horizontal parabola
- Circle
- Vertical ellipse
- Horizontal ellipse
- Vertical hyperbola

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- i. Horizontal hyperbola

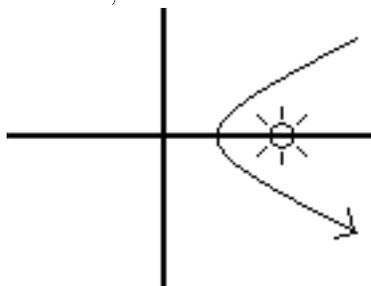
Exercise 3

The United States Capitol building contains an elliptical room. It is 96 feet in length and 46 feet in width.

- a. Write an equation to describe the shape of the room. Assume that it is centered on the origin and that the major axis is horizontal.
- b. John Quincy Adams discovered that if he stood at a certain spot in this elliptical chamber, he could overhear conversations being whispered at the opposing party leader's desk. This is because both the desk, and the secret listening spot, were **foci** of the ellipse. How far was Adams standing from the desk?
- c. How far was Adams standing from the edge of the room closest to him?

Exercise 4

A comet zooms in from outer space, whips around the sun, and zooms back out. Its path is one branch of a hyperbola, with the sun at one of the foci. Just at the vertex, the comet is 10 million miles from the center of the hyperbola, and 15 million miles from the sun. Assume the hyperbola is horizontal, and the **center** of the hyperbola is at $(0,0)$.



- a. Find the equation of the hyperbola.
- b. When the comet is very far away from the sun, its path is more or less a line. As you might guess, that is represented by the asymptotes of the hyperbola. (One asymptote as it comes in, another as it goes out.) Write the equation for the line that describes the path of the comet after it has **left** the sun and gotten far out of our solar system.

Exercise 5

$$4x^2 - 36y^2 + 144y = 153$$

- a. Put in standard form.
- b. Is it horizontal or vertical?
- c. What is the center?
- d. How long is the transverse axis?
- e. How long is the conjugate axis?
- f. What are the coordinates of the two foci?
- g. Graph it. I will be looking for the vertices (the endpoints of the transverse axis), and for the asymptotes to be drawn correctly.

Extra Credit:

Consider a hyperbola with foci at $(-5,0)$ and $(5,0)$. In order to be on the hyperbola, a point must have the following property: its distance to one focus, **minus** its distance to the other focus, must be 6. Write the equation for this hyperbola by using the geometric definition of a hyperbola (3 points). Then simplify it to standard form (2 points).