

## Ellipses

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### LESSON OVERVIEW

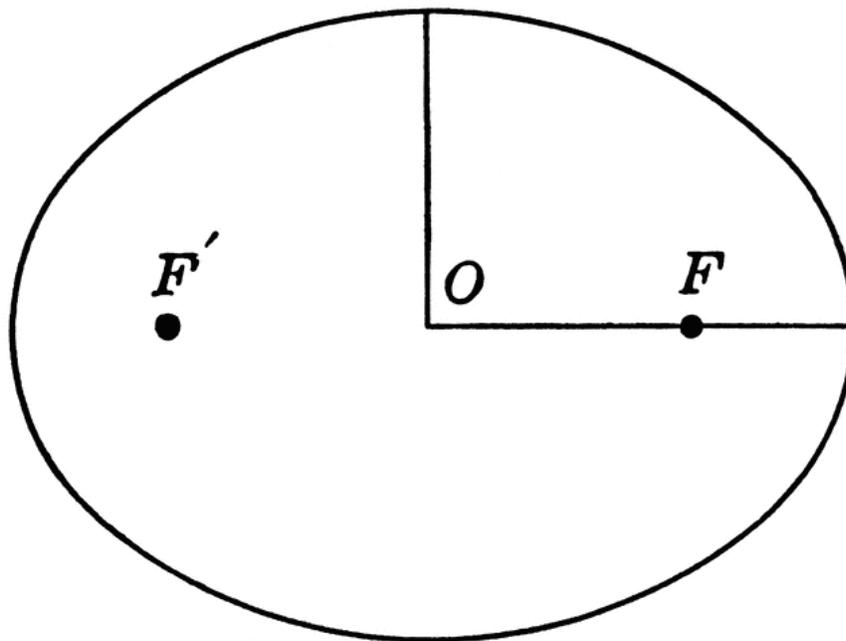
<b>Subject(s)</b>	Mathematics
<b>Topic or Unit of Study</b>	Conic Sections
<b>Grade/Level</b>	Grade 10
<b>Objective</b>	Students will be able to define and identify the center, foci, major axis, minor axis, vertices, co-vertices of an ellipse. Students will be able to write the equation of an ellipse in standard form given the vertex, co-vertex, and the fact that the center is at the origin.
<b>Summary</b>	

### IMPLEMENTATION

<b>Learning Context</b>	Students have studied other conic sections, parabolas and circles, in previous lessons in this unit. Some of the vocabulary applied to ellipses are similar to that of other conic sections, but with slightly different definitions and/or locations.
<b>Teaching Strategies</b>	Direct instruction, think-pair-share, pair-off
<b>Time Allotment</b>	1 class periods. 50 Mins. per class.
<b>Sample Student Products</b>	
<b>Author's Comments &amp; Reflections</b>	Because of the amount of vocabulary in this lesson (and students will take a quiz before the beginning of this lesson for another sub-topic), the topic of ellipses will be spread over two 50 minute periods.

### PROCEDURE

<b>Anticipatory Set</b>	<p><b><u>Review of Ellipses (Think-Pair-Share)</u></b></p> <p>What are ellipses? Where do we find ellipses? Take a minute to think about what you know about ellipses and then talk to elbow-partner.</p> <p><b><u>Introduction</u></b></p> <p>An ellipse is the shape commonly referred to as an oval. Unlike a circle, we must look at more than one point to find the equation of an ellipse. There are two fixed points we are interested in are called the foci. These two foci define the ellipse, just as the center of a circle defined it. Now before we go more into the vocabulary of ellipses, I want to talk about drawing ellipses.</p> <p><b><u>Interesting Fact of the Day</u></b></p> <p>Did you know that you can create an ellipse with three pencils and a piece of string? The shadow of a ball? Or a modified swing?  <a href="https://www.youtube.com/watch?v=1v5Aqo6PaFw">https://www.youtube.com/watch?v=1v5Aqo6PaFw</a></p>
<b>Modeling</b>	<p><b><u>Example 1: Modeling/Cloze Worksheet</u></b></p> <p><i>Teacher will cover all of the lesson's vocabulary by giving definitions and identifying terms on a graph of an ellipse. Students are to complete the cloze worksheet as the teacher models.</i></p>



[http://etc.usf.edu/clipart/36600/36678/ellipse\\_36678\\_md.gif](http://etc.usf.edu/clipart/36600/36678/ellipse_36678_md.gif)

Vertical Major Axis

<https://dr282zn36sxxg.cloudfront.net/datastreams/f-d%3Aae9a9f49ef58c7164c4dca65d7c37edb7150e101bb1c639aca403c10%2BIMAGE%2BIMAGE.1>

Horizontal Major Axis

<https://dr282zn36sxxg.cloudfront.net/datastreams/f-d%3A259f07ca71fee9c2e5c937d11c42402c481c5751b5c1422720a2c936%2BIMAGE%2BIMAGE.1>

**Standard Forms of an Equation of an Ellipse, with center at the origin and  $a > b > 0$**

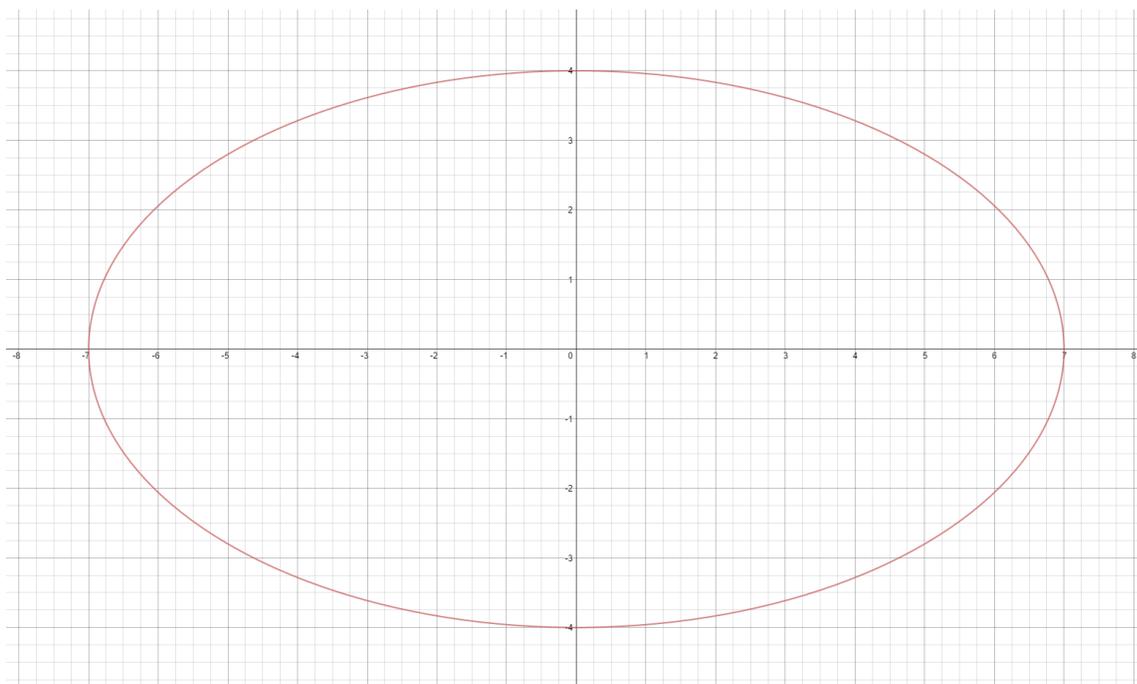
Standard form of an equation of an ellipse with a vertical major axis:  $\frac{x^2}{b^2} + \frac{y^2}{a^2} = 1$

Standard form of an equation of an ellipse with a horizontal major axis:  $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$

**Example 3: Writing the Equation**

*Teacher will model how to write the equation of an ellipse given the vertex, co-vertex, and the fact that the center is at the origin.*

Find the equation of an ellipse in standard form that has a vertex at  $(-7, 0)$ , a co-vertex at  $(0, 4)$ , and a center at the origin.



The distance from the center to one of the vertices is 7. The distance from the center to one of the co-vertices is 4. Thus,  $a = 7$  and  $b = 4$ .

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

$$\frac{x^2}{7^2} + \frac{y^2}{4^2} = 1$$

$$\frac{x^2}{49} + \frac{y^2}{16} = 1$$

**Attachments:**

1. [Example3.pdf](#) Basic drawing of the ellipse in example 3.

**Guided Practice**

**Example 2: Cloze Worksheet**

Students will identify the components of an ellipse and assign the corresponding vocabulary term to each. This same ellipse will be used for Example 3.

**Example 4: Writing the Equation**

Students will write the equation of an ellipse given the vertex, co-vertex, and the fact that the center is at the origin.

Find the equation of an ellipse in standard form with the following attributes:

1. the distance from the center of the ellipse to the endpoint of one axis is 3 cm,
2. the distance between the endpoints of the other axis of the ellipse is 18 cm, and
3. the center of the ellipse is at the origin.

$$b = 3, b^2 = 9, a = 9, a^2 = 81$$

$$\frac{x^2}{9} + \frac{y^2}{81} = 1$$

**Independent Practice**

**Homework**

Students will complete the following as homework: pages 581 problems 1-8 (all), 10-16 (evens only).

**Closure**

**Pair-Off**

Students will turn to their elbow partner and give the definition of one of the lesson's vocabulary terms without looking at their

notes. The other student in the pair will check the definition against their notes. The pair will switch roles until every definition has been covered.

**Follow-Up****Warm-Up**

Students will complete the following problem as the next day's warm-up.

Directions: Write the equation of an ellipse in standard form with the center at the origin and with a vertex at (5, 0) and the co-vertex at (0, 2).

$$a = 5, a^2 = 25, b = 2, b^2 = 4$$

$$\frac{x^2}{25} + \frac{y^2}{4} = 1$$

**MATERIALS AND RESOURCES****Instructional Materials**

Cloze worksheets for students to complete while the teacher models the new vocabulary.

**Attachments:**

1. [Ellipses\\_Cloze.pdf](#) Cloze worksheet to learn vocabulary terms.
2. [Ellipses\\_Cloze\\_Key.pdf](#) Answers to the cloze worksheet.

**Resources**

- Materials and resources:  
Textbook, document camera, projector, whiteboard and supplies
- Technology resources:  
Firefox, IE Explorer
- The number of computers required is 1.
- To show a Youtube video.

**STANDARDS & ASSESSMENT****Standards**

**Display:**  Collapse All  Expand All

▼ **CA- California K-12 Academic Content Standards**

▼ **Subject:** Mathematics

▼ **Grade:** Grades Eight Through Twelve The standards for grades eight through twelve are organized differently from those for kindergarten through grade seven. In this section strands are not used for organizational purposes as they are in the elementary grades because the mathematics studied in grades eight through twelve falls naturally under discipline headings: algebra, geometry, and so forth. Many schools teach this material in traditional courses; others teach it in an integrated fashion. To allow local educational agencies and teachers flexibility in teaching the material, the standards for grades eight through twelve do not mandate that a particular discipline be initiated and completed in a single grade. The core content of these subjects must be covered; students are expected to achieve the standards however these subjects are sequenced.

Standards are provided for algebra I, geometry, algebra II, trigonometry, mathematical analysis, linear algebra, probability and statistics, Advanced Placement probability and statistics, and calculus. Many of the more advanced subjects are not taught in every middle school or high school. Moreover, schools and districts have different ways of combining the subject matter in these various disciplines. For example, many schools combine some trigonometry, mathematical analysis, and linear algebra to form a precalculus course. Some districts prefer offering trigonometry content with algebra II.

▼ **Area:** Algebra II This discipline complements and expands the mathematical content and concepts of algebra I and geometry. Students who master algebra II will gain experience with algebraic solutions of problems in various content areas, including the solution of systems of quadratic equations, logarithmic and exponential functions, the binomial theorem, and the complex number system.

**Sub-Strand 16.0:** Students demonstrate and explain how the geometry of the graph of a conic section (e.g., asymptotes, foci, eccentricity) depends on the coefficients of the quadratic equation representing it.

**Assessment Plan**

Homework is out of 20 points. The teacher will check 5 questions and grade each question (worth 4 points). The 5 questions will be from different sections of the assignment to avoid grading 5 questions that are the same problem-type (example: 5 problems asking to plot a linear equation) which may not adequately represent the student's progress towards the lesson's learning goal/standard.

**Assessment/Rubrics****Rubrics:**

1. [Textbook Homework Rubric](#)