

# Translating Conic Sections

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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 write the equation of a translated conic section in standard form when provided a written description of the features of the conic section and its translation or given a graph of the translated conic section.
<b>Summary</b>	Students will use their understanding of conic sections to identify which quadratic equation is which type of conic section. This lesson is focused on guided practice as little to no new information or skills are introduced in this lesson.

## IMPLEMENTATION

<b>Learning Context</b>	Students have learned how to identify, write the equations, and graph conic sections. Some of the lessons have emphasized translations, but not all of them. Students have learned how to translate absolute value functions and circles.
<b>Teaching Strategies</b>	Direct instruction, whiteboards
<b>Time Allotment</b>	1 class periods. 50 Mins. per class.
<b>Sample Student Products</b>	
<b>Author's Comments &amp; Reflections</b>	

## PROCEDURE

<b>Anticipatory Set</b>	<p><b><u>Interesting Fact of the Day</u></b></p> <p><b><u>Introduction</u></b></p> <p>Review the different conic sections starting with the video below:</p> <p><a href="https://www.youtube.com/watch?v=vflwX15X7_o">https://www.youtube.com/watch?v=vflwX15X7_o</a></p> <p>Have students answer which drawing is which conic section.</p>
<b>Modeling</b>	<p><b><u>Review of Equations</u></b></p> <p>Teacher will show the table below to the class to ensure that each student has all of these equations somewhere in their notes.</p>

Conic	Standard Form of Equation
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Section		
Parabola	Vertex (0, 0) $y = ax^2$ $x = ay^2$	Vertex (h, k) $y - k = a(x - h)^2$ or $y = a(x - h)^2 + k$ $x - h = a(y - k)^2$ or $x = a(y - k)^2 + h$
Circle	Center (0, 0) $x^2 + y^2 = r^2$	Center (h, k) $(x - h)^2 + (y - k)^2 = r^2$
Ellipse	Center (0, 0) $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ $\frac{x^2}{b^2} + \frac{y^2}{a^2} = 1$	Center (h, k) $\frac{(x - h)^2}{a^2} + \frac{(y - k)^2}{b^2} = 1$ $\frac{(x - h)^2}{b^2} + \frac{(y - k)^2}{a^2} = 1$
Hyperbola	Center (0, 0) $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ $\frac{y^2}{a^2} - \frac{x^2}{b^2} = 1$	Center (h, k) $\frac{(x - h)^2}{a^2} - \frac{(y - k)^2}{b^2} = 1$ $\frac{(y - k)^2}{a^2} - \frac{(x - h)^2}{b^2} = 1$

### **How to Tell Conic Sections Apart in Quadratic Form**

- Hyperbolas have opposite square-term signs
- Ellipses have the same square-term sign
- Circles have two square-term with the same coefficient and sign
- Parabolas only have one square-term

<http://www.andrews.edu/~calkins/math/webtexts/numb19.htm>

### **Example 1**

$$x^2 + 2x + y + 14y - 31 = 0$$

$$x^2 + 2x + ( ) + y^2 + 14y + ( ) = 31$$

$$\begin{array}{r} x \quad 1 \qquad \qquad y \quad 7 \\ x \quad x^2 \quad x \qquad \qquad y \quad y^2 \quad 7y \\ 1 \quad x \quad 1 \qquad \qquad 7 \quad 7y \quad 49 \end{array}$$

$$(x + 1)^2 + (y + 7)^2 = 31 + 1 + 49$$

$$(x + 1)^2 + (y + 7)^2 = 81$$

$$\text{Radius} = 9 (\sqrt{81} = 9)$$

Center at (-1, -7)

### Guided Practice

#### Whiteboards

Teacher will write on the front board a quadratic equation. Then, students will identify the type of conic section described by the equation and graph the equation on their personal whiteboard.

$$x^2 - 2x - y + 3 = 0$$

$$y = x^2 - 2x + 3$$

$$y = ( ) + 3$$

$$\begin{array}{r} x \quad -1 \\ x \quad x^2 \quad -x \\ -1 \quad -x \quad +1 \end{array}$$

$$y = (x - 1)^2 + 3 - 1$$

$$y = (x - 1)^2 + 2$$

Vertex at (1, 2)

### Independent Practice

#### Homework

Students will complete the following as homework: workbook practice 10-6 page 507 problems 2-10 (even - do *not* graph), 12-20 (even - graph), 22-32 (even).

### Closure

#### Review of Strategies

Teacher reviews strategies to quickly identify different conic sections by looking at the equation.

### Follow-Up

#### Review Packet

Students will receive a review packet to complete and study with to prepare for the unit exam.

#### Warm-Up

The following will be the student's warm-up at the beginning of the next lesson.

Directions:

## MATERIALS AND RESOURCES

### Instructional Materials

#### Resources

- Materials and resources: document camera, computer connected to projector, whiteboard markers, student whiteboards, and whiteboard erasers.

## 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 17.0:** Given a quadratic equation of the form  $ax^2 + bx + c = 0$ , students can use the method for completing the square to put the equation into standard form and can recognize whether the graph of the equation is a circle, ellipse, parabola, or hyperbola. Students can then graph the equation.

### 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:

- [Textbook Homework Rubric](#)