

# 11 Conics

Content Area: **TEMPLATE**  
Course(s):  
Time Period: **Full Year**  
Length: **2 weeks (Honors)**  
Status: **Published**

## **General Overview, Course Description or Course Philosophy**

This course is an extension of Algebra 1. Emphasis is upon the development of insights into the structure of algebra as a deductive process. The content includes function foundations, equations and inequalities, polynomial functions and equations, rational functions and equations, radical expressions and equations, exponential and logarithmic functions and equations, trigonometric functions and equations, introductory data analysis, and probability.

## **OBJECTIVES, ESSENTIAL QUESTIONS, ENDURING UNDERSTANDINGS**

Objectives:

- Conic sections are a cross-section of a cone from various directions
- Conic sections are represented algebraically through distance relationships
- Graph circles, parabolas, ellipse, and hyperbolas
- Identify a conic section from its equation
- Rewrite the general form of a conic to its standard form.

Essential Questions:

- What are conic sections?
- In what situations could you use conic sections to model a relationship?
- What is the intersection of a cone and a plane parallel to a line along the side of the cone?
- What do graphs of conics look like?
- What is the difference between the algebraic representations of ellipses and hyperbolas?
- How are the conic sections related to the equation for distance?

Enduring Understanding:

- A circle is the set of points in a plane equal distance from the same point
- A parabola is the set of points equal distance from a focus point and its directrix
- An ellipse is the set of points that is the sum of distances from two foci
- A hyperbola is the set of points that is the difference between distances from two foci

## CONTENT AREA STANDARDS

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### G.GMD

- A. Explain volume formulas and use them to solve problems
- B. Visualize relationships between two-dimensional and three-dimensional objects

### G.GPE

- A. Translate between the geometric description and the equation for a conic section
- B. Use coordinates to prove simple geometric theorems algebraically

### G.MG

- A. Apply geometric concepts in modeling situations

### G.SRT

- A. Understand similarity in terms of similarity transformations
- B. Prove theorems involving similarity
- C. Define trigonometric ratios and solve problems involving right triangles
- D. Apply trigonometry to general triangles

MA.A-REI.B.4a	Use the method of completing the square to transform any quadratic equation in $x$ into an equation of the form $(x - p)^2 = q$ that has the same solutions. Derive the quadratic formula from this form.
MA.A-REI.D.10	Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line).
MA.G-GPE.A.1	Derive the equation of a circle of given center and radius using the Pythagorean Theorem; complete the square to find the center and radius of a circle given by an equation.
MA.G-GPE.A.2	Derive the equation of a parabola given a focus and directrix.
MA.G-GPE.A.3	Derive the equations of ellipses and hyperbolas given the foci, using the fact that the sum or difference of distances from the foci is constant.

### RELATED STANDARDS (Technology, 21st Century Life & Careers, ELA Companion Standards are Required)

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9.1.8.PB.1: Predict future expenses or opportunities that should be included in the budget planning process. • 9.1.8.PB.2: Explain how different circumstances can affect one's personal budget. • 9.1.8.PB.3: Explain how to create budget that aligns with financial goals. • 9.1.8.PB.4: Construct a simple personal savings and spending plan based on various sources of income and different stages of life (e.g. teenager, young adult,

family).

CS.K-12.4.a	Extract common features from a set of interrelated processes or complex phenomena.
CS.K-12.4.c	Create modules and develop points of interaction that can apply to multiple situations and reduce complexity.
CS.K-12.4.d	Model phenomena and processes and simulate systems to understand and evaluate potential outcomes.
LA.K-12.NJSLSA.R7	Integrate and evaluate content presented in diverse media and formats, including visually and quantitatively, as well as in words.
PFL.9.1.K12.P.4	Demonstrate creativity and innovation.
PFL.9.1.K12.P.5	Utilize critical thinking to make sense of problems and persevere in solving them.
PFL.9.1.K12.P.6	Model integrity, ethical leadership and effective management.
PFL.9.1.K12.P.8	Use technology to enhance productivity increase collaboration and communicate effectively.
PFL.9.1.K12.P.9	Work productively in teams while using cultural/global competence.

## **STUDENT LEARNING TARGETS**

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Refer to the 'Declarative Knowledge' and 'Procedural Knowledge' sections.

### **Declarative Knowledge**

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Students will understand that:

- Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line)

### **Procedural Knowledge**

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Students will be able to:

- Derive the equations of ellipses and hyperbolas given the foci, using the fact that the sum or difference of distances from the foci is constant
- Derive the equation of a circle of given center and radius using the Pythagorean Theorem.
- Derive the equation of a parabola given a focus and directrix
- Derive the quadratic formula by completing the square.
- Complete the square to find the center and radius of a circle given by an equation
- Use the method of completing the square to transform any quadratic equation in  $x$  into

an equation of the form  $(x - p)^2 = q$  that has the same solutions

## **EVIDENCE OF LEARNING**

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Refer to the 'Formative Assessments' and 'Summative Assessments' sections.

## **Alternate Assessments**

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- Portfolios
- Verbal Assessment (instead of written)
- Multiple choice
- Modified Rubrics
- Performance Based Assessments

## **Benchmark Assessments**

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Benchmark Assessments conducted three times per year, using Pear Assessment (Standards Based Assessments)

## **Formative Assessments**

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- Class Discussion
- Teacher observation
- Exit/Entrance Tickets
- Classwork
- Homework

## **Summative Assessments**

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- Quizzes
- Test
- Projects

## **RESOURCES (Instructional, Supplemental, Intervention Materials)**

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### **Core Instructional Materials**

- Sullivan Algebra and Trigonometry Textbook (Chapter 2.4 and 11)

### **Supplemental Materials**

- [Khan Academy](#)
- [Deltamath](#)
- [Illustrative Mathematics Tasks by standard](#)
- [Illustrative Mathematics Curriculum](#)
- [Desmos](#)
- [Reference pages](#)
- [Introduction Activity using Technology](#)
- [Folding Conic Section Project](#)
- [Conic Section Desmos Project](#)

## **INTERDISCIPLINARY CONNECTIONS**

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Interdisciplinary connections are frequently addressed through modeling and application problems whereby students solve and analyze situations such as planetary travel, focal point of light, and bridge construction. Examples can be found in topic specific textbook problems and digital resources.

## **ACCOMMODATIONS & MODIFICATIONS FOR SUBGROUPS**

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See link to Accommodations & Modifications document in course folder.

