

# Pre-Calculus H Unit 8: Topics in Analytic Geometry

<b>Unit #:</b>	APSDO-00019266	<b>Duration:</b>	6.0 Week(s)	<b>Date(s):</b>	
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**Grades:**  
 10, 11, 12

**Subjects:**  
 Mathematics

## Unit Focus

In this unit, students will work with conic sections and equations in parametric and polar form. Students will solve problems involving conic sections, eventually classifying a conic by its equation in general form. Students will also learn to rotate a conic section in order to simplify its equation. In addition, students will be introduced to parametric and polar forms for writing and graphing equations. They will also use polar coordinates to represent and solve problems involving conic sections. Summative assessments may include projects, labs and test. Primary instructional materials for this unit include Pre-Calculus with Limits, Larson, Hostetler, and Edwards, 2008.

## Stage 1: Desired Results - Key Understandings

Established Goals	Transfer	
<p><b>Common Core</b>  <i>Mathematics: 10</i></p> <ul style="list-style-type: none"> <li>• 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.  <i>CCSS.MATH.CONTENT.HSG.GPE.A.1</i></li> <li>• Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.  <i>CCSS.MATH.CONTENT.HSA.CED.A.2</i></li> </ul>	<p><b>T1</b> (T50) Based on an understanding of any problem, initiate a plan, execute it and evaluate the reasonableness of the solution.</p> <p><b>T2</b> (T53) Articulate how mathematical concepts relate to one another in the context of a problem or in the theoretical sense.</p> <p><b>T3</b> (T51) Examine alternate methods to accurately and efficiently solve problems.</p> <p><b>T4</b> (T52) Use appropriate tools strategically to deepen understanding of mathematical concepts.</p> <p><b>T5</b> (T22) Describe and/or solve problems using algebraic expressions, equations, inequalities, and functions.</p> <p><b>T6</b> (T24) Classify, interpret, and compare functions or equations.</p>	
	Meaning	
	Understandings	Essential Questions

<ul style="list-style-type: none"> <li>Derive the equation of a parabola given a focus and directrix. <i>CCSS.MATH.CONTENT.HSG.GPE.A.2</i></li> <li>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. <i>CCSS.MATH.CONTENT.HSG.GPE.A.3</i></li> <li>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). <i>CCSS.MATH.CONTENT.HSA.REI.D.10</i></li> <li>Look for and make use of structure. <i>CCSS.MATH.MP.7</i></li> <li>Reason abstractly and quantitatively. <i>CCSS.MATH.MP.2</i></li> </ul>	<p><b>U1</b> (U510) Every problem is a member of a category of problems that has a similar structure and set of characteristics.</p> <p><b>U2</b> (U512) Mathematicians use diagrams, symbols, and terms to describe problems or situations</p> <p><b>U3</b> (U560) Patterns and structures are characterized by consistent relationships.</p> <p><b>U4</b> (U209) Algebraic relationships can be represented by analytical geometry.</p> <p><b>U5</b> (U203) Certain mathematical manipulations preserve the relationship in an expression or equation, even though they change the representation.</p>	<p><b>Q1</b> (Q511) What characteristics/attributes define this type of problem?</p> <p><b>Q2</b> (Q512) What information is needed and how do I use it to solve a problem?</p> <p><b>Q3</b> (Q562) How do values and/or concrete models relate to each other?</p> <p><b>Q4</b> (Q560) What is the pattern/structure in this problem?</p> <p><b>Q5</b> (Q205) How can I represent this relationship as a function or equation? (Gr. 6-12)</p> <p><b>Q6</b> (Q207) How do I classify, interpret, and compare functions or equations? (Gr. 8-12)</p>
<b>Acquisition of Knowledge and Skill</b>		
<b>Knowledge</b>	<b>Skills</b>	
<p><i>Mathematics: 11</i></p> <ul style="list-style-type: none"> <li>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. <i>CCSS.MATH.CONTENT.HSG.GPE.A.1</i></li> <li>Derive the equation of a parabola given a focus and directrix. <i>CCSS.MATH.CONTENT.HSG.GPE.A.2</i></li> <li>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. <i>CCSS.MATH.CONTENT.HSG.GPE.A.3</i></li> <li>Represent complex numbers on the complex plane in rectangular and polar form (including real and imaginary numbers), and explain why the rectangular and polar forms of a given complex number represent the same number.</li> </ul>		<p><b>S1</b></p> <p>Identify the critical characteristics for each of conic graphs</p> <p><b>S2</b></p> <p>Write the equation of a circle given the center and radius (algebraically or graphically) and by completing the square</p> <p><b>S3</b></p> <p>Write the equation of a parabola given the focus and directrix</p> <p><b>S4</b></p> <p>Write the equation of an ellipse or a hyperbola given the foci</p> <p><b>S5</b></p> <p>Graph a parabola, circle, ellipse, hyperbola</p>

**S6**

Understand asymptotes in relationship to hyperbolas

**S7**

Solve systems of equations and inequalities involving conics

**S8**

Use conic equations to model various applications

**S9**

Rotate the coordinate axes to eliminate the  $xy$ -term in equations of conics

**S10**

Use the discriminant to classify conics

**S11**

Evaluate sets of parametric equations to evaluate given values of the parameter

**S12**

Graph curves that are represented by sets of parametric equations

**S13**

Rewrite sets of parametric equations as single rectangular equations by eliminating the parameter

**S14**

Find sets of parametric equations for graphs

**S15**

		<p>Plot points and find multiple representations of points in the polar coordinate system</p> <p><b>S16</b></p> <p>Convert points and equations from rectangular to polar form and vice versa</p> <p><b>S17</b></p> <p>Graph polar equations by plotting points, using symmetry, zeros, and maximum r values</p> <p><b>S18</b></p> <p>Recognize special polar graphs</p> <p><b>S19</b></p> <p>Define conics in terms of eccentricities</p> <p><b>S20</b></p> <p>Write and graph equations of conics in polar form</p> <p><b>S21</b></p> <p>Use equations of conics in polar form to model real life problems</p>
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### Stage 3: Learning Plan

Coding	Code	Description of Learning Activity
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