

# Abington Heights School District Precalculus Curriculum



In Precalculus, students develop their numeracy skills through the following areas of study:

1. Functions and Their Graphs
2. Polynomial and Rational Functions
3. Exponential and Logarithmic Functions
4. Trigonometric Functions
5. Trigonometric Applications

**Board Approval Date:** June 7, 2023

**Adoption:** 2023 - 2024 SY

**Review Date:**

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

## AH MATHEMATICS

Where collaborative problem solving and  
perseverance lead to excellence

# Abington Heights Math Framework

Stakeholders	Actions
<b>Students</b>	<ul style="list-style-type: none"> <li>★ Engage in mathematical discussions, share their ideas openly, be inquisitive, seek to understand and learn more about mathematical concepts, and try their best daily.</li> <li>★ Exhibit creativity and curiosity in problem solving individually and collaboratively.</li> <li>★ Persevere in engaging and challenging daily mathematical practice.</li> <li>★ Come prepared to learn every day.</li> </ul>
<b>Teachers</b>	<ul style="list-style-type: none"> <li>★ Create a safe and collaborative classroom environment where students feel vested in a shared vision for mathematical excellence.</li> <li>★ Develop high quality instruction that meets the needs of all learners through differentiation.</li> <li>★ Use a variety of 21st century methodologies to advance learning.</li> <li>★ Partner with parents and guardians to support student success.</li> <li>★ Establish a collaborative community within the building and amongst grade levels to ensure a cohesive level of instruction.</li> </ul>
<b>Building Leaders</b>	<ul style="list-style-type: none"> <li>★ Deeply understand the needs of teachers, students, the instructional materials being used, programs being implemented, and the expectations for state-level assessment scores <ul style="list-style-type: none"> <li>○ Knowledgeable about program and grade level standards</li> <li>○ Ensure consistent and equal access to high-quality instructional materials and resources, building.</li> </ul> </li> <li>★ Be partners with teachers, students and families: <ul style="list-style-type: none"> <li>○ Provide guidance and support to the mathematical community.</li> <li>○ Understand needs of teachers, students and families.</li> </ul> </li> <li>★ Trust the educators to make professional decisions based on program, student, and district needs.</li> </ul>
<b>Central Admin</b>	<ul style="list-style-type: none"> <li>★ Effectively communicate to the school board and community specific areas of need and how to support teachers and building leaders in a quest for mathematical excellence</li> <li>★ Deeply understand the needs of teachers, students, the instructional materials being used, programs being implemented, and the expectations for state-level assessment scores <ul style="list-style-type: none"> <li>○ Have a common metric for mathematical excellence.</li> <li>○ Ensure consistent and equal access to high-quality instructional materials and resources, district.</li> <li>○ Re-examine best practices/curriculum routinely (6 years).</li> </ul> </li> <li>★ Support a culture of collaboration between the other stakeholder groups to maintain the standard of excellence of the Abington Heights</li> <li>★ Trust the educators to make professional decisions based on program, student, and district needs.</li> </ul>
<b>Parents/Community</b>	<ul style="list-style-type: none"> <li>★ Be a strong support system and contribute by building a positive math community for students.</li> <li>★ Encourage a positive math mindset.</li> <li>★ Have conversations with their children about school and ask what they are learning about in school.</li> <li>★ Be open, receptive to the district's ideas about student learning and reach out to teachers/school to learn more about how they can support.</li> <li>★ Trust the educators to make professional decisions based on program, student, and district needs.</li> </ul>
<b>School Board</b>	<ul style="list-style-type: none"> <li>★ Provide the fiscal resources to support: <ul style="list-style-type: none"> <li>○ Highly qualified professionals for mathematics</li> <li>○ High-quality instructional materials</li> <li>○ Effective and efficient math interventions for remediation</li> <li>○ Professional development for math content and instructional practices</li> </ul> </li> <li>★ Trust the educators to make professional decisions based on program, student, and district needs.</li> </ul>

### Precalculus Scope and Sequence

Month	Unit	Estimated Number of Weeks
September	Trigonometry	4
October	Trigonometry	4
November	Trigonometry	3
December	Trigonometry	3
January	Trigonometry	3
February	Analytic Trigonometry	3
March	Additional Topics in Trigonometry	4
April	Exponential and Logarithmic Functions	4
May	Function Basics and Families of Functions	4
June	Final Exam Review	1

	Essential Questions	Content	Skills	<a href="#">PA Core Standards</a>	Activities	Assessment/ Evidence of Learning
<b>Trigonometry</b>	<p>How do trigonometric and circular functions model real-world problems and their solutions?</p> <p>What are the six trigonometric ratios and how do they relate to each other?</p> <p>What do the key features of a trigonometric function represent?</p> <p>How do trigonometric and circular functions model real-world problems and their solutions?</p>	<p>Radian and Degree Measure</p> <p>Trig Functions: The Unit Circle</p> <p>Right Triangle Trigonometry</p> <p>Trig Functions of any Angle</p> <p>Graphs of Sine and Cosine Functions</p> <p>Inverse Trigonometric Functions</p> <p>Applications and Models</p>	<p>Draw angles in standard position</p> <p>Convert from degree to radian mode</p> <p>Convert from radian to degree mode</p> <p>Use angles to model real world situations</p> <p>Use angular and linear speed to model real world situations</p> <p>Construct the Unit Circle</p> <p>Evaluate functions using the Unit Circle</p> <p>Use calculator to evaluate trigonometric functions</p>	<p>CC.2.2.HS.D.2</p> <p>CC.2.2.HS.D.8</p> <p>CC.2.2.HS.D.9</p> <p>CC.2.2.HS.D.10</p> <p>CC.2.2.HS.C.2</p> <p>CC.2.2.HS.C.3</p> <p>CC.2.2.HS.C.4</p> <p>CC.2.2.HS.C.6</p> <p>CC.2.2.HS.C.7</p> <p>CC.2.2.HS.C.8</p> <p>CC.2.2.HS.C.9</p> <p>CC.2.3.HS.A.7</p> <p>CC.2.3.HS.A.9</p>	<p>Radian and Degree Measure flipchart</p> <p>Radian and Degree Measure WebWork</p> <p>Trigonometric Functions: The Unit Circle Flipchart</p> <p>Unit Circle Construction: Plate and special triangles</p> <p>Right Triangle Trigonometry flipchart</p> <p>Radian and Degree Measure, Trigonometric Functions: The Unit Circle, Right Triangle Trigonometry WebWork</p> <p>Trigonometric Identities flipchart</p>	<p>Homework</p> <p>Radian and Degree Measure WebWork</p> <p>Radian and Degree Measure Quiz</p> <p>Unit Circle Quiz</p> <p>Right Triangle Trig Quiz</p> <p>Trig Functions of any angle WebWork</p> <p>Trig Functions of any angle Quiz</p> <p>Sine and Cosine Functions WebWork</p>

	Essential Questions	Content	Skills	<a href="#">PA Core Standards</a>	Activities	Assessment/ Evidence of Learning
<b>Trigonometry (continued)</b>			<p>Evaluate trigonometric functions of acute angles</p> <p>Use the fundamental trigonometric identities</p> <p>Evaluate trigonometric functions of any angle</p> <p>Use reference angles to evaluate trigonometric functions</p> <p>Sketch graphs of sine, cosine functions</p> <p>Find amplitude, period, vertical displacement, and phase shifts of trigonometric functions</p> <p>Write an equation of a sinusoid given its graph as both sine and cosine</p>		<p>Trigonometric Functions of Any Angle flipchart</p> <p>Trigonometric Functions of Any Angle WebWork</p> <p>Graphs of Sine and Cosine Functions flipchart</p> <p>Graphs of Sine and Cosine Functions WebWork</p> <p>Inverse Trigonometric Functions flipchart</p> <p>Inverse Trigonometric Functions WebWork</p> <p>Applications and Models WebWork</p> <p>Applications and Models of Trigonometric Functions flipchart</p>	<p>Sine and Cosine Functions Quiz-draw one full cycle</p> <p>Sine and Cosine Functions Quiz-given the graph write an equation for both sine and cosine of the given graph</p> <p>Inverse Functions Quiz</p> <p>Applications and Models WebWork</p> <p>Applications and Models Quiz</p>

	Essential Questions	Content	Skills	<a href="#">PA Core Standards</a>	Activities	Assessment/ Evidence of Learning
<b>Trigonometry (continued)</b>			<p>Evaluate inverse trigonometric functions</p> <p>Evaluate compositions of trigonometric functions</p> <p>Solve real-life problems involving trigonometric functions</p> <p>Solve real-life problems involving harmonic motion</p> <p>Solve real-life problems involving navigational bearings</p>			
<b>Analytic Trigonometry</b>	<p>How can I use identities to simplify trigonometric expressions and prove other identities?</p> <p>How can I use identities to solve trigonometric equations?</p>	<p>Identities</p> <p>Verifying Trigonometric Identities</p> <p>Solving Trigonometric Equations</p>	Recognize and write fundamental trigonometric identities		<p>Using Fundamental Identities Flipchart</p> <p>Solving Trigonometric Equations flipchart</p>	<p>Homework</p> <p>Using Fundamental Identities Quiz</p> <p>Solving Trigonometric Equations Quiz: Basic Types</p>

	Essential Questions	Content	Skills	<a href="#">PA Core Standards</a>	Activities	Assessment/ Evidence of Learning
<b>Analytic Trigonometry (continued)</b>			<p>Use fundamental trigonometric identities to evaluate trigonometric functions, simplify trigonometric expressions, and rewrite trigonometric expressions</p> <p>Verify trigonometric identities</p> <p>Use standard algebraic techniques to solve trigonometric equations</p> <p>Solve trigonometric equations of quadratic type</p> <p>Solve trigonometric equations involving multiple angles</p>			<p>Solving Trigonometric Equations</p> <p>Quiz: Advanced types</p>

	Essential Questions	Content	Skills	<a href="#">PA Core Standards</a>	Activities	Assessment/ Evidence of Learning
<b>Analytic Trigonometry (continued)</b>			Use inverse trigonometric functions to solve trigonometric equations			
<b>Additional Topics in Trigonometry</b>	<p>How can I use the Law of Sines and the Law of Cosines to solve real-world problems?</p> <p>What are vectors and how do I use them?</p>	<p>Law of Sines</p> <p>Law of Cosines</p> <p>Vectors</p>	<p>Use the Law of Sines to solve oblique triangles (AAS, ASA, and SSA)</p> <p>Find the area of oblique triangles</p> <p>Use the Law of Sines to model and solve real-life problems</p> <p>Use the Law of Cosines to solve oblique triangles (SSS and SAS)</p> <p>Use the Law of Cosines to model and solve real-life problems</p> <p>Use Heron's Area formula to find areas of triangles (SSS)</p>		<p>Law of Sines flipchart</p> <p>Possible Triangle construction given SSA using geosticks(?)</p> <p>Law of Sines Webwork</p> <p>Law of Cosines flipchart</p> <p>Law of Cosines WebWork</p>	<p>Homework</p> <p>Law of Sines Quiz</p> <p>Law of Sines WebWork</p> <p>Law of Cosines WebWork</p> <p>Law of Cosines Quiz</p> <p>Vectors Quiz</p>



	Essential Questions	Content	Skills	<a href="#">PA Core Standards</a>	Activities	Assessment/ Evidence of Learning
<b>Additional Topics in Trigonometry (continued)</b>			<p>Represent vectors as directed line segments</p> <p>Write the component forms of vectors</p> <p>Perform basic vector operation and represent them graphically</p> <p>Write vectors as linear combinations of unit vectors</p>			
<b>Exponential and Logarithmic Functions</b>	<p>What is a logarithm?</p> <p>How are logarithms and exponentials related?</p> <p>How can I graph exponential functions and logarithmic functions?</p>	<p>Exponential Functions and Their Graphs</p> <p>Properties of Logarithms</p>	<p>Graph exponential functions</p> <p>Recognize, evaluate, and graph exponential functions with base <math>a</math> and <math>e</math></p> <p>Use exponential functions to model and solve real-life problems</p>	<p>CC.2.1.HS.F.1</p> <p>CC.2.1.HS.F.3</p> <p>CC.2.1.HS.F.4</p> <p>CC.2.2.HS.D.5</p> <p>CC.2.2.HS.D.8</p> <p>CC.2.2.HS.D.9</p> <p>CC.2.2.HS.D.10</p> <p>CC.2.2.HS.C.2</p> <p>CC.2.2.HS.C.3</p>	<p>Exponential Functions and Their Graphs flipchart</p> <p>Find Exponential Functions from graph practice</p> <p>Logarithmic Functions and Their Graphs flipchart</p> <p>Properties of Logarithms flipchart</p>	<p>Homework</p> <p>Exponential Functions and Their Graphs, Logarithmic Functions and Their Graphs, Properties of Logarithms WebWork</p> <p>Exponential Functions and Their Graphs Quiz</p>

	Essential Questions	Content	Skills	<a href="#">PA Core Standards</a>	Activities	Assessment/ Evidence of Learning
<b>Exponential and Logarithmic Functions (continued)</b>	<p>How can I use the properties of logarithms to expand, condense, rewrite, or evaluate logarithmic expressions?</p> <p>How do I use exponential growth functions to model and solve real-life problems?</p>		<p>Rewrite logarithmic functions with different bases</p> <p>Use properties of logarithms to evaluate or rewrite logarithmic expressions</p> <p>Use properties of logarithms to expand or condense logarithms</p> <p>Solve exponential and logarithmic equations</p>	<p>CC.2.2.HS.C.4</p> <p>CC.2.2.HS.C.5</p> <p>CC.2.2.HS.C.6</p>	<p>Exponential Functions and Their Graphs, Logarithmic Functions and Their Graphs, Properties of Logarithms WebWork</p> <p>Solving Exponential and Logarithmic Functions flipchart</p>	<p>Properties of Logarithms and Logarithmic Equations Quiz</p> <p>Solving Exponential Equations Quiz</p>
<b>Function Basics and Families of Functions</b>	What are functions and how can functions be built and represented (graphically, numerically, and algebraically)?	<p>Functions</p> <p>Analyzing Graphs of Functions</p> <p>A Library of Parent Functions</p> <p>Transformations of Functions</p>	<p>Determine whether relations between two variables are functions</p> <p>Use function notation and evaluate functions</p>	<p>CC.2.1.HS.F.3</p> <p>CC.2.1.HS.F.4</p> <p>CC.2.2.HS.D.4</p> <p>CC.2.2.HS.D.7</p> <p>CC.2.2.HS.D.8</p> <p>CC.2.2.HS.C.1</p> <p>CC.2.2.HS.C.2</p>	<p>Function Basics Flipchart</p> <p>Analyzing Functions Flipchart</p> <p>Families of Functions Flipchart</p>	<p>Homework</p> <p>Equations of Functions and Parent Function Graphs Quiz</p> <p>Identifying Transformations of the Parent Function Quiz</p>

	Essential Questions	Content	Skills	<a href="#">PA Core Standards</a>	Activities	Assessment/ Evidence of Learning
<b>Function Basics and Families of Functions (continued)</b>	<p>How can I describe the characteristics of and recognize graphs of the parent functions?</p> <p>How can I use the Fundamental Theorem of Algebra to determine the number of zeros of polynomial functions?</p> <p>How can I use the domain and asymptotes of a rational function to find and analyze its graph?</p>		<p>Use function notation and the graph of a function to evaluate</p> <p>Find the domains of functions (implied domain and domain restrictions included)</p> <p>Use the Vertical Line Test</p> <p>Find Zeros of function</p> <p>Determine the intervals on which functions are increasing or decreasing and determine relative maximum and relative minimum values of functions</p> <p>Use the graph of the function to find domain and range</p> <p>Find x and y intercepts</p>	<p>CC.2.2.HS.C.3</p> <p>CC.2.2.HS.C.4</p> <p>CC.2.2.HS.C.5</p>	<p>Families of Functions</p> <p>WebWork</p>	

	Essential Questions	Content	Skills	<a href="#">PA Core Standards</a>	Activities	Assessment/ Evidence of Learning
Function Basics and Families of Functions (continued)			<p>Evaluate end behavior</p> <p>Find asymptotes and holes of rational functions</p> <p>Identify the graph of parent functions- linear, quadratic, absolute value, exponential, rational, cubic, square root, logarithmic</p> <p>Determine if a function is continuous or discontinuous</p> <p>Identify transformations of functions- vertical and horizontal shifts, vertical and horizontal reflections</p>			

## Portrait of an Abington Heights Mathematician



By the end of Precalculus, students will:

Functions and Their Graphs	Polynomial and Rational Functions	Exponential and Logarithmic Functions	Trigonometric Functions	Trigonometric Applications
<ul style="list-style-type: none"> <li><input type="checkbox"/> Graph and analyze functions and use their properties to make connections between the different representations</li> <li><input type="checkbox"/> Analyze functions and graphs of functions, including characteristics such as increasing/decreasing, odd/even, relative and absolute minima and maxima</li> <li><input type="checkbox"/> Recognize graphs of common functions and use rigid and nonrigid transformations</li> <li><input type="checkbox"/> Combine and compose functions</li> <li><input type="checkbox"/> Find and graph inverse functions</li> </ul>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Model real-life problems using quadratic functions</li> <li><input type="checkbox"/> Understand the relationship between zeros and factors of polynomials to make generalizations about functions and their graphs</li> <li><input type="checkbox"/> Analyze and sketch graphs of rational functions, including domain, range, asymptotes, and discontinuities</li> </ul>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Recognize, evaluate, and graph exponential functions</li> <li><input type="checkbox"/> Use exponential functions to model and solve real-life problems</li> <li><input type="checkbox"/> Recognize, evaluate, and graph exponential functions</li> <li><input type="checkbox"/> Use logarithmic functions to model and solve real-life problems</li> <li><input type="checkbox"/> Solve exponential and logarithmic equations</li> </ul>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Apply radian measure of an angle and the unit circle to analyze the trigonometric functions</li> <li><input type="checkbox"/> Extend the concept of similarity to determine arc lengths and areas of sectors of circles</li> <li><input type="checkbox"/> Choose trigonometric functions to model periodic phenomena and describe the properties of the graphs</li> <li><input type="checkbox"/> Prove the Pythagorean identity and use it to calculate trigonometric ratios</li> <li><input type="checkbox"/> Apply trigonometric ratios to solve problems involving right triangles</li> <li><input type="checkbox"/> Solve trigonometric equations, including using algebraic techniques, Pythagorean identities, and multiple angles</li> </ul>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Use fundamental trigonometric identities to evaluate trigonometric functions, and to simplify and rewrite trigonometric expressions</li> <li><input type="checkbox"/> Use the Law of Sines and/or the Law of Cosines to solve triangles</li> <li><input type="checkbox"/> Solve real-life problems using the Law of Sines and/or the Law of Cosines</li> <li><input type="checkbox"/> Find the area of oblique triangles</li> </ul>