



SCIENCE HILL HIGH SCHOOL

Course at a Glance

Advanced Algebra and Trig (Precalculus)

Unit 1 - Functions and Their Properties

Duration: Approximately 14 days

Objectives/Essential Questions:

How do the algebraic and graphical properties of a function reveal its behavior, and how can functions be built, transformed, and inverted to model relationships?

Instructional Materials:

Pencil, paper, Chromebook, calculator, handouts

Major Tasks, Assessments and Field Trips:

Mid-Chapter Quiz and End of Unit Tests

Standards Addressed:

Tennessee State Standards:

- P.F.BF.A.1 – Analyze how algebraic changes to a function transform its graph
- P.F.BF.A.2 – Build new functions through arithmetic combination and composition
- P.F.BF.A.3 – Compose functions in applied contexts
- P.F.BF.A.4 – Construct and simplify the difference quotient
- P.F.BF.A.5 – Find inverse functions and verify by composition
- P.F.BF.A.6 – Explain why a function and its inverse are reflections over $y = x$
- P.F.IF.A.1 – Determine whether a function is even, odd, or neither
- P.F.IF.A.6 – Describe intervals where a function is increasing or decreasing
- P.A.REI.A.4 – Solve nonlinear inequalities, including absolute value, by graphing

ACT Standards:

- F505 – Understands a function as a well-defined output for each input
- F506 – Understands domain and range in terms of valid input/output
- F604 – Evaluates composite functions at integer values
- A606 – Solves absolute value equations
- A701 – Solves simple absolute value inequalities
- AF705 – Identifies graph characteristics from a set of conditions or an equation

Unit 2 - Polynomial Functions

Duration: Approximately 5 days

Objectives/Essential Questions:

How do the zeros, factors, and end behavior of a polynomial function relate to its graph, and how can a polynomial be constructed from given characteristics?

Instructional Materials:

Pencil, paper, Chromebook, calculator, handouts

Major Tasks, Assessments and Field Trips:

Mid-Chapter Quiz and End of Unit Tests

Standards Addressed:

Tennessee State Standards:

- P.N.CN.B.7 – Extend polynomial identities to the complex numbers
- P.N.CN.B.8 – Solve quadratic equations that have complex solutions
- P.N.CN.B.9 – Apply the Fundamental Theorem of Algebra
- P.F.IF.A.4 – Identify real zeros and relate them to x-intercepts of a graph
- P.F.IF.A.5 – Identify graph characteristics from conditions or a general equation
- P.F.IF.A.6 – Locate and classify critical points of a function's graph

ACT Standards:

- A507 – Solves quadratic equations in factored form
- A508 – Factors simple quadratics
- A605 – Solves quadratic equations
- A703 – Applies the remainder theorem for polynomials
- F508 – Finds the domain of polynomial functions
- F509 – Finds the range of polynomial functions

Unit 3 - Rational Functions

Duration: Approximately 5 days

Objectives/Essential Questions:

How do the structure of a rational expression and the behavior of a rational function relate to its graph, and what must be considered when solving rational equations?

Instructional Materials:

Pencil, paper, Chromebook, calculator, handouts

Major Tasks, Assessments and Field Trips:

Mid-Chapter Quiz and End of Unit Tests

Standards Addressed:

Tennessee State Standards:

- P.N.NE.A.4 – Simplify complex radical and rational expressions
- P.N.NE.A.5 – Add, subtract, multiply, and divide rational expressions
- P.A.REI.A.3 – Solve rational equations and identify extraneous solutions
- P.F.IF.A.7 – Graph rational functions, identifying zeros, asymptotes, holes, and end behavior

ACT Standards:

- A513 – Determines when an expression is undefined
- F508 – Finds the domain of rational functions
- F510 – Finds where a rational function's graph has a vertical asymptote

Unit 4 - Exponential and Logarithmic Functions

Duration: Approximately 15 days

Objectives/Essential Questions:

How are exponential and logarithmic functions related as inverses, and how can they be used to model and solve real-world growth and decay situations?

Instructional Materials:

Pencil, paper, Chromebook, calculator, handouts

Major Tasks, Assessments and Field Trips:

Mid-Chapter Quiz and End of Unit Tests

Standards Addressed:

Tennessee State Standards:

- P.N.NE.A.1 – Use laws of exponents and logarithms to expand, collect, or simplify expressions
- P.N.NE.A.2 – Understand the inverse relationship between exponents and logarithms
- P.F.BF.A.5 – Find inverse functions, including exponential and logarithmic
- P.F.IF.A.2 – Analyze and model real-world situations with exponential and logarithmic functions

ACT Standards:

- F702 – Builds functions for relations that are exponential
- F707 – Exhibits knowledge of logarithms
- AF701 – Solves multistep arithmetic problems involving percent increase/decrease

Unit 5 - Triangles and Circles

Duration: Approximately 7 days

Objectives/Essential Questions:

How can right-triangle trigonometry, the Laws of Sines and Cosines, vectors, and radian measure be used to solve problems involving triangles, circles, and directed quantities?

Instructional Materials:

Pencil, paper, Chromebook, calculator, handouts

Major Tasks, Assessments and Field Trips:

Mid-Chapter Quiz and End of Unit Tests

Standards Addressed:

Tennessee State Standards:

- P.N.VM.A.1 – Recognize vector quantities as having magnitude and direction
- P.N.VM.A.2 – Find the components of a vector
- P.N.VM.A.3 – Solve problems involving velocity and other vector quantities
- P.F.TF.A.1 – Understand radian measure as arc length on the unit circle
- P.G.AT.A.1 – Use the six trigonometric ratios to solve right-triangle problems
- P.G.AT.A.2 – Derive the area formula $A = \frac{1}{2}ab \sin(C)$
- P.G.AT.A.3 – Derive and apply the formula for the area of a sector
- P.G.AT.A.4 – Calculate the arc length of a circle
- P.G.AT.A.5 – Prove the Laws of Sines and Cosines
- P.G.AT.A.6 – Apply the Laws of Sines and Cosines to find unknown measures

ACT Standards:

- G509 – Expresses sine, cosine, and tangent as ratios of side lengths
- G602 – Uses the Pythagorean theorem
- G604 – Applies basic trigonometric ratios to solve right-triangle problems
- F706 – Uses trigonometric concepts and basic identities to solve problems

Unit 6 - The Unit Circle

Duration: Approximately 7 days

Objectives/Essential Questions:

How does the unit circle define the trigonometric functions for all real numbers, and how do the Pythagorean identities allow trigonometric expressions to be simplified?

Instructional Materials:

Pencil, paper, Chromebook, calculator, handouts

Major Tasks, Assessments and Field Trips:

Mid-Chapter Quiz and End of Unit Tests

Standards Addressed:

Tennessee State Standards:

- P.F.TF.A.1 – Understand radian measure as arc length on the unit circle
- P.F.TF.A.2 – Convert between radians and degrees
- P.F.TF.A.3 – Use special triangles and the unit circle to find exact trig values
- P.F.TF.A.4 – Use the unit circle to explain symmetry and periodicity of trig functions
- P.G.TI.A.1 – Apply Pythagorean and other identities to simplify expressions

ACT Standards:

- F704 – Exhibits knowledge of unit circle trigonometry
- F706 – Uses trigonometric concepts and basic identities to solve problems

Unit 7 - Graphing Trig Functions

Duration: Approximately 14 days

Objectives/Essential Questions:

How do the parameters of a trigonometric function determine the shape of its graph, and how can a trigonometric function be written to model periodic behavior?

Instructional Materials:

Pencil, paper, Chromebook, calculator, handouts

Major Tasks, Assessments and Field Trips:

Mid-Chapter Quiz and End of Unit Tests

Standards Addressed:

Tennessee State Standards:

- P.F.TF.A.5 – Choose trigonometric functions to model periodic phenomena
- P.F.GT.A.1 – Interpret transformations of trigonometric functions
- P.F.GT.A.2 – Determine the effect of angle-measure units when graphing
- P.F.GT.A.3 – Graph the six trig functions, identifying period, amplitude, phase shift, and asymptotes

ACT Standards:

- F705 – Matches graphs of basic trigonometric functions with their equations
- AF706 – Finds a translated graph given a specified horizontal/vertical shift

Unit 8 - Trigonometric Identities

Duration: Approximately 8 days

Objectives/Essential Questions:

How can sum, difference, double-angle, and half-angle identities be derived and applied to simplify expressions and solve trigonometric equations?

Instructional Materials:

Pencil, paper, Chromebook, calculator, handouts

Major Tasks, Assessments and Field Trips:

Mid-Chapter Quiz and End of Unit Tests

Standards Addressed:

Tennessee State Standards:

- P.G.TI.A.1 – Apply trigonometric identities to verify identities and solve equations
- P.G.TI.A.2 – Prove the addition and subtraction formulas for sine, cosine, and tangent

ACT Standards:

- F706 – Uses trigonometric concepts and basic identities to solve problems

Unit 9 - Solving Trig Equations

Duration: Approximately 8 days

Objectives/Essential Questions:

How can inverse trigonometric functions and known identities be used to solve trigonometric equations over finite and infinite domains, including equations of multiple angles?

Instructional Materials:

Pencil, paper, Chromebook, calculator, handouts

Major Tasks, Assessments and Field Trips:

Mid-Chapter Quiz and End of Unit Tests

Standards Addressed:

Tennessee State Standards:

- P.F.GT.A.4 – Find values of inverse trigonometric expressions with domain/range restrictions
- P.F.GT.A.5 – Understand how restricting a domain allows an inverse to be constructed
- P.F.GT.A.6 – Determine the domain and range of inverse trigonometric functions
- P.F.GT.A.7 – Graph the inverse trigonometric functions and identify key characteristics
- P.F.GT.A.8 – Use inverse functions to solve trigonometric equations in context

ACT Standards:

- F704 – Exhibits knowledge of unit circle trigonometry
- F706 – Uses trigonometric concepts and basic identities to solve problems