Sophomore Year: Algebra II

- **Textbook:**
  Algebra II, Common Core Edition
  Larson, Boswell, Kanold, Stiff
  Holt McDougal
  2012

- **Course Description:**

The purpose of this course is to give students a strong foundation in working with functions. Students are exposed to advanced topics in Algebra, Trigonometry, Analytic Geometry, Probability and Statistics.

The course begins with a review of concepts the students learned in their Algebra I course freshman year. Students spend a significant amount of time studying functions, including domain, range, and the vertical line test. Emphasis is placed on graphing equations including: polynomial functions, root functions, rational functions, absolute value functions, greatest integer functions, trigonometric functions, conics (parabolas, circles, hyperbolas, ellipses), logarithmic functions, and exponential functions. Students also learn how to graph various transformations of each of these functions. Students study inverse functions, including inverse trigonometric functions. Significant time is also spent on solving algebraic, rational, radical, trigonometric, logarithmic, and exponential equations.

- **Course Goals:**
  1. Students will become proficient with graphing algebraic, radical, rational, trigonometric, logarithmic, and exponential equations and transformations of equations.
  2. Students will develop problem-solving skills by working with and solving algebraic, rational, radical, trigonometric, logarithmic, and exponential equations.
  3. Students will be comfortable working in either degrees or radians.
  4. Students will become proficient at using their graphing calculator to solve problems and interpret results (i.e. to realize that graphing calculators do not always provide the correct answer).
  5. Students will be able to solve problems graphical, analytically, or numerically.
  6. Students will build experience with applying mathematics to real-world situations.

- **Course Objectives:**
  At the end of the course, students will be able to:
  1. Graph 12 basic equations and transformations of the graphs (including horizontal and vertical translations, horizontal and vertical stretches and shrinks, reflections, amplitude changes, period changes, or phase angle changes):

     $y = x \quad y = x^2 \quad y = x^3 \quad y = \frac{1}{x} \quad y = \sqrt{x} \quad y = |x| \quad y = [[x]]$

     $y = \log_a x \quad y = a^x \quad y = \sin x \quad y = \cos x \quad y = \tan x$

2. Find the domain and range of a function. Find vertical asymptotes of a function.
3. Understand how to use the unit circle, 30-60-90 triangle, and 45-45-90 triangle to find the sine, cosine, and tangent of 30°, 45°, and 60° angles.
4. Quickly find (or have memorized) the sine, cosine, and tangent of the following angles: 0°, 30°, 45°, 60°, 90°, 180°, 270° (in both degree and radian form).
5. Memorize specified trigonometric identities and be able to use them to manipulate an equation or to prove that a statement is correct.
6. Solve equations of the following type: algebraic, rational, radical, trigonometric, logarithmic, and exponential.
7. Understand why division by a variable can result in the loss of a solution.
8. Graph conic sections and identify their appropriate properties (foci, directrix, major axis, minor axis, etc.)
9. Understand the difference between permutations and combinations and solve basic probability problems.
10. Find the inverse of a function, understand the properties of inverse functions, and know how to restrict the domain of trig functions so that they have inverses.

Calculator Policy: A TI-84 (any version) is required for this course. During the course, students will use the calculator for investigations and to solve problems. Students will be expected to understand how to solve problem both with the calculator and without the calculator. However, students should not expect to be able to use their calculator on every quiz, test, and homework assignment.

Course Sequence:

Chapter 1: Quadratic Functions and Factoring
1.1 Graph Quadratic Functions in Standard Form
1.2 Graph Quadratic Functions in Vertex or Intercept Form
1.3 Solve $x^2 + bx + c = 0$ by Factoring
1.4 Solve $ax^2 + bx + c = 0$ by Factoring
1.5 Solve Quadratic Equations by Finding Square Roots
1.6 Perform Operations with Complex Numbers
1.7 Complete the Square
1.8 Use the Quadratic Formula and the Discriminant
1.9 Graph and Solve Quadratic Inequalities

Chapter 2: Polynomials and Polynomial Functions
2.1 Use Properties of Exponents
2.2 Evaluate and Graph Polynomial Functions
2.3 Add, Subtract, and Multiply Polynomials
2.4 Factor and Solve Polynomial Equations
2.5 Apply the Remainder and Factor Theorems

2.6 Find Rational Zeros
2.7 Apply the Fundamental Theorem of Algebra
2.8 Analyze Graphs of Polynomial Functions

Chapter 3: Rational Exponents and Radical Functions
3.1 Evaluate nth Roots and Use Rational Exponents
3.2 Apply Properties of Rational Exponents
3.3 Perform Function Operations and Composition
3.4 Use Inverse Functions
3.5 Graph Square Root and Cube Root Functions
3.6 Solve Radical Equations

Chapter 4: Graph Exponential and Logarithmic Functions
4.1 Graph Exponential Growth Functions
4.2 Graph Exponential Decay Functions
4.3 Use Functions Involving *e*
4.4 Evaluate Logarithms and Graph Logarithmic Functions
4.5 Apply Properties of Logarithms
4.6 Solve Exponential and Logarithmic Equations
4.7 Write and Apply Exponential and Power Functions

Chapter 5: Rational Functions
5.1 Model Inverse and Joint Variation
5.2 Graph Simple Rational Functions
5.3 Graph General Rational Functions
5.4 Multiply and Divide Rational Expressions
5.5 Add and Subtract Rational Expressions
5.6 Solve Rational Equations
5.7 Describe and Compare Function Characteristics

Chapter 6: Data Analysis and Statistics (6.2 – 6.5 covered if time allows)
6.1 Use Combinations and the Binomial Theorem
6.2 Construct and Interpret Binomial Distributions
6.3 Use Normal Distributions
6.4 Select and Draw Conclusions from Samples
6.5 Compare Surveys, Experiments, and Observational Studies

Chapter 7: Sequences and Series
7.1 Define and Use Sequences and Series
7.2 Analyze Arithmetic Sequences and Series

7.3 Analyze Geometric Sequences and Series
7.4 Find Sums of Infinite Geometric Series
7.5 Use Recursive Rules with Sequences and Functions

Chapter 8: Quadratic Relations and Conic Sections
8.1 Apply the Distance and Midpoint Formulas
8.2 Graph and Write Equations of Parabolas
8.3 Graph and Write Equations of Circles
8.4 Graph and Write Equations of Ellipses
8.5 Graph and Write Equations of Hyperbolas
8.6 Translate and Classify Conic Sections
8.7 Solve Quadratic Systems

Chapter 9: Trigonometric Ratios and Functions
9.1 Use Trigonometry with Right Triangles
9.2 Define General Angles and Use Radian Measure
9.3 Evaluate Trigonometric Functions of Any Angle
9.4 Evaluate Inverse Trigonometric Functions
9.5 Apply the Law of Sines
9.6 Apply the Law of Cosines

Chapter 10: Trigonometric Graphs, Identities, and Equations
10.1 Graph Sine, Cosine, and Tangent Functions
10.2 Translate and Reflect Trigonometric Graphs
10.3 Verify Trigonometric Identities
10.4 Solve Trigonometric Equations
10.5 Write Trigonometric Functions and Models
10.6 Apply Sum and Difference Formulas
10.7 Apply Double-Angle and Half-Angle Formulas

Evaluation: The evaluation procedures vary by teachers, but typically include a combination of homework, quizzes, and tests.