

Students will take “Self Tests” covering the topics found in Chapter R (Reference: Basic Algebraic Concepts) and Chapter 1 (Linear Functions, Equations, and Inequalities). If any deficiencies are revealed, the student will be responsible for bringing themselves up to speed using the Study Plan or other exercises. This material will be included on the first exam.

Lecture will begin with a unit on **Advanced Factoring**, as students will be expected to have basic factoring skills coming in. A breakdown by topic of the remainder of the course follows.

Chapter 2. Analysis of Graphs of Functions

2.1: Graphs of Basic Functions and Relations; Symmetry

- Continuity
- Increasing, Decreasing and Constant Functions
- The Identity Function
- The Squaring Function and Symmetry with Respect to the y-Axis
- The Cubing Function and Symmetry with Respect to the Origin
- The Square Root and Cube Root Functions
- The Absolute Value Function
- The Relation $x = y^2$ and Symmetry with Respect to the x-Axis
- Even and Odd Functions

2.2: Vertical and Horizontal Shifts of Graphs

- Vertical Shifts
- Horizontal Shifts
- Combinations of Vertical and Horizontal Shifts
- Effects of Shifts on Domain and Range
- Horizontal Shifts Applied to Equations for Modeling

2.3: Stretching, Shrinking, and Reflecting Graphs

- Vertical Stretching
- Vertical Shrinking
- Horizontal Stretching and Shrinking
- Reflecting Across an Axis
- Combining Transformations of Graphs

2.4: Absolute Value Functions

- The Graph of $y = |f(x)|$
- Properties of Absolute Value
- Equations and Inequalities Involving Absolute Value

2.5: Piecewise-Defined Functions

- Graphing Piecewise-Defined Functions
- The Greatest Integer Function
- Applications of Piecewise-Defined Functions

2.6: Operations and Composition

- Operations on Functions
- The Difference Quotient
- Composition of Functions
- Applications of Operations and Composition

Chapter 3. Polynomial Functions

3.1: Complex Numbers

- The Imaginary Unit i
- Operations with Complex Numbers

3.2: Quadratic Functions and Graphs

- Completing the Square
- Graphs of Quadratic Functions
- Vertex Formula
- Extreme Values
- Applications and Quadratic Models

3.3: Quadratic Equations and Inequalities

- Zero-Product Property
- Square Root Property and Completing the Square
- Quadratic Formula and the Discriminant
- Solving Quadratic Equations
- Solving Quadratic Inequalities
- Formulas Involving Quadratics

3.4: Further Applications of Quadratic Functions and Models

- Applications of Quadratic Functions

3.5: Higher-Degree Polynomial Functions and Graphs

- Cubic Functions
- Quartic Functions
- Extrema
- End Behavior
- x -Intercepts (Real Zeros)
- Comprehensive Graphs

3.6: Topics in the Theory of Polynomial Functions (I)

- Intermediate Value Theorem
- Division of Polynomials by $x - k$ and Synthetic Division
- Remainder and Factor Theorems
- Division of Any Two Polynomials

3.7: Topics in the Theory of Polynomial Functions (II)

- Complex Zeros and the Fundamental Theorem of Algebra
- Number of Zeros
- Rational Zeros Theorem
- Descartes' Rule of signs
- Boundedness Theorem

3.8: Polynomial Equations and Inequalities; Further Applications and Models

- Polynomial Equations and Inequalities
- Complex n th Roots
- Applications

Chapter 4. Rational, Power, and Root Functions

4.1: Rational Functions and Graphs (I)

- The Reciprocal Function $f(x) = \frac{1}{x}$
- The Function $f(x) = \frac{1}{x^2}$

4.2: Rational Functions and Graphs (II)

- Vertical and Horizontal Asymptotes
- Graphing Techniques
- Oblique Asymptotes
- Graphs with Points of Discontinuity
- Graphs with No Vertical Asymptotes

4.3: Rational Equations, Inequalities, Models, and Applications

- Solving Rational Equations and Inequalities
- Models and Applications of Rational Functions
- Rate of work

4.4: Functions Defined by Powers and Roots

- Power and Root Functions
- Modeling Using Power Functions
- Graphs of $f(x) = \sqrt[n]{ax + b}$
- Graphing Circles and Parabolas Using Root Functions

4.5: Equations, Inequalities, and Applications Involving Root Functions

- Equations and Inequalities
- An Application of Root Functions

Chapter 5. Inverse, Exponential, and Logarithmic Functions

5.1: Inverse Functions

- Inverse Operations
- One-to-One Functions
- Inverse Functions and Their Graphs
- Equations of Inverse Functions

5.2: Exponential Functions

- Real-Number Exponents
- Graphs of Exponential Functions
- Exponential Equations (Type 1)
- Compound Interest
- The Number e and Continuous Compounding

5.3: Logarithms and Their Properties

- Definition of Logarithm
- Common Logarithms
- Natural Logarithms
- Properties of Logarithms
- Change-of-Base Rule

5.4: Logarithmic Functions

- Graphs of Logarithmic Functions
- Finding an Inverse of an Exponential Function
- A Logarithmic Model

5.5: Exponential and Logarithmic Equations and Inequalities

- Exponential Equations and Inequalities (Type 2)
- Logarithmic Equations and Inequalities
- Equations Involving Exponentials and Logarithms
- Formulas Involving Exponentials and Logarithms

5.6: Further Applications and Modeling with Exponential and Logarithmic Functions

- Physical Science Applications
- Financial and Other Applications

Chapter 6. Systems and Matrices

6.1: Systems of Equations

- Linear Systems
- Substitution Method
- Elimination Method
- Special Systems
- Nonlinear Systems
- Applications of Systems

6.2: Solution of Linear Systems in Three Variables

- Geometric Considerations
- Analytic Solution of Systems in Three Variables
- Applications of Systems

6.7: Systems of Inequalities

- Solving Linear Inequalities
- Solving Systems of Inequalities

6.8: Partial Fractions (if time allows)

- Decomposition of Rational Expressions
- Distinct Linear Factors
- Repeated Linear factors
- Distinct Linear and Quadratic Factors
- Repeated Quadratic Factors