MATHEMATICS
HINSDALE SCHOOL DISTRICT

**Course: Advanced Mathematics/Text: Advanced Mathematics, by Richard G. Brown**
**Standard: Numbers and Operations**

| Knowledge & Skills | Content | Activities<br>Resources & Materials | Assessments |
|---|---|---|---|
| M:N&O:AM:1 **Demonstrates conceptual understanding of the real number system** as an extension of the rational numbers by representing real numbers as infinite decimal expansions (that provide successive rational approximations to the number) and as points on a number line. | Real number system<br><br>Rationals<br><br>Irrationals<br><br>As approximations to a number or as points on a number line | Presented as part of introductory unit/overview during the first two days of classes, p. 26 | Homework/graded homework/quizzes/chapter tests |
| Determines whether the decimal expansion of a rational number given in fractional form eventually repeats or terminates (without using a calculator). | Repeating rationals versus terminating | Included as introductory material during first two days of classes | |

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| **Accurately solves problems.**<br>Solves problems involving scientific notation and assesses the precision of the answer in terms of significant digits. | Solves problems involving scientific notation | Page 267 problem 21 | Homework/graded homework/quizzes/chapter tests |
| Solves problems involving complex numbers by adding, multiplying, dividing, and computing conjugates; interprets complex numbers geometrically; and understands complex numbers as an extension of the real numbers | Complex numbers<br>Complex Conjugates<br>Relationship to real numbers | pages 25-29<br>page 25-29<br>pages 25-29 | |
| Manipulates complex numbers using rectangular and polar coordinates.<br>Finds the *n*th roots of a complex number using De Moivre's Theorem. | Rectangular coordinates and complex numbers | p 408, 493 | |
| Solves compound interest problems including continuously compounded interest. | Compound interest and continuous compounding | p. 187-189 | |

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|---|---|---|---|
| M:N&O:AM:8 **Explores field properties** with vectors and matrices; **algebraically/geometrically interpret** vectors, vector addition, and scalar multiplication in the plane; and **solves problems** using matrices (e.g., inverses, identity, determinants, and augmented matrices). | Vectors with matrices<br><br>Vectors<br><br>Vector addition<br><br>Scalar multiplication<br><br>Determinants, inverses, identity matrices, augmented matrices | p. 427<br><br>p 419-421<br><br>p 419-421<br><br>p 441<br><br>p 518, 531,530,523-525,530-532 | Homework/graded homework/quizzes/chapter tests |

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**Course: Advanced Mathematics**
**Standard: Geometry and Measurement**

| Knowledge & Skills | Content | Activities<br>Resources & Materials | Assessments |
|---|---|---|---|
| M:G&M:AM: **Extends and deepens knowledge and usage of proofs and proof techniques**; and uses geometric models to represent and distinguish between Euclidean and Non-Euclidean Systems. | Knowledge of proofs and proof techniques<br><br>Coordinate proofs<br><br>Mathematical induction: | Many problems in the problems sets contain proofs, or "show that." These problems are often included in the homework.<br><br>p 214-217<br><br>p. 510-512 | Homework/graded homework/quizzes/chapter tests |
| M:G&M:AM: **Derives and uses formulas for lengths of arcs and areas of sectors and areas of segments of circles.** | Formulas for lengths of arcs<br><br>Lengths of sectors<br><br>Areas of segments of circles | p. 263-264<br><br>p 263-264<br><br>p. 263-264 | |
| M:G&M:AM:7 **Uses radian measure appropriately** when solving problems; **converts** between radian measure and degree measure; and understands why radian measure is useful. | Radian measure<br><br>Conversions<br><br>Utility | Unit circle project, geometer's sketchpad unit on discovering radians. Use of applets on internet to demonstrate radian measure and unit circle<br>Text pages 258-260 | |

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**Course: Advanced Mathematics**
**Standard: Geometry and Measurement**

| Knowledge & Skills | Content | Activities<br>Resources & Materials | Assessments |
|---|---|---|---|
| M:G&M:AM:9 **Solves problems using analytic geometry** (including three-dimensions) **and circular trigonometry** (e.g., find the equation of a circle inscribed in a triangle; find the distance between opposite vertices in a rectangular solid);<br><br>**explores and interprets the characteristics of conic sections graphically and algebraically** including understanding how different planar slices of a double cone yield different conic sections; knows the characterization of conic sections as loci of points in the plane satisfying certain distance requirements, and uses the distance formula to obtain equations for the conic sections. | Analytic geometry applications<br><br>Circular trigonometry applications<br><br>Rectangular solids<br><br>Conics<br><br>Graphically and algebraically<br><br>Characteristics of conics<br><br>Distance formula applications | p. 213-218<br><br>p 219-222, p 224 # 47<br><br>p 225-229, p 231-242<br><br>p 247-252, p 456<br><br>p .252<br><br>p. 4, p. 219-229 | Homework/graded homework/quizzes/chapter tests |

**Course: Advanced Mathematics**
**Standard: Functions and Algebra**

| Knowledge & Skills | Content | Activities<br>Resources & Materials | Assessments |
|---|---|---|---|
| M:F&A:AM:1 Computes partial sums of infinite arithmetic and geometric sequences, determines when an infinite geometric series converges, and finds its sum. Connects arithmetic and geometric sequences to linear and exponential functions, respectively. Works between recursive and explicit representations. | Geometric sequences<br><br>Partial sums<br><br>Infinite geometric series convergence and their sums<br><br>Connection of arithmetic and geometric sequences to linear/exponential functions<br><br>Recursive/explicit representations | p. 473<br><br>p. 181, 473-481,500<br><br>p. 493-496, 500, 501,502<br><br>p. 486, 487,488<br><br>p 486-488 | Homework/graded homework/quizzes/chapter tests |

**Course: Advanced Mathematics**
**Standard: Functions and Algebra**

| Knowledge & Skills | Content | Activities Resources & Materials | Assessments |
|---|---|---|---|
| | Linear versus nonlinear | Pages 1-4, 7-10,14-16,19-22. | Homework/graded homework/quizzes/chapter tests |
| | Definition of functions | Pages 1-4, 7-10,14-16,19-22. | |
| | Operations of functions | Pages 124-127 | |
| | Composition of functions | p. 126 | |
| | Algebraic to numeric to graphic representation | pgs. 1-22 | |

**Course: Advanced Mathematics**
**Standard: Functions and Algebra**

| Knowledge & Skills | Content | Activities<br>Resources & Materials | Assessments |
|---|---|---|---|
| M:F&A:AM:3 **Conceptual understanding of algebraic expressions.** | | | Homework/graded homework/quizzes/chapter tests |
| Simplifies complex fractions. | Simplify complex expressions | pp. 169-172 | |
| Uses the Remainder Theorem, the Factor Theorem and Rational Root Theorem for polynomials. | Remainder, Factor, Rational Root theorems | pp. 59, 60, 82, | |
| Knows the Fundamental Theorem of Algebra and that non-constant polynomials always factor into linear factors over the complex numbers. | Fundamental theorem of algebra | p. 85 | |
| | Factoring non-constant polynomials | pp. 80-83 | |
| Understands the difference between factoring polynomials over integer, rational, real, and complex numbers. | Factoring polynomials | pp. 59-60 | |

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|---|---|---|---|
| M:F&A:AM:4 **Demonstrates conceptual understanding of equality.**<br><br>Solves equations and verifies/proves identities involving trigonometric expressions.<br><br>Solves equations involving exponential and logarithmic expressions; graphs and interprets the solutions.<br><br>Uses matrices or determinants to solve systems of equations with or without technology.<br><br>Knows and applies the Intermediate Value Theorem to find exact or approximate solutions of equations or zeros of continuous functions. | Trigonometric identities<br><br>Proving/verifying identities/solve equations<br><br>Exponential functions<br>Inverses<br>Graphs<br>Solutions of equations<br><br>matrices to solve equations<br><br>Intermediate value theorem and application, or the location principle | P 317-326<br><br>p. 318-320, problems and handouts that contain identities<br><br>p. 180-182, 187-189, 184, 183, 170<br><br>p. 191-209<br><br>p. 518, 530-533, activities include using TI-83 and inverse matrices to solve 2x2 and 3x3 simultaneous equations<br><br>p. 76 | Homework/graded homework/quizzes/chapter tests |

**Course: Advanced Mathematics**
**Standard: Data, Statistics, and Probability**

| Knowledge & Skills | Content | Activities<br>Resources & Materials | Assessments |
|---|---|---|---|
| | Standard deviation<br>Variance<br>Percentiles | p. 653-657, 674-677 | Homework/graded homework/quizzes/chapter tests |
| | Measures of central tendency | p. 639-642 | |
| | Correlation coefficient<br>Coefficient of determination | p 660-665 | |
| | Method of least squares | p. 684, these problems use a graphing calculator | |
| | Median median for linear regression | p. 830-834, these problems use a graphing calculator | |

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**Course: Advanced Math**
**Standard: Functions and Algebra**

| Knowledge & Skills | Content | Activities<br>Resources & Materials | Assessments |
|---|---|---|---|
| Analyzes characteristics of classes of functions and inverse functions (exponential, logarithmic, trigonometric) to include domain, range, intercepts, increasing and decreasing intervals and rates of change, periodicity, end behavior, maximum and minimum values, continuity, and asymptotes; graphs classes of functions; and understands domain restrictions and their effects on functions. | Exponential functions<br>Domain/range/characteristics<br><br>Logarithmic functions<br>Domain/range/characteristics<br><br>Trigonometric functions<br>Domain/range/characteristics<br><br>Intercepts<br><br>Periodicity<br><br>Rates of change<br><br>End behavior<br><br>Maximum and minimum values | pp. 180-182, 20, 119, TI-83 activity<br><br>p. 191-209, handout on acidity and logs<br>handout on logarithmic functions and rules<br><br>p 256-293<br><br>p. 221, 2-3<br><br>p. 138-142<br><br>p. 7-10<br><br>p. 62-65<br><br>p. 68-70<br><br>Each of these topics has a technology exploration in the text which uses a graphing calculator.<br>Geometer's sketchpad lessons aare also available | Homework/graded homework/quizzes/chapter tests |

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| Analyzes properties of functions including onto (surjectivity), critical points and inflection points. Determine graphically and analytically whether a function is even, odd or neither.<br><br>Analyzes informally the idea of continuity and limits. | Asymptotes<br><br>Critical points<br><br>Inflection points<br><br>Even versus odd versus neither<br><br>Limits<br><br>Definition<br><br>Existence<br><br>Limits and continuity<br><br>Right and left handed limits | p. 232<br><br>p. 166 in Larson, Calculus of a Single Varible<br><br>p. 192, 193 in Larson.<br><br>p. 137-138<br><br>pp. 45,48,52,59,60,63 in Larson<br><br>p. 52 in Larson<br><br>p. 73 in Larson<br><br>p. 70,73 in Larson<br><br>p. 83 in Larson | Homework/graded homework/quizzes/chapter tests |

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| Knowledge & Skills | Content | Activities<br>Resources & Materials | Assessments |
|---|---|---|---|
| Understanding quadratics and quadratic applications | Graphing quadratics | p. 37 | |
| | Finding zeros and the discriminant | p. 38-39 | |
| | Intersection of quadratics and linears | p. 40 | |
| | The quadratic formula | p. 31 | |
| | Complete the square | p. 31 | |
| | Factor | | |
| | Graphing | p. 38 | |
| | Significance of max or min | p. 38-39 | |
| | Real versus imaginary roots | p. 31-40 | |

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| Knowledge & Skills | Content | Activities<br>Resources & Materials | Assessments |
|---|---|---|---|
| Finding limits graphically and analytically | Concept of limit | Textbook: Larson, Hostetler, Calculus of a single Variable, 9th edition | Homework completion assessment, assessed homework |
| | How to find a limit | Teacher-led instruction<br>Chapter 1.2 | Quizzes/tests |
| | Numerical approximations | Find a limit numerically by creating a table<br>Chapter 1.2 | Calculator problems |
| | Properties of limits | Calculate the limit of a sum, difference, product and quotient of a function | |
| | Limits of trigonometric functions/one sided limits, asymptotes | Chapter 1.3 | |
| Continuity | Infinite Limits | Examine infinite limits graphically, numerically, and algebraically. Use the concept of infinite limit to find vertical asymptotes, Chapt 1.3, p 61<br>p. 205 | |
| | Definition of continuity, continuity of functions, and the properties of functions. | Use a graphing calculator to find the limit of a function from both the tables and from the graph | |
| | | Find when a limit does not exist | |

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| Students will have an understanding of the Intermediate Value Theorem (ITV). | Definition of the ITV<br><br>The relationship between the tangent line and slope | Use the definition of continuity to determine whether a function is continuous at a point or on an interval, chapt 1.3<br><br>Find points of discontinuity for a function | Homework completion assessment, assessed homework<br>Quizzes/tests<br>Calculator problems |

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