



Glencoe

**MINNESOTA
Mathematics Academic Standards
Grades 9, 10, 11 and Grades 11-12
Advanced Mathematical Concepts
Precalculus with Applications © 2004**

CONTENT STANDARDS	PAGE REFERENCES
GRADES 9, 10, 11	
I. MATHEMATICAL REASONING	
Standard: Apply skills of mathematical representation, communication and reasoning throughout the remaining three content strands.	
The student will:	
1. Assess the reasonableness of a solution by comparing the solution to appropriate graphical or numerical estimates or by recognizing the feasibility of solutions in a given context and rejecting extraneous solutions.	SE: 112-118, 251-257, 272 ex 2, 744 #6c, 745 #14c, 747 #21d, 974 #45 TWE: EA 254 <i>Study Guide and Practice</i> 33-34, 71-72
2. Appropriately use examples and counterexamples to make and test conjectures, justify solutions, and explain results.	SE: 17 #3, 185 #4, 308 #3, 363 #1, 410 #11-#12, 411 #32-#37, 421-422, 427 #1, 467 #3, 589 #3, 627 #4, 848 #3, 923 #4 TWE: OEA 86
3. Translate a problem described verbally or by tables, diagrams or graphs, into suitable mathematical language, solve the problem mathematically and interpret the result in the original context.	SE: 17 #3, 18 #29, 23 #4, 37 #32, 41 #2, 48 #3, 50 #27, 110 #24, 118 #22, 133 #4, 149 #3, 157 #45, 168 #39, 218 #1, 350 #61
4. Support mathematical results by explaining why the steps in a solution are valid and why a particular solution method is appropriate.	SE: 15 ex 3, 46 #4, 76 #3, 115 #3, 149 #3, 155 #1, 176 #1, 724 #61 TWE: OEA 77, 151, 168, 228
5. Determine whether or not relevant information is missing from a problem and if so, decide how to best express the results that can be obtained without that information.	SE: 65 #2
6. Know and use the relationship that exists among a logical implication of the form “if A, then B,” its converse “if B, then A,” its inverse “if not A, then not B,” and its contrapositive “if not B, then not A.”	This objective is covered in Glencoe’s <i>Geometry</i> © 2004 on pages 75-80 and Glencoe’s <i>Algebra 2</i> © 2003 pages 15 #36-#39, 34, 42, 69, 195, 250, 301, 412, 485, 533.

CONTENT STANDARDS	PAGE REFERENCES
II. NUMBER SENSE, COMPUTATION, AND OPERATIONS	
A. Number Sense Standard: Use real numbers, represented in a variety of ways, to quantify information and to solve real-world and mathematical problems. The student will:	SE: 64 #2, 65 #3, 206, 229, 273 #6, 282 #62, 695-703, 711 #32, 716 #18, 732 #67, 750 #11-#20
B. Computation and Operation Standard: Appropriately use calculators and other technologies to solve algebraic, geometric, probabilistic and statistical problems. The student will:	
1. Apply the correct order of operations and grouping symbols when using calculators and other technologies.	TWE: GCE 86 TT 307
2. Know, use and translate calculator notational conventions to mathematical notation.	TWE: TT 696
3. Recognize the impact of units such as degrees and radians on calculations.	SE: <i>Graphing Calculator Tip</i> 286
4. Recognize that applying an inverse function with a calculator may lead to extraneous or incomplete solutions.	See Glencoe's <i>Algebra 2</i> © 2003 SE: 201 #47-#52 <i>Graphing Calculator Investigation</i> 205
5. Understand the limitations of calculators such as missing or additional features on graphs due to viewing parameters or misleading representations of zero or very large numbers.	SE: <i>Graphing Calculator Exploration</i> 323 #4 TWE: TT 374
6. Understand that use of a calculator requires appropriate mathematical reasoning and does not replace the need for mental computation.	SE: <i>Graphing Calculator Exploration</i> 86 <i>Graphing Calculator Tip</i> 67 TWE: GCE 86, 602 TT 307
III. PATTERNS, FUNCTIONS, AND ALGEBRA	
A. Patterns and Functions Standard: Represent and analyze real-world and mathematical problems using numeric, graphic and symbolic methods for a variety of functions. The student will:	
1. Know the numeric, graphic and symbolic properties of linear, step, absolute value and quadratic functions. Graphic properties may include rates of change, intercepts, maxima and minima.	SE: 45-51, 20-25, 653-661 TWE: AIN 23 EC 51 FTC 655 OEA 25, 661 <i>Study Guide and Practice</i> 5-6, 13-14, 185-186
2. Model exponential growth and decay, numerically, graphically and symbolically, using exponential functions with integer inputs.	SE: 16 ex 3, 17 #9, 18 #25-#27, 707 ex 3, 714 #6, 760, 815 ex 1, 819 #10, 820 #31, 832 #45-#50
3. Analyze the effects of coefficient changes on linear and quadratic functions and their graphs.	SE: 137-145, 151 #46, 168 #41, 198 #19-#22, 709 #22-#23 <i>Graphing Calculator Exploration</i> 26 TWE: AIN 141 FTC 139 OEA 145 <i>Study Guide and Practice</i> 41-42

CONTENT STANDARDS	PAGE REFERENCES
4. Apply basic concepts of linear, quadratic and exponential expressions or equations in real-world problems such as loans, investments and the path of a projectile.	SE: 38-44, 258-264, 740-748 <i>Graphing Calculator Exploration</i> 265 TWE: AIN 40, 260 EC 44 FTC 39 OEA 44, 264
5. Distinguish functions from other relations using graphic and symbolic methods.	SE: 6 ex 4, 9 #10-#11, 10 #32-#37, 19 #36, 25 #45, 31 #34, 37 #39, 44 #18, 51 #36 TWE: OEA 12
B. Algebra (Algebraic Thinking)	
<u>Standard:</u> Solve simple equations and inequalities numerically, graphically, and symbolically. Use recursion to model and solve real-world and mathematical problems.	
The student will:	
1. Translate among equivalent forms of expressions, such as: simplify algebraic expressions involving nested pairs of parentheses and brackets, simplify rational expressions, factor a common term from an expression and apply associative, commutative and distributive laws.	SE: 7 ex 6, 8 ex 7, 9 #13-#14, 11 #41-#47, 19 #37, 58 #11-#17, 431-436 TWE: EC 11, 436 <i>Study Guide and Practice</i> 121-122
2. Understand the relationship between absolute value and distance on the number line and graph simple expressions involving absolute value such as $ x - 3 = 6$ or $ x + 2 < 5$.	This objective is covered in Glencoe's <i>Algebra Concepts and Applications</i> © 2004 on pages 128-131 and in Glencoe's <i>Algebra 2</i> © 2003 40-44, 97 Example 2.
3. Find equations of a line given two points on the line, a point and the slope of the line or the slope and the y-intercept of the line.	SE: 27-31, 32-37, 44 #19, 51 #32, 59 #39-#52, A56 #14-#17 <i>Extra Practice Lesson 1-4 A</i> 26 <i>Extra Practice Lesson 1-5 A</i> 27 TWE: EC 37 OEA 37
4. Translate among equivalent forms of linear equations and inequalities.	SE: 67-72, 73-77, 86 #55, 96 #36, 104 #55, 107-111, 118 #28, 120 #11-#16, 122 #45-#48 TWE: EC 72, 76
5. Use a variety of models such as equations, inequalities, algebraic formulas, written statements, tables and graphs or spreadsheets to represent functions and patterns in real-world and mathematical problems.	SE: 69 ex 4, 114 ex 2, 115 #6-#7, 118 #23, 122 #51, 125 #10, 154 ex 4, 175 ex 4, 209 ex 5, 215 ex 3, 220 #37
6. Apply the laws of exponents to perform operations on expressions with integer exponents.	SE: 124 ex 1, 125 #9, 445 #64, 613 #5, 695-696, 700 #9, 701 #36-#37, 711 #32, 750 #15
7. Solve linear equations and inequalities in one variable with numeric, graphic and symbolic methods.	SE: 67-72, 73-77, 86 #55, 96 #36, 104 #55, 107-111, 118 #28, 120 #11-#16, 122 #45-#48 TWE: EC 72, 76
8. Find real solutions to quadratic equations in one variable with numeric, graphic and symbolic methods.	SE: 213-221, 235 #30, 242 #40, 268 #16-#21, 271 #57, 298 #53, 674 ex 5, A59 #2-#4 TWE: EC 220 OEA 221

CONTENT STANDARDS	PAGE REFERENCES
9. Use appropriate terminology and mathematical notation to define and represent recursion.	SE: 16 ex 3, 17 #9, 18 #25-#27, 707 ex 3, 714 #6, 760, 815 ex 1, 819 #10, 820 #31, 832 #45-#50
10. Create and use recursive formulas to model and solve real-world and mathematical problems.	SE: 16 ex 3, 17 #9, 18 #25-#27, 707 ex 3, 714 #6, 760, 815 ex 1, 819 #10, 820 #31, 832 #45-#50
11. Solve systems of two linear equations and inequalities with two variables using numeric, graphic and symbolic methods.	SE: 67-72, 73-77, 86 #55, 96 #36, 104 #55 TWE: AIN 75 EC 72, 76 OEA 72, 77
12. Understand how slopes can be used to determine whether lines are parallel or perpendicular. Given a line and a point not on the line, find the equations for the lines passing through that point and parallel or perpendicular to the given line.	SE: 32-37, 51 #32, 56 #29, 59 #47-#52, 72 #41, 96 #39, 104 #57 TWE: EC 37 OEA 37 <i>Study Guide and Practice</i> 9-10
IV. DATA ANALYSIS, STATISTICS, AND PROBABILITY	
A. Data and Statistics	
<u>Standard:</u> Represent data and use various measures associated with data to draw conclusions and identify trends. Understand the effects of display distortion and measurement error on the interpretation of data.	
The student will:	
1. Construct and analyze circle graphs, bar graphs, histograms, box-and-whisker plots, scatter plots and tables, and demonstrate the strengths and weaknesses of each format by choosing appropriately among them for a given situation.	SE: 258-264, 270 #54-#55, 740-748, 889-896, 934 #11-#13 <i>Graphing Calculator Exploration</i> 265-266 <i>Internet Project</i> 937 TWE: AIN 891 <i>Study Guide and Practice</i> 73-74, 255-256
2. Use measures of central tendency and variability, such as, mean, median, maximum, minimum, range, standard deviation, quartile and percentile, to describe, compare and draw conclusions about sets of data.	SE: 111 #33, 150 #43, 897-907, 908-917, 934 #14-#18, 935 #19-#22, 937 #41, 939 #9 <i>Enrichment</i> 158, 159 <i>Study Guide and Practice</i> 257-258, 259-260
3. Determine an approximate best-fit line from a given scatter plot and use the line to draw conclusions.	SE: 38-44, 51 #31, 60 #53, 61 #69, 145 #49, 151 #51, 258-264 TWE: AIN 40, 260 EC 44
4. Know the influence of outliers on various measures and representations of data about real-world and mathematical problems.	SE: 909, 915 #20e, 916 #23c
5. Understand the relationship between correlation and causation.	Correlation is found on pages SE: 38-44.
6. Interpret data credibility in the context of measurement error and display distortion.	SE: 927-932, 936 #36-#39 <i>Graphing Calculator Exploration</i> 877 TWE: AIN 929
7. Compare outcomes of voting methods such as majority, plurality, ranked by preference, run-off and pair-wise comparison.	This can be found in Glencoe's <i>Contemporary Mathematics in Context Course 2</i> © 2003 page 207.

CONTENT STANDARDS	PAGE REFERENCES
<p>B. Probability <u>Standard:</u> Use appropriate counting procedures, calculate probabilities in various ways and apply theoretical probability concepts to solve real-world and mathematical problems. <u>The student will:</u></p>	
1. Select and apply appropriate counting procedures to solve real-world and mathematical problems, including probability problems.	SE: 837-845, 846-851, 852-858, 859-867, 868-874, 875-880, 883 #27-#34, 884 #37-#40 TWE: MTL 846 <i>Study Guide and Practice</i> 239-240, 241-242
2. Use area, trees, unions and intersections to calculate probabilities and relate the results to mutual exclusiveness, independence and conditional probabilities, in real-world and mathematical problems.	SE: 837, 839 ex 2
3. Use probability models, including area and binomial models, in real-world and mathematical problems.	SE: 875-880, 884 #44-#47 TWE: EC 880 OEA 880 <i>Study Guide and Practice</i> 249-250
4. For simple probability models, determine the expected values of random variables.	SE: <i>Graphing Calculator Exploration</i> 877
5. Know the effect of sample size on experimental and simulation probabilities.	SE: 928
6. Use a variety of experimental, simulation and theoretical methods to calculate probabilities.	SE: <i>Graphing Calculator Exploration</i> 877 TWE: OEA 880
<p>V. SPATIAL SENSE, GEOMETRY AND MEASUREMENT</p>	
<p>A. Spatial Sense <u>Standard:</u> Use models to represent and understand two- and three-dimensional shapes and how various motions affect them. Recognize the relationship between different representations of the same shape. <u>The student will:</u></p>	
1. Use models and visualization to understand and represent three-dimensional objects and their cross sections from different perspectives.	SE: 623
<p>B. Geometry <u>Standard:</u> Apply basic theorems of plane geometry, right triangle trigonometry, coordinate geometry and a variety of visualization tools to solve real-world and mathematical problems. <u>The student will:</u></p>	
1. Know and use theorems about triangles and parallel lines in elementary geometry to justify facts about various geometrical figures and solve real-world and mathematical problems. These theorems include criteria for two triangles to be congruent or similar and facts about parallel lines cut by a transversal.	SE: 144 #41, 612 ex 1, 613 #1
2. Know and use theorems about circles to justify geometrical facts and solve real-world and mathematical problems. These theorems include the relationships involving tangent lines and radii, the relationship between inscribed and central angles and the relationship between the measure of a central angle and arc length.	SE: 345, 348 #11-#12, 349 #40-#42, 444 #56, 612, 628 #39, 951-952

CONTENT STANDARDS	PAGE REFERENCES
3. Know and use properties of two- and three-dimensional figures to solve real-world and mathematical problems such as: finding area, perimeter, volume and surface area; applying direct or indirect methods of measurement; the Pythagorean theorem and its converse; and properties of 45° - 45° - 90° and 30° - 60° - 90° triangles.	SE: 168 #46, 178 #35, 187 #44, 192-193 ex 5, 229, 318 #42, 358 #51, 510 #38, 612, 701 #68
4. Apply the basic concepts of right triangle trigonometry including sine, cosine and tangent to solve real-world and mathematical problems.	SE: 284-290, 291-298, 305-312 TWE: AIN 286, 295 EC 290, 298 OEA 290, 298, 312
5. Use coordinate geometry to represent and examine geometric concepts such as the distance between two points, the midpoint of a line segment, the slope of a line and the slopes of parallel and perpendicular lines.	SE: 135 #40, 272-273, 617 ex 3, 618 ex 5, 619 #4, 620 #8-#9, 621 #33, 640 #55, 652 #51, 688 #11-#13, 948 #57
6. Use numeric, graphic and symbolic representations of transformations such as reflections, translations and change of scale in one, two and three dimensions to solve real-world and mathematical problems.	SE: 88-96, 535-542, 670-677 TWE: EC 96, 677 <i>Study Guide and Practice</i> 27-28, 151-152, 189-190
7. Perform basic constructions with a straightedge and compass.	SE: 135 #40 <i>History of Mathematics</i> 534
8. Draw accurate representations of planar figures using a variety of tools.	SE: 135 #40 <i>History of Mathematics</i> 534
C. Measurement Standard: Use the interconnectedness of geometry, algebra and measurement to explore real-world and mathematical problems.	SE: 135 #40, 272-273, 617 ex 3, 618 ex 5, 619 #4, 620 #8-#9, 621 #33, 640 #55, 652 #51, 688 #11-#13, 948 #57
GRADES 11-12	
STATISTICS Standard: Use tables of the normal distribution and properties of that distribution to make judgments about populations based on random samples from these populations. The student will:	
1. Use the concept of normal distribution and its properties to answer questions about sets of data.	SE: 918-925, 935 #23-#28, 932 #34, 937 #42 <i>Graphing Calculator Exploration</i> 926 TWE: AIN 921 EC 925 OEA 925 <i>Enrichment</i> 160 <i>Study Guide and Practice</i> 261-262
2. Describe and use sampling distributions and the central limit theorem. Calculate confidence intervals when appropriate.	SE: Frequency distributions can be found on pages 889-896.

CONTENT STANDARDS	PAGE REFERENCES
3. Understand the importance of appropriate sampling methods. For instance, the time of day of a survey could lead to inaccuracies in the outcome.	SE: 928
ALGEBRA Standard: Demonstrate facility with a wide range of algebraic operations and use the relationship between coordinate geometry and algebraic equations to solve real-world and mathematical problems. The student will:	
1. Solve systems of two, three or more simultaneous linear equations or inequalities, in particular, deciding whether a given system of equations has one solution, no solution or infinitely many solutions and, in this latter case, describing them parametrically.	SE: 67-72, 73-77, 86 #55, 96 #36, 104 #55 TWE: AIN 75 EC 72, 76 OEA 72, 77
2. Solve problems with quadratic functions and equations, where some of the coefficients may be expressed in terms of parameters.	SE: 220 #35, #38
3. Perform the four arithmetic operations with polynomials, except that division is restricted to division by monomials and linear binomials.	SE: 14 ex 1, 17 #11-#14, 19 #39, 31 #33, 51 #34, 58 #18-#23, 86 #62, 202 ex 2, 203 #6, 581-582
4. Simplify a wide variety of algebraic expressions, including those in which numerator or denominator needs to be rationalized.	SE: 7 ex 6, 8 ex 7, 9 #13-#14, 11 #41-#47, 19 #37, 58 #11-#17, 124 ex 1, 125 #9, 582 ex 5, 594
5. Apply the laws of exponents to perform operations on expressions with fractional exponents.	SE: 695-703, 716 #18, 732 #67, 750 #12, #19-#20, 814 #46 TWE: GCE 696 <i>Study Guide and Practice</i> 197-198
6. Know the numeric, graphic and symbolic properties of power, logarithmic and exponential functions.	SE: 704-711, 718-725, 740-748, 750 #21-#26 TWE: MTL 719 <i>Enrichment</i> 122 <i>Study Guide and Practice</i> 199-200, 203-204, 209-210
7. Solve a wide variety of mathematical and real-world problems involving power, exponential and logarithmic functions and equations, discard extraneous solutions and present results graphically.	SE: 704-711, 718-725, 740-748, 750 #21-#26 TWE: MTL 719 <i>Enrichment</i> 122 <i>Study Guide and Practice</i> 199-200, 203-204, 209-210
8. Know the numeric, graphic and symbolic properties of rational functions.	SE: 180-188, 196 #42, 200 #48-#51, 212 #57, 242 #41 TWE: EC 188 OEA 188 TT 182 <i>Enrichment</i> 31 <i>Study Guide and Practice</i> 51-52

CONTENT STANDARDS	PAGE REFERENCES
9. Solve a wide variety of mathematical and real-world problems involving rational functions, discard extraneous solutions and present results graphically.	SE: 180-188, 196 #42, 200 #48-#51, 212 #57, 242 #41 TWE: EC 188 OEA 188 TT 182 <i>Enrichment 31</i> <i>Study Guide and Practice 51-52</i>
10. Factor polynomials representing the difference of squares, perfect square trinomials and quadratics with rational factors.	SE: 203 #1, 211 #40-#47, 217, 219 #9-#10, 220 #31, 221 #45, 456 ex 1
11. Make sketches including axes, centers, asymptotes, vertices of parabola, ellipses (including circles) and hyperbolas with axes parallel to the coordinate axes, given their equations, and completing the square if necessary.	SE: 631-641, 642-652, 653-661, 669 #45 TWE: EC 660 FTC 655 OEA 641, 661 <i>Enrichment 113</i> <i>Study Guide and Practice 181-182, 182-184, 185-186</i>
12. Find equations of parabolas, ellipses and hyperbolas when presented with their graphs having axes parallel to the coordinate axes.	SE: 631-641, 642-652, 653-661, 669 #45 TWE: EC 660 FTC 655 OEA 641, 661 <i>Enrichment 113</i> <i>Study Guide and Practice 181-182, 182-184, 185-186</i>
13. Add, subtract, multiply and divide complex numbers, interpret sums geometrically, and find complex solutions of quadratic equations.	SE: 210 #11-#13, 221 #39, 235 #30, 250 #49, 580-585, 586-591, 593-598, 610 #43-#50 TWE: EC 591 OEA 591-598
14. Know and use the Factor and Remainder Theorems.	SE: 222-228, 235 #6, 250 #48, 268 #22-#25, 283 #70, 366 #62, 641 #59, 880 #50 TWE: EC 228 <i>Study Guide and Practice 63-64</i>
15. Find the inverse of a function and the composition of functions by numeric and symbolic methods. Know the relationship between the graphs of a function and its inverse.	SE: 152-158, 168 #40, 188 #49, 196 #43, 198 #29-#34, 221 #41 TWE: AIN 154 EC 158 FTC 155 OEA 158
16. Know and use formal notation for sequences and series to solve related problems.	SE: 759-765, 766-773, 774-783, 793 #37-#38, 794-800, 815-821, 828 #30 TWE: AIN 761 EC 764, 821
TRIGONOMETRY & GEOMETRY <u>Standard:</u> Understand the properties of the standard trigonometric functions and apply them to real-world and mathematical problems, especially geometrical problems. Develop increased mastery of geometric proof methodology. The student will:	
1. Know the six trigonometric functions defined for an angle in a right triangle.	SE: 284-290, 291-298, 305-312 TWE: AIN 286, 295 EC 290, 298 OEA 290, 298, 312

CONTENT STANDARDS	PAGE REFERENCES
2. Given the coordinates of a point on the terminal side of an angle in standard position in the xy -plane, find the values of the trigonometric functions.	SE: 291-298, 337 #27-#36 TWE: EC 298 OEA 298 <i>Study Guide and Practice</i> 83-84
3. Convert between degrees and radian measures.	SE: 343-344, 348 #5-#8, 377 #1, 394 #23, 414 #11-#16 TWE: FTC 345 TT 344 <i>Study Guide and Practice</i> 99-100
4. Solve applied problems about triangles using the law of sines including the ambiguous case.	SE: 313-318, 320-326, 332 #33, 338 #51-#54 TWE: AIN 315 EC 317 OEA 318, 326 <i>Study Guide and Practice</i> 89-90, 91-92
5. Solve applied problems about triangles using the law of cosines.	SE: 327-332, 338 #55-#58 TWE: EC 332 FTC 328 OEA 332 TT 328 <i>Enrichment</i> 56 <i>Study Guide and Practice</i> 93-94
6. Graph the functions of the form $A\sin(Bt + C)$, $A\cos(Bt + C)$, and $A\tan(Bt + C)$ and know the meaning of the terms frequency, amplitude, phase shift and period.	SE: 368-377, 378-386 TWE: AIN 381 EC 376, 386 MTL 338 OEA 377, 386 <i>Enrichment</i> 64, 65 <i>Study Guide and Practice</i> 105-106, 107-108
7. Simplify trigonometric expressions using identities and verify simple trigonometric identities including $\sin^2 x + \cos^2 x = 1$, sum, difference, double angle and half-angle formulas for sine and cosine.	SE: 421-430, 431-436, 437-445, 448-455 TWE: EC 429, 455 OEA 430, 455 <i>Study Guide and Practice</i> 119-120, 125-126
8. Find all the solutions of a trigonometric equation on various intervals.	SE: 456-461, 469 #38, 479 #34-#39 TWE: AIN 457 EC 461 OEA 461 <i>Study Guide and Practice</i> 127-128
9. Know and be able to use the definitions of the inverse trigonometric functions and related methods to solve problems such as find $\cos(x)$ and $\tan(x)$ given the value of $\sin x$ and the quadrant containing the terminal side.	SE: 305-312 TWE: AIN 308 EC 311 MTL 305 OEA 312 <i>Study Guide and Practice</i> 87-88

Codes Used for TWE Pages

AIN	Addressing Individual Needs
EA	Error Analysis
EC	Extra Credit
FTC	From the Classroom of...
GCE	Graphing Calculator Exploration
MTL	Motivating the Lesson
OEA	Open-Ended Assessment
TT	Teaching Tip