



Glencoe

NEW JERSEY
Core Curriculum Content Standards for Mathematics
Grade 12
Algebra 2 © 2005

CONTENT STANDARDS	PAGE REFERENCES
Standard 4.1 (Number and Numerical Operations) All students will develop number sense and will perform standard numerical operations and estimations on all types of numbers in a variety of ways.	
Building upon knowledge and skills gained in preceding grades, by the end of Grade 12 , students will:	
A. Number Sense	
1. Extend understanding of the number system to all real numbers.	SE: 11-18 TWE: AA 13 CC 13 DI 14 H 11
2. Compare and order rational and irrational numbers.	SE: 5 #25-#32, 15 #27, 814
3. Develop conjectures and informal proofs of properties of number systems and sets of numbers.	SE: 14 #3, 16 #59-#62, 18 #74-#77, 618-621, 626 #49-#50 TWE: A 620
B. Numerical Operations	
1. Extend understanding and use of operations to real numbers and algebraic procedures.	SE: 11-18, 221 #7-#12 TWE: DI 18
2. Develop, apply, and explain methods for solving problems involving rational and negative exponents.	SE: 226 #26, 227 #39-#40, 257-262, 267 #47-#49, 275 #74-#76, 279 #52-#57, 281 #18-#19 TWE: A 262 DI 258
3. Perform operations on matrices. <ul style="list-style-type: none">• Addition and subtraction• Scalar multiplication	SE: 160-166, 174 #47-#49, 181 #49-#50, 210 #15-#18, 215 #6-#7 TWE: A 166 DI 161, 162
4. Understand and apply the laws of exponents to simplify expressions involving numbers raised to powers.	SE: 222-224, 226 #4-#12, 227 #33-#41, 228 #64, 232 #58-#60, 277 #11-#14 TWE: CC 224 DI 223
C. Estimation	
1. Recognize the limitations of estimation, assess the amount of error resulting from estimation, and determine whether the error is within acceptable tolerance limits.	SE: 296 ex 4

CONTENT STANDARDS	PAGE REFERENCES
Standard 4.2 (Geometry and Measurement) All students will develop spatial sense and the ability to use geometric properties, relationships, and measurement to model, describe and analyze phenomena.	
A. Geometric Properties	
1. Use geometric models to represent real-world situations and objects and to solve problems using those models (e.g., use Pythagorean theorem to decide whether an object can fit through a doorway).	SE: 821 #19-#20
2. Draw perspective views of 3D objects on isometric dot paper, given 2D representations (e.g., nets or projective views).	SE: <i>Algebra Activity</i> 580 TWE: AA 580
3. Apply the properties of geometric shapes. <ul style="list-style-type: none"> • Parallel lines - transversal, alternate interior angles, corresponding angles • Triangles <ul style="list-style-type: none"> a. Conditions for congruence b. Segment joining midpoints of two sides is parallel to and half the length of the third side c. Triangle inequality • Minimal conditions for a shape to be a special quadrilateral • Circles - arcs, central and inscribed angles, chords, tangents • Self-similarity 	See Glencoe's <i>Geometry</i> © 2005 pages 126-138, 200-215, and 529-558.
4. Use reasoning and some form of proof to verify or refute conjectures and theorems. <ul style="list-style-type: none"> • Verification or refutation of proposed proofs • Simple proofs involving congruent triangles • Counterexamples to incorrect conjectures 	SE: 14 #3, 16 #59-#62, 18 #74-#77, 618-621, 626 #49-#50 TWE: A 620
B. Transforming Shapes	
1. Determine, describe, and draw the effect of a transformation, or a sequence of transformations, on a geometric or algebraic object, and, conversely, determine whether and how one object can be transformed to another by a transformation or a sequence of transformations.	SE: 175-181, 188 #56-#58, 194 #45-#47, 212 #23-#26 TWE: A 181 DI 177 STP 176
2. Recognize three-dimensional figures obtained through transformations of two-dimensional figures (e.g., cone as rotating an isosceles triangle about an altitude), using software as an aid to visualization.	This objective can be met during teacher/class discussion.

CONTENT STANDARDS	PAGE REFERENCES
3. Determine whether two or more given shapes can be used to generate a tessellation.	See Glencoe's <i>Geometry</i> © 2005 pages 483-487.
4. Generate and analyze iterative geometric patterns. <ul style="list-style-type: none"> • Fractals (e.g., Sierpinski's Triangle) • Patterns in areas and perimeters of self-similar figures • Outcome of extending iterative process indefinitely 	SE: 608 ex 3 <i>Algebra Activity</i> 611
C. Coordinate Geometry	
1. Use coordinate geometry to represent and verify properties of lines. <ul style="list-style-type: none"> • Distance between two points • Midpoint and slope of a line segment • Finding the intersection of two lines • Lines with the same slope are parallel • Lines that are perpendicular have slopes whose product is -1 	SE: 68-74, 110-115, 412-416, 425 #50-#52, 431 #60-#62, 462 #11-#16, 467 #4-#9 <i>Algebra Activity</i> 417 TWE: A 115, 416
2. Show position and represent motion in the coordinate plane using vectors. <ul style="list-style-type: none"> • Addition and subtraction of vectors 	See Glencoe's <i>Geometry</i> © 2005 pages 498-505.
D. Units of Measurement	
1. Understand and use the concept of significant digits.	See Glencoe's <i>Geometry</i> © 2005 pages 13-19.
2. Choose appropriate tools and techniques to achieve the specified degree of precision and error needed in a situation. <ul style="list-style-type: none"> • Degree of accuracy of a given measurement tool • Finding the interval in which a computed measure (e.g., area or volume) lies, given the degree of precision of linear measurements 	See Glencoe's <i>Geometry</i> © 2005 pages 13-19.
E. Measuring Geometric Objects	
1. Use techniques of indirect measurement to represent and solve problems. <ul style="list-style-type: none"> • Similar triangles • Pythagorean theorem • Right triangle trigonometry (sine, cosine, tangent) 	SE: 705 ex 6, 706 #13, 707 #41-#42, 821 #19-#20

CONTENT STANDARDS	PAGE REFERENCES
<p>2. Use a variety of strategies to determine perimeter and area of plane figures and surface area and volume of 3D figures.</p> <ul style="list-style-type: none"> • Approximation of area using grids of different sizes • Finding which shape has minimal (or maximal) area, perimeter, volume, or surface area under given conditions using graphing calculators, dynamic geometric software, and/or spreadsheets • Estimation of area, perimeter, volume, and surface area 	<p>SE: 22 ex 6, 27 #83, 255 #49, 266 #12, 382 #55, 415 #35, 862 #4-#5</p>
<p>Standard 4.3 (Patterns and Algebra) All students will represent and analyze relationships among variable quantities and solve problems involving patterns, functions, and algebraic concepts and processes.</p>	
<p>A. Patterns</p>	
<p>1. Use models and algebraic formulas to represent and analyze sequences and series.</p> <ul style="list-style-type: none"> • Explicit formulas for n^{th} terms • Sums of finite arithmetic series • Sums of finite and infinite geometric series 	<p>SE: 578-582, 583-587, 588-592, 594-598, 599-604 TWE: A 582, 587, 592, 598, 604</p>
<p>2. Develop an informal notion of limit.</p>	<p>SE: <i>Graphing Calculator Investigation</i> 593 TWE: A 593</p>
<p>3. Use inductive reasoning to form generalizations.</p>	<p>SE: 618-621, 626 #49-#50, 627 #21-#22 TWE: A 620</p>
<p>B. Functions and Relationships</p>	
<p>1. Understand relations and functions and select, convert flexibly among, and use various representations for them, including equations or inequalities, tables, and graphs.</p>	<p>SE: 56-62, 68-74, 75-80, 101 #9-#12, 102 #32-#35, 105 #4-#5 TWE: A 62</p>
<p>2. Analyze and explain the general properties and behavior of functions of one variable, using appropriate graphing technologies.</p> <ul style="list-style-type: none"> • Slope of a line or curve • Domain and range • Intercepts • Continuity • Maximum/minimum • Estimating roots of equations • Intersecting points as solutions of systems of equations • Rates of change 	<p>SE: 56-62, 65 ex 4, 67 #64-#65, 68-74, 89-95, 101 #9-#12, 102 #26-#35, 105 #4-#5 TWE: A 95 GCI 91</p>
<p>3. Understand and perform transformations on commonly-used functions.</p> <ul style="list-style-type: none"> • Translations, reflections, dilations • Effects on linear and quadratic graphs of parameter changes in equations • Using graphing calculators or computers for more complex functions 	<p>SE: 322-328, 340 #42-#50, 530 #71-#75 <i>Graphing Calculator Investigation</i> 70, 91, 320-321 TWE: A 321 H 322</p>

CONTENT STANDARDS	PAGE REFERENCES
<p>4. Understand and compare the properties of classes of functions, including exponential, polynomial, rational, and trigonometric functions.</p> <ul style="list-style-type: none"> • Linear vs. non-linear • Symmetry • Increasing/decreasing on an interval 	<p>SE: 523-530, 767 #38 <i>Study Tip</i> 288</p> <p>TWE: A 530 GCI 524</p>
C. Modeling	
<p>1. Use functions to model real-world phenomena and solve problems that involve varying quantities.</p> <ul style="list-style-type: none"> • Linear, quadratic, exponential, periodic (sine and cosine), and step functions (e.g., price of mailing a first-class letter over the past 200 years) • Direct and inverse variation • Absolute value • Expressions, equations and inequalities • Same function can model variety of phenomena • Growth/decay and change in the natural world • Applications in mathematics, biology, and economics (including compound interest) 	<p>SE: 89 ex 1, 93 #12-#14, 94 #48, 525 ex 3, 528 #19-#20, 529 #57-#64</p> <p>TWE: H 89</p>
<p>2. Analyze and describe how a change in an independent variable leads to change in a dependent one.</p>	<p>SE: 59</p>
<p>3. Convert recursive formulas to linear or exponential functions (e.g., Tower of Hanoi and doubling).</p>	<p>SE: <i>Algebra Activity</i> 607</p> <p>TWE: AA 607</p>
D. Procedures	
<p>1. Evaluate and simplify expressions.</p> <ul style="list-style-type: none"> • Add and subtract polynomials • Multiply a polynomial by a monomial or binomial • Divide a polynomial by a monomial 	<p>SE: 229-232, 233-238, 244 #63-#68, 249 #71-#72, 256 #62-#63, 267 #54-#59</p> <p>TWE: A 232, 238 DI 236 TTT 234</p>
<p>2. Select and use appropriate methods to solve equations and inequalities.</p> <ul style="list-style-type: none"> • Linear equations - algebraically • Quadratic equations - factoring (when the coefficient of x^2 is 1) and using the quadratic formula • All types of equations using graphing, computer, and graphing calculator techniques 	<p>SE: 20-27, 32 #61-#63, 39 #62, 49 #25-#33, 51 #19-#21</p> <p>TWE: A 27 DI 22 TT 21</p>

CONTENT STANDARDS	PAGE REFERENCES
3. Judge the meaning, utility, and reasonableness of the results of symbol manipulations, including those carried out by technology.	SE: 20-27, 32 #59-#60, 46 #68-#70, 48 #22-#24, 51 #13-#18 TWE: A 27 DI 22 TT 21
Standard 4.4 (Data Analysis, Probability, and Discrete Mathematics) All students will develop an understanding of the concepts and techniques of data analysis, probability, and discrete mathematics, and will use them to model situations, solve problems, and analyze and draw appropriate inferences from data.	
A. Data Analysis	
1. Use surveys and sampling techniques to generate data and draw conclusions about large groups. <ul style="list-style-type: none"> Advantages/disadvantages of sample selection methods (e.g., convenience sampling, responses to survey, random sampling) 	SE: 682-685, 692 #38-#39, 708 #51-#52, 714 #68-#69 TWE: A 684 DI 683
2. Evaluate the use of data in real-world contexts. <ul style="list-style-type: none"> Accuracy and reasonableness of conclusions drawn Bias in conclusions drawn (e.g., influence of how data is displayed) Statistical claims based on sampling 	SE: 682-685, 692 #38-#39, 708 #51-#52, 714 #68-#69 TWE: A 684 DI 683 TTT 86
3. Design a statistical experiment, conduct the experiment, and interpret and communicate the outcome.	SE: <i>Algebra Activity 522</i> TWE: DI 672 TTT 86
4. Estimate or determine lines of best fit (or curves of best fit if appropriate) with technology, and use them to interpolate within the range of the data.	SE: 81-86 <i>Graphing Calculator Investigation 87</i> TWE: DI 82 H 81 TTT 86
5. Analyze data using technology, and use statistical terminology to describe conclusions. <ul style="list-style-type: none"> Measures of dispersion: variance, standard deviation, outliers Correlation coefficient Normal distribution (e.g., approximately 95% of the sample lies between two standard deviations on either side of the mean) 	SE: 664-670, 671-675, 690 #26-#28, 691 #29-#32 TWE: GCI 666 TNT 668
B. Probability	
1. Calculate the expected value of a probability-based game, given the probabilities and payoffs of the various outcomes, and determine whether the game is fair.	SE: <i>Algebra Activity 681</i>
2. Use concepts and formulas of area to calculate geometric probabilities.	See Glencoe's <i>Geometry</i> © 2005 pages 622-627.

CONTENT STANDARDS	PAGE REFERENCES
3. Model situations involving probability with simulations (using spinners, dice, calculators and computers) and theoretical models, and solve problems using these models.	TWE: A 663 AA 652
4. Determine probabilities in complex situations. <ul style="list-style-type: none"> • Conditional events • Complementary events • Dependent and independent events 	SE: 644-650, 651-657, 658-663 TWE: A 650 DI 654
5. Estimate probabilities and make predictions based on experimental and theoretical probabilities.	SE: 649 #66-#69
6. Understand and use the “law of large numbers” (that experimental results tend to approach theoretical probabilities after a large number of trials).	SE: <i>Study Tip</i> 682
C. Discrete Mathematics–Systematic Listing and Counting	
1. Calculate combinations with replacement (e.g., the number of possible ways of tossing a coin 5 times and getting 3 heads) and without replacement (e.g., number of possible delegations of 3 out of 23 students).	SE: 640, 641 #16-#21, 650 #72 TWE: A 643
2. Apply the multiplication rule of counting in complex situations, recognize the difference between situations with replacement and without replacement, and recognize the difference between ordered and unordered counting situations.	SE: 632-637, 643 #44-#45, 650 #73-#74 TWE: DI 634 H 632
3. Justify solutions to counting problems.	SE: 632-637, 643 #44-#45, 650 #73-#74 TWE: DI 634 H 632
4. Recognize and explain relationships involving combinations and Pascal’s Triangle, and apply those methods to situations involving probability.	SE: 676-680 TWE: A 680
D. Discrete Mathematics–Vertex-Edge Graphs and Algorithms	
1. Use vertex-edge graphs and algorithmic thinking to represent and solve practical problems. <ul style="list-style-type: none"> • Circuits that include every edge in a graph • Circuits that include every vertex in a graph • Scheduling problems (e.g., when project meetings should be scheduled to avoid conflicts) using graph coloring • Applications to science (e.g., who-eats-whom graphs, genetic trees, molecular structures) 	SE: 632 ex 1, 636 #32-#33

CONTENT STANDARDS	PAGE REFERENCES
2. Explore strategies for making fair decisions. <ul style="list-style-type: none"> • Combining individual preferences into a group decision (e.g., determining winner of an election or selection process) • Determining how many Student Council representatives each class (9th, 10th, 11th, and 12th grade) gets when the classes have unequal sizes (apportionment) 	SE: 636 #33
Standard 4.5 (Mathematical Processes) All students will use mathematical processes of problem solving, communication, connections, reasoning, representations, and technology to solve problems and communicate mathematical ideas.	
Cumulative Progress Indicators	
At each grade level, with respect to content appropriate for that grade level, students will:	
A. Problem Solving	
1. Learn mathematics through problem solving, inquiry, and discovery.	SE: 89 ex 1, 94 #48, 98 #35-#37, 105 #30-#32, 120 #12, 121 #45-#49, 125 #10-#11, 131 ex 3, 140 ex 4, 206 #33
2. Solve problems that arise in mathematics and in other contexts (cf. workplace readiness standard 8.3). <ul style="list-style-type: none"> • Open-ended problems • Non-routine problems • Problems with multiple solutions • Problems that can be solved in several ways 	SE: 89 ex 1, 94 #48, 98 #35-#37, 105 #30-#32, 120 #12, 121 #45-#49, 125 #10-#11, 131 ex 3, 140 ex 4, 206 #33
3. Select and apply a variety of appropriate problem-solving strategies (e.g., try a simpler problem or make a diagram) to solve problems.	SE: 14 ex 4
4. Pose problems of various types and levels of difficulty.	TWE: A 27
5. Monitor their progress and reflect on the process of their problem-solving activity.	SE: 24 #3 TWE: A 27
B. Communication	
1. Use communication to organize and clarify their mathematical thinking. <ul style="list-style-type: none"> • Reading and writing • Discussion, listening, and questioning 	SE: 65 #1, 98 #2, 112 #3 TWE: A 39, 46, 62, 80, 86, 98, 122
2. Communicate their mathematical thinking coherently and clearly to peers, teachers, and others, both orally and in writing.	SE: 65 #1, 98 #2, 112 #3 TWE: A 39, 46, 62, 80, 86, 98, 122
3. Analyze and evaluate the mathematical thinking and strategies of others.	SE: 43 #3, 60 #3, 71 #3, 142 #2, 185 #2, 199 #3, 205 #3, 226 #3, 236 #3, 303 #3
4. Use the language of mathematics to express mathematical ideas precisely.	SE: 65 #1, 98 #2, 112 #3 TWE: A 39, 46, 62, 80, 86, 98, 122
C. Connections	
1. Recognize recurring themes across mathematical domains (e.g., patterns in number, algebra, and geometry).	SE: 352 #53-#55

CONTENT STANDARDS	PAGE REFERENCES
2. Use connections among mathematical ideas to explain concepts (e.g., two linear equations have a unique solution because the lines they represent intersect at a single point).	SE: 110-115, 122 #67-#70, 123-127, 129-135 <i>Graphing Calculator Investigation</i> 128
3. Recognize that mathematics is used in a variety of contexts outside of mathematics.	SE: 62 #54, 66 #25-#26, 227 #57, 235 #55-#57, 489 #40-#42, 563 #13-#14, 656 #46, 724 #68, 757 #24, 779 #13
4. Apply mathematics in practical situations and in other disciplines.	SE: 62 #54, 66 #25-#26, 227 #57, 235 #55-#57, 489 #40-#42, 563 #13-#14, 656 #46, 724 #68, 757 #24, 779 #13
5. Trace the development of mathematical concepts over time and across cultures (cf. world languages and social studies standards).	SE: 489 #40-#42 <i>More About...</i> 16, 372, 612, 661
6. Understand how mathematical ideas interconnect and build on one another to produce a coherent whole.	SE: 110-115, 122 #67-#70, 123-127, 129-135 <i>Graphing Calculator Investigation</i> 128
D. Reasoning	
1. Recognize that mathematical facts, procedures, and claims must be justified.	SE: 618-621, 626 #49-#50, 627 #21-#22, 637 #34, 643 #46-#47 TWE: A 620
2. Use reasoning to support their mathematical conclusions and problem solutions.	SE: 618-621, 626 #49-#50, 627 #21-#22, 637 #34, 643 #46-#47 TWE: A 620
3. Select and use various types of reasoning and methods of proof.	SE: 618-621, 626 #49-#50, 627 #21-#22, 637 #34, 643 #46-#47 TWE: A 620
4. Rely on reasoning, rather than answer keys, teachers, or peers, to check the correctness of their problem solutions.	SE: 43 #3, 60 #3, 71 #3, 142 #2, 185 #2, 199 #3, 205 #3, 226 #3, 236 #3, 303 #3
5. Make and investigate mathematical conjectures. <ul style="list-style-type: none"> • Counterexamples as a means of disproving conjectures • Verifying conjectures using informal reasoning or proofs. 	SE: 14 #3, 16 #59-#62, 32 #68-#71, 92 #1, 185 #4, 242 #2, 619 ex 3, 620 #8-#9, 621 #25-#30, 643 #46-#47
6. Evaluate examples of mathematical reasoning and determine whether they are valid.	SE: 43 #3, 60 #3, 71 #3, 142 #2, 185 #2, 199 #3, 205 #3, 226 #3, 236 #3, 303 #3
E. Representations	
1. Create and use representations to organize, record, and communicate mathematical ideas. <ul style="list-style-type: none"> • Concrete representations (e.g., base-ten blocks or algebra tiles) • Pictorial representations (e.g., diagrams, charts, or tables) • Symbolic representations (e.g., a formula) • Graphical representations (e.g., a line graph) 	SE: 39 #56-#58 <i>Algebra Activity</i> 12, 136-137 <i>Graphing Calculator Investigation</i> 36, 70, 91, 128 <i>Key Concept</i> 28 TWE: A 74 DI 59

CONTENT STANDARDS	PAGE REFERENCES
2. Select, apply, and translate among mathematical representations to solve problems.	SE: 39 #56-#58 <i>Algebra Activity</i> 12, 136-137 <i>Graphing Calculator Investigation</i> 36, 70, 91, 128 <i>Key Concept</i> 28 TWE: A 74 DI 59
3. Use representations to model and interpret physical, social, and mathematical phenomena.	SE: 39 #56-#58 <i>Algebra Activity</i> 12, 136-137 <i>Graphing Calculator Investigation</i> 36, 70, 91, 128 <i>Key Concept</i> 28 TWE: A 74 DI 59
F. Technology	
1. Use technology to gather, analyze, and communicate mathematical information.	SE: <i>Graphing Calculator Investigation</i> 87-88, 300, 359, 539-540, 666
2. Use computer spreadsheets, software, and graphing utilities to organize and display quantitative information.	SE: <i>Graphing Calculator Investigation</i> 87-88, 300, 359, 539-540, 666
3. Use graphing calculators and computer software to investigate properties of functions and their graphs.	SE: <i>Graphing Calculator Investigation</i> 70, 91, 355-356, 491, 524
4. Use calculators as problem-solving tools (e.g., to explore patterns, to validate solutions).	SE: <i>Graphing Calculator Investigation</i> 87-88, 128, 163, 208, 241, 396, 512, 552-553, 585
5. Use computer software to make and verify conjectures about geometric objects.	See Glencoe's <i>Geometry</i> © 2005 pages 288, 410, 695, and 708.
6. Use computer-based laboratory technology for mathematical applications in the sciences.	See Glencoe's <i>Algebra 2</i> WebQuest and Project Resources and Graphing Calculator and Spreadsheet Masters.

Codes Used for TWE Pages

A	Assess
AA	Algebra Activity
CC	Concept Check
DI	Daily Intervention
GCI	Graphing Calculator Investigation
H	How
STP	Standardized Test Practice
TT	Teaching Tip
TNT	Tips for New Teachers
TTT	Teacher to Teacher