



**NEW HAMPSHIRE**  
**Mathematics Content Standards**  
**Grades 9-10**  
**Algebra 1 © 2003**

OBJECTIVES	PAGE REFERENCES
<b>NUMBERS, NUMERATION, OPERATIONS, and NUMBER THEORY</b>	
Today's mathematics program must be rich in experiences that go far beyond the traditional emphasis on number and operation.	
<b>NUMBER SENSE AND NUMERATION</b>	
Students should be given opportunities to read, write, and use real numbers.	SE: 68-70, 72 #62, 73-75, 79-81, 84-85, 104-106, 107 #8-11, 108 #50, 114, 825 #9-16
Have students use Venn diagrams or concept maps to illustrate the relationships among natural numbers, integers, rational numbers, irrational numbers, and real numbers.	SE: 41 #47-49, 68, 70 #17, 104, 769, 771, 772, 775 # 48-51 <i>Reading Mathematics</i> 393
Given a set of real numbers, students should be able to order them from least to greatest.	SE: 68-70, 106 #5, 108 #64-69 See Glencoe's <i>Algebra 2</i> © 2003 page 270 for a discussion of complex numbers.
Students should begin to explore imaginary and complex numbers and their relationship to the set of real numbers.	See Glencoe's <i>Algebra 2</i> © 2003 pages 270-273.
<b>CONCEPTS OF NUMBER OPERATIONS</b>	
Students should model the addition and subtraction of polynomials using a concrete manipulative such as Algebra Tiles or Algeblocks, and connect this to the addition and subtraction of whole numbers, fractions, and decimals.	SE: 73-75, 111, 439-440, 467, 672-674, 678-680, 798-799 <i>Algebra Activity</i> 431, 437-438
Have students connect the multiplication of polynomials to multiplication of whole numbers and fractions using Algebra Tiles or Algeblocks and the area model.	SE: 79-81, 111, 136, 452-454, 468, 800-801 <i>Algebra Activity</i> 444-445, 450-451
Students should have opportunities to apply the field properties in appropriate situations.	SE: 26-29, 32-34, 59-60, 150-151, 170 #61-66, 196 #66-71, 386 #51-54, 464 #1
Have students explore the four basic operations from a functional perspective: $3 + 5 = 8$ is $f(3,5) = 8$ .	SE: 227-228, 230 #45-48, 231 #54-55, 238 #61-63, 249 #40-45, 251 #30, 266 #5
<b>COMPUTATION</b>	
Students should have opportunities to evaluate algebraic expressions for real number values of the variables.	SE: 12-13, 14 #32-39, 20 #9, 31 #66-69, 36 #62-66, 70 #14-16, 71 #45-56, 78 #67-69, 83 #58, 86 #13-15

OBJECTIVES	PAGE REFERENCES
Have students simplify expressions with grouping symbols using the standard algebraic order of operations by hand and by use of a calculator.	SE: 11-12, 14 #32-39, 29 #4-6, 31 #56, 33 #3, 35 #36-43, 36 #52-56, 42 #57-59, 87 #71-73 TWE: UM 13
Have students apply the properties of a field when simplifying expressions.	SE: 21-23, 26-29, 30 #15-28, 31 #56, 32-34, 35 #44-47, 36 #52-57, 59-60, 196 #66-71, 454 #4
Provide students opportunities to simplify expressions involving scientific notation.	SE: 427 #4-5, 428 #12-15, 429 #44-55, 430 #64-67, 436 #61-64, 465, 469 #16-18
Students should perform simple calculations with imaginary and complex numbers.	See Glencoe's <i>Algebra 2</i> © 2003 pages 270-273.
<b>ESTIMATION AND MENTAL CALCULATION</b>	
Provide opportunities for students to use estimation and mental calculation to determine the reasonableness of answers.	SE: 17 #4, 54 #13 <i>Algebra Activity 49</i> TWE: DI 90 TNT 106
Have students select and use appropriate mental calculation and estimation strategies to simplify expressions with real numbers when it is appropriate to do so.	SE: 17 #4, 54 #13, 147 #56, 535 #5 <i>Study Tip 50</i> TWE: TNT 106
Continue to encourage estimations of quantities involving length, area, dry volume, temperature, fluid capacity, and weight in metric and customary English units.	SE: 147 #51, 169 #41, 175 #24, 613 #11-12, 620 #31
<b>GEOMETRY, MEASUREMENT and TRIGONOMETRY</b> Geometry helps students describe the world in which they live and serves as a natural link to the integration of mathematics across the curriculum. Students need to investigate, experiment, and explore geometric properties using both technology and hands-on materials. Geometry lends itself to having students work in groups; we encourage you to use group work extensively (Davidson, 1990).	
<b>GEOMETRY AND SPATIAL SENSE</b>	
Have students represent and solve real-world problems with two- and three-dimensional geometric models.	SE: 195 #40-43, 206 #2, 220 #3, 261 #57, 274 #5, 300-301, 435 #55-56, 614 #40-42, 620 #31-32, 629 #61-62
Using technology, manipulatives, and/or coordinate geometry, have students explore, deduce, and explain the properties of geometric figures. For example, have students explore the relationships among the diagonals in the family of quadrilaterals or the concurrence of the medians, perpendicular bisectors, altitudes, and angle bisectors in a triangle.	SE: 294 #2-3, 296 #45, 484 #40-41, 539-541, 613 #33 <i>Algebra Activity 293, 416, 622</i> TWE: DI 607
Provide activities for students to deepen their understanding of congruence and similarity.	SE: 616-618, 619 #26, 620 #31-32, 621 #55, 629 #61-62, 630 #63-64 <i>Algebra Activity 622, 626</i>
Have students further explore the basic transformations and extend the work to include dilations and glide reflections; explore the compositions of these transformations.	SE: 197-200, 201 #11-16, 202 #27-29, 203 #44-46, 211 #57-59, 247, 415 #71-73
Students should further apply the Pythagorean relationship to the solution of problems.	SE: 605-607, 608 #13-18, 609 #46-47, 611-612, 613 #4-7, 614 #37, 615 #47-50, 634-635

OBJECTIVES	PAGE REFERENCES
Have students explore short deductive sequences and write simple proofs.	SE: 37-39, 40 #10-12, 41 #30-35, 623-626, <i>Reading Mathematics</i> 239 TWE: OEA 42
<b>MEASUREMENT</b>	
Students should use appropriate measurements to solve problems.	SE: 8 #2, 9 #47, 15 #46, 124 #23-26, 268 #43-44, 330 #45, 513 #55-56, 813-817
Students should convert commonly used measurements to equivalent ones within a measurement system and find and use appropriate conversion rules between systems when needed.	SE: 167 #4, 513 #55-56, 656 #3, 657 #10, 661 #5, 662 #3, 663 #38-39
Students should use dimensional analysis in the solution of real-life problems. Dimensional analysis is a powerful technique which is also used in the science classroom.	SE: 167 #4, 169 #37, 266 #5, 274 #5, 656 #3, 657 #10, 658 #35, 661 #5, 663 #40-41
Students should apply the Pythagorean theorem to solve measurement problems.	SE: 605-607, 608 #6-9, 609 #45, 610 #50, 611-612, 613 #11-12, 614 #41, 634
Have students select appropriate procedures to determine a measure when a direct measurement cannot be made.	SE: 609 #46-47, 611-613, 614 #37, 615 #57-62, 618, 623-625, 629 #61-62, 630 #63-64 <i>Algebra Activity</i> 626
Have students use ratio and proportion to find the measures of all sides of similar figures; apply this technique to problem solving situations.	SE: 159 #33, 182, 616-618, 619 #26, 620 #31, 625 #4, 627 #4-5, 628 #15-17, 635
<b>TRIGONOMETRY</b>	
Explore the basic trigonometric ratios of sine, cosine, and tangent with students.	SE: 623-625, 627 #4-5, 628 #19-24, 636 <i>Algebra Activity</i> 622, 626
Students should use the basic trigonometric ratios to solve real-world problems.	SE: 625, 628 #18, 629 #61-62, 630 #63-64 <i>Algebra Activity</i> 626
Have students use technology to investigate periodic phenomenon and relate to sine and cosine functions.	See Glencoe's <i>Algebra 2</i> © 2003 pages 739-742.
<b>DATA ANALYSIS, STATISTICS, AND PROBABILITY</b> Collecting, organizing, displaying, and interpreting data, as well as using that information to make predictions and decisions, are extremely important in today's society. However, before collecting data, students need to clearly define the problem and decide what information they will collect in order to solve the problem. Data collection and analysis lend themselves to small group work. Statistical instruction should be investigative and explorative in nature, so that students can answer questions about data. Probability should also be active and engaging, with students experimenting and modeling situations. Students need to investigate fairness, chances of winning, and uncertainty. Technology is an integral tool when students work with data and chance.	
Have students construct and draw inferences from charts, tables, and graphs that summarize data from real-world situations.	SE: 43-45, 50-52, 53 #6-9, 55 #17, 62, 218-220, 223 #75-78, 806-809 <i>Algebra Activity</i> 49 <i>Graphing Calculator Investigation</i> 224-225
Students should use tables, box-and-whisker plots, and stem-and-leaf graphs to analyze data.	SE: 50-52, 62, 88-91, 134 #74-75, 737-739, 741 #38, 758 #27-30 <i>Spreadsheet Investigation</i> 56

OBJECTIVES	PAGE REFERENCES
Have students collect ordered pairs of data, and make a scatter plot.	SE: 298-301, 303 #18-23, 304 #29-33, 305 #41-42, 312 <i>Graphing Calculator Investigation</i> 306-307, 729-730
Have students use different linear regression techniques such as the median-median line and other curve fitting techniques to predict trends from data. Have students make use of the several technologies that are available to help do this.	SE: 300-301, 302 #10-13, 312 <i>Graphing Calculator Investigation</i> 306-307, 729-730
Students should understand, find (using technology), and apply measures of central tendency, variability, and correlation.	SE: 90-91, 731-733, 734 #11-14, 735 #29-33, 736 #34, 737-739, 740 #20-23, 741 #30-31, 747-748, 818-819
Explore sampling techniques and have students recognize its role in statistical claims.	SE: 708-709, 710 #6, 711 #12, 712 #20, 713 #31, 745 <i>Reading Mathematics</i> 714
Provide opportunities for students to design statistical experiments to study problems, conduct experiments, and interpret and communicate the outcomes.	SE: 50-52, 88-91, 92 #26-27, 93 #32-34, 300-301, 708-710 <i>Algebra Activity</i> 299 <i>Reading Mathematics</i> 95, 714 <i>Spreadsheet Investigation</i> 56
Have students explore counting principles and tree diagrams as they apply to a sample space.	SE: 754-756, 757 #23, 758 #26, 760-762, 764 #11, 765 #37, 766 #50, 767 #58, 789, 793 #4-5
Provide class time to discuss equally likely outcomes and outcomes that are not equally likely and their relationship to probability.	SE: 96-97, 98 #1, 126 #60-62, 754-756, 760-764 <i>Algebra Activity</i> 102, 783
Have students conduct experiments and simulations to assign probabilities to events which are not equally likely.	SE: 96-97, 98 #4-6, 99 #36-41, 765 #44, 784 #3-4, 785 #9-12 <i>Algebra Activity</i> 102, 783
Have students explore real-world probability situations, such as lotteries and medical testing.	SE: 100 #57-58, 774 #36-37, 776 #52, 778 #2, 779 #14-17, 780 #18-20, 784 #4 <i>Algebra Activity</i> 102 TWE: ICE 770, 772
Have students interpret real-world probabilities and odds, and their relationship.	SE: 100 #57-58, 774 #36-37, 776 #52, 778 #2, 779 #14-17, 780 #18-20, 784 #4 <i>Algebra Activity</i> 102 TWE: ICE 770, 772
Students should use spreadsheets and statistical graphing software to explore how the same data may be represented through many different kinds of graphs or charts. Discuss how the choice of graph affects the interpretation of the data.	SE: 50-52, 53 #6-9, 54 #10-11, 55 #17, 62, 298-301, 806-809 <i>Algebra Activity</i> 49 <i>Graphing Calculator Investigation</i> 306-307 <i>Spreadsheet Investigation</i> 56, 368

OBJECTIVES	PAGE REFERENCES
<p><b>FUNCTIONS, RELATIONS, and ALGEBRA</b>            One of the central themes of mathematics is the study of patterns, relations, and functions. This study requires students to recognize, describe, and generalize patterns and build mathematical models to predict the behavior of real-world phenomenon that exhibit the observed pattern. This study of patterns leads to an exploration of functions, a concept which is an important unifying idea in all aspects of mathematics. Functional relationships are of primary importance in many other disciplines such as the natural sciences, business [compound interest], the social sciences, and psychology [learning curves].</p>	
<p><b>FUNCTIONS AND RELATIONS</b></p>	
<p>Students should represent and analyze relationships using tables, charts, verbal rules, graphs, and equations.</p>	<p>SE: 43-45, 50-52, 53 #6-9, 205-207, 218-220, 223 #75-78, 806-809  <i>Algebra Activity 49</i>  <i>Graphing Calculator Investigation 204</i></p>
<p>Have students show how the change in one variable affects the value of the other variable in a relationship.</p>	<p>SE: 43-45, 47 #17-19, 48 #24, 218-221, 226-228, 256-259, 264-267, 642-644  <i>Graphing Calculator Investigation 224-225</i></p>
<p>Provide opportunities for students to identify relationships that are functions and explain why a relationship is or is not a function.</p>	<p>SE: 43-45, 48 #24, 212-214, 219-220, 226-228, 436 #69-70  <i>Algebra Activity 49</i>  <i>Graphing Calculator Investigation 204, 224-225</i></p>
<p>Have students regularly translate among tables, equations, verbal rules, and graphs.</p>	<p>SE: 43-45, 50-52, 53 #6-9, 205-207, 218-220, 223 #75-78, 806-809  <i>Algebra Activity 49</i>  <i>Graphing Calculator Investigation 204</i></p>
<p>Students should recognize when a table, equation, rule, or graph represents the same data and describes the same relationship.</p>	<p>SE: 45, 50, 53 #6-9, 205-207, 208 #14-17, 213 #3, 218-220, 806-809  <i>Algebra Activity 49</i>  <i>Spreadsheet Investigation 56</i></p>
<p>Students should use functions and relations to predict the outcome of an unobserved value of a variable in a function; apply to statistical prediction.</p>	<p>SE: 52 #3, 233-235, 237 #50-53, 283, 440 #3, 563 #5  <i>Algebra Activity 299</i>  <i>Graphing Calculator Investigation 306-307</i>  <i>Spreadsheet Investigation 232</i>            TWE: ICE 282</p>
<p><b>ALGEBRA</b></p>	
<p>Students should solve linear equations and inequalities in one unknown.</p>	<p>SE: 121 #2, 128-131, 132 #51-53, 133 #56-57, 135-137, 142-144, 318-320, 325-328  <i>Algebra Activity 127, 141, 324</i></p>
<p>Have students graph linear equations and inequalities in two unknowns.</p>	<p>SE: 213 #3, 214 #10-11, 218-220, 222 #54, 248, 264-267, 272-274  <i>Algebra Activity 271</i>  <i>Graphing Calculator Investigation 224-225</i></p>
<p>Have students model division and factoring of polynomials using Algebra Tiles and Algeblocks.</p>	<p>SE: 495, 500 #53  <i>Algebra Activity 480, 487-488, 667</i></p>
<p>Provide students opportunities to discuss the results of doing addition and subtraction of polynomials and connect the “adding of like terms” to the distributive property.</p>	<p>SE: 439-440, 441 #12-25, 442 #32-33, 443 #46  <i>Algebra Activity 437-438</i></p>

OBJECTIVES	PAGE REFERENCES
Provide students the opportunity to discuss the use of the distributive property in the process of multiplying two polynomials.	SE: 452-454, 455 #2, 457 #57, 458-460 <i>Algebra Activity</i> 450-451
Have students explore the sum, difference, product and quotient of two polynomials under various constraints, such as adding or multiplying two polynomials of degree one; students should formulate conjectures about the answers and defend their conjectures.	SE: 439-440, 452-454, 458-461, 468, 672-674, 678-680, 686 #4 <i>Algebra Activity</i> 437-438, 450-451, 667
Students should have opportunities to perform the four basic operations on polynomials.	SE: 439-440, 444-445, 452-454, 458-460, 467, 666-668, 698 <i>Algebra Activity</i> 437-438, 450-451
Have students discuss and write about the connections between concrete representations with manipulatives (Algebra Tiles or Algeblocks) and the abstract, symbol-manipulating techniques of more traditional algebraic methods.	SE: 376-378, 489-492, 495, 539-541, 666-668 <i>Algebra Activity</i> 28, 127, 141, 437-438, 480, 487-488
Provide opportunities for students to solve systems of linear equations in two and three unknowns and linear inequalities in two unknowns.	SE: 369-371, 389-390, 391 #27-38, 394-396, 398 #36-38, 400-402, 630 #77-79 <i>Graphing Calculator Investigation</i> 375 <i>Spreadsheet Investigation</i> 368
Students should represent situations that involve variable quantities using expressions, equations, inequalities, and matrices.	SE: 28-29, 42 #70-72, 148 #81-83, 149-151, 166-168, 240-243, 318-320, 339-341, 345-346, 715-717
Have students develop, construct, and evaluate formulas to solve a variety of real-world and mathematical problems.	SE: 122 #3, 123 #6-7, 124 #23-28, 167 #3, 183-184, 234-235, 561-563, 567-570 <i>Reading Mathematics</i> 566 <i>Spreadsheet Investigation</i> 178
Provide opportunities for students to develop an understanding of the value, importance, and power of abstraction and symbolism.	SE: 6-7, 37-39, 50-52, 68, 334 #5 <i>Reading Mathematics</i> 10, 507 <i>Study Tip</i> 348, 588
Have students explore non-linear functions that arise from problem situations (quadratic, step, and exponential, for example).	SE: 524-527, 533-535, 539-541, 546-549, 554-557, 561-563, 567-570 <i>Graphing Calculator Investigation</i> 531-532, 545, 553, 604
Provide opportunities for students to solve linear, quadratic, polynomial, exponential, and other equations using graphing calculators to explore the relationships between the solution of the equations and the zeros of the function.	SE: 148 #59-64, 535 #5, 547 #2, 556 #3 <i>Graphing Calculator Investigation</i> 224-225, 333, 418, 553, 600, 604

OBJECTIVES	PAGE REFERENCES
<p><b>MATHEMATICS OF CHANGE</b>  All natural phenomena are characterized by change, and mathematics is one of the primary tools used for representing and describing change. Understanding rates of change is a preliminary precursor to the more formal ideas of calculus. Through investigations and explorations of patterns, tables, graphs, and functions which focus on the nature of change, the representation, understanding, and recognition of types of change can be promoted. Real-world examples of change such as unit pricing, rates of speed, and averages should be explored. Fractions, decimals, percents, proportional reasoning, and slopes of lines are integral to this process.</p>	
Provide opportunities for students to use proportional reasoning and/or dimensional analysis to solve algebraic problems about rates of change.	SE: 157 #4, 167 #4, 258-259, 260 #13, 261 #40, 266 #5, 274 #5, 290 #58-60 <i>Algebra Activity</i> 271, 573 <i>Reading Mathematics</i> 566
Have students explore number and geometric patterns and predict the tenth, hundredth, and nth terms in the pattern using words and symbols.	SE: 233-235, 240-243, 245 #35, 249-250, 567-570, 571 #35-42, 578 <i>Graphing Calculator Investigation</i> 418 <i>Reading Mathematics</i> 239 <i>Spreadsheet Investigation</i> 232
Students need opportunities to discuss rates of change of functions in graphs, such as the slope of a line or the curvature of a parabola.	SE: 256-259, 260 #13, 261 #53-55, 266-267, 272-274, 290 #58-60, 533-535 <i>Algebra Activity</i> 271, 573 <i>Reading Mathematics</i> 566
Have students recognize and describe different types of change: e.g., arithmetic, geometric, periodic, oscillating, etc.	SE: 157 #4, 167 #4, 258-259, 261 #57, 266-267, 274 #5, 290 #58-60, 533-535, 554-557 <i>Algebra Activity</i> 271, 573 <i>Reading Mathematics</i> 566
Provide opportunities for students to describe change from both continuous and discrete contexts.	SE: 157 #4, 167 #4, 258-259, 261 #57, 266-267, 274 #5, 290 #58-60, 533-535, 554-557 <i>Algebra Activity</i> 271, 573 <i>Reading Mathematics</i> 566
Have students analyze and interpret information about change in familiar contexts: e.g., percent of change, average change, or distance per unit of time.	SE: 157 #4, 167 #4, 258-259, 261 #57, 266-267, 274 #5, 290 #58-60, 533-535, 554-557 <i>Algebra Activity</i> 271, 573 <i>Reading Mathematics</i> 566
Relate ratios and rate of change to concepts from other disciplines: e.g., science (density), social studies (population growth), language arts (sentence complexity or reading level).	SE: 157 #5, 167 #4, 258-259, 261 #53-55, 266 #5, 269 #52-53, 290 #58-60, 556-557 <i>Algebra Activity</i> 271, 573
<p><b>DISCRETE MATHEMATICS</b>  Discrete mathematics is defined as the study of topics which involve items that can be counted rather than continuous quantities which can only be measured. Discrete mathematics is actually an umbrella term which can include such topics as counting techniques, sets, relations, functions, logic, reasoning, and algorithms. Information and communication continue to impact the modern world and require the understanding of topics in discrete mathematics. Decision-making, involving sets and systems having a countable number of elements, needs to be integrated throughout the curriculum. Students should have experience with finite graphs, matrices, sequences, recursion, and the development and testing of algorithms.</p>	
Have students represent data and solve problems using graphs, trees, and matrices.	SE: 43-45, 715-717, 722-724, 754-756, 806-807 <i>Graphing Calculator Investigation</i> 306-307, 333, 418, 531-532, 654

OBJECTIVES	PAGE REFERENCES
Provide opportunities for students to use algebraic and geometric iteration to explore patterns and solve problems.	SE: 233-235, 240-243, 245 #35, 249-250, 567-570, 571 #35-42, 578 <i>Graphing Calculator Investigation</i> 418 <i>Reading Mathematics</i> 239 <i>Spreadsheet Investigation</i> 232
Students should use combinations and permutations to solve complex counting problems.	SE: 760-763, 764 #13, 765 #34-35, 766 #56, 767 #58 <i>Reading Mathematics</i> 768
Have students create their own algorithms to solve optimization problems.	SE: 11, 74-75, 121-122, 142-144, 151, 453-454, 456 #52, 468, 546-549, 605-607
Encourage students to create and interpret discrete probability distributions using technology whenever appropriate.	SE: 777-778, 779 #1-3, 780 #25, 781 #1-3, 786 #22, 787 #36-38, 791
Have students explore the use of linear programming to solve problems.	SE: 787 #36-38 <i>Graphing Calculator Investigation</i> 224-225, 358, 600, 654 TWE: ICE 557
Continue to explore elementary logic notions relating to “and,” “or,” and “not” statements and relate them to Venn diagrams.	SE: 68, 104, 769, 771, 772 <i>Reading Mathematics</i> 393
Students should explore the relation among an if-then statement and its converse, inverse, and contrapositive statement.	SE: 37-39, 40 #18-23, 41 #36-43
Provide opportunities for students to write simple computer programs to solve problems.	SE: 787 #36-38

### Codes Used for TWE Pages

DI	Differentiated Instruction
ICE	In-Class Example
OEA	Open-Ended Assessment
TNT	Tips for New Teachers
UM	Unlocking Misconceptions