



SOUTH DAKOTA
Mathematics Standards Grades 9-12
Advanced Mathematical Concepts
***Precalculus with Applications* © 2004**

STANDARDS	PAGE REFERENCES
GRADES 9-12 ALGEBRA STANDARDS	
1. select, justify, and apply a technique to solve quadratic equations over the set of complex numbers and interpret the results graphically.	SE: 208, 210 #11-#13, 214 ex 2, 218 ex 5, 219 #8, 220 #32, 221 #39, 235 #30, 250 #49, 268 #21
2. analyze the relationships among the coefficients, factors, and roots of polynomials.	SE: 222-228, 229-235, 236-242 TWE: AIN 226 EC 228, 242 MTL 229 OEA 228, 235 TT 231
3. apply commutative, associative, distributive, identity, and inverse properties when combining functions.	SE: 13-19, 152-158 <i>Graphing Calculator Exploration 86</i>
4. use matrices to organize and manipulate data, including matrix addition, subtraction, and scalar multiplication.	SE: 78-86, 88-96, 98-105, 120 #20-#27, 179 #46, 250 #54 TWE: OEA 86, 105
5. analyze various expressions which emphasize the distributive property, e.g., $3(x + 2)$; $(x^3 - 4x^2 + 3x + 1)(x^2 - 2x + 3)$.	SE: 101 ex 5, 581 ex 3, 583 #23-#24, 591 #51, 604 #1, 609 #39-#40, 824 ex 3 <i>Chapter 9 Test A 64 #23-#24</i>
6. explain the logic of algebraic procedures.	SE: 76 #2, 101 ex 5, 102 #4, 115 #1, 191 ex 3, 209 ex 5, 214 ex 2, 219 #4 <i>Graphing Calculator Exploration 86</i> TWE: OEA 77
7. extend the concepts of algebra to other types of functions, e.g., trigonometric, exponential, and logarithmic.	SE: 704-711, 718-725, 740-748 TWE: AIN 721 EC 711, 725 GCE 704 MTL 719 OEA 711, 725
8. apply recursive formulas to express iterative patterns of change including those of exponential growth and decay, e.g., mortgages, investment returns.	SE: 706 ex 2, 707 ex 3-ex 4, 708 #8-#9, 709 #24-#27, 714 #6, 715 #12, 716 #17 TWE: AIN 707 EC 711 OEA 711
9. determine roots of polynomial functions including complex roots.	SE: 208, 210 #11-#13, 214 ex 2, 218 ex 5, 219 #8, 220 #32, 221 #39, 235 #30, 250 #49, 268 #21

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10. determine equations for lines meeting certain conditions.	SE: 27-31, 32-37, 44 #19, 51 #32, 59 #39-#52 <i>Chapter 1 Test A56 #14-#17</i> <i>Extra Practice Lesson 1-4 A27</i> <i>Extra Practice Lesson 1-5 A27</i> TWE: EC 37 OEA 37
11. use inductive reasoning to test and prove that a formula is correct.	SE: 822-828 TWE: EC 828
12. explore and develop procedures to identify the real roots of polynomial functions.	SE: 206 ex 2, 209 #7-#8, 222-228, 229-235, 236-242 TWE: AIN 232 EC 228, 235 MTL 222 OEA 235
13. determine the solution of systems of equations in multiple ways.	SE: 67-72, 73-77, 86 #55, 96 #36, 104 #55 TWE: AIN 75 EC 72, 76 OEA 72, 77
14. solve problems using the quadratic formula including graphic representation and analysis.	SE: 213-221, 235 #30, 242 #40, 268 #16-#21, 271 #57, 298 #53, 674 ex 5 <i>Chapter 3 Test A59 #2-#4</i> TWE: EC 220 OEA 221
15. analyze the binomial theorem.	SE: 801-805, 814 #43, 821 #37, 832 #35-#40, 851 #40, 875-880, 884 #44-#47 TWE: AIN 803 EC 805 OEA 805
16. solve linear-quadratic and quadratic-quadratic systems of equations algebraically and graphically.	SE: 678-684, 690 #55-#58, 737 #64 TWE: EC 684 MTL 679 OEA 684 TT 679
17. derive procedures for determining critical features of circles, ellipses, hyperbolas, or parabolas given equations in standard form.	SE: 623-630, 631-640, 642-652, 653-661 TWE: AIN 626, 632 EC 651 OEA 630, 641, 661
18. use matrices to investigate networks and graphs.	SE: 85 #54
19. create algebraic models to represent problem situations.	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, 213 ex 3, 220 #37
20. compare quadratic growth with linear and exponential growth.	SE: 213-221, 704-711
21. explain the graphical impact of the xy term in a quadratic equation.	SE: 662
22. graph and interpret complex numbers in vector and polar form.	SE: 580-585, 586-591, 593-598, 610 #43-#50 TWE: EC 591 OEA 591, 598

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23. build formulas representing patterns that are algebraic, trigonometric, logarithmic and exponential.	SE: 759-765, 766-773, 794-800, 806-814, 815-821 TWE: EC 799, 821 MTL 794 OEA 773, 800
24. find sums, differences, scalar products, dot products, and norms of vectors noting properties which apply.	SE: 493-499, 500-504, 505-511, 519 #33, 525 #41, 544 #19-#32 TWE: AIN 495, 507 EC 498 OEA 511
25. determine, interpret, and use a unit directional vector, perpendicular components, and norms to express vectors in the coordinate plane.	SE: 495-496, 497 #11-#12, 502 ex 5, 503 #29-#34, 505-511, 519 #33, 525 #41, 545 #33-#41, 851 #44 TWE: AIN 507
GRADES 9-12 GEOMETRY STANDARDS	
1. know, use, derive formulas for, and solve problems involving perimeter, circumference, area, volume, lateral area, and surface area of common geometric figures.	SE: 168 #46, 178 #35, 187 #42, 192-193 ex 5, 226 #13, 229, 318 #42, 358 #51, 510 #38, 612, 701 #68
2. prove the properties of geometric figures using algebraic and deductive proofs.	SE: 429 #58, 436 #45, 764 #54
3. justify conjectures pertaining to geometric figures.	SE: 36 #11, 110 #23, 144 #41, 429 #58, 436 #45, 764 #54, 947 #39
4. use given information to deduce properties of and relationship between figures.	SE: 35 ex 5, 71 #33, 110 #23, 135 #39, 144 #41
5. explore and analyze the properties of triangles.	SE: 71 #33, 104 #50, 123 #53, 144 #41, 310 #34-#35, 468 #32, 492 #49
6. investigate and identify congruence and similarity relationships among triangles.	SE: 144 #41
7. determine the values of the six trigonometric functions of angles in standard position.	SE: 284-290, 291-298, 305-312 TWE: AIN 286, 295 EC 290, 298 OEA 290, 298, 312
8. investigate and use properties of angles, arcs, chords, tangents, and secants to solve problems.	SE: 345, 348 #11-#12, 349 #40-#42, 444 #56, 612, 628 #39, 951-952
9. identify, create, and solve practical problems involving triangles and vectors.	SE: 487 ex 3, 490 #13, 491 #40, 492 #41, 495 ex 3, 497 #13, 498 #45, 503 #11, 504 #41-#42, 508 ex 4
10. build three-dimensional figures from two-dimensional shapes or drawings.	This objective is covered in Glencoe's <i>Geometry</i> © 2004 on pages 639, 640, 645, 646, 647, and 648.
11. draw two-dimensional drawings of three-dimensional objects from various perspectives.	This objective is covered in Glencoe's <i>Geometry</i> © 2004 on pages 636-637, 639, 640, 643, 644, 645, 646, and 647.
12. build three-dimensional objects to scale.	SE: 95 #33, 234 #26
13. use matrices to translate, reflect, rotate, or scale polygonal figures represented on the coordinate plane.	SE: 145 #46, 541 #23
14. use graphing tools to study transformations, e.g., congruence using rigid motion, similarity using magnification of images.	SE: 88-96, 535-542, 670-677

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15. select transformations required to map images of objects.	SE: 95 #34
16. use proportional reasoning to solve practical problems.	SE: 191-193, 692-693
17. identify, create, and solve practical problems using a system of vectors and their horizontal and vertical components.	SE: 487 ex 3, 490 #13, 491 #40, 492 #41, 495 ex 3, 497 #13, 498 #45, 503 #11, 504 #41-#42, 508 ex 4
18. represent situations using the properties of coordinate geometry to answer pertinent questions.	SE: 135 #40, 272-273, 617 ex 3, 618 ex 5, 619 #4, 620 #8-#9, 621 #33, 948 #57
GRADES 9-12 MEASUREMENT STANDARDS	
1. investigate and explain the relationships between linear, square, and cubic measures and describe how changes in one of the measures of an object affect the others.	This objective is covered in Glencoe's <i>Geometry</i> © 2004 on pages 599, 608, 615, 698, and 708-710.
2. analyze unit combinations to check answers, e.g., feet per second.	SE: 191 ex 2c, 353 ex 3
3. use quotient measures and relate them to slope, e.g., speed, density.	SE: 23 #11, 24 #35, 28 ex 3 TWE: OEA 25
4. derive and use formulas for solving problems involving measurements.	SE: 168 #46, 178 #35, 187 #42, 192-193 ex 5, 226 #13, 229, 318 #42, 358 #51, 510 #38, 612, 701 #68
5. develop units or combinations of units for a given situation or application.	SE: 191 ex 2c, 353 ex 3
6. create tools or application processes to solve problems that defy direct measurement.	SE: 299 ex 2, 301 ex 4, 302 #9, 303 #23, 304 #29, 307 ex 4, 309 #14, 317 #31, 326 #41, 332 #34
7. use the concept of significant digits in giving answers to an appropriate degree of accuracy.	This objective is covered in Glencoe's <i>Geometry</i> © 2004 on pages 13-19.
8. create tools or application processes to improve accuracy or minimize error in measurement situations.	The standard error of the mean can be found on pages 927-928.
9. analyze specific measurement situations to determine necessary degree of accuracy and/or allowable error tolerance.	This objective is covered in Glencoe's <i>Geometry</i> © 2004 on pages 13-19.
10. identify the structural parts and characteristics of objects to answer questions about them, e.g., a penny can be seen as a cylinder with a small height so its volume is $V = \pi r^2 h$.	SE: 549 #8, 968 #40
11. solve measurement problems involving perimeter, area, volume, and mass of irregularly-shaped objects.	SE: 257 #51, 533 #29, 549 #6, 684 #50
GRADES 9-12 NUMBER SENSE STANDARDS	
1. describe the structure of the real number system and related subsets.	SE: 206
2. apply properties and axioms of the real number system to various subsets, e.g., axioms of order, closure.	SE: 13-19, 152-158 <i>Graphing Calculator Exploration 86</i> TWE: OEA 703
3. understand that real numbers can be represented in a variety of forms, e.g., integers, fractions, decimals, percents, scientific notation, exponents, radicals, absolute value, logarithms.	SE: 64 #2, 65 #8, 273 #2, 282 #62, 695-703, 732 #67

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4. describe the relationship of the real number system to the complex number system.	SE: 206, 209 #3
5. explain the meaning of the number e .	SE: 712-717, 725 #67 TWE: OEA 717
6. add, subtract, multiply, and divide algebraic expressions.	SE: 124 #1, 184 ex 4, 187 #30-#33, 203 #6, 483 #7, 549 #5
7. evaluate algebraic expressions.	SE: 11 #41-#47, 12 #56, 19 #39, 25 #43, 58 #11-#17, 203 #4, 273 #7 TWE: EC 19
8. add, subtract, multiply, and divide real numbers including roots and exponents using appropriate computational strategies, e.g., mental mathematics, paper and pencil, calculator.	SE: 12 #57, 51 #37, 56 #32, 64 ex 2, 65 #3, 125 #2, 136 #50, 695-703
9. explain the effects of arithmetic operations on real numbers, e.g., roots, exponents, and inverse relationships.	SE: 51 #37, 56 #32, 64 ex 2, 65 #8, 125 #4, 136 #50, 695-703, 711 #32, 750 #11-#14
10. analyze and describe fractional exponents, e.g., $10^{3/4}$.	SE: 695-703, 716 #18, 732 #67, 750 #19-#20, 814 #46 TWE: GCE 696
11. analyze the decimal representation of numbers, e.g., $1/3 = .33333 \dots$, $.010010001\dots$	SE: 779 ex 6, 780 #8-#9, 781 #24-#29, 831 #26 TWE: EC 783
12. add, subtract, multiply, divide, and simplify expressions containing fractional exponents.	SE: 695-703, 716 #18, 732 #67, 750 #19-#20, #12, 814 #46 TWE: GCE 696
13. use estimation strategies in complex situations to predict results and to check the reasonableness of results.	SE: 272 ex 2, 744 #6c, 745 #14c, 747 #21d, 974 #45
14. select and justify alternative strategies, e.g., use properties of numbers that allow operational shortcuts for computational procedures.	SE: 64 ex 2
15. apply properties of arithmetic and geometric sequences and series to solve problems, e.g., write the first n terms, find the n th term, evaluate summation formulas.	SE: 759-765, 766-773, 774-783, 793 #37-#38, 794-800, 815-821, 828 #30 TWE: AIN 761 EC 764, 821
16. use logic strategies to develop and defend mathematical arguments.	SE: 239 #1, 308 #3, 363 #1, 410 #11-#12, 421-422, 427 #1, 438 #1a, 589 #3, 627 #4, 848 #3
17. understand and use basic concepts of infinity and limits.	SE: 774-783, 786-793, 805 #39, 821 #38, 831 #22-#27 TWE: AIN 789 MTL 775 TT 778
18. compare, contrast, and extend arithmetic and geometric patterns of growth and use them to make predictions about events for which there is no data.	SE: 762 ex 6, 763 #16, 768 ex 3, 770 ex 6, 772 #43, 833 #54 TWE: MTL 759

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19. understand the relative size of sets of rational numbers and irrational numbers.	SE: 206
20. describe impact of powers on products and quotients.	SE: 695-703
21. apply operations to numbers expressed in scientific notation.	SE: 273 #6, 282 #62, 695 ex 1, 700 #19, 701 #68, 727 ex 2, 753 #76 TWE: AIN 698
GRADES 9-12 PATTERNS, RELATIONS, AND FUNCTIONS STANDARDS	
1. use various representations of functions, e.g., graphs, tables, symbolic forms.	SE: 5-12, 20-25, 31 #30, 32-37, 45-51
2. analyze direct and inverse relations to determine their characteristic patterns.	SE: 189-196, 200 #56-#58, 283 #72, 298 #54, 677 #56 TWE: AIN 192 EC 196 OEA 196
3. apply transformations to the graph of a basic function and predict and analyze the results.	SE: 709 #22-#23 <i>Graphing Calculator Exploration 26</i>
4. determine the domain, range, zeros, y-intercepts, end behavior, relative maximum and minimum points, and symmetry of functions.	SE: 5-6, 8 ex 8, 159-168, 171-179, 199 #44-#47, 210 #31, 229-235 TWE: EC 178 OEA 25, 168
5. demonstrate and explain the effect that changing coefficients and/or constants has on the graph of a function.	SE: 137-145, 151 #46, 168 #41, 198 #19-#22, 709 #22-#23 <i>Graphing Calculator Exploration 26</i> TWE: AIN 141 FTC 139 OEA 145
6. use a graph of a function to find the graph of the inverse function.	SE: 152-158, 168 #40, 188 #49, 196 #43, 198 #29-#34, 221 #41 TWE: AIN 154 EC 158 FTC 155 OEA 158
7. determine the restrictions that must be placed on the domain and range of a relation for it to be a function.	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
8. create tables or graphs to interpret relations and/or functions.	SE: 5-12, 20-25, 31 #30, 32-37, 45-51
9. create geometric and numerical patterns that model relations and/or functions.	SE: 759-765, 766-773, 774-783, 793 #37-#38, 794-800, 815-821, 828 #30 TWE: AIN 761 EC 764, 821
10. determine which type of function best models a situation, write an equation, and use this equation to answer questions about the situation.	SE: 38-44, 258-264, 740-748 <i>Graphing Calculator Exploration 265</i> TWE: AIN 40, 260 EC 44 FTC 39 OEA 44, 264
11. use laws of logarithms to simplify expressions and solve equations involving logarithms and exponents.	SE: 718-725, 726-732, 733-737, 748 #26, 751 #30-#51, 752 #60-#69, 773 #50 TWE: EC 725, 732 OEA 725

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12. analyze the relationship between exponential and logarithmic functions.	SE: 718-725, 726-732, 733-737, 748 #26, 751 #30-#51, 752 #60-#69, 773 #50 TWE: EC 725, 732 OEA 725
13. graph various parametric polar equations.	SE: 574-579 <i>Graphing Calculator Exploration 602</i>
14. identify natural phenomena that are cyclic.	SE: 361 ex 5, 363 #12, 365 #53, 371 ex 5, 372 ex 6, 375 #59, 376 #61, 381 ex 4, 385 #43, 429 #62
15. apply special number relationships, e.g., sequences and series to real-world problems.	SE: 762 ex 6, 763 #16, 764 #52, 768 ex 3, 771 #15, 772 #43, 773 #47, 779 ex 5, 781 #13, 799 #46
16. compare, contrast, and extend arithmetic and geometric patterns of growth and use them to make predictions.	SE: 762 ex 6, 763 #16, 768 ex 3, 770 ex 6, 772 #43, 833 #54 TWE: MTL 759
17. determine and use recursive formulas to express iterative patterns of change including those of exponential growth and decay.	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
18. use concepts of infinity and limits to solve problems.	SE: 774-783, 786-793, 805 #39, 821 #38, 831 #22-#27 TWE: AIN 789 MTL 775 TT 778
19. use successive approximation techniques to solve problems.	SE: 815 ex 1b, 961-968, 980 #39-#42 TWE: OEA 968
20. apply limits of geometric series to problem situations.	SE: 770 ex 6, 771 #15, 772 #43, 773 #47, 779 ex 5, 781 #13, 782 #42
21. use iteration and recursion to evaluate problem situations.	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
22. solve equations that include both infinite solutions and restricted domain solutions.	SE: 70 #6, 76 #6, 170 #9-#10, 244 ex 2, 247 #12-#21, 252 ex 2, 255 #12-#27 TWE: OEA 72
23. estimate the limit of a given infinite sequence.	SE: 774-783, 786-793, 805 #39, 821 #38, 831 #22-#27 TWE: AIN 789 MTL 775 TT 778
GRADES 9-12 STATISTICS & PROBABILITY STANDARDS	
1. analyze and evaluate surveys and experiments conducted by others, e.g., bias, randomness, analysis, interpretation.	SE: 927-932 <i>Graphing Calculator Exploration 877</i>
2. create, implement, and defend a plan for gathering data to answer relevant questions.	SE: 917-932 <i>Internet Project 937</i> TWE: AIN 891 MTL 889, 926 OEA 907
3. compare multiple one-variable data sets, using statistical techniques including measures of central tendency and dispersion.	SE: 111 #33, 150 #43, 897-907, 908-917, 925 #23, 934 #14-#18, 935 #19-#22, 937 #41, 939 #9

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4. calculate measures of central tendency and dispersion for complex sets of data.	SE: 111 #33, 150 #43, 897-907, 908-917, 925 #23, 934 #14-#18, 935 #19-#22, 937 #41, 939 #9
5. demonstrate how statistical analysis can quantify variability.	SE: 897-907, 908-917, 925 #22, 932 #34, 935 #19-#22 TWE: EC 916
6. describe the normal curve and use it to predict percentiles and probabilities.	SE: 918-925, 935 #23-#28 <i>Graphing Calculator Exploration</i> 926 TWE: AIN 921 EC 925 OEA 925
7. use scatterplots, regression lines, and correlation coefficients to model data and support conclusions.	SE: 38-44, 51 #31, 60 #53, 61 #69, 145 #49, 151 #51, 258-264 TWE: AIN 40, 260 EC 44
8. determine probabilities using counting procedures, tables, tree diagrams, and formulas for permutations and combinations.	SE: 837-845, 846-851, 852-858, 859-867, 868-874, 875-880, 883 #27-#34, 884 #37-#40, 886 ex 1 TWE: MTL 846
9. determine probability of compound, complementary, independent, and dependent events.	SE: 837-845, 883 #35-#36 TWE: TT 838
10. evaluate effectiveness and accuracy of the model in respect to the theoretical probability.	SE: 877, 878 #2 TWE: AIN 877 OEA 880
11. design, implement, and interpret simulations to estimate probabilities of events.	SE: <i>Graphing Calculator Exploration</i> 877 TWE: OEA 880
12. determine probability using given graphs of distributions or table of outcomes.	SE: 849 #20, 857 #42, 871 #12-#13, 873 #42
13. predict outcomes of simple and compound events using given theoretical probabilities.	SE: 837-845, 883 #35-#36 TWE: TT 838
14. determine whether experimental or theoretical methods were used to calculate a particular probability.	SE: 877, 878 #2, 886 ex 2 TWE: AIN 877 OEA 880
15. use combinations, permutations, and probabilities to solve problems.	SE: 837-845, 846-851 TWE: AIN 848 EC 845, 850 FTC 838 OEA 845, 851 TT 839

Codes Used for TWE Pages

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