correlated to the

Michigan High School Mathematics Content Expectations
McDougal Littell
Algebra 1 – Geometry – Algebra 2
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Michigan High School Mathematics Content Expectations

STRAND 1: QUANTITATIVE LITERACY AND LOGIC (L)

STANDARD L1: REASONING ABOUT NUMBERS, SYSTEMS, AND QUANTITATIVE SITUATIONS
Based on their knowledge of the properties of arithmetic, students understand and reason about numbers, number systems, and the relationships between them. They represent quantitative relationships using mathematical symbols, and interpret relationships from those representations.

L1.1 Number Systems and Number Sense

L1.1.1 Know the different properties that hold in different number systems, and recognize that the applicable properties change in the transition from the positive integers, to all integers, to the rational numbers, and to the real numbers.

Alg 1: Lesson 2.1: Use Integers and Rational Numbers, 64-73
Lesson 2.2: Add Real Numbers, 75-79
Lesson 2.3: Subtract Real Numbers, 80-85
Lesson 2.4: Multiply Real Numbers, 88-93
Lesson 2.5: Apply the Distributive Property, 96-101
Lesson 2.6: Divide Real Numbers, 103-108
Lesson 2.7: Find Square Roots and Compare Real Numbers, 110-116

Geom: Lesson 2.5: Reason Using Properties from Algebra, 105-111
Skills Review Handbook: Using the Distributive Property, 872

Alg 2: Lesson 1.1: Apply Properties of Real Numbers, 2-9
Lesson 4.6: Perform Operations with Complex Numbers, 275-282
Skills Review Handbook: Operations with Positive and Negative Numbers, 975
Tables: Properties of Real Numbers, 1033

L1.1.2 Explain why the multiplicative inverse of a number has the same sign as the number, while the additive inverse of a number has the opposite sign.

Alg 1: Lesson 2.1: Opposites, 66, 67, 68
Lesson 2.2: Additive Inverse, 75-76, 77, 78
Lesson 2.6: Multiplicative Inverse, 103-106

Geom: Lesson 2.5: Reason Using Properties from Algebra, 105-111

Alg 2: Lesson 1.1: Properties of Addition and Multiplication, 3-4
Tables: Properties of Real Numbers, 1033
L1.1.3  Explain how the properties of associativity, commutativity, and distributivity, as well as identity and inverse elements, are used in arithmetic and algebraic calculations.

Alg 1:  Lesson 2.2: Add Real Numbers, 75-79  
Lesson 2.4: Multiply Real Numbers, 89-93  
Lesson 2.5: Apply the Distributive Property, 96-101  
Lesson 2.6: Divide Real Numbers, 103-108  
Lesson 3.3: Solving Multi-Step Equations, 148-153  
Lesson 3.4: Solve Equations with Variables on Both Sides, 154-159  
Lesson 9.2: Multiply Polynomials, 562-568

Geom: Lesson 2.5: Reason Using Properties from Algebra, 105-111  
Skills Review Handbook: Using the Distributive Property, 872

L1.1.4  Describe the reasons for the different effects of multiplication by, or exponentiation of, a positive number by a number less than 0, a number between 0 and 1, and a number greater than 1.

Alg 1: Lesson 2.4: Multiply Real Numbers, 87, 88-93  
Lesson 8.3: Define and Use Zero and Negative Exponents, 503-508  
Lesson 8.3: Extension: Define and Use Fractional Exponents, 509-510  
Lesson 8.4: Use Scientific Notation, 512-519  
Skills Review Handbook: Multiplying and Dividing Fractions, 915


Alg 2:  Lesson 6.2: Apply Properties of Rational Exponents, 420-427  
Skills Review Handbook: Scientific Notation, 982

L1.1.5  Justify numerical relationships (e.g., show that the sum of even integers is even; that every integer can be written as $3m + k$, where $k$ is 0, 1, or 2, and $m$ is an integer; or that the sum of the first $n$ positive integers is $n(n+1)/2$).

Alg 1: Lesson 2.1: Use Integers and Rational Numbers, 64-65  
Lesson 2.2: Activity: Addition of Integers, 73  
Lesson 2.7: Extension: Use Logical Reasoning, 117-118

Geom:  Lesson 2.1: Use Inductive Reasoning, 72-78

Alg 2: Lesson 12.5: Use Recursive Rules with Sequences and Functions, 826, 827-833  
Lesson 12.5: Extension: Prove Statements Using Mathematical Induction, 836-837
L1.1.6 Explain the importance of the irrational numbers $\sqrt{2}$ and $\sqrt{3}$ in basic right triangle trigonometry; the importance of $\pi$ because of its role in circle relationships; and the role of $e$ in applications such as continuously compounded interest.

Alg 1:  Lesson 2.7: Find Square Roots and Compare Real Numbers, 111-116  
Lesson 11.4: Apply the Pythagorean Theorem and Its Converse, 736, 737-742  
Skills Review Handbook: Circumference and Area of a Circle, 926

Geom:  Lesson 1.7: Find Perimeter, Circumference, and Area, 49-56  
Lesson 7.1: Apply the Pythagorean Theorem, 432-439  
Lesson 7.2: Use the Converse of the Pythagorean Theorem, 441-447  
Lesson 7.4: Special Right Triangles, 457-464

Alg 2:  Lesson 7.3: Use Functions Involving $e$, 493-498  
Lesson 13.1: Use Trigonometry with Right Triangles, 852-858  
Lesson 13.2: Radian Measure, 860  
Lesson 13.3: Reference Angle Relationships, 868  
Skills Review Handbook: Circumference and Area of a Circle, 992  
Skills Review Handbook: Triangle Relationships, 995

L1.2 Representations and Relationships

L1.2.1 Use mathematical symbols (e.g., interval notation, set notation, summation notation) to represent quantitative relationships and situations.

Alg 1:  Symbols throughout, e.g., 2, 3, 9, 21, 22, 43, 64, 66, 94, 103, 110, 112, 162, 174, 213, 235, 244, 253, 262, 380, 503, 510, 512, 844, 852, 856, 875, 879; Table of Symbols, 951

Geom:  Symbols throughout, e.g., xxii, 2, 3, 8, 9, 11, 24, 25, 43, 49, 50, 72, 81, 94, 147, 171, 217, 227, 250, 272, 328, 337, 356, 372, 389, 398, 466, 473, 483, 515, 531, 572, 574, 608, 651, 659, 771; Table of Symbols, 920

Alg 2:  Symbols throughout, e.g., 2, 3, 4, 26, 41, 51, 52, 72, 75, 82, 84, 178, 187, 203, 210, 266, 275, 279, 339, 414, 428, 492, 499, 500, 684, 685, 690, 698, 715, 716, 744, 745, 796, 852, 875; Table of Symbols, 1024

L1.2.2 Interpret representations that reflect absolute value relationships (e.g. $|x - a| \leq b$, or $a \pm b$) in such contexts as error tolerance.

Alg 1:  Lesson 2.1: Absolute Value, 66-69  
Lesson 6.5: Solve Absolute Value Equations, 390-395  
Lesson 6.6: Graph Absolute Value Equations, 396-397  
Lesson 6.7: Solve Absolute Value Inequalities, 398-403

Geom:  Chapter 4 Algebra Review: Solve Inequalities and Absolute Value Equations, 287  
Skills Review Handbook: Simplifying and Evaluating Expressions, 870

Alg 2:  Lesson 1.7: Absolute Value Equations and Inequalities, 50, 51-58  
Lesson 2.7: Use Absolute Value Functions and Transformations, 121-129  
Lesson 2.8: Graph Linear Inequalities in Two Variables, 135, 136  
Lesson 3.3: Graph Systems of Linear Inequalities, 169-173  
Lesson 4.6: Perform Operations with Complex Numbers, 279, 280

L1.2.3 Use vectors to represent quantities that have magnitude and direction; interpret direction and magnitude of a vector numerically, and calculate the sum and difference of two vectors.

Geom:  Lesson 9.1: Vectors, 574-579
L1.2.4 **Organize and summarize a data set in a table, plot, chart, or spreadsheet; find patterns in a display of data; understand and critique data displays in the media.**

**Alg 1:** Lesson 1.7: Represent Functions as Graphs, 42, 43-48
Lesson 5.6: Fit a Line to Data, 325-331, 332-333
Lesson 5.7: Predict with Linear Models, 334, 335-341, 342
Lesson 10.8: Compare Linear, Exponential, and Quadratic Models, 684-691, 692-693

**Geom:** Lesson 1.7: Activity: Investigate Perimeter and Area, 48
Lesson 2.1: Use Inductive Reasoning, 74, 77
Lesson 2.3: Apply Deductive Reasoning, 89
Lesson 7.7: Multiple Representations, 488
Lesson 11.6: Activity: Perimeter and Area of Polygons, 769
Lesson 12.5: Activity: Minimize Surface Area, 837
Skills Review Handbook: Displaying Data, 888-889

**Alg 2:** Lesson 2.5: Model Direct Variation, 107-111
Lesson 2.6: Drawing Scatter Plots and Best-Fitting Lines, 112, 113-120
Lesson 4.10: Write Quadratic Functions and Models, 308, 311, 314-314
Lesson 5.9: Write Polynomial Functions and Models, 396, 398
Lesson 7.7: Write and Apply Exponential and Power Functions, 528, 530-536
Lesson 11.5: Fitting a Model to Data, 774
Lesson 11.5: Choosing the Best Model for Two-Variable Data, 775-780, 781
Lesson 12.5: Use Recursive Rules, 826, 827-833, 834-835
Skills Review Handbook: Graphing Statistical Data, 1006-1007
Skills Review Handbook: Organizing Statistical Data, 1008-1009

L1.3 **Counting and Probabilistic Reasoning**

L1.3.1 **Describe, explain, and apply various counting techniques (e.g., finding the number of different 4-letter passwords; permutations; and combinations); relate combinations to Pascal’s triangle; know when to use each technique.**

**Alg 1:** Lesson 13.2: Find Probabilities Using Permutations, 851-855
Lesson 13.3: Find Probabilities Using Combinations, 856-859, 860

**Geom:** Skills Review Handbook: Counting Methods, 891-892

**Alg 2:** Lesson 10.1: Apply the Counting Principle and Permutations, 682-689
Lesson 10.2: Use Combinations and the Binomial Theorem, 690-697
Lesson 10.3: Define and Use Probability, 699, 702

L1.3.2 **Define and interpret commonly used expressions of probability (e.g., chances of an event, likelihood, odds).**

**Alg 1:** Lesson 13.1: Find Probabilities and Odds, 843-848
Lesson 13.4: Find Probabilities of Compound Events, 861-867

**Geom:** Lesson 11.7: Use Geometric Probability, 770, 771-777
Skills Review Handbook: Probability, 893

**Alg 2:** Lesson 10.3: Define and Use Probability, 698-705
Lesson 10.4: Find Probabilities of Disjoint and Overlapping Events, 707-713
Lesson 10.5: Find Probabilities of Independent and Dependent Events, 717-723
L1.3.3 Recognize and explain common probability misconceptions such as “hot streaks” and “being due.”

Alg 1: Lesson 13.1: Find Probabilities and Odds, 846, 847
Lesson 13.4: Find Probabilities of Compound Events, 866

Geom: Lesson 11.7: Use Geometric Probability, 770, 774

Alg 2: Lesson 10.3: Define and Use Probability, 698, 702, 704
Lesson 10.4: Find Probabilities of Disjoint and Overlapping Events, 711, 712
Lesson 10.5: Find Probabilities of Independent and Dependent Events, 719, 722, 723

STANDARD L2: CALCULATION, ALGORITHMS, AND ESTIMATION
Students calculate fluently, estimate proficiently, and describe and use algorithms in appropriate situations (e.g., approximating solutions to equations.) They understand the basic ideas of iteration and algorithms.

L2.1 Calculation Using Real and Complex Numbers

L2.1.1 Explain the meaning and uses of weighted averages (e.g., GNP, consumer price index, grade point average).

Alg 2: Lesson 11.2: Apply Transformations to Data, 751-755

L2.1.2 Calculate fluently with numerical expressions involving exponents; use the rules of exponents; evaluate numerical expressions involving rational and negative exponents; transition easily between roots and exponents.

Alg 1: Lesson 1.1: Evaluate Expressions, 4-7
Lesson 1.2: Apply Order of Operations, 8-12, 13
Lesson 8.1: Apply Exponent Properties Involving Products, 488, 489-494
Lesson 8.2: Apply Exponent Properties Involving Quotients, 495-501, 502
Lesson 8.3: Define and Use Zero and Negative Exponents, 502-510
Lesson 8.4: Use Scientific Notation, 512-518, 519

Geom: Chapter 2 Algebra Review: Simplify Rational and Radical Expressions, 139
Skills Review Handbook: Simplifying and Evaluating Expressions, 870

Alg 2: Lesson 1.2: Evaluate and Simplify Algebraic Expressions, 10-17
Lesson 5.1: Use Properties of Exponents, 330-335
Lesson 6.1: Evaluate nth Roots and Use Rational Exponents, 414-419
Lesson 6.2: Apply Properties of Rational Exponents, 420-427

L2.1.3 Explain the exponential relationship between a number and its base 10 logarithm, and use it to relate rules of logarithms to those of exponents in expressions involving numbers.

Alg 2: Lesson 7.4: Evaluate Logarithms, 499-501, 503-505
Lesson 7.5: Apply Properties of Logarithms, 507-513
Lesson 7.6: Solve Exponential and Logarithmic Equations, 515-522

L2.1.4 Know that the complex number $i$ is one of two solutions to $x^2 = -1$.

Alg 2: Lesson 4.6: Complex Numbers, 275-276

L2.1.5 Add, subtract, and multiply complex numbers; use conjugates to simplify quotients of complex numbers.

Alg 2: Lesson 4.6: Perform Operations with Complex Numbers, 275-282
L2.1.6 Recognize when exact answers aren’t always possible or practical; use appropriate algorithms to approximate solutions to equations (e.g., to approximate square roots).

Alg 1: Lesson 2.7: Find Square Roots and Compare Real Numbers, 111-116
Lesson 5.7: Predict with Linear Models, 335-341, 342
Lesson 6.5: Use Absolute Deviation, 392, 395
Lesson 6.7: Activity: Linear Inequalities in Two Variables, 404

Geom: Lesson 1.7: Find Perimeter, Circumference, and Area, 50, 54
Lesson 7.1: Approximate, 434
Lesson 7.5: Find Tangent Ratios, 467
Lesson 7.6: Using a Tangent Ratio, 482
Lesson 7.7: Solve Right Triangles, 483-489
Lesson 11.1: Extension: Determine Precision and Accuracy, 727-728
Lesson 11.4: Circumference and Arc Length, 746-752

Alg 2: Lesson 2.6: Best-Fitting Lines, 112, 113, 115-120
Lesson 5.1: Use Properties of Exponents, 335
Lesson 5.7: Approximate Real Zeros, 382-383, 384
Lesson 6.1: Approximate Roots, 415, 417
Lesson 9.4: Problem Solving Workshop: Using Alternative Methods, 640
Skills Review Handbook: Significant Digits, 983

L2.2 Sequences and Iteration
L2.2.1 Find the \( n \)th term in arithmetic, geometric, or other simple sequences.

Geom: (related topic)
Lesson 2.1: Use Inductive Reasoning, 72-73, 75, 76, 78

Alg 2: Lesson 12.1: Sequence and Series, 794-796, 798-800, 801
Lesson 12.2: Analyze Arithmetic Sequences and Series, 802-809
Lesson 12.3: Analyze Geometric Sequences and Series, 810-817

L2.2.2 Compute sums of finite arithmetic and geometric sequences.

Alg 2: Lesson 12.1: Sequence and Series, 797, 799-800, 801
Lesson 12.2: Analyze Arithmetic Sequences and Series, 804-809
Lesson 12.3: Analyze Geometric Sequences and Series, 812-817

L2.2.3 Use iterative processes in such examples as computing compound interest or applying approximation procedures.

Alg 2: Lesson 12.5: Use Recursive Rules with Sequences and Functions, 826, 827-833, 834-835
STANDARD L3: MEASUREMENT AND PRECISION
Students apply measurement units and calculations, and understand the concept of error.

L3.1 Measurement Units, Calculations, and Scales

L3.1.1 Convert units of measurement within and between systems; explain how arithmetic operations on measurements affect units, and carry units through calculations correctly.

Alg 1:  Lesson 1.3: Unit Analysis, 17
        Lesson 1.5: Formulas, 30
        Lesson 1.6: Activity: Make a Table, 41
        Lesson 3.3: Unit Analysis, 150
        Lesson 3.6: Unit Analysis, 170-173
        Lesson 3.8: Rewrite Equations and Formulas, 184-189
        Lesson 5.1: Unit Analysis, 285, 289
        Lesson 6.2: Unit Analysis, 365
        Lesson 8.1: Order of Magnitude, 491, 494
        Skills Review Handbook: Converting Units of Measurement, 929
        Tables: Measures, 956

Geom:  Lesson 1.7: Find Perimeter, Circumference, and Area, 49, 51, 53-54
        Lesson 6.1: Unit Analysis, 356, 359, 362-363
        Lesson 6.2: Unit Analysis, 366
        Lesson 7.4: Unit Analysis, 460
        Lesson 11.1: Unit Analysis, 722
        Lesson 11.3: Unit Analysis, 738, 739
        Lesson 12.4: Problem Solving Workshop: Using Alternative Methods, 826-827
        Skills Review Handbook: Converting Measurements and Rates, 886
        Tables: Measures, 921

Alg 2:  Lesson 1.1: Unit Analysis and Conversion, 5, 7, 8-9
        Skills Review Handbook: Converting Units of Measurement, 981
        Tables: Measures, 1025

L3.1.2 Describe and interpret logarithmic relationships in such contexts as the Richter scale, the pH scale, or decibel measurements (e.g., explain why a small change in the scale can represent a large change in intensity); solve applied problems.

Alg 1:  (related topic)
        Lesson 2.1: Sound Intensity, 69; Apparent and Absolute Magnitude, 70

Alg 2:  Lesson 7.5: Logarithmic Scales, 507, 511, 512
        Lesson 7.6: Logarithmic Scales, 521-422, 524, 525
L3.2 Understanding Error

L3.2.1 Determine what degree of accuracy is reasonable for measurements in a given situation; express accuracy through use of significant digits, error tolerance, or percent of error; describe how errors in measurements are magnified by computation; recognize accumulated error in applied situations.

Alg 1: Lesson 6.5: Absolute Deviation, 392, 393, 394-395
Lesson 6.6: Relative Absolute Deviation, 403
Lesson 8.4: Use Scientific Notation, 514, 516-518, 519

Geom: Lesson 11.1: Extension: Determine Precision and Accuracy, 727-728

Alg 2: Lesson 1.7: Tolerance, 54, 57, 58
Lesson 5.1: Scientific Notation, 331, 332, 334-335
Lesson 11.4: Margin of Error, 768-771
Skills Review Handbook: Scientific Notation, 982
Skills Review Handbook: Significant Digits, 983

L3.2.2 Describe and explain round-off error, rounding, and truncating.

Geom: Lesson 11.1: Extension: Determine Precision and Accuracy, 727-728

Alg 2: Skills Review Handbook: Significant Digits, 983

L3.2.3 Know the meaning of and interpret statistical significance, margin of error, and confidence level.

Alg 1: Lesson 6.5: Absolute Deviation, 392, 393, 394-395
Lesson 6.6: Relative Absolute Deviation, 403

Geom: Lesson 11.1: Extension: Determine Precision and Accuracy, 727-728

Alg 2: Lesson 1.7: Tolerance, 54, 57, 58
Lesson 2.6: Correlation, 113-114, 116, 117-120
Lesson 11.4: Margin of Error, 768-771
Skills Review Handbook: Significant Digits, 983
STANDARD L4: MATHEMATICAL REASONING, LOGIC, AND PROOF

Students understand mathematical reasoning as being grounded in logic and proof and can distinguish mathematical arguments from other types of arguments. They can interpret arguments made about quantitative situations in the popular media. Students know the language and laws of logic and can apply them in both mathematical and everyday settings. They write proofs using direct and indirect methods and use counterexamples appropriately to show that statements are false.

L4.1 Mathematical Reasoning

L4.1.1 Distinguish between inductive and deductive reasoning, identifying and providing examples of each.

Alg 1: Lesson 2.7: Extension: Use Logical Reasoning, 117-118
Geom: Lesson 2.1: Use Inductive Reasoning, 72-78
Lesson 2.3: Apply Deductive Reasoning, 87-93
Alg 2: Lesson 12.5: Extension: Prove Statements Using Mathematical Induction, 836-837
Skills Review Handbook: Logical Argument, 1000-1001

L4.1.2 Differentiate between statistical arguments (statements verified empirically using examples or data) and logical arguments based on the rules of logic.

Alg 1: Lesson 2.7: Extension: Use Logical Reasoning, 117-118
Lesson 5.7: Activity: Model Data from the Internet, 342
Lesson 13.5: Analyze Surveys and Samples, 871-874
Geom: Lesson 2.1: Use Inductive Reasoning, 72-78
Lesson 2.3: Apply Deductive Reasoning, 87-93
Lesson 6.1: Sampling and Surveys, 359, 362, 369
Skills Review Handbook: Sampling and Surveys, 890
Alg 2: Lesson 11.3: Extension: Hypothesis Testing, 764-765
Lesson 11.4: Select and Draw Conclusions from Samples, 766-771
Lesson 11.4: Extension: Design Surveys and Experiments, 772-773
Lesson 12.5: Extension: Prove Statements Using Mathematical Induction, 836-837
Skills Review Handbook: Logical Argument, 1000-1001
L4.1.3 Define and explain the roles of axioms (postulates), definitions, theorems, counterexamples, and proofs in the logical structure of mathematics; identify and give examples of each.

**Alg 1:** (preparation)
- Lesson 2.1: Conditional Statements, 66-68
- Lesson 2.7: Writing Statements in If-Then Form, 109, 113, 114
- Lesson 2.7: Extension: Use Logical Reasoning, 117-118
- Lesson 5.5: Activity: If-Then Statements and Their Converses, 318

**Geom:**
- Lesson 1.1: Identify Points, Lines, and Planes, 2-8
- Lesson 2.1: Use Inductive Reasoning, 72-78
- Lesson 2.3: Apply Deductive Reasoning, 87-93
- Lesson 2.6: Prove Statements about Segments and Angles, 112-119
- Postulates, 9, 10, 24, 25, 96, 126, 148, 154, 161, 172, 234, 240, 249, 381, 660, 720, 819
- Theorems throughout
- Tables: Postulates, 926; Theorems, 927-931

**Alg 2:** (related topics)
- Lesson 5.5: Apply the Remainder and Factor Theorems, 362-369
- Lesson 5.6: Find Rational Zeros, 370-377, 378
- Lesson 5.7: Apply the Fundamental Theorem of Algebra, 379-386, 511, 693
- Lesson 12.5: Extension: Prove Statements Using Mathematical Induction, 836-837
- Skills Review Handbook: Logical Argument, 1000-1001
- Skills Review Handbook: Conditional Statements and Counterexamples, 1002-1003

L4.2 Language and Laws of Logic

L4.2.1 Know and use the terms of basic logic (e.g., proposition, negation, truth and falsity, implication, if and only if, contrapositive, and converse).

**Alg 1:**
- Lesson 2.1: Conditional Statements, 66-68
- Lesson 2.7: Writing Statements in If-Then Form, 109, 113, 114
- Lesson 2.7: Extension: Use Logical Reasoning, 117-118
- Lesson 5.5: Activity: If-Then Statements and Their Converses, 318
- Lesson 11.4: The Pythagorean Theorem and Its Converse, 736, 737, 739, 741
- Skills Review Handbook: Venn Diagrams and Logical Reasoning, 930

**Geom:**
- Lesson 2.1: Use Inductive Reasoning, 72-78
- Lesson 2.2: Analyze Conditional Statements, 79-85
- Lesson 2.3: Apply Deductive Reasoning, 87-93
- Lesson 2.3: Extension: Symbolic Notation and Truth Tables, 94-95

**Alg 2:**
- Lesson 12.5: Extension: Prove Statements Using Mathematical Induction, 836-837
- Skills Review Handbook: Logical Argument, 1000-1001
- Skills Review Handbook: Conditional Statements and Counterexamples, 1002-1003
- Skills Review Handbook: Venn Diagrams, 1004
L4.2.2 Use the connectives “NOT,” “AND,” “OR,” and “IF..., THEN,” in mathematical and everyday settings. Know the truth table of each connective and how to logically negate statements involving these connectives.

Alg 1: Lesson 2.1: Conditional Statements, 66-68
Lesson 2.7: Writing Statements in If-Then Form, 109, 113, 114
Lesson 2.7: Extension: Use Logical Reasoning, 117-118
Lesson 5.5: Activity: If-Then Statements and Their Converses, 318
Lesson 6.4: Activity: Statements with And and Or, 379, 384, 385

Geom: Lesson 2.2: Analyze Conditional Statements, 79-85
Lesson 2.3: Apply Deductive Reasoning, 87-93
Lesson 2.3: Extension: Symbolic Notation and Truth Tables, 94-95

L4.2.3 Use the quantifiers “THERE EXISTS” and “ALL” in mathematical and everyday settings and know how to logically negate statements involving them.

Geom: Lesson 2.2: Analyze Conditional Statements, 79-85
Lesson 2.3: Apply Deductive Reasoning, 87-93
Lesson 2.3: Extension: Symbolic Notation and Truth Tables, 94-95

L4.2.4 Write the converse, inverse, and contrapositive of an “If..., then...” statement; use the fact, in mathematical and everyday settings, that the contrapositive is logically equivalent to the original while the inverse and converse are not.

Alg 1: (preparation)
Lesson 2.1: Conditional Statements, 66-68
Lesson 5.5: Activity: If-Then Statements and Their Converses, 318
Lesson 11.4: The Pythagorean Theorem and Its Converse, 736, 737, 739, 741

Geom: Lesson 2.2: Analyze Conditional Statements, 79-85
Lesson 2.3: Apply Deductive Reasoning, 87-93
Lesson 2.3: Extension: Symbolic Notation and Truth Tables, 94-95
Lesson 5.6: Using a Contrapositive, 341

L4.3 Proof

L4.3.1 Know the basic structure for the proof of an “If..., then...” statement (assuming the hypothesis and ending with the conclusion) and know that proving the contrapositive is equivalent.

Alg 1: (preparation)
Lesson 2.1: Conditional Statements, 66-68
Lesson 2.7: Writing Statements in If-Then Form, 109, 113, 114, 117-118
Lesson 5.5: Activity: If-Then Statements and Their Converses, 318

Geom: Lesson 2.6: Prove Statements about Segments and Angles, 112-119, 120-121
Lesson 2.7: Prove Angle Pair Relationships, 124-131
Lesson 3.3: Prove Lines Are Parallel, 163-169
Lesson 5.6: Using a Contrapositive, 341

Alg 2: (related topics)
Lesson 5.5: Apply the Remainder and Factor Theorems, 362-369
Lesson 5.6: Find Rational Zeros, 370-377, 378
Lesson 5.7: Apply the Fundamental Theorem of Algebra, 379-386
Lesson 7.5: Prove Properties of Logarithms, 511
Lesson 12.5: Extension: Prove Statements Using Mathematical Induction, 836-837
Skills Review Handbook: Conditional Statements and Counterexamples, 1002-1003

L4.3.2 Construct proofs by contradiction; use counterexamples, when appropriate, to disprove a statement.

Alg 1: (preparation)
Lesson 2.1: Conditional Statements, 66-68
Lesson 5.5: Activity: If-Then Statements and Their Converses, 318

Geom: Lesson 2.1: Counterexamples, 74, 76, 78
Lesson 5.6: Indirect Reasoning, 337-338, 339-340

Alg 2: (related topics)
Skills Review Handbook: Conditional Statements and Counterexamples, 1002-1003

L4.3.3 Explain the difference between a necessary and a sufficient condition within the statement of a theorem; determine the correct conclusions based on interpreting a theorem in which necessary or sufficient conditions in the theorem or hypothesis are satisfied.

Geom: Lesson 2.2: Biconditional Statements, 82
Lesson 2.3: Extension: Symbolic Notation and Truth Tables, 94-95
Lesson 8.4: Biconditionals, 536

RECOMMENDED:

*L1.2.5 Read and interpret representations from various technological sources, such as contour or isobar diagrams.

Alg 1: Lesson 5.7: Activity: Model Data from the Internet, 342

Geom: Lesson 5.4: Activity: Investigate Points of Concurrency, 326
Lesson 6.6: Extension: Fractals, 406-407
Lesson 9.2: Use Properties of Matrices, 580-587

Alg 2: Lesson 3.3: Extension: Use Linear Programming, 174
Lesson 4.6: Investigate the Mandelbrot Set, 281
Lesson 14.5: Activity: Collect and Model Trigonometric Data, 948
*L2.1.7 Understand the mathematical bases for the differences among voting procedures.

Alg 1: (relate topic)
Lesson 13.5: Analyze Surveys and Samples, 871-874

Geom: (related topics)
Lesson 6.1: Sampling and Surveys, 359, 362, 369
Skills Review Handbook: Sampling and Surveys, 890

Alg 2: (related topics)
Lesson 11.4: Select and Draw Conclusions from Samples, 766-771
Lesson 11.4: Extension: Design Surveys and Experiments, 772-773

*L2.2.4 Compute sums of infinite geometric sequences.

Alg 2: Lesson 12.4: Find Sums of Infinite Geometric Series, 819, 820-825

STRAND 2: ALGEBRA AND FUNCTIONS (A)

STANDARD A1: EXPRESSIONS, EQUATIONS, AND INEQUALITIES
Students recognize, construct, interpret, and evaluate expressions. They fluently transform symbolic expressions into equivalent forms. They determine appropriate techniques for solving each type of equation, inequality, or system of equations, apply the techniques correctly to solve, justify the steps in the solutions, and draw conclusions from the solutions. They know and apply common formulas.

A1.1 Construction, Interpretation, and Manipulation of Expressions (linear, quadratic, polynomial, rational, power, exponential, logarithmic, and trigonometric)

A1.1.1 Give a verbal description of an expression that is presented in symbolic form, write an algebraic expression from a verbal description, and evaluate expressions given values of the variables.

Alg 1: Lesson 1.1: Evaluate Expressions, 2-7
Lesson 1.2: Use Order of Operations, 8-12, 13
Lesson 1.3: Activity: Patterns and Expressions, 14
Lesson 1.3: Write Expressions, 15-20

Geom: (related topics)
Chapter 1 Algebra Review: Solve Linear Equations and Word Problems, 65
Chapter 2 Algebra Review: Simplify Rational and Radical Expressions, 139
Chapter 11 Algebra Review: Use Algebraic Models to Solve Problems, 785
Skills Review Handbook: Simplifying and Evaluating Expressions, 870
Skills Review Handbook: Using the Distributive Property, 872
Skills Review Handbook: Radical Expressions, 874

Alg 2: Lesson 1.2: Evaluate and Simplify Algebraic Expressions, 10-16, 17
Lesson 5.1: Use Properties of Exponents, 331-335
Lesson 6.2: Apply Properties of Rational Exponents, 423, 425-427
Skills Review Handbook: Writing Algebraic Expressions, 984
A1.1.2 Know the definitions and properties of exponents and roots, transition fluently between them, and apply them in algebraic expressions.

Alg 1:  
Lesson 1.1: Evaluate Expressions, 3-7  
Lesson 1.2: Apply Order of Operations, 8-12, 13  
Lesson 8.1: Apply Exponent Properties Involving Products, 488, 489-494  
Lesson 8.2: Apply Exponent Properties Involving Quotients, 495-501  
Lesson 8.3: Define and Use Zero and Negative Exponents, 502, 503-510  
Lesson 8.4: Use Scientific Notation, 512-518, 519

Geom:  
Chapter 2 Algebra Review: Simplify Rational and Radical Expressions, 139  
Skills Review Handbook: Radical Expressions, 874

Alg 2:  
Lesson 4.5: Properties of Square Roots, 266, 269  
Lesson 5.1: Use Properties of Exponents, 330-335  
Lesson 6.1: Evaluate \( n \)th Roots and Use Rational Exponents, 414-419  
Lesson 6.2: Apply Properties of Rational Exponents, 420-427  
Tables: Properties of Radicals and Rational Exponents, 1034

A1.1.3 Factor algebraic expressions using, for example, greatest common factor, grouping, and the special product identities (e.g., differences of squares and cubes).

Alg 1:  
Lesson 9.4: Factoring, 576-580  
Lesson 9.5: Factor \( x^2 + bx + c \), 582, 583-589  
Lesson 9.6: Factor \( ax^2 + bx + c \), 592, 593-599  
Lesson 9.7: Factor Special Products, 600-605  
Lesson 9.8: Factor Polynomials Completely, 606-613

Geom:  
Chapter 10 Algebra Review: Factor Binomials and Trinomials, 713

Alg 2:  
Lesson 4.3: Factoring Quadratic Expressions, 252-256  
Lesson 4.4: Factoring Quadratic Expressions, 259-260, 263-264  
Lesson 5.4: Factoring Polynomial Expressions, 353-355, 356-357  
Lesson 5.5: Factor Theorem, 364, 366

A1.1.4 Add, subtract, multiply, and simplify polynomials and rational expressions (e.g., multiply \( (x - 1) (1 - x^2 + 3) \); simplify \( 9x \cdot x^3 / x + 3 \)).

Alg 1:  
Lesson 9.1: Add and Subtract Polynomials, 554-559  
Lesson 9.2: Multiply Polynomials, 561, 562-568  
Lesson 9.3: Find Special Products of Polynomials, 569-574  
Lesson 12.4: Simplify Rational Expressions, 794-800  
Lesson 12.5: Multiply and Divide Rational Expressions, 802-809  
Lesson 12.5: Extension: Simplify Complex Fractions, 810-811  
Lesson 12.6: Add and Subtract Rational Expressions, 812-819

Geom:  
Skills Review Handbook: Binomial Products, 873

Alg 2:  
Lesson 5.3: Add, Subtract, and Multiply Polynomials, 346-352  
Lesson 8.4: Multiply and Divide Rational Expression, 573-580, 581  
Lesson 8.5: Add and Subtract Rational Expressions, 582-588  
Skills Review Handbook: Binomial Products, 985

A1.1.5 Divide a polynomial by a monomial.

Alg 1:  
Lesson 12.3: Divide Polynomials, 784, 787, 788

Alg 2:  
(related topic)  
Lesson 5.5: Apply the Remainder and Factor Theorems, 362-368, 985
A1.1.6 Transform exponential and logarithmic expressions into equivalent forms using the properties of exponents and logarithms including the inverse relationship between exponents and logarithms.

Alg 2: Lesson 7.4: Evaluate Logarithms, 499, 501, 503, 504
Lesson 7.5: Apply Properties of Logarithms, 507-513

A1.2 Solutions of Equations and Inequalities (linear, quadratic, polynomial, rational, power, exponential, logarithmic, trigonometric)

A1.2.1 Write equations and inequalities with one or two variables to represent mathematical or applied situations, and solve.

Alg 1: Lesson 1.5: Use a Problem Solving Plan: 28-33, 34
Lesson 3.1: Solve One-Step Equations, 132-133, 134-140
Lesson 3.2: Solve Two-Step Equations, 141-146, 147
Lesson 3.3: Solve Multi-Step Equations, 148-153
Lesson 3.4: Solve Equations with Variables on Both Sides, 154-159, 160
Lesson 3.5: Write Ratios and Proportions, 162-168
Lesson 3.6: Solve Proportions Using Cross Products, 168-173
Lesson 3.6: Extension: Apply Proportions to Similar Figures, 174-175
Lesson 3.7: Solve Percent Problems, 176-181, 182-183
Lesson 3.8: Rewrite Equations and Formulas, 184-189
Lesson 4.5: Extension: Solve Linear Equations by Graphing, 251-252
Lesson 4.6: Model Direct Variation, 253-259, 260-261
Lesson 5.1: Write Linear Equations in Slope-Intercept Form 282, 283-289, 290-291
Lesson 5.2: Use Linear Equations in Slope-Intercept Form, 292-299, 300-301
Lesson 5.3: Write Linear Equations in Point-Slope Form, 302-308, 309-310
Lesson 5.4: Write Linear Equations in Standard Form, 311-316
Lesson 5.5: Write Equations of Parallel and Perpendicular Lines, 319-324
Lesson 5.6: Fit a Line to Data, 325-331, 332-333
Lesson 5.7: Predict with Linear Models, 334, 335-341, 342
Lesson 6.1: Solve Inequalities Using Addition and Subtraction, 356-361
Lesson 6.2: Solve Inequalities Using Multiplication and Division, 362, 363-368
Lesson 6.3: Solve Multi-Step Inequalities, 369-374, 375-376, 377
Lesson 6.4: Solve Compound Inequalities, 380-388, 389
Lesson 6.5: Solve Absolute Value Equations, 390-395
Lesson 6.6: Solve Absolute Value Inequalities, 398-403
Lesson 8.6: Exponential Growth and Decay, 534, 536-538
Lesson 9.4: Solve Polynomial Equations in Factored Form, 575-580
Lesson 9.5: Factor $x^2 + bx + c$, 585-589
Lesson 9.6: Factor $ax^2 + bx + c$, 595-599
Lesson 10.3: Solve Quadratic Equations by Graphing, 643-649, 650-651
Lesson 10.4: Use Square Roots to Solve Quadratic Equations, 652-658, 660
Lesson 10.5: Solve Quadratic Equations by Completing the Square, 663-668
Lesson 10.6: Solve Quadratic Equations by the Quadratic Formula, 671-676
Lesson 10.7: Interpret the Discriminant, 677-683
Lesson 10.8: Compare Linear, Exponential, and Quadratic Models, 686-687, 689-691
Lesson 11.3: Solve Radical Equations, 731, 733-734
Lesson 12.1: Model Inverse Variation, 765-772
Lesson 12.7: Solve Rational Equations, 822-826, 827-828
Geom:  Chapter 1 Algebra Review: Solve Linear Equations and Word Problems, 65
     Lesson 2.5: Reason Using Properties from Algebra, 105-111
     Lesson 3.5: Write and Graph Equations of Lines, 180-187, 188-189
     Chapter 11 Algebra Review: Use Algebraic Models to Solve Problems, 785
Alg 2:  Lesson 1.3: Solve Linear Equations, 19, 20, 23-24
     Lesson 1.6: Solve Linear Inequalities, 41-47
     Lesson 1.7: Solve Absolute Value Equations and Inequalities, 50, 51-58
     Lesson 2.4: Write Equations of Lines, 98-104, 105
     Lesson 2.5: Model Direct Variation, 107-111
     Lesson 2.8: Linear Inequalities, 134-138
     Lesson 4.5: Solve Quadratic Equations, 267-271
     Lesson 4.9: Solve Quadratic Inequalities, 301-307
     Lesson 5.4: Factor and Solve Polynomial Equations, 353-359, 360-361
     Lesson 6.6: Solve Radical Equations, 452-459, 460-461
     Lesson 6.6: Extension: Solve Radical Inequalities, 462-463
     Lesson 7.6: Solve Exponential and Logarithmic Equations, 515-522, 523-525
     Lesson 7.6: Extension: Solve Exponential and Logarithmic Inequalities, 526-527
     Lesson 8.6: Solve Rational Equations, 589, 594-595
     Lesson 8.6: Solve Rational Inequalities, 598-600
     Lesson 9.2: Write Equations of Parabolas, 621-626
     Lesson 9.3: Write Equations of Circles, 627-632
     Lesson 9.4: Write Equations of Ellipses, 635-639
     Lesson 9.5: Write Equations of Hyperbolas, 643-648
     Lesson 13.4: Write Trigonometric Equations, 877, 879-880
     Lesson 14.4: Solve Trigonometric Equations, 931-937

A1.2.2  Associate a given equation with a function whose zeros are the solutions of the equation.

Alg 1:  Lesson 4.2: Extension: Identify Discrete and Continuous Functions, 223-224
     Lesson 4.7: Graph Linear Functions, 262-268
     Lesson 10.8: Compare Linear, Exponential, and Quadratic Models, 684-691
     Lesson 10.3: Activity: Find Minimum and Maximum Values and Zeros, 650-651
Geom:  Chapter 8 Algebra Review: Graph Nonlinear Functions, 565
     Skills Review Handbook: Functions, 884
Alg 2:  Lesson 2.1: Functions as Equations in Two Variables, 74-75
     Lesson 4.3: Zeros of Quadratic Functions, 254-256
     Lesson 4.4: Factoring and Zeros, 262
     Lesson 5.6: Find Rational Zeros, 370-377, 378
     Lesson 5.7: Apply the Fundamental Theorem of Algebra, 379-386
A1.2.3  Solve (and justify steps in the solutions) linear and quadratic equations and inequalities, including systems of up to three linear equations with three unknowns; apply the quadratic formula appropriately.

**Alg 1:**
- Lesson 3.1: Solve One-Step Equations, 132-133, 134-140
- Lesson 3.2: Solve Two-Step Equations, 141-146, 147
- Lesson 3.3: Solve Multi-Step Equations, 148-153
- Lesson 3.4: Solve Equations with Variables on Both Sides, 154-159, 160
- Lesson 3.5: Write Ratios and Proportions, 162-168
- Lesson 3.6: Solve Proportions Using Cross Products, 168-173
- Lesson 3.6: Extension: Apply Proportions to Similar Figures, 174-175
- Lesson 3.7: Solve Percent Problems, 176-181, 182-183
- Lesson 3.8: Rewrite Equations and Formulas, 184-189
- Lesson 4.5: Extension: Solve Linear Equations by Graphing, 251-252
- Lesson 6.1: Solve Inequalities Using Addition and Subtraction, 356-361
- Lesson 6.2: Solve Inequalities Using Multiplication and Division, 362, 363-368
- Lesson 6.3: Solve Multi-Step Inequalities, 369-374, 375-376, 377
- Lesson 6.4: Solve Compound Inequalities, 380-388, 389
- Lesson 7.1: Solve Linear Systems by Graphing, 426, 427-433, 434
- Lesson 7.2: Solve Linear Systems by Substitution, 435-441, 442
- Lesson 7.3: Solve Linear Systems by Adding or Subtracting, 443, 444-450
- Lesson 7.4: Solve Linear Systems by Multiplying First, 451-457
- Lesson 7.5: Solve Special Types of Linear Systems, 459-465
- Lesson 7.6: Solve Systems of Linear Inequalities, 466-472
- Lesson 10.3: Solve Quadratic Equations by Graphing, 643-649, 650-651
- Lesson 10.4: Use Square Roots to Solve Quadratic Equations, 652-658, 660
- Lesson 10.5: Solve Quadratic Equations by Completing the Square, 663-668
- Lesson 10.6: Solve Quadratic Equations by the Quadratic Formula, 671-676
- Lesson 10.7: Interpret the Discriminant, 677-683

**Geom:**
- Chapter 1 Algebra Review: Solve Linear Equations and Word Problems, 65
- Lesson 2.5: Reason Using Properties from Algebra, 105-111
- Lesson 3.5: Write and Graph Equations of Lines, 180-187, 188-189
- Chapter 3 Algebra Review: Graph and Solve Linear Inequalities, 207
- Chapter 4 Algebra Review: Solve Inequalities, 287
- Chapter 6 Algebra Review: Solve Quadratic Equations and Simplify Radicals, 423
- Chapter 9 Algebra Review: Multiply Binomials and Use Quadratic Formula, 641
- Skills Review Handbook: Solving Linear Equations, 875
- Skills Review Handbook: Solving and Graphing Linear Inequalities, 876
- Skills Review Handbook: Systems of Linear Equations, 880
- Skills Review Handbook: Linear Inequalities, 881

**Alg 2:**
- Lesson 1.3: Solve Linear Equations, 18-24, 25
- Lesson 1.6: Solve Linear Inequalities, 41-47, 48-49
- Lesson 3.1: Solve Linear Systems by Graphing, 152, 153-158, 159
- Lesson 3.2: Solve Linear Systems Algebraically, 160-168
- Lesson 3.3: Graph Systems of Linear Inequalities, 168-176
- Lesson 3.4: Solve Systems of Linear Equations in Three Variables, 177, 178-185
- Lesson 3.8: Use Inverse Matrices to Solve Linear Systems, 210-217, 218
- Lesson 4.3: Solve $x^2 + bx + c = 0$ by Factoring, 252-258
- Lesson 4.4: Solve $ax^2 + bx + c = 0$ by Factoring, 259-265
- Lesson 4.5: Solve Quadratic Equations by Finding Square Roots, 266-271, 272-273
- Lesson 4.7: Complete the Square, 284-291
Lesson 4.8: Use the Quadratic Formula and the Discriminant, 292-299
Lesson 4.9: Graph and Solve Quadratic Inequalities, 300-307

A1.2.4 Solve absolute value equations and inequalities (e.g., solve |x - 3| ≤ 6), and justify steps in the solution.

Alg 1:  Lesson 6.5: Solve Absolute Value Equations, 390-395
Lesson 6.6: Solve Absolute Value Inequalities, 398-403

Geom: Chapter 4 Algebra Review: Solve Inequalities and Absolute Value Equations, 287

Alg 2:  Lesson 1.7: Solve Absolute Value Equations and Inequalities, 50, 51-58
Lesson 2.8: Linear Inequalities in Two Variables, 135, 136

A1.2.5 Solve polynomial equations and equations involving rational expressions (e.g., solve -2x (x^2 + 4x + 3) = 0; solve x - 1 / x + 6 = 3), and justify steps in the solution.

Alg 1:  Lesson 9.4: Solve Polynomial Equations in Factored Form, 575-580
Lesson 9.5: Factor x^2 + bx + c, 585-589
Lesson 9.6: Factor ax^2 + bx + c, 595-599
Lesson 12.7: Solve Rational Equations, 820-826, 827-828

Alg 2:  Lesson 5.4: Factor and Solve Polynomial Equations, 353-359, 360-361
Lesson 8.6: Solve Rational Equations, 589-595, 596-597

A1.2.6 Solve power equations (e.g., (x + 1)^3 = 8) and equations including radical expressions (e.g., \sqrt{3x - 7} = 7), justify steps in the solution, and explain how extraneous solutions may arise.

Alg 1:  Lesson 11.3: Solve Radical Equations, 729-734
Alg 2:  Lesson 6.6: Solve Radical Equations, 452-459, 460-461

A1.2.7 Solve exponential and logarithmic equations (e.g., 3(2^x) = 24), 2 \ln (x + 1) = 4), and justify steps in the solution.

Alg 1: (related topic)
Lesson 8.6: Exponential Growth and Decay, 534, 536-538

Geom: (related topic)
Skills Review Handbook: Functions, 884

Alg 2:  Lesson 7.6: Solve Exponential and Logarithmic Equations, 515-522, 523-525

A1.2.8 Solve an equation involving several variables (with numerical or letter coefficients) for a designated variable, and justify steps in the solution.

Alg 1:  Lesson 3.8: Rewrite Equations and Formulas, 184-189

Skills Review Handbook: Solving Formulas, 877

Alg 2:  Lesson 1.4: Rewrite Formulas and Equations, 26-32
A1.2.9 Known common formulas (e.g., slope, distance between two points, quadratic formula, compound interest, distance = velocity x time), and apply appropriately in contextual situations.

**Alg 1:**
- Lesson 1.5: Use a Problem Solving Plan: 30, 31-33
- Lesson 3.8: Rewrite Equations and Formulas, 184-189
- Lesson 4.4: Find Slope and Rate of Change, 235-242
- Lesson 7.3: Write and Solve a Linear System, 446, 449-450
- Lesson 8.5: Compound Interest, 523, 525, 527
- Lesson 10.6: Solve Quadratic Equations by the Quadratic Formula, 671-676, 677
- Lesson 11.5: Apply the Distance and Midpoint Formulas, 744-750
  Tables: Formulas, 952-953

**Geom:**
- Lesson 1.3: Use Midpoint and Distance Formulas, 15-22
- Lesson 2.5: Reason Using Properties from Algebra, 111
- Lesson 3.4: Find and Use Slopes of Lines, 171-178, 179
- Chapter 9 Algebra Review: Use Quadratic Formula, 641
- Skills Review Handbook: Solving Formulas, 877
- Skills Review Handbook: Use the Quadratic Formula, 883
  Tables: Formulas, 922-923

**Alg 2:**
- Lesson 1.4: Rewrite Formulas and Equations, 26-32
- Lesson 1.5: Use Problem Solving Strategies and Models, 34-40
- Lesson 2.2: Find Slope and Rate of Change, 82-88
- Lesson 4.8: Use the Quadratic Formula and the Discriminant, 292-299
- Lesson 9.1: Apply the Distance and Midpoint Formulas, 614-619
  Tables: Formulas, 1026-1032

A1.2.10 Use special values of the inverse trigonometric functions to solve trigonometric equations over specific intervals (e.g., $2\sin x - 1 = 0$ for $0 \leq x \leq 2\pi$).

**Alg 2:**
- Lesson 14.4: Solve Trigonometric Equations, 931-937, 938-939
STANDARD A2: FUNCTIONS
Students understand functions, their representations, and their attributes. They perform transformations, combine
and compose functions, and find inverses. Students classify functions and know the characteristics of each family.
They work with functions with real coefficients fluently.

A2.1 Definitions, Representations, and Attributes of Functions

A2.1.1 Recognize whether a relationship (given in contextual, symbolic, tabular, or graphical form) is a function; and identify its domain and range.

Alg 1: Lesson 1.7: Extension: Determine Whether a Relation Is a Function, 49-50
Geom: (related topics)
    Lesson 1.5: Multiple Representations, 41
    Skills Review Handbook: Functions, 884
Alg 2: Lesson 2.1: Represent Relations and Functions, 73-74, 76-77, 79
    Lesson 6.4: Inverse Functions, 438, 440, 441, 443
    Lesson 9.2: Identify Functions, 620

A2.1.2 Read, interpret, and use function notation, and evaluate a function at a value in its domain.

Alg 1: Lesson 4.7: Graph Linear Functions, 262-268
Alg 2: Lesson 2.1: Represent Relations and Functions, 72-79, 80-81
    Lesson 5.8: Polynomial Functions, 391
    Lesson 6.5: Square Root and Cube Root Functions, 446-447
    Lesson 7.1: Exponential Growth Functions, 479, 482, 485
    Lesson 7.2: Exponential Decay Functions, 487, 489, 491

A2.1.3 Represent functions in symbols, graphs, tables, diagrams, or words, and translate among representations.

Alg 1: Lesson 1.6: Represent Functions as Rule and Tables, 35-40, 41
    Lesson 4.1: Graph a Function, 207-208, 211-212
    Lesson 4.7: Graph Linear Functions, 262-268
    Lesson 5.3: Linear Function in Point-Slope Form, 304, 307-308
    Lesson 6.5: Extension: Graph Absolute Value Functions, 396-397
    Lesson 8.5: Write and Graph Exponential Growth Functions, 520-527, 528-529
    Lesson 8.6: Write and Graph Exponential Decay Functions, 530, 531-538, 539-540
    Lesson 10.1: Graph Simple Quadratic Functions, 628-634

Geom: (related topics)
    Lesson 1.5: Multiple Representations, 41
    Lesson 2.1: Multiple Representations, 77
    Lesson 2.5: Multiple Representations, 111
    Lesson 6.1: Multiple Representations, 363
    Lesson 6.3: Multiple Representations, 378
    Chapter 7 Algebra Review: Graph Quadratic Functions, 499
    Lesson 8.1: Multiple Representations, 513
    Chapter 8 Algebra Review: Graph Nonlinear Functions, 565
    Chapter 11 Algebra Review: Use Algebraic Models to Solve Problems, 785
    Lesson 12.5: Multiple Representations, 835
    Lesson 12.7: Multiple Representations, 853
    Skills Review Handbook: Functions, 884
Alg 2:  Lesson 2.1: Represent Relations and Functions, 72-79, 80-81
Lesson 2.3: Write Equations of Lines, 95
Lesson 2.4: Graph Equations of Lines, 104
Lesson 2.4: Using Alternative Methods, 105
Lesson 2.6: Scatter Plots and Best-Fitting Lines, 119
Lesson 2.7: Use Absolute Value Functions, 129
Lesson 4.1: Quadratic Functions in Standard Form, 242
Lesson 4.3: Quadratic Functions by Factoring, 258
Lesson 4.5: Using Alternative Methods, 272-273
Lesson 4.7: Complete the Square, 290
Lesson 4.10: Quadratics Functions and Models, 314
Lesson 5.2: Polynomial Functions, 343
Lesson 5.4: Using Alternative Methods, 360-361
Lesson 5.8: Graphs of Polynomial Functions, 392
Lesson 6.3: Operations with Functions, 434
Lesson 6.5: Square Root Functions, 451
Lesson 6.6: Using Alternative Methods, 460-461
Lesson 7.1: Exponential Growth Functions, 485
Lesson 7.6: Logarithmic Functions, 521
Lesson 7.6: Using Alternative Methods, 523-525
Lesson 8.2: Simple Rational Functions, 562
Lesson 8.3: General Rational Functions, 570
Lesson 8.6: Using Alternative Methods, 596-597
Lesson 11.5: Using Alternative Methods, 781
Lesson 14.4: Using Alternative Methods, 938-939

A2.1.4 Recognize that functions may be defined by different expressions over different intervals of their domains; such functions are piecewise-defined (e.g., absolute value and greatest integer functions).

Alg 1:  Lesson 4.2: Extension: Identify Discrete and Continuous Functions, 223-224
Lesson 6.5: Extension: Graph Absolute Value Functions, 396-397

Alg 2:  Lesson 2.1: Extension: Use Discrete and Continuous Functions, 80-81
Lesson 2.7: Use Absolute Value Functions, 121-129
Lesson 2.7: Extension: Use Piecewise Functions, 130-131

A2.1.5 Recognize that functions may be defined recursively, and compute values of and graph simple recursively defined functions (e.g., \( f(0) = 5, \) and \( f(n) = f(n-1) + 2 \)).

Alg 1:  Lesson 5.3: Extension: Relate Arithmetic Sequences to Linear Functions, 309-310
Lesson 8.6: Extension: Relate Geometric Sequences to Exponential Functions, 539-540

Alg 2:  Lesson 12.5: Use Recursive Rules with Sequences and Functions, 827-833, 834-835
A2.1.6 Identify the zeros of a function and the intervals where the values of a function are positive or negative, and describe the behavior of a function, as x approaches positive or negative infinity, given the symbolic and graphical representations.

Alg 1:  
Lesson 10.3: Zeros of Quadratic Functions, 645-646, 647-649, 650-651  
Lesson 12.2: Graph Rational Functions, 773-774, 775-782

Alg 2:  
Lesson 4.3: Zeros of a Quadratic Function, 254-256  
Lesson 4.4: Factoring and Zeros, 262  
Lesson 5.2: Evaluate and Graph Polynomial Functions, 336, 337-344  
Lesson 5.5: Factor Theorem, 364, 365, 366, 367  
Lesson 5.7: Apply the Fundamental Theorem of Algebra, 379-385  
Lesson 5.8: Analyze Graphs of Polynomial Functions, 387-392  
Lesson 8.3: General Rational Functions, 566

A2.1.7 Identify and interpret the key features of a function from its graph or its formula(e), (e.g. slope, intercept(s), asymptote(s), maximum and minimum value(s), symmetry, average rate of change over an interval, and periodicity).

Alg 1:  
Lesson 5.1: Write Linear Equations in Slope-Intercept Form, 284, 287-289  
Lesson 5.2: Use Linear Equations in Slope-Intercept Form, 295, 299, 300-301  
Lesson 5.3: Write Linear Equations in Point-Slope Form, 304, 307-308  
Lesson 10.3: Find Minimum and Maximum Values, 650-651  
Lesson 12.1: Graphs of Variation, 767  
Lesson 12.2: Graph Rational Functions, 773-774, 775-782  
Lesson 12.3: Activity: Find Asymptotes of Graphs, 792-793

Alg 2:  
Lesson 2.3: Equations of Lines, 89-96, 97  
Lesson 2.7: Absolute Value Functions, 121-122, 123-129  
Lesson 2.7: Extension: Piecewise Functions, 130-131  
Lesson 4.1: Quadratic Functions in Standard Form, 236-243  
Lesson 4.2: Quadratic Functions in Vertex or Intercept Form, 244, 245-251  
Lesson 5.2: Evaluate and Graph Polynomial Functions, 336, 337-344  
Lesson 5.8: Analyze Graphs of Polynomial Functions, 387-392  
Lesson 6.5: Graph Square Root and Cube Root Functions, 446-451  
Lesson 7.1: Graph Exponential Growth Functions, 478-485  
Lesson 7.2: Graph Exponential Decay Functions, 486-491  
Lesson 7.4: Graph Logarithmic Functions, 502-503, 504-505  
Lesson 8.2: Graph Simple Rational Functions, 558-563, 564  
Lesson 8.3: Graph General Rational Functions, 565-571  
Lesson 14.1: Graph Sine, Cosine, and Tangent Functions, 908-914
A2.2 Operations and Transformations

A2.2.1 Combine functions by addition, subtraction, multiplication, and division.


A2.2.2 Apply given transformations (e.g., vertical or horizontal shifts, stretching or shrinking, or reflections about the x- and y-axes) to basic functions, and represent symbolically.

- Alg 1: Lesson 4.7: Graph Linear Functions, 264, 266
  Lesson 6.5: Extension: Graph Absolute Value Functions, 396-397
  Lesson 10.1: Graph Simple Quadratic Functions, 628-630
  Lesson 10.2: Graph General Quadratic Functions, 635-636
  Lesson 12.2: Graph Rational Functions, 775-777

- Alg 2: Lesson 2.3: Graph Equations of Lines, 89-96, 97
  Lesson 2.7: Use Absolute Value Functions and Transformations, 121-122, 123-129
  Lesson 4.1: Graph Quadratic Functions in Standard Form, 236-243
  Lesson 4.2: Graph Quadratic Functions in Vertex or Intercept Form, 245-251
  Lesson 6.5: Graph Radical Functions, 446-451
  Lesson 7.1: Graph Exponential Growth Functions, 478-485
  Lesson 7.2: Graph Exponential Decay Functions, 486-491
  Lesson 8.2: Graph Simple Rational Functions, 558-563, 564
  Lesson 14.1: Graph Sine, Cosine, and Tangent Functions, 908-914
  Lesson 14.2: Translate and Reflect Trigonometric Graphs, 915-922

A2.2.3 Recognize whether a function (given in tabular or graphical form) has an inverse and recognize simple inverse pairs (e.g., $f(x) = x^3$ and $g(x) = x^{1/3}$).

- Alg 2: Lesson 6.4: Use Inverse Functions, 437, 438-445
  Lesson 13.4: Evaluate Inverse Trigonometric Functions, 874, 875-880

A2.3 Families of Functions (linear, quadratic, polynomial, rational, power, exponential, logarithmic, and trigonometric)

A2.3.1 Identify a function as a member of a family of functions based on its symbolic, or graphical representation; recognize that different families of functions have different asymptotic behavior at infinity, and describe

- Alg 1: Lesson 4.7: Parent Function for Linear Functions, 263-264
  Lesson 5.1: Activity: Investigate Families of Lines, 290-291
  Lesson 6.5: Extension: Parent Function for Absolute Value Functions, 396-397
  Lesson 10.1: Parent Quadratic Functions, 628-634
  Lesson 12.2: Parent Rational Functions, 775-782

- Alg 2: Lesson 2.3: Parent Function for Linear Functions, 89
  Lesson 2.7: Parent Function for Absolute Value Functions, 121, 123
  Lesson 4.1: Parent Function for Quadratic Functions, 236
  Lesson 5.2: Behavior of Polynomial Functions, 336, 339
  Lesson 6.5: Parent Functions for Square Root and Cube Root Functions, 446
  Lesson 7.1: Parent Function for Exponential Growth Functions, 478
  Lesson 7.2: Parent Function for Exponential Decay Functions, 486
  Lesson 7.4: Parent Graphs for Logarithmic Functions, 502
  Lesson 8.2: Parent Function for Simple Rational Functions, 558
  Lesson 14.1: Characteristics of Trigonometric Functions, 908-909, 911
A2.3.2 Describe the tabular pattern associated with functions having constant rate of change (linear); or variable rates of change.

**Alg 1:**
- Lesson 1.6: Represent Functions as Rule and Tables, 35-40, 41
- Lesson 4.1: Function Represented by a Table, 207-208, 211-212
- Lesson 4.2: Linear Functions, 217-218, 221
- Lesson 5.3: Linear Model from a Table, 304
- Lesson 6.5: Extension: Absolute Value Functions, 396-397
- Lesson 8.5: Exponential Growth Functions, 520-521, 524, 526, 528-529
- Lesson 8.6: Exponential Decay Functions, 531-532, 535
- Lesson 10.1: Simple Quadratic Functions, 628-629

**Lesson 10.8:** Compare Linear, Exponential, and Quadratic Functions, 684-691, 692-693

**Geom:**
(related topics)
- Lesson 1.5: Multiple Representations, 41
- Lesson 2.1: Multiple Representations, 77
- Lesson 2.5: Multiple Representations, 111
- Lesson 6.1: Multiple Representations, 363
- Lesson 6.3: Multiple Representations, 378
- Chapter 7 Algebra Review: Graph Quadratic Functions, 499
- Lesson 8.1: Multiple Representations, 513
- Chapter 8 Algebra Review: Graph Nonlinear Functions, 565
- Chapter 11 Algebra Review: Use Algebraic Models to Solve Problems, 785
- Lesson 12.5: Multiple Representations, 835
- Lesson 12.7: Multiple Representations, 853
- Skills Review Handbook: Functions, 884

**Alg 2:**
- Lesson 2.1: Represent Relations and Functions, 72-73, 75, 80
- Lesson 2.5: Model Direct Variation, 108, 110, 111
- Lesson 2.6: Fitting a Line to Data, 112, 113-120
- Lesson 4.1: Quadratic Functions, 236-237, 240
- Lesson 4.5: Using Alternative Methods, 272, 273
- Lesson 5.2: Polynomial Functions, 340, 343
- Lesson 5.4: Using Alternative Methods, 360, 361
- Lesson 6.5: Square Root and Cube Root Functions, 446-447
- Lesson 6.6: Using Alternative Methods, 460, 461
- Lesson 7.1: Exponential Growth Functions, 478
- Lesson 7.2: Exponential Decay Functions, 486
- Lesson 7.6: Using Alternative Methods, 523, 524
- Lesson 8.1: Inverse and Joint Variation, 552-553, 555
- Lesson 8.6: Using Alternative Methods, 596, 597
- Lesson 11.5: Fitting a Model to Data, 774, 775-781
- Lesson 14.5: Trigonometric Functions, 943, 946
A2.3.3 Write the general symbolic forms that characterize each family of functions. (e.g., \( f(x) = A0a^x; f(x) = AsinBx \))

Alg 1:  
Lesson 4.7: Parent Function for Linear Functions, 263-264  
Lesson 5.1: Activity: Investigate Families of Lines, 290-291  
Lesson 6.5: Extension: Parent Function for Absolute Value Functions, 396-397  
Lesson 10.1: Parent Quadratic Functions, 628-634  
Lesson 12.2: Parent Rational Functions, 775-782

Alg 2:  
Lesson 2.3: Parent Function for Linear Functions, 89  
Lesson 2.7: Parent Function for Absolute Value Functions, 121, 123  
Lesson 4.1: Parent Function for Quadratic Functions, 236  
Lesson 5.2: Behavior of Polynomial Functions, 336, 339  
Lesson 6.5: Parent Functions for Square Root and Cube Root Functions, 446  
Lesson 7.1: Parent Function for Exponential Growth Functions, 478  
Lesson 7.2: Parent Function for Exponential Decay Functions, 486  
Lesson 7.4: Parent Graphs for Logarithmic Functions, 502  
Lesson 8.2: Parent Function for Simple Rational Functions, 558  
Lesson 14.1: Characteristics of Trigonometric Functions, 908-909, 911

A2.4 Lines and Linear Functions

A2.4.1 Write the symbolic forms of linear functions (standard [i.e., \( Ax + By = C \), where \( B \neq 0 \)], point-slope, and slope-intercept) given appropriate information, and convert between forms.

Alg 1:  
Lesson 5.1: Write Linear Functions in Slope-Intercept Form, 284, 287-289  
Lesson 5.2: Use Linear Functions in Slope-Intercept Form, 294-295, 297-299, 300-301  
Lesson 5.3: Write Linear Models in Point-Slope Form, 304-308  
Lesson 5.4: Write Linear Models in Standard Form, 313, 315-316

Geom: (related topics)  
Lesson 1.5: Multiple Representations, 41  
Lesson 2.1: Multiple Representations, 77  
Lesson 2.5: Multiple Representations, 111  
Skills Review Handbook: Functions, 884

Alg 2:  
Lesson 2.1: Linear Functions, 75-79  
Lesson 2.3: Graph Equations of Lines, 89-96, 97  
Lesson 2.4: Write Equations of Lines, 98-104, 105  
Lesson 2.5: Model Direct Variation, 107-111

A2.4.2 Graph lines (including those of the form \( x = h \) and \( y = k \)) given appropriate information.

Alg 1:  
Lesson 4.2: Graph Linear Equations, 215-221, 222  
Lesson 4.7: Graph Linear Functions, 263-268  
Lesson 5.1: Activity: Investigate Families of Lines, 290-291

Geom:  
Lesson 3.5: Write and Graph Equations of Lines, 180-187

Alg 2:  
Lesson 2.3: Graph Equations of Lines, 89-97  
Lesson 2.5: Model Direct Variation, 107-111
A2.4.3 Relate the coefficients in a linear function to the slope and \( x \)- and \( y \)-intercepts of its graph.

**Alg 1:** Lesson 5.1: Write Linear Functions, 284, 287-289
Lesson 5.3: Write Linear Models, 304-308

**Geom:** Lesson 3.5: Write and Graph Equations of Lines, 180-187

**Alg 2:** Lesson 2.1: Linear Functions, 75
Lesson 2.2: Classify Lines Using Slope, 83-84, 86, 87
Lesson 2.3: Graph Equations of Lines, 89-96, 97
Lesson 2.4: Write Equations of Lines, 98-104, 105

A2.4.4 Find an equation of the line parallel or perpendicular to given line, through a given point; understand and use the facts that non-vertical parallel lines have equal slopes, and that non-vertical perpendicular lines have slopes that multiply to give -1.

**Alg 1:** Lesson 5.5: Write Equations of Parallel and Perpendicular Lines, 319-324

**Geom:** Lesson 3.5: Write and Graph Equations of Lines, 180-181, 185

**Alg 2:** Lesson 2.2: Parallel and Perpendicular Lines, 84-86
Lesson 2.4: Write Equations of Parallel or Perpendicular Lines, 99, 102

A2.5 Exponential and Logarithmic Functions

A2.5.1 Write the symbolic form and sketch the graph of an exponential function given appropriate information. (e.g., given an initial value of 4 and a rate of growth of 1.5, write \( f(x) = 4(1.5)^x \)).

**Alg 1:** Lesson 8.5: Write and Graph Exponential Growth Functions, 520-527, 528-529
Lesson 8.6: Write and Graph Exponential Decay Functions, 531-538, 539-540

**Geom:** (related topics)
Chapter 8 Algebra Review: Graph Nonlinear Functions, 565
Skills Review Handbook: Functions, 884

**Alg 2:** Lesson 7.1: Graph Exponential Growth Functions, 478-485
Lesson 7.2: Graph Exponential Decay Functions, 486-491
Lesson 7.4: Graph Logarithmic Functions, 502-503, 504-505
Lesson 7.5: Activity: Graph Logarithmic Functions, 514
Lesson 7.7: Write and Apply Exponential Functions, 529-531, 533-536

A2.5.2 Interpret the symbolic forms and recognize the graphs of exponential and logarithmic functions (e.g., \( f(x) = 10^x \), \( f(x) = \log x \), \( f(x) = e^x \), \( f(x) = \ln x \)); recognize the logarithmic function as the inverse of the exponential function.

**Alg 1:** Lesson 8.5: Write and Graph Exponential Growth Functions, 520-527, 528-529
Lesson 8.6: Write and Graph Exponential Decay Functions, 530, 531-538, 539-540
for Logarithmic Functions, see *McDougal Littell Algebra 2*

**Geom:** (related topics)
Chapter 8 Algebra Review: Graph Nonlinear Functions, 565
Skills Review Handbook: Functions, 884

**Alg 2:** Lesson 7.1: Graph Exponential Growth Functions, 478-485
Lesson 7.2: Graph Exponential Decay Functions, 486-491
Lesson 7.4: Graph Logarithmic Functions, 501, 502-505
Lesson 7.5: Activity: Graph Logarithmic Functions, 514
Lesson 7.7: Write and Apply Exponential Functions, 529-531, 533-536
A2.5.3 Apply properties of exponential and logarithmic functions (e.g., \( a^x + y = a^xa^y \); \( \log(ab) = \log a + \log b \)).

Alg 1: (related topics)
Lesson 8.1: Apply Exponent Properties Involving Products, 489-494
Lesson 8.2: Apply Exponent Properties Involving Quotients, 495-501

Geom: (related topics)
Chapter 8 Algebra Review: Graph Nonlinear Functions, 565
Skills Review Handbook: Functions, 884

Alg 2: Lesson 7.5: Apply Properties of Logarithms, 507-513
Lesson 7.6: Solve Exponential and Logarithmic Equations, 515-517, 519-520

A2.5.4 Understand and use the fact that the base of an exponential function determines whether the function increases or decreases and understand how the base affects the rate of growth or decay.

Alg 1: Lesson 8.5: Write and Graph Exponential Growth Functions, 520-527, 528-529
Lesson 8.6: Write and Graph Exponential Decay Functions, 530, 531-538, 539-540

Geom: (related topics)
Chapter 8 Algebra Review: Graph Nonlinear Functions, 565
Skills Review Handbook: Functions, 884

Alg 2: Lesson 7.1: Graph Exponential Growth Functions, 478-485
Lesson 7.2: Graph Exponential Decay Functions, 486-491

A2.5.5 Relate exponential and logarithmic functions to real phenomena, including half-life and doubling time.

Alg 1: Lesson 8.5: Exponential Growth Models, 522-523, 525-527, 528-529
Lesson 8.6: Exponential Decay Models, 534, 537-538

Geom: (related topics)
Chapter 8 Algebra Review: Graph Nonlinear Functions, 565
Skills Review Handbook: Functions, 884

Alg 2: Lesson 7.1: Exponential Growth Models, 480-481, 483-485
Lesson 7.2: Exponential Decay Models, 488, 490-491
Lesson 7.7: Model Data with Exponential Functions, 528, 530, 534-536

A2.6 Quadratic Functions

A2.6.1 Write the symbolic form and sketch the graph of a quadratic function given appropriate information (e.g., vertex, intercepts, etc.).

Alg 1: Lesson 10.1: Graph Simple Quadratic Functions, 628-634
Lesson 10.2: Graph General Quadratic Functions, 635-640, 641-642

Geom: Chapter 7 Algebra Review: Graph Quadratic Functions, 499
Chapter 8 Algebra Review: Graph Nonlinear Functions, 565

Alg 2: Lesson 4.1: Graph Quadratic Functions in Standard Form, 236-243, 244
Lesson 4.2: Graph Quadratic Function in Vertex or Intercept Form, 245-251
Lesson 4.10: Write Quadratic Functions, 309-310, 312-313
A2.6.2 Identify the elements of a parabola (vertex, axis of symmetry, direction of opening) given its symbolic form or its graph, and relate these elements to the coefficient(s) of the symbolic form of the function.

**Alg 1:** Lesson 10.1: Graph Simple Quadratic Functions, 628-634
Lesson 10.2: Graph General Quadratic Functions, 635-640, 641-642
Lesson 10.5: Extension: Graph Quadratic Functions in Vertex Form, 669-670

**Geom:** Chapter 7 Algebra Review: Graph Quadratic Functions, 499
Chapter 8 Algebra Review: Graph Nonlinear Functions, 565

**Alg 2:** Lesson 4.1: Graph Quadratic Functions in Standard Form, 236-243, 244
Lesson 4.2: Graph Quadratic Function in Vertex or Intercept Form, 245-251

A2.6.3 Convert quadratic functions from standard to vertex form by completing the square.

**Alg 1:** Lesson 10.5: Extension: Graph Quadratic Functions in Vertex Form, 669-670

**Alg 2:** Lesson 4.7: Quadratic Function in Vertex Form, 287, 289, 290

A2.6.4 Relate the number of real solutions of a quadratic equation to the graph of the associated quadratic function.

**Alg 1:** Lesson 10.3: Zeros of Quadratic Functions, 645-646, 647-649, 650-651

**Alg 2:** Lesson 4.3: Zeros of a Function, 254-255, 256

A2.6.5 Express quadratic functions in vertex form to identify their maxima or minima, and in factored form to identify their zeros.

**Alg 1:** Lesson 10.3: Activity: Find Minimum and Maximum Values and Zeros, 650-651
Lesson 10.5: Extension: Graph Quadratic Functions in Vertex Form, 669-670

**Alg 2:** Lesson 4.2: Graph Quadratic Function in Vertex or Intercept Form, 245-251
Lesson 4.3: Zeros of a Function, 254-255, 256
Lesson 4.4: Factoring and Zeros, 262, 263
Lesson 4.7: Maximum of a Quadratic Function in Vertex Form, 287, 289, 290
Lesson 4.10: Write Quadratic Functions, 309-310, 312-313

A2.7 Power Functions (including roots, cubics, quartics, etc.)

A2.7.1 Write the symbolic form and sketch the graph of power functions.

**Alg 1:** Lesson 11.1: Graph Square Root Functions, 710-716, 717
Lesson 7.7: Write and Apply Power Functions, 531-535

**Alg 2:** Lesson 6.5: Graph Square Root and Cube Functions, 446-451

A2.7.2 Express direct and inverse relationships as functions (e.g., \(y = kx^n\) and \(y = kx^{-n}, \ n > 0\)) and recognize their characteristics (e.g., in \(y = x^3\), note that doubling \(x\) results in multiplying \(y\) by a factor of 8).

**Alg 2:** Lesson 6.4: Inverse of a Power Function, 440, 441-443

A2.7.3 Analyze the graphs of power functions, noting reflectional or rotational symmetry.

**Alg 1:** Lesson 11.1: Graph Square Root Functions, 710-716, 717

**Alg 2:** Lesson 6.5: Graph Square Root and Cube Functions, 446-451
Lesson 7.7: Write and Apply Power Functions, 531-535
A2.8 Polynomial Functions

A2.8.1 Write the symbolic form and sketch the graph of simple polynomial functions.
Alg 2:
Lesson 5.2: Evaluate and Graph Polynomial Functions, 336, 337-344, 345
Lesson 5.8: Analyze Graphs of Polynomial Functions, 387-392
Lesson 5.9: Write Polynomial Functions and Models, 393-399, 406

A2.8.2 Understand the effects of degree, leading coefficient, and number of real zeros on the graphs of polynomial functions of degree greater than 2.
Alg 2:
Lesson 5.2: Evaluate and Graph Polynomial Functions, 336, 337-344, 345
Lesson 5.7: Apply the Fundamental Theorem of Algebra, 379-386
Lesson 5.8: Analyze Graphs of Polynomial Functions, 387-392

A2.8.3 Determine the maximum possible number of zeros of a polynomial function, and understand the relationship between the x-intercepts of the graph and the factored form of the function.
Alg 2:
Lesson 5.6: Find Rational Zeros, 370-377, 378
Lesson 5.7: Apply the Fundamental Theorem of Algebra, 379-386
Lesson 5.8: Analyze Graphs of Polynomial Functions, 387-392

A2.9 Rational Functions

A2.9.1 Write the symbolic form and sketch the graph of simple rational functions.
Alg 1:
Lesson 12.2: Graph Rational Functions, 773-774, 775-782
Alg 2:
Lesson 8.2: Graph Simple Rational Functions, 560, 562-563, 564

A2.9.2 Analyze graphs of simple rational functions (e.g., \( f(x) = 2x + 1 / x - 1 \); \( g(x) = x / x^2 - 4 \)) and understand the relationship between the zeros of the numerator and denominator and the function’s intercepts, asymptotes, and domain.
Alg 1:
Lesson 12.2: Graph Rational Functions, 773-774, 775-782
Lesson 12.3: Activity: Find Asymptotes of Graphs, 792-793
Alg 2:
Lesson 8.2: Graph Simple Rational Functions, 558-563, 564
Lesson 8.3: Graph General Rational Functions, 565-571

A2.10 Trigonometric Functions

A2.10.1 Use the unit circle to define sine and cosine; approximate values of sine and cosine (e.g., \( \sin 3 \), or \( \cos 0.5 \)); use sine and cosine to define the remaining trigonometric functions; explain why the trigonometric functions are periodic.
Alg 2:
Lesson 13.3: Evaluate Trigonometric Functions of Any Angle, 866-872

A2.10.2 Use the relationship between degree and radian measures to solve problems.
Alg 2:
Lesson 13.2: Define General Angles and Use Radian Measure, 860-865

A2.10.3 Use the unit circle to determine the exact values of sine and cosine, for integer multiples of \( \pi / 6 \) and \( \pi / 4 \).
Alg 2:
Lesson 13.3: Evaluate Trigonometric Functions of Any Angle, 867-869, 871
A2.10.4 Graph the sine and cosine functions; analyze graphs by noting domain, range, period, amplitude, and location of maxima and minima.

Alg 2: Lesson 13.4: Activity: Investigating Inverse Trigonometric Functions, 874
      Lesson 14.1: Graph Sine, Cosine, and Tangent Functions, 908-914

A2.10.5 Graph transformations of basic trigonometric functions (involving changes in period, amplitude, and midline) and understand the relationship between constants in the formula and the transformed graph.

Alg 2: Lesson 14.2: Translate and Reflect Trigonometric Graphs, 915-922

STANDARD A3: MATHEMATICAL MODELING
Students construct or select a function to model a real-world situation in order to solve applied problems. They draw on their knowledge of families of functions to do so.

A3.1 Models of Real-world Situations Using Families of Functions. Example: An initial population of 300 people grows at 2% per year. What will the population be in 10 years?

A3.1.1 Identify the family of functions best suited for modeling a given real-world situation (e.g., quadratic functions for motion of an object under the force of gravity; exponential functions for compound interest; trigonometric functions for periodic phenomena. In the example above, recognize that the appropriate general function is exponential \( P = P_0 e^{kt} \)

Alg 1: Lesson 4.6: Model Direct Variation, 253-259, 260-261
      Lesson 8.5: Exponential Growth Models, 522-523, 525-527, 528-529
      Lesson 8.6: Exponential Decay Functions, 530, 531-538, 539-540
      Lesson 10.4: Quadratic Models, 654, 657-658, 659-660
      Lesson 10.8: Compare Linear, Exponential, and Quadratic Functions, 684-691, 692-693
      Lesson 12.1: Model Inverse Variation, 768, 770-772

Geom: (related topic)
      Chapter 11 Algebra Review: Use Algebraic Models to Solve Problems, 785

Alg 2: Lesson 2.5: Model Direct Variation, 107-111
      Lesson 4.10: Write Quadratic Functions and Models, 308, 309-315
      Lesson 5.9: Write Polynomial Functions and Models, 393-399
      Lesson 7.1: Exponential Growth Models, 480-481, 483-485
      Lesson 7.2: Exponential Decay Models, 488-491
      Lesson 7.4: Logarithmic Models, 500, 504-505
      Lesson 7.7: Write and Apply Exponential and Power Functions, 528, 529-536
      Lesson 8.1: Model Inverse and Joint Variation, 550, 551-557
      Lesson 11.5: Choose the Best Model for Two-Variable Data, 774, 775-780, 781
      Lesson 14.5: Write Trigonometric Functions and Models, 941-947, 948
A3.1.2  Adapt the general symbolic form of a function to one that fits the specifications of a given situation by using the information to replace arbitrary constants with numbers. In the example above, substitute the given values \( P_0 = 300 \) and \( a = 1.02 \) to obtain \( P = 300(1.02)^t \).

Alg 1:  Lesson 4.6: Model Direct Variation, 253-259, 260-261
        Lesson 8.5: Exponential Growth Models, 522-523, 525-527, 528-529
        Lesson 8.6: Exponential Decay Functions, 530, 531-538, 539-540
        Lesson 10.4: Quadratic Models, 654, 657-658, 659-660
        Lesson 10.8: Compare Linear, Exponential, and Quadratic Functions, 684-691, 692-693
        Lesson 12.1: Model Inverse Variation, 768, 770-772

Geom:  (related topic)
        Chapter 11 Algebra Review: Use Algebraic Models to Solve Problems, 785

Alg 2:  Lesson 2.5: Model Direct Variation, 107-111
        Lesson 4.10: Write Quadratic Functions and Models, 308, 309-315
        Lesson 5.9: Write Polynomial Functions and Models, 393-399
        Lesson 7.1: Exponential Growth Models, 480-481, 483-485
        Lesson 7.2: Exponential Decay Models, 488-491
        Lesson 7.4: Logarithmic Models, 500, 504-505
        Lesson 7.7: Write and Apply Exponential and Power Functions, 528, 529-536
        Lesson 8.1: Model Inverse and Joint Variation, 550, 551-557
        Lesson 11.5: Choose the Best Model for Two-Variable Data, 774, 775-780, 781
        Lesson 14.5: Write Trigonometric Functions and Models, 941-947, 948

A3.1.3  Using the adapted general symbolic form, draw reasonable conclusions about the situation being modeled. In the example above, the exact solution is 365.698, but for this problem an appropriate approximation is 365.

Alg 1:  Lesson 4.6: Model Direct Variation, 253-259, 260-261
        Lesson 8.5: Exponential Growth Models, 522-523, 525-527, 528-529
        Lesson 8.6: Exponential Decay Functions, 530, 531-538, 539-540
        Lesson 10.4: Quadratic Models, 654, 657-658, 659-660
        Lesson 10.8: Compare Linear, Exponential, and Quadratic Functions, 684-691, 692-693
        Lesson 12.1: Model Inverse Variation, 768, 770-772

Geom:  (related topic)
        Chapter 11 Algebra Review: Use Algebraic Models to Solve Problems, 785

Alg 2:  Lesson 2.5: Model Direct Variation, 107-111
        Lesson 4.10: Write Quadratic Functions and Models, 308, 309-315
        Lesson 5.9: Write Polynomial Functions and Models, 393-399
        Lesson 7.1: Exponential Growth Models, 480-481, 483-485
        Lesson 7.2: Exponential Decay Models, 488-491
        Lesson 7.4: Logarithmic Models, 500, 504-505
        Lesson 7.7: Write and Apply Exponential and Power Functions, 528, 529-536
        Lesson 8.1: Model Inverse and Joint Variation, 550, 551-557
        Lesson 11.5: Choose the Best Model for Two-Variable Data, 774, 775-780, 781
        Lesson 14.5: Write Trigonometric Functions and Models, 941-947, 948

RECOMMENDED:

*A1.1.7  Transform trigonometric expressions into equivalent forms using basic identities such as \( \sin^2\theta + \cos^2\theta = 1 \), \( \tan\theta = \sin\theta / \cos\theta \) and \( \tan^2\theta + 1 = \sec^2\theta \)

Alg 2:  Lesson 14.3: Investigating Trigonometric Identities, 923
        Lesson 14.3: Verify Trigonometric Identities, 924-930
If a function has an inverse, find the expression(s) for the inverse.

Alg 2: Lesson 6.4: Use Inverse Functions, 437, 438-445
      Lesson 13.4: Evaluate Inverse Trigonometric Functions, 874, 875-880

Write an expression for the composition of one function with another; recognize component functions when a function is a composition of other functions.

Alg 2: Lesson 6.3: Composition of Functions, 430-435

Know and interpret the function notation for inverses and verify that two functions are inverses using composition.

Alg 2: Lesson 6.4: Use Inverse Functions, 438-445

Use methods of linear programming to represent and solve simple real-life problems.

Alg 2: Lesson 3.3: Extension: Use Linear Programming, 174-176

STRAND 3 GEOMETRY AND TRIGONOMETRY (G)

STANDARD G1: FIGURES AND THEIR PROPERTIES
Students represent basic geometric figures, polygons, and conic sections and apply their definitions and properties in solving problems and justifying arguments, including constructions and representations in the coordinate plane.
Students represent three-dimensional figures, understand the concepts of volume and surface area, and use them to solve problems. They know and apply properties of common three-dimensional figures.

G1.1 Lines and Angles; Basic Euclidean and Coordinate Geometry

G1.1.1 Solve multi-step problems and construct proofs involving vertical angles, linear pairs of angles, supplementary angles, complementary angles, and right angles.

Geom: Lesson 1.5: Describe Angle Pair Relationships, 35-41
      Lesson 2.7: Prove Angle Pair Relationships, 122-123, 124-131

G1.1.2 Solve multi-step problems and construct proofs involving corresponding angles, alternate interior angles, alternate exterior angles, and same-side (consecutive) interior angles.

Geom: Lesson 3.1: Identify Pairs of Lines and Angles, 147-152
      Lesson 3.2: Use Parallel Lines and Transversals, 153, 154-160
      Lesson 3.3: Prove Lines Are Parallel, 161-169

G1.1.3 Perform and justify constructions, including midpoint of a line segment and bisector of an angle, using straightedge and compass.

Geom: Lesson 1.4: Construction: Copy and Bisect Segments and Angles, 33-34

G1.1.4 Given a line and a point, construct a line through the point that is parallel to the original line using straightedge and compass; given a line and a point, construct a line through the point that is perpendicular to the original line; justify the steps of the constructions.

Geom: Lesson 3.1: Construction, 152
      Lesson 3.3: Challenge, 169
      Lesson 3.6: Construction, 195

G1.1.5 Given a line segment in terms of its endpoints in the coordinate plane, determine its length and midpoint.

Alg 1: Lesson 11.5: Apply the Distance and Midpoint Formulas, 743, 744-750

Geom: Lesson 1.3: Use Distance and Midpoint Formulas, 15-22
G1.1.6 Recognize Euclidean Geometry as an axiom system; know the key axioms and understand the meaning of and distinguish between undefined terms (e.g., point, line, plane), axioms, definitions, and theorems.

Geom: Lesson 1.1: Undefined and Defined Terms, 2-3
Lesson 2.4: Postulates, 96
Lesson 2.6: Theorems, 113
Tables: Postulates, 926; Theorems, 927-931

G1.2 Triangles and Their Properties

G1.2.1 Prove that the angle sum of a triangle is 180° and that an exterior angle of a triangle is the sum of the two remote interior angles.
Geom: Lesson 4.1: Apply Triangle Sum Properties, 216, 218-219

G1.2.2 Construct and justify arguments and solve multi-step problems involving angle measure, side length, perimeter, and area of all types of triangles.
Geom: Lesson 1.7: Find Perimeter, Circumference, and Area, 49-56
Lesson 4.1: Apply Triangle Sum Properties, 216, 217-224
Lesson 5.5: Use Inequalities in a Triangle, 328-334
Lesson 5.6: Inequalities in Two Triangles and Indirect Proof, 335-341
Lesson 11.1: Areas of Triangles, 721-726

Alg 2: Lesson 13.5: Area of a Triangle, 885, 887, 888

G1.2.3 Know a proof of the Pythagorean Theorem and use the Pythagorean Theorem and its converse to solve multi-step problems.
Alg 1: Lesson 11.4: Apply the Pythagorean Theorem and Its Converse, 736, 737-742
Geom: Lesson 7.1: Apply the Pythagorean Theorem, 432-439
Lesson 7.2: Use the Converse of the Pythagorean Theorem, 441-447
Lesson 7.3: Using Similar Right Triangles, 455
Lesson 7.6: Problem-Solving Workshop: Using Alternative Methods, 481-482
Alg 2: Lesson 13.6: Using Alternative Methods, 895
Skills Review Handbook: Triangle Relationships, 995

G1.2.4 Prove and use the relationships among the side lengths and the angles of 30°- 60°- 90° triangles and 45°- 45°- 90° triangles.
Geom: Lesson 7.4: Special Right Triangles, 457-464

Alg 2: Lesson 13.1: Special Angles, 853, 856

G1.2.5 Solve multi-step problems and construct proofs about the properties of medians, altitudes, and perpendicular bisectors to the sides of a triangle, and the angle bisectors of a triangle; using a straightedge and compass, construct these lines.
Geom: Lesson 5.2: Use Perpendicular Bisectors, 303-309
Lesson 5.3: Use Angle Bisectors of Triangles, 310-316
Lesson 5.4: Use Median and Altitudes, 318, 319-325, 326-327
G1.3 Triangles and Trigonometry

G1.3.1 Define the sine, cosine, and tangent of acute angles in a right triangle as ratios of sides; solve problems about angles, side lengths, or areas using trigonometric ratios in right triangles.

**Geom:**
- Lesson 7.5: Apply the Tangent Ratio, 466-472
- Lesson 7.6: Apply the Sine and Cosine Ratios, 473-480, 481-482
- Lesson 7.7: Solve Right Triangles, 483-489

**Alg 2:**
- Lesson 13.1: Use Trigonometry with Right Triangles, 852-858

G1.3.2 Know and use the Law of Sines and the Law of Cosines and use them to solve problems; find the area of a triangle with sides $a$ and $b$ and included angle $\phi$ using the formula $\text{Area} = \frac{1}{2}ab \sin \phi$.

**Geom:**
- Lesson 7.7: Extension: Law of Sines and Law of Cosines, 490-491

**Alg 2:**
- Lesson 13.5: Apply the Law of Sines, 881, 882-888
- Lesson 13.6: Apply the Law of Cosines, 889-894

G1.4 Quadrilaterals and Their Properties

G1.4.1 Solve multi-step problems and construct proofs involving angle measure, side length, diagonal length, perimeter, and area of squares, rectangles, parallelograms, kites, and trapezoids.

**Alg 1:** (related topics)
- Lesson 3.8: Rewrite Equations and Formulas, 185, 187, 190
- Lesson 5.1: Activity: Modeling Linear Relationships, 282
- Skills Review Handbook: Perimeter and Area, 924-925

**Geom:**
- Lesson 1.7: Find Perimeter and Area, 49, 51, 52-56, 57
- Lesson 8.2: Use Properties of Parallelograms, 515-521
- Lesson 8.4: Properties of Rhombuses, Rectangles, and Squares, 533-540, 541
- Lesson 8.5: Use Properties of Trapezoids and Kites, 542-549
- Lesson 11.1: Areas of Triangles and Parallelograms, 720-726
- Lesson 11.2: Areas of Trapezoids, Rhombuses, and Kites, 729, 730-736

**Alg 2:** (related topics)
- Lesson 1.4: Rewrite Formulas and Equations, 26-27, 30, 32
- Skills Review Handbook: Perimeter and Area, 991

G1.4.2 Solve multi-step problems and construct proofs involving quadrilaterals (e.g., prove that the diagonals of a rhombus are perpendicular) using Euclidean methods or coordinate geometry.

**Geom:**
- Lesson 8.2: Use Properties of Parallelograms, 515-521
- Lesson 8.3: Show that a Quadrilateral Is a Parallelogram, 522-530, 530-531
- Lesson 8.4: Properties of Rhombuses, Rectangles, and Squares, 533-540, 541
- Lesson 8.5: Use Properties of Trapezoids and Kites, 542-549

G1.4.3 Describe and justify hierarchical relationships among quadrilaterals, (e.g. every rectangle is a parallelogram).

**Alg 1:**
- Skills Review Handbook: Classifying Quadrilaterals, 920

**Geom:**
- Lesson 8.3: Show that a Quadrilateral Is a Parallelogram, 522-530, 530-531
- Lesson 8.6: Identify Special Quadrilaterals, 552-557
G1.4.4 Prove theorems about the interior and exterior angle sums of a quadrilateral.


G1.5 Other Polygons and Their Properties

G1.5.1 Know and use subdivision or circumscription methods to find areas of polygons (e.g., regular octagon, non-regular pentagon).

Geom: Lesson 11.6: Areas of Regular Polygons, 762-768, 769
Alg 2: (related topic)
    Lesson 12.1: Geometry, 799

G1.5.2 Know, justify, and use formulas for the perimeter and area of a regular \( n \)-gon and formulas to find interior and exterior angles of a regular \( n \)-gon and their sums.

Geom: Lesson 8.1: Find Angle Measures in Polygons, 506, 509-513
    Lesson 11.6: Areas of Regular Polygons, 762-768, 769
Alg 2: (related topic)
    Lesson 12.1: Geometry, 799

G1.6 Circles and Their Properties

G1.6.1 Solve multi-step problems involving circumference and area of circles.

Alg 1: (related topics)
    Lesson 3.8: Rewrite Equations and Formulas, 189
    Skills Review Handbook: Circumference and Area of a Circle, 926
Geom: Lesson 1.7: Find Circumference and Area, 49-50, 53-55
    Lesson 11.4: Circumference, 746-747, 749, 750, 751
    Lesson 11.5: Areas of Circles, 755, 758, 760, 761
Alg 2: (related topics)
    Lesson 1.4: Rewrite Equations and Formulas, 26, 31, 32
    Skills Review Handbook: Circumference and Area of a Circle, 992

G1.6.2 Solve problems and justify arguments about chords (e.g., if a line through the center of a circle is perpendicular to a chord, it bisects the chord) and lines tangent to circles (e.g., a line tangent to a circle is perpendicular to the radius drawn to the point of tangency).

Geom: Lesson 10.2: Use Properties of Tangents, 650, 651-658
    Lesson 10.3: Apply Properties of Chords, 664-670

G1.6.3 Solve problems and justify arguments about central angles, inscribed angles and triangles in circles.

Geom: Lesson 5.2: Circumcenter, 306
    Lesson 10.4: Use Inscribed Angles, 671, 672, 674, 679

G1.6.4 Know and use properties of arcs and sectors, and find lengths of arcs and areas of sectors.

Geom: Lesson 10.2: Find Arc Measures, 659-663
    Lesson 11.4: Arc Length, 747-752
    Lesson 11.5: Areas of Sectors, 756-761
Alg 2: Lesson 13.2: Sectors of Circles, 861-862, 863-865
G1.7  Conic Sections and Their Properties

G1.7.1  Find an equation of a circle given its center and radius; given the equation of a circle, find its center and radius.

Geom:  Lesson 10.7: Write and Graph Equations of Circles, 699-705
Alg 2:  Lesson 9.3: Graph and Write Equations of Circles, 626-632, 633

G1.7.2  Identify and distinguish among geometric representations of parabolas, circles, ellipses, and hyperbolas; describe their symmetries, and explain how they are related to cones.

Alg 2:  Lesson 9.2: Graph and Write Equations of Parabolas, 620-625
Lesson 9.3: Graph and Write Equations of Circles, 626-632, 633
Lesson 9.4: Graph and Write Equations of Ellipses, 634-639
Lesson 9.5: Graph and Write Equations of Hyperbolas, 642-648
Lesson 9.6: Translate and Classify Conic Sections, 649, 650-657

G1.7.3  Graph ellipses and hyperbolas with axes parallel to the x- and y-axes, given equations.

Alg 2:  Lesson 9.4: Graph and Write Equations of Ellipses, 635, 637-639
Lesson 9.5: Graph and Write Equations of Hyperbolas, 643, 645-648

G1.8  Three-Dimensional Figures

G1.8.1  Solve multi-step problems involving surface area and volume of pyramids, prisms, cones, cylinders, hemispheres, and spheres.

Alg 1:  (related topics)
Lesson 3.8: Rewrite Equations and Formulas, 187, 188
Lesson 8.1: Volume, 494
Lesson 12.5: Extension: Geometry, 811
Skills Review Handbook: Surface Area and Volume, 927-928

Geom:  Lesson 12.2: Surface Area of Prisms and Cylinders, 802, 803-809
Lesson 12.3: Surface Area of Pyramids and Cones, 810-817
Lesson 12.4: Volume of Prisms and Cylinders, 819-825, 826-827
Lesson 12.5: Volume of Pyramids and Cones, 828, 829-836, 837
Lesson 12.6: Surface Area and Volume of Spheres, 838-845
Lesson 12.7: Explore Similar Solids, 846, 847-854

Alg 2:  Lesson 5.1: Volumes, 332, 334, 335
Lesson 5.3: Polynomial Functions, 350, 351
Lesson 5.6: Pyramid, 373
Lesson 6.2: Sphere, 427
Lesson 6.5: Cone, 451
Lesson 8.3: Cylinder, 567
Lesson 8.4: Cylinder and Sphere, 580
Skills Review Handbook: Surface Area and Volume, 993

G1.8.2  Identify symmetries of pyramids, prisms, cones, cylinders, hemispheres, and spheres.

Geom:  (related topics)
Lesson 8.5: Extension: Draw Three-Dimensional Figures, 550
Lesson 12.1: Explore Solids, 794-801
STANDARD G2: RELATIONSHIPS BETWEEN FIGURES
Students use and justify relationships between lines, angles, area and volume formulas, and 2- and 3-dimensional representations. They solve problems and provide proofs about congruence and similarity.

G2.1 Relationships Between Area and Volume Formulas

G2.1.1 Know and demonstrate the relationships between the area formula of a triangle, the area formula of a parallelogram, and the area formula of a trapezoid.

Alg 1: (related topics)
Lesson 3.8: Rewrite Equations and Formulas, 185, 187
Skills Review Handbook: Perimeter and Area, 924-925

Geom: Lesson 11.1: Areas of Triangles and Parallelograms, 720-726
Lesson 11.2: Areas of Trapezoids, Rhombuses, and Kites, 729, 730-736

G2.1.2 Know and demonstrate the relationships between the area formulas of various quadrilaterals (e.g., explain how to find the area of a trapezoid based on the areas of parallelograms and triangles).

Alg 1: (related topics)
Lesson 3.8: Rewrite Equations and Formulas, 185, 187
Skills Review Handbook: Perimeter and Area, 924-925

Geom: Lesson 11.1: Areas of Triangles and Parallelograms, 720-726
Lesson 11.2: Areas of Trapezoids, Rhombuses, and Kites, 729, 730-736

Alg 2: (related topics)
Lesson 1.4: Rewrite Formulas and Equations, 27, 30
Skills Review Handbook: Perimeter and Area, 991

G2.1.3 Know and use the relationship between the volumes of pyramids and prisms (of equal base and height) and cones and cylinders (of equal base and height).

Alg 1: (related topics)
Lesson 3.8: Rewrite Equations and Formulas, 188
Skills Review Handbook: 927-928

Geom: Lesson 12.5: Volume of Pyramids and Cones, 828, 829, 834

G2.2 Relationships Between Two-dimensional and Three-dimensional Representations

G2.2.1 Identify or sketch a possible 3-dimensional figure, given 2-dimensional views (e.g., nets, multiple views); create a 2-dimensional representation of a 3-dimensional figure.

Geom: Lesson 8.5: Extension: Draw Three-Dimensional Figures, 550
Lesson 12.1: Explore Solids, 794-801

G2.2.2 Identify or sketch cross-sections of 3-dimensional figures; identify or sketch solids formed by revolving 2-dimensional figures around lines.

Geom: Lesson 8.5: Extension: Draw Three-Dimensional Figures, 550
Lesson 12.1: Explore Solids, 794-801
G2.3 Congruence and Similarity

G2.3.1 Prove that triangles are congruent using the SSS, SAS, ASA, and AAS criteria, and for right triangles, the hypotenuse-leg criterion.

Geom: Lesson 4.4: Prove Triangles Congruent by SAS and HL, 240-246, 247
Lesson 4.5: Prove Triangles Congruent by ASA and AAS, 249-255

Alg 2: (related topic)
Skills Review Handbook: Congruent and Similar Figures, 996-997

G2.3.2 Use theorems about congruent triangles to prove additional theorems and solve problems, with and without use of coordinates.

Geom: Lesson 4.6: Use Congruent Triangles, 256-263
Lesson 4.7: Use Isosceles and Equilateral Triangles, 264-270

Alg 2: (related topic)
Skills Review Handbook: Congruent and Similar Figures, 996-997

G2.3.3 Prove that triangles are similar by using SSS, SAS, and AA conditions for similarity.

Geom: Lesson 6.4: Prove Triangles Similar by AA, 381-387
Lesson 6.5: Prove Triangles Similar by SSS and SAS, 388-395

Alg 2: (related topic)
Skills Review Handbook: Congruent and Similar Figures, 996-997

G2.3.4 Use theorems about similar triangles to solve problems with and without use of coordinates.

Geom: Lesson 6.4: Prove Triangles Similar by AA, 383, 386-387
Lesson 6.5: Prove Triangles Similar by SSS and SAS, 390, 393-395

Alg 2: (related topic)
Skills Review Handbook: Congruent and Similar Figures, 996-997

G2.3.5 Know and apply the theorem stating that the effect of a scale factor of k relating one two-dimensional figure to another or one three-dimensional figure to another, on the length, area, and volume of the figures is to multiply each by $k$, $k^2$, and $k^3$, respectively.

Alg 1: (related topic)
Lesson 3.6 Extension: Apply Proportions to Similar Figures, 174-175

Geom: Lesson 6.3: Use Similar Polygons, 372-379
Lesson 11.3: Perimeter and Area of Similar Figures, 737-743, 744
Lesson 12.7: Explore Similar Solids, 846, 847-854

Alg 2: (related topic)
Skills Review Handbook: Congruent and Similar Figures, 996-997
STANDARD G3: TRANSFORMATIONS OF FIGURES IN THE PLANE
Students will solve problems about distance-preserving transformations and shape-preserving transformations. The transformations will be described synthetically and, in simple cases, by analytic expressions in coordinates.

G3.1 Distance-preserving Transformations: Isometries

G3.1.1 Define reflection, rotation, translation, and glide reflection and find the image of a figure under a given isometry.

Alg 1: Lesson 4.1: Extension: Perform Transformations, 213, 214
Skill Review Handbook: Transformations, 922, 923

Geom: Lesson 4.8: Perform Congruence Transformations, 272-279
Lesson 9.1: Translate Figures and Use Vectors, 572-579
Lesson 9.3: Perform Reflections, 588, 589-596
Lesson 9.4: Perform Rotations, 598-606

Alg 2: Skills Review Handbook: Transformations, 988, 989

G3.1.2 Given two figures that are images of each other under an isometry, find the isometry and describe it completely.

Alg 1: Lesson 4.1: Extension: Perform Transformations, 213, 214

Geom: Lesson 4.8: Perform Congruence Transformations, 271, 272-279
Lesson 9.1: Translate Figures and Use Vectors, 572-579
Lesson 9.3: Perform Reflections, 588, 589-596
Lesson 9.4: Perform Rotations, 598-606

Alg 2: Skills Review Handbook: Transformations, 988, 989

G3.1.3 Find the image of a figure under the composition of two or more isometries, and determine whether the resulting figure is a reflection, rotation, translation, or glide reflection image of the original figure.

Alg 1: Lesson 4.1: Extension: Perform Transformations, 214

Geom: Lesson 9.5: Apply Compositions of Transformations, 607, 608-615

G3.2 Shape-preserving Transformations: Dilations and Isometries

G3.2.1 Know the definition of dilation, and find the image of a figure under a given dilation.

Alg 1: Skill Review Handbook: Transformations, 922, 923

Geom: Lesson 6.7: Perform Similarity Transformations, 408, 409-415
Lesson 9.7: Identify and Perform Dilations, 626-632

Alg 2: Skills Review Handbook: Transformations, 989

G3.2.2 Given two figures that are images of each other under some dilation, identify the center and magnitude of the dilation.

Geom: Lesson 6.7: Perform Similarity Transformations, 410-411, 414-415
Lesson 9.7: Identify and Perform Dilations, 626-632
RECOMMENDED:

*G1.4.5  Understand the definition of a cyclic quadrilateral, and know and use the basic properties of cyclic quadrilaterals.

Geom:  Lesson 10.4: Inscribed Quadrilateral, 675, 677, 678

*G1.7.4  Know and use the relationship between the vertices and foci in an ellipse, the vertices and foci in a hyperbola, and the directrix and focus in a parabola; interpret these relationships in applied contexts.

Alg 2:  Lesson 9.2: Graph and Write Equations of Parabolas, 620-625
        Lesson 9.4: Graph and Write Equations of Ellipses, 634-639
        Lesson 9.5: Graph and Write Equations of Hyperbolas, 642-648

*G3.2.3  Find the image of a figure under the composition of a dilation and an isometry.

Alg 1:  Lesson 4.1 Extension: Perform Transformations, 213-214

Geom:  Lesson 6.7: Perform Similarity Transformations, 413
        Lesson 9.7: Find Image of a Composition, 628, 630-631, 633

Alg 2:  Lesson 2.7: Multiple Transformations of Graphs, 124-125, 126-129

STRAND 4: STATISTICS AND PROBABILITY (S)

STANDARD S1: UNIVARIATE DATA – EXAMINING DISTRIBUTIONS

Students plot and analyze univariate data by considering the shape of distributions and analyzing outliers; they find and interpret commonly-used measures of center and variation; and they explain and use properties of the normal distribution.

S1.1  Producing and Interpreting Plots

S1.1.1  Construct and interpret dot plots, histograms, relative frequency histograms, bar graphs, basic control charts, and box plots with appropriate labels and scales; determine which kinds of plots are appropriate for different types of data; compare data sets and interpret differences based on graphs and summary statistics.

Alg 1:  Lesson 13.7: Interpret Stem-and-Leaf Plots and Histograms, 881-885, 886
        Lesson 13.8: Interpret Box-and-Whisker Plots, 887-892, 893
        Skills Review Handbook: Bar Graphs, 933; Line Graphs, 934

Geom:  Skills Review Handbook: Displaying Data, 888-889

        Skills Review Handbook: Organizing Statistical Data, 1008-1009
S1.1.2 Given a distribution of a variable in a data set, describe its shape, including symmetry or skewness, and state how the shape is related to measures of center (mean and median) and measures of variation (range and standard deviation) with particular attention to the effects of outliers on these measures.

Alg 1: Lesson 13.6: Use Measures of Central Tendency and Dispersion, 875-878, 879-880
Lesson 13.8: Interpret Box-and-Whisker Plots, 887-892, 893
Skills Review Handbook: Mean, Median, and Mode, 918

Geom: Skills Review Handbook: Mean, Median, and Mode, 887
Skills Review Handbook: Displaying Data, 888-889

Alg 2: Lesson 11.1: Find Measures of Central Tendency and Dispersion, 744-749, 750
Lesson 11.2: Apply Transformations to Data, 751-755
Skills Review Handbook: Mean, Median, and Mode, 1005
Skills Review Handbook: Graphing Statistical Data, 1006-1007
Skills Review Handbook: Organizing Statistical Data, 1008-1009

S1.2 Measures of Center and Variation

S1.2.1 Calculate and interpret measures of center including: mean, median, and mode; explain uses, advantages and disadvantages of each measure given a particular set of data and its context.

Alg 1: Lesson 13.6: Use Measures of Central Tendency and Dispersion, 875, 877-878
Skills Review Handbook: Mean, Median, and Mode, 918

Geom: Skills Review Handbook: Mean, Median, and Mode, 887

Alg 2: Lesson 11.1: Find Measures of Central Tendency and Dispersion, 744-749, 750
Skills Review Handbook: Mean, Median, and Mode, 1005

S1.2.2 Estimate the position of the mean, median, and mode in both symmetrical and skewed distributions, and from a frequency distribution or histogram.

Alg 1: Lesson 13.7: Interpret Stem-and-Leaf Plots and Histograms, 881-885, 886
Lesson 13.8: Interpret Box-and-Whisker Plots, 887-892, 893, 918

Geom: Skills Review Handbook: Displaying Data, 888-889

Alg 2: Lesson 11.2: Apply Transformations to Data, 751-755
Skills Review Handbook: Organizing Statistical Data, 1008-1009

S1.2.3 Compute and interpret measures of variation, including percentiles, quartiles, interquartile range, variance, and standard deviation.

Alg 1: Lesson 13.6: Extension: Calculate Variance and Standard Deviation, 879-880
Lesson 13.8: Interpret Box-and-Whisker Plots, 887-892

Geom: Skills Review Handbook: Displaying Data, 888-889

Alg 2: Lesson 11.1: Find Measures of Central Tendency and Dispersion, 744-749, 750
Skills Review Handbook: Organizing Statistical Data, 1008-1009
S1.3  The Normal Distribution

S1.3.1  Explain the concept of distribution and the relationship between summary statistics for a data set and parameters of a distribution.
Alg 2:  Lesson 11.3: Use Normal Distributions, 757-762

S1.3.2  Describe characteristics of the normal distribution, including its shape and the relationships among its mean, median, and mode.
Alg 2:  Lesson 11.3: Use Normal Distributions, 757-762, 763-765

S1.3.3  Know and use the fact that about 68%, 95%, and 99.7% of the data lie within one, two, and three standard deviations of the mean, respectively in a normal distribution.
Alg 2:  Lesson 11.3: Use Normal Distributions, 757-762

S1.3.4  Calculate z-scores, use z-scores to recognize outliers, and use z-scores to make informed decisions.
Alg 2:  Lesson 11.3: Use Normal Distributions, 758, 761-762

STANDARD S2: BIVARIATE DATA – EXAMINING RELATIONSHIPS
Students plot and interpret bivariate data by constructing scatterplots, recognizing linear and nonlinear patterns, and interpreting correlation coefficients; they fit and interpret regression models, using technology as appropriate.

S2.1  Scatterplots and Correlation

S2.1.1  Construct a scatterplot for a bivariate data set with appropriate labels and scales.
Alg 1:  Lesson 5.6: Fit a Line to Data, 325-331
Alg 2:  Lesson 2.6: Draw Scatter Plots and Best-Fitting Lines, 112, 113-120
Lesson 11.5: Choose the Best Model for Two-Variable Data, 775-780, 781

S2.1.2  Given a scatterplot, identify patterns, clusters, and outliers; recognize no correlation, weak correlation, and strong correlation.
Alg 1:  Lesson 5.6: Fit a Line to Data, 325-331
Alg 2:  Lesson 2.6: Draw Scatter Plots and Best-Fitting Lines, 113-120
Lesson 11.5: Choose the Best Model for Two-Variable Data, 775-780, 781

S2.1.3  Estimate and interpret Pearson’s correlation coefficient for a scatterplot of a bivariate data set; recognize that correlation measures the strength of linear association.
Alg 1:  Lesson 5.6: Activity: Perform Linear Regression, 332-333
Alg 2:  Lesson 2.6: Draw Scatter Plots and Best-Fitting Lines, 114-120

S2.1.4  Differentiate between correlation and causation; know that a strong correlation does not imply a cause-and-effect relationship; recognize the role of lurking variables in correlation.
Alg 1:  Lesson 5.6: Activity: Perform Linear Regression, 332-333
Alg 2:  Lesson 2.6: Draw Scatter Plots and Best-Fitting Lines, 114-120
S2.2  Linear Regression

S2.2.1  For bivariate data which appear to form a linear pattern, find the least squares regression line by estimating visually and by calculating the equation of the regression line; interpret the slope of the equation for a regression line.

Alg 1:  Lesson 5.6: Activity: Perform Linear Regression, 332-333
        Lesson 5.7: Predict with Linear Models, 335-341, 342

Alg 2:  Lesson 2.6: Draw Scatter Plots and Best-Fitting Lines, 116-120
        Lesson 11.5: Choose the Best Model for Two-Variable Data, 775-780, 781

S2.2.2  Use the equation of the least squares regression line to make appropriate predictions.

Alg 1:  Lesson 5.6: Activity: Perform Linear Regression, 332-333
        Lesson 5.7: Predict with Linear Models, 335-341, 342

Alg 2:  Lesson 2.6: Draw Scatter Plots and Best-Fitting Lines, 116-120
        Lesson 11.5: Choose the Best Model for Two-Variable Data, 775-780, 781

STANDARD S3: SAMPLES, SURVEYS, AND EXPERIMENTS

Students understand and apply sampling and various sampling methods, examine surveys and experiments, identify bias in methods of conducting surveys, and learn strategies to minimize bias. They understand basic principles of good experimental design.

S3.1  Data Collection and Analysis

S3.1.1  Know the meanings of a sample from a population and a census of a population, and distinguish between sample statistics and population parameters.

Alg 1:  Lesson 13.5: Analyze Surveys and Samples, 871, 873-874

Geom:  Lesson 6.1: Surveys, 359, 362
        Skills Review Handbook: Sampling and Surveys, 890

Alg 2:  Lesson 11.4: Select and Draw Conclusions from Samples, 766, 768-771

S3.1.2  Identify possible sources of bias in data collection and sampling methods and simple experiments; describe how such bias can be reduced and controlled by random sampling; explain the impact of such bias on conclusions made from analysis of the data; and know the effect of replication on the precision of estimates.

Alg 1:  Lesson 13.5: Analyze Surveys and Samples, 872-874


Alg 2:  Lesson 11.4: Select and Draw Conclusions from Samples, 767, 769, 770-771, 772-773

S3.1.3  Distinguish between an observational study and an experimental study, and identify, in context, the conclusions that can be drawn from each.

Alg 1:  Lesson 13.1: Activity: Experiment, 842
        Lesson 13.5: Analyze Surveys and Samples, 871, 873

Geom:  Lesson 11.7: Activity: Experiment, 770
        Skills Review Handbook: Sampling and Surveys, 890

Alg 2:  Lesson 10.6: Binomial Experiment, 725, 728
        Lesson 11.4: Select and Draw Conclusions from Samples, 766-771, 772-773
STANDARD S4: PROBABILITY MODELS AND PROBABILITY CALCULATION
Students understand probability and find probabilities in various situations, including those involving compound events, using diagrams, tables, geometric models and counting strategies; they apply the concepts of probability to make decisions.

S4.1 Probability

S4.1.1 Understand and construct sample spaces in simple situations (e.g., tossing two coins, rolling two number cubes and summing the results).

Alg 1: Lesson 13.1: Find Probabilities and Odds, 843-848
Geom: Lesson 11.7: Use Geometric Probability, 772-777
Skills Review Handbook: Probability, 893

Alg 2: Lesson 10.3: Define and Use Probability, 698-705

S4.1.2 Define mutually exclusive events, independent events, dependent events, compound events, complementary events and conditional probabilities; and use the definitions to compute probabilities.

Alg 1: Lesson 13.1: Find Probabilities and Odds, 842, 843-848
Lesson 13.4: Find Probabilities of Compound Events, 861-867

Geom: Lesson 11.7: Use Geometric Probability, 770, 771-777
Skills Review Handbook: Probability, 893

Alg 2: Lesson 10.3: Define and Use Probability, 698-704
Lesson 10.4: Find Probabilities of Disjoint and Overlapping Events, 706, 707-713, 714
Lesson 10.4: Extension: Apply Set Theory, 715-716
Lesson 10.5: Find Probabilities of Independent and Dependent Events, 717-723

S4.2 Application and Representation

S4.2.1 Compute probabilities of events using tree diagrams, formulas for combinations and permutations, Venn diagrams, or other counting techniques.

Alg 1: Lesson 13.1: Find Probabilities and Odds, 842, 843-848, 849-850
Lesson 13.2: Find Probabilities Using Permutations, 851-855
Lesson 13.3: Find Probabilities Using Combinations, 856-859, 860
Lesson 13.4: Find Probabilities of Compound Events, 861-867, 868-869

Geom: Lesson 11.7: Use Geometric Probability, 770, 771-777
Skills Review Handbook: Counting Methods, 891-891
Skills Review Handbook: Probability, 893

Alg 2: Lesson 10.1: Apply the Counting Principle and Permutations, 682-689
Lesson 10.2: Use Combinations and the Binomial Theorem, 690-697
Lesson 10.3: Define and Use Probability, 698-704
Lesson 10.4: Find Probabilities of Disjoint and Overlapping Events, 706, 707-713, 714
Lesson 10.4: Extension: Apply Set Theory, 715-716
Lesson 10.5: Find Probabilities of Independent and Dependent Events, 717-723
Lesson 10.6: Construct and Interpret Binomial Distributions, 724-730, 731
S4.2.2 Apply probability concepts to practical situations, in such settings as finance, health, ecology, or epidemiology, to make informed decisions.

Alg 1:  Lesson 13.1: Find Probabilities and Odds, 844, 847-848, 849-850
Lesson 13.2: Find Probabilities Using Permutations, 853, 855-855
Lesson 13.3: Find Probabilities Using Combinations, 857, 859, 860
Lesson 13.4: Find Probabilities of Compound Events, 863, 865-867, 868-869

Geom:  Lesson 11.7: Use Geometric Probability, 772-777
Skills Review Handbook: Probability, 893

Alg 2:  Lesson 10.3: Define and Use Probability, 699, 703
Lesson 10.4: Find Probabilities of Disjoint and Overlapping Events, 708, 709, 711-713
Lesson 10.4: Extension: Apply Set Theory, 716
Lesson 10.5: Find Probabilities of Independent and Dependent Events, 719-720, 722-723
Lesson 10.6: Construct and Interpret Binomial Distributions, 726, 729-730, 731

RECOMMENDED:

*S3.1.4 Design simple experiments or investigations to collect data to answer questions of interest; interpret and present results.

Alg 1:  Lesson 13.1: Activity: Perform an Experiment, 842
Lesson 13.1: Extension: Perform Simulations, 849-850
Lesson 13.4: Using Alternative Methods, 868, 869
Lesson 13.5: Analyze Surveys and Samples, 871, 873

Geom:  Lesson 11.7: Activity: Experiment, 770

Alg 2:  Lesson 10.4: Using Alternative Methods, 714
Lesson 10.6: Binomial Experiment, 725, 728
Lesson 11.4: Extension: Design Surveys and Experiments, 772-773

*S3.1.5 Understand methods of sampling, including random sampling, stratified sampling, and convenience samples, and be able to determine, in context, the advantages and disadvantages of each.

Alg 1:  Lesson 13.5: Analyze Surveys and Samples, 871-874


Alg 2:  Lesson 11.4: Select and Draw Conclusions from Samples, 766-771, 772-773

*S3.1.6 Explain the importance of randomization, double-blind protocols, replication, and the placebo effect in designing experiments and interpreting the results of studies.

Alg 2:  Lesson 11.4: Extension: Design Surveys and Experiments, 772-773

*S3.2.1 Explain the basic ideas of statistical process control, including recording data from a process over time.

Alg 2:  (related topics)
Lesson 11.4: Select and Draw Conclusions from Samples, 766-771, 772-773

*S3.2.2 Read and interpret basic control charts; detect patterns and departures from patterns.

Alg 2:  (related topics)
Lesson 11.4: Extension: Design Surveys and Experiments, 772-773
**S4.1.3** Design and carry out an appropriate simulation using random digits to estimate answers to questions about probability; estimate probabilities using results of a simulation; compare results of simulations to theoretical probabilities.

**Alg 1:** Lesson 13.1: Extension: Perform Simulations, 849-850
Lesson 13.4: Using Alternative Methods, 868, 869

**Geom:** Lesson 11.7: Activity: Investigate Geometric Probability, 770

**Alg 2:** Lesson 10.4: Using Alternative Methods, 714