

Grades 7, 8, and Algebra 1

Fundamentals of Algebra, Foundations of Algebra, and Algebra 1 comprise a three-book series that is part of a comprehensive program aimed at preparing students for mastery in the study of Algebra and future success in the study of Geometry. As you will see in the detailed analysis that follows, algebraic concepts are introduced, developed, and maintained throughout the three books. Applications of the geometric concepts that are developed in the first two books are then integrated throughout the third book. In addition, the third book goes on to develop trigonometry of the right triangle.

Offering maximum flexibility in presentation, the program may be used consecutively in Grades 7, 8, and 9. Alternatively, an accelerated, two-year program may begin in Grade 7 with *Fundamentals of Algebra* and then follow directly with *Algebra 1* in Grade 8.

As deemed appropriate, *Algebra 1* may be offered in 1 year, $1\frac{1}{2}$ years, or 2 years.

The chart below shows the chapter titles for the three source books. The pages that follow detail the topics included in these source books and show the lessons in which particular topics may be found. Citations are also given for corresponding enrichment, technology, and skills-update resources that are included in these source books. Separate practice books and a variety of other support materials accompany the source books.

Chapter	Fundamentals of Algebra	Foundations of Algebra	Algebra 1
1	Integers	Rational Numbers	Basic Concepts of Algebra
2	Expressions and Equations	Real Numbers	Linear Equations
3	Inequalities	Expressions and Equations	Linear Inequalities
4	Rational Numbers: Decimals	Inequalities	Relations and Functions
5	Rational Numbers: Fractions	Polynomials and Factoring	Linear Functions
6	Ratio and Proportion	Linear Functions and Inequalities	Systems of Linear Equations and Inequalities
7	Percent and Consumer Applications	Ratio and Proportion	Operations with Polynomials
8	Data Analysis and Statistics	Percent Applications	Factoring Polynomials
9	Two-Dimensional Geometry	Two-Dimensional Geometry	Radical Expressions and Equations
10	Two-Dimensional Geometry and Measurement Applications	Geometric Measures and Coordinate Geometry	Quadratic Functions and Equations
11	Three-Dimensional Geometry	Patterns and Nonlinear Functions	Ratio, Proportion, and Trigonometry
12	Probability	Three-Dimensional Geometry	Rational Expressions and Equations
13	Patterns, Relations, and Functions	Data Analysis and Statistics	Exponential and Other Nonlinear Functions
14	Polynomials, Equations, and Inequalities	Probability and Logic	Data Analysis and Probability

Key For Citations

Basic citations are given as chapter number-lesson number (e.g., 5-18).

Enrichment citations are given as page numbers (e.g., E-p.144), and are placed in context.

Skills updates are given with Roman numerals (e.g., SU-VI), and are placed in context.

Technology citations are given as chapter number-lesson number with T in front of each lesson number (e.g., T8-8) and are also cited as a group at the end.

PROBLEM-SOLVING STRATEGIES

	Grade 7	Grade 8	Algebra 1
Guess and test	1-12	3-14	11-9
Organize data	2-10	2-12	13-9
Find a pattern	3-7	5-14	7-9
Make a drawing	5-18	1-15	1-15
Solve a simpler problem	6-11	7-12	2-9
Reason logically	7-15	6-14	3-8
Adopt a different point of view	9-14	9-13	10-11
Account for all possibilities	10-13	11-10	9-7
Work backward	11-12	10-12	4-9
Consider extreme cases	13-13	13-12	5-11
Review of strategies	4-16, 8-14, 12-9, 14-11	4-12, 8-8, 12-11, 14-14	4-6, 8-9 12-10, 14-17

NUMBERS

Operations and Theory

	Grade 7	Grade 8	Algebra 1
Whole Numbers			
Place value	SU-I	SU-I	SU-I
Compare and order whole numbers	SU-II		
Round whole numbers	SU-III		
Estimate whole-number sums and differences	SU-V		
Add and subtract whole numbers	SU-VI		
Estimate whole-number products	SU-IX		
Multiply whole numbers	SU-XI		
Estimate whole-number quotients	SU-X		
Divide whole numbers	SU-XII		
Zeros in a product or quotient		SU-X	
Common factors and GCF	5-2, E-p.144	1-3	SU-V
Multiples and LCM	5-3	1-4	SU-V
Primes/composites; prime factorization	5-1	1-3, SU-VII	SU-IV
Divisibility rules	5-1	SU-VI	SU-III
Factorials	12-2, 7	14-8	14-13
Perfect squares and roots	10-3	2-3	1-1
Numbers in different bases	E-p.104	E-p.92	E-p.36

Operations and Theory (continued)

	Grade 7	Grade 8	Algebra 1
Integers			
Absolute value	1-1	1-2	1-2
Compare and order integers	1-2		
Add integers	1-3		
Subtract integers	1-4		
Multiply integers	1-5		
Divide integers	1-6		
Order of Operations	1-10	SU-V	
Rational Numbers			
Rational numbers	4-1, 2	1-1, 2, 3-11	1-1
Compare and order rational numbers	4-3, 5-5	1-5	1-2
Density of Rational; Numbers	5-5	1-11	
Add and subtract signed numbers	4-5, 5-6, 7	1-7, 8	1-3
Multiply and divide signed numbers	4-6, 8, 5-8, 9, 10, 11	1-9, 10	1-4
Order of operations	1-10, 5-13	1-14	1-6
Fractions and Mixed Numbers			
Improper fractions ↔ Mixed numbers	SU-XV	SU-XI	SU-VII
Compare and order fractions and mixed numbers	5-5	1-5	
Estimate with fractions	5-4	1-6	
Add and subtract fractions	5-6, 7, SU-XVI	SU-XII	SU-VIII
Add and subtract mixed numbers	5-7	1-7, 8	SU-VII
Multiply fractions	5-8, SU-XVII	SU-XIII	SU-IX
Multiply mixed numbers	5-9	1-9	SU-VII
Divide fractions	5-10, SU-XVIII	SU-XIII	SU-IX
Divide mixed numbers	5-11	1-10	SU-VII
Decimals			
Compare and order decimals	4-3, SU-IV	1-5, SU-II	
Estimate decimal sums and differences	4-4, SU-V	1-7, 1-8, SU-III	
Add and subtract decimals	4-5, SU-VI		
Estimate decimal products and quotients	4-7, SU-IX, X	1-7, 1-8	
Multiply decimals	4-6, SU-XIII	SU-VIII, IX	SU-VI
Divide decimals	4-8, SU-XIV	SU-VIII, IX	SU-VI
Terminating and repeating decimals	4-1	1-1, 3-11	1-1
Irrational Numbers			
Irrational numbers	10-4	2-5, 7	1-1
Square roots as irrational numbers	10-4	2-6	1-1
Estimate square roots	10-4	2-4	1-1
Real Numbers			
Real Numbers	10-4	2-7	1-2
Real-number line		2-7	1-2

Operations and Theory (continued)

	Grade 7	Grade 8	Algebra 1
Exponents			
Powers of 10	4-7	SU-1	SU-1
Positive integer exponents	1-9	1-12	1-5
Zero exponent	1-9	1-12	1-5
Negative integer exponents	4-9	1-12, T2-11	1-5
Laws of exponents	1-9	1-13	1-5
Scientific Notation			
Standard \leftrightarrow Scientific	4-10	2-1	1-7
Operations with scientific notation	4-11	2-2	1-7
Matrices			
Add and subtract matrices		E-p.32	1-11
Multiplication with matrices			1-12

Properties of Operations

Closure	1-8	2-8	1-2
Associative, Commutative, Distributive	1-7, 5-12	1-9, 2-8, SU-IV	1-9
Inverses and Identities	1-7	2-8, SU-IV	1-3, 4

Estimation

Estimation strategies		SU-III	SU-II
Estimate with whole numbers	SU-V, IX, X		
Estimate with decimals	4-4, 7, SU-V, IX, X	1-8	
Estimate with fractions	5-4	1-6	
Estimate with percents	7-7	8-2	
Estimate square roots	10-4	2-4	1-1

Ratio, Proportion, and Percent

Ratios			
Ratio forms	6-1	7-1	11-1
Rates and unit rates	6-2	7-1	11-1
Golden ratio		E-p.212	
Proportions			
Solve proportions	6-3	7-2	11-2
Direct proportions and variation	6-4	6-9, 7-5	5-2
Partitive proportions	6-5	7-6	
Inverse proportions and variation	6-9	7-7, 11-8	13-1
Scale drawings and models	6-6	7-8	11-2
Convert units of measure	6-10	7-3, SU-IV, V	11-1, SU-XIII
Dimensional analysis	6-10	7-4	11-1
Percents			
Model percent	7-1		
Percent and ratio	7-1	8-1	11-4

Ratio, Proportion, and Percent (continued)

	Grade 7	Grade 8	Algebra 1
Percents (continued)			
Fractions, decimals, and percents	7-2	8-1	SU-X
Estimate with percents	7-7	8-2	
Find percents and percentages	7-3, 4, 5, 6	8-3, 4, 5	11-4
Problems involving percent, including: sales tax, gratuities, commissions, discounts and markups, simple and compound interests	7-10, 11, 12, 13, 14, E-p.204	8-3, 4, 5, 6, 7	11-4
Percent of change: increase/decrease	7-8, 9	8-6	11-4

SETS, RELATIONS, AND FUNCTIONS**Set Theory**

	Grade 7	Grade 8	Algebra 1
Set notation			1-10
Intersection, Union, Complement			1-10
Venn diagrams	8-9	2-12, 13-2	1-10

Sequences and Patterns

Multiplication and division patterns	SU-VII, VIII		
Visual and algebraic sequences	13-2	11-1	
Fibonacci sequences		11-1, E-p.314	
Arithmetic sequences	13-1	11-2	4-4
Geometric sequences	13-1	11-3	4-5
Sequence sums	E-p.26		
Infinite geometric series			E-p.354
Infinite continued fractions			E-p.326

Relations and Functions

Relation, domain, range, representations	13-4, 5	6-1	4-1
Relationships and graphs	13-9	11-4	
Identify functions; vertical-line test	13-4	6-1	4-2
Function notation		11-5	4-2
Write function rules	13-4, 5	6-2	4-3

ALGEBRA**Expressions and Polynomials**

	Grade 7	Grade 8	Algebra 1
Words \leftrightarrow Symbols	2-1	3-1	1-8
Simplify/evaluate algebraic expressions	2-2	3-2	1-8
Polynomials: form, degree, classify	14-1	5-1, 2	7-1
Model polynomials	14-2	5-3	
Add polynomials	14-3	5-4	7-2
Subtract polynomials	14-4	5-5	7-2
Multiply monomials	14-5	5-6	7-3
Multiply a polynomial by a monomial	14-6	5-6	7-3

Expressions and Polynomials (continued)

	Grade 7	Grade 8	Algebra 1
Divide monomials	14-5	5-9	7-7
Divide a polynomial by a monomial	14-7	5-9	7-7
Model binomial multiplication		5-7	7-4
Multiply binomials		5-7, 8	7-5
Multiply polynomials			7-6
Cube binomial expressions			E-p.222
Divide polynomials using long division			7-8

Factoring

Common monomial factors		5-10	8-1
Factor trinomials		5-11, 13	8-2, 3
Special products and factoring		5-8, 12	8-4, 5
Factor by grouping			8-6
Factor completely		5-13	8-7
Factor polynomials using a graph			T8-8
Factor sums and differences of cubes			E-p.222

Linear Equations

Open sentences and solution sets	2-3	3-3	2-1
Properties of Equality: addition/subtraction	2-4, 5	3-4	2-2
Properties of Equality: multiplication/division	2-6	3-5	2-3
Addition and subtraction equations	2-4, 5, 4-12, 5-14	3-4	2-2
Multiplication and division equations	2-6, 7, 4-13, 5-15	3-5	2-3
Two-step and multi-step equations	2-8, 4-14, 5-16, 14-8	3-6, 7, 10	2-4, 5
Equations with variables on both sides	14-8	3-9	2-5
Equations with grouping symbols		3-8	2-5
Equations with absolute value		3-12	2-6
Formulas and literal equations	2-9	3-13	2-7, T2-8
Equations and repeating decimals		3-11	
Diophantine equations			E-p.66

Linear Inequalities

Words \leftrightarrow Symbols	3-1	4-1	3-1
Graph inequalities on number lines	3-2	4-1, 2	3-1
Domain, replacement and solution sets	3-2	4-2	3-1
Properties of inequality: addition/subtraction	3-3, 4	4-3, 4	3-2
Properties of inequality: multiplication/division	3-3, 5, 6	4-5, 6	3-3
Addition and subtraction inequalities	3-4, 14-9	4-3, 4	3-2
Multiplication and division inequalities	3-5, 6, 14-10	4-5, 6	3-3
Two-step and multi-step inequalities		4-7, 8, 9, 10	3-4
Compound inequalities		4-11	3-5
Absolute-value inequalities			3-6

Linear Functions

	Grade 7	Grade 8	Algebra 1
Linear function	13-6	6-2	5-1
Graphs of linear functions from tables	13-6	6-2	5-1
Slope of a line	13-7	6-4	5-1, E-p.146
Intercepts of a line		6-5	5-3
Slope-intercept form: equations / graphs		6-6	5-3
Point-slope form: equations / graphs		6-7	5-4
Standard form and changing forms		6-6	5-5
Slopes of parallel and perpendicular lines; write equations of lines		6-8	5-6
Families of lines			T5-10
Linear inequalities in coordinate plane		6-12	5-7, T5-9

Quadratic Functions and Equations

Quadratic function	13-8	11-6	10-1
Graph of a quadratic function — Parabola	13-8	11-6, T11-9	10-1, 2
Solve quadratic equations by factoring			10-3, 4
Write quadratic equations			10-4
Completing the square			10-5
Quadratic formula and discriminant			10-6
Solve quadratic equations by formula			10-7
Families of quadratic functions			T10-10

Solve Systems of Equations and Inequalities

Solve systems of linear equations graphically		6-10	6-1, E-p.146
Solve systems of linear equations algebraically by substitution		6-11	6-2
Solve systems of linear equations algebraically by elimination		6-11	6-3, 4
Solve systems of linear equations using matrices			E-p.172
Apply systems of linear equations			6-5
Solve systems of linear inequalities graphically		6-13	6-6, T6-8
Solve systems of linear and quadratic equations algebraically and graphically			10-8

Rational Expressions and Equations

Rational expressions		E-p.152	12-1
Simplify rational expressions		E-p.152	12-1, 2
Multiply rational expressions		E-p.152	12-3
Divide rational expressions		E-p.152	12-4
Add and subtract rational expressions			12-5, 6
Mixed expressions and complex fractions			12-7
Rational equations \leftrightarrow linear equations			12-8
Rational equations \leftrightarrow quadratic equations			12-9
Graph rational functions			13-2, T13-6

Radical Expressions and Equations

	Grade 7	Grade 8	Algebra 1
Radical expressions		2-3, 6	1-1, 9-1
Simplify radical expressions		2-6	9-1
Add and subtract radical expressions			9-2
Multiply and divide radical expressions			9-3
Solve radical equations			9-4
Graph radical functions			13-3, T13-7

Exponential and Other Nonlinear Functions

Graphs of exponential functions		11-7	13-4
Exponential growth and decay		11-7	13-5, T13-8
Absolute-value functions	13-8, E-p.404	11-7	5-8
Hyperbola		11-7, 8, T11-9	13-3
Step function		11-7	
Greatest-Integer function			E-p.112
Zeros of polynomial functions			T10-9

GEOMETRY**Basic Terms and Angles**

	Grade 7	Grade 8	Algebra 1
Points, Lines, Planes, Angles	9-1	SU-XVI	SU-XIV
Classify and measure angles	9-2	SU-XVII	SU-XIV
Angle pairs	9-3	9-1	
Angles of parallel lines	9-4	9-2	
Angles of polygons		9-4	

Polygons and Circles

Polygons	9-7	9-3	SU-XV
Triangles	9-8	9-3, E-p.120	SU-XVII
Quadrilaterals	9-11, E-p.268	9-3	SU-XVIII
Circles	9-12	9-6	SU-XV
Symmetry	10-10	10-8, 9	
Tesselations	10-11	9-12	
Optical illusions		E-p.262	

Similarity and Congruence

Similar polygons	6-7	7-9	SU-XVI
Indirect measure	6-8	7-11	
Congruent angles and line segments	9-5	7-9, 9-5	
Congruent polygons	9-9	9-5	SU-XVI
Fractals		E-p.232	4-5

Geometric Inequalities

Triangle inequality Theorem	9-8		E-p.90
Inequalities in a triangle		E-p.232	

Right Triangles and Trigonometry

	Grade 7	Grade 8	Algebra 1
Similar right triangles, indirect measure	6-8		
Pythagorean Theorem	10-5	2-9, E-p.60	9-5
Trigonometric ratios: define, write, find values and angle measures		7-10	11-5
Special right triangles		2-10	
Applications of trigonometric ratios			11-6, E-p.302
Angles of elevation and depression		9-11	11-7, E-p.302
Graph sine and cosine functions			T11-8

Constructions

Angle constructions	9-3	9-8	
Line constructions	9-6	9-9	
Triangle constructions	9-10	9-10	

Three-Dimensional Figures

Polyhedrons and other 3-D figures	11-1	12-1	
Views/cross sections of 3-D figures	11-2	12-2	
Nets of 3-D figures	11-3, 4	12-3, 4, E-p.340	
Similar 3-D figures	E-p.326	12-8	
Effects of changing dimensions	11-11	12-9	
Explore properties of 3-D figures		12-10	
Platonic solids		E-p.340	
Conic sections			E-p.276

Coordinate Geometry and Transformations

Coordinate Geometry			
The coordinate plane	1-11	SU-XX	SU-XI
Distance in the coordinate plane		10-7	9-6
Distance in three dimensions			E-p.242
Perimeter and area in coordinate plane		10-7	
Midpoint of a line segment		2-7	
Use slope in coordinate geometry			E-p.146
Transformations in the Coordinate Plane			
Reflections and translations	13-10	10-8	SU-XII
Rotations	13-11	10-9	SU-XII
Dilations	13-12	10-10	SU-XII
Combine transformations	E-p.378	10-11, T10-13	

MEASUREMENT**Precision**

	Grade 7	Grade 8	Algebra 1
Significant digits	10-1	10-1	
Greatest possible and relative errors	10-1	10-1	11-3

Systems of Measure

	Grade 7	Grade 8	Algebra 1
Metric system	4-15	7-3, SU-XIV	SU-XIII
Customary system	5-17, SU-XXI	7-3, SU-XV	SU-XIII

Geometric Measures

Perimeter, Circumference, and Area			
Perimeter	10-2	10-2	SU-XVIII
Area of triangles	10-7	10-3, 6, E-p.290	SU-XVIII
Area of quadrilaterals	10-6, 7	10-3, 6	SU-XVIII
Circumference and area of circles	10-8	10-4	
Area of complex figures	10-9, E-p.298	10-5	
Area of regular polygons		10-3	
Perimeter and area of similar polygons	E-p.326	10-2, 6	
Relate perimeter and area	T10-12		
Surface Area			
Prisms	11-3	12-3	SU-XIX
Pyramids	11-4	12-4	SU-XIX
Cylinders	11-5	12-3	
Cones	11-5	12-4	
Estimate surface area	11-6		
Complex three-dimensional figures	11-10		
Volume			
Prisms	11-7	12-5	SU-XIX
Pyramids	11-8	12-6	
Cylinders	11-9	12-5	
Cones	11-9	12-6	
Spheres		12-7	
Complex three-dimensional figures	11-10		
Volume of similar polygons	E-p.326		

STATISTICS AND PROBABILITY**Data Collection and Analysis**

	Grade 7	Grade 8	Algebra 1
Sampling techniques	8-1	13-2	14-1
Range and measures of central tendency	8-2, 3	13-1, 3	14-2
Frequency tables	8-1, 6	13-1	14-4
Outliers, clusters, gaps	8-8	13-1, 4	14-5
Quartiles, interquartile range	8-8	13-4	14-5
Organize data in spreadsheets	T8-3, E-p.236		
Percentiles			14-6

Constructing and Interpreting Statistical Graphs

	Grade 7	Grade 8	Algebra 1
Bar graphs: single, multiple, stacked, sliding, compressed scale	SU-XIX, 8-5, T8-13	13-5, 6, SU-XXI	SU-XX
Line graphs: single and multiple	SU-XX, 8-10, T8-13	13-8, SU-XXI	SU-XX
Line plots		13-1	SU-XXI
Circle graphs	T8-13, 9-13	9-7	SU-XXI
Stem-and-leaf plots: single and back-to-back	8-7	13-3	14-3
Histograms	8-6	13-7, T13-11	14-4
Box-and-whisker plots	8-8	13-4, T13-11	14-5, 6
Scatter plots	8-11	6-3	14-7
Choose an appropriate graph	8-4	13-9	
Misleading statistics and graphs	8-12	13-10	14-1

Probability

Sample space: Counting Principle, tree diagram	12-1, 2	14-1	14-10
Experimental probability	12-4	14-3	14-8
Theoretical probability	12-3	14-2, E-p.400	14-9
Odds of an event	12-5	14-4	SU-XXII
Complementary events		14-4	14-9
Compound events (mutually exclusive, independent/dependent; and/or)	12-6	14-5, 6	14-10, 11
Conditional probability			14-12
Pascal's Triangle and probability	E-p.348	14-7	
Simulate events			T14-15
Geometric probability			E-p.400
Permutations	12-7	14-8	14-13
Combinations	12-8	14-9	14-14
Pascal's Triangle and combinations		14-9	

REASONING**Logic**

	Grade 7	Grade 8	Algebra 1
Connectives; truth tables		14-10	
Converse, Inverse, and Contrapositive		14-11	
Inductive and Deductive Reasoning		14-12	
Conjectures and counterexamples	13-3	14-13	1-2
Algebraic fallacies		E-p.184	

TECHNOLOGY

Calculator or Handheld Device

	Grade 7	Grade 8	Algebra 1
Numbers and Algebra			
Evaluate powers and roots		T2-11	
Evaluate numerical and algebraic expressions			T1-13
Operations with matrices			T1-14
Solve linear and literal equations			T2-8
Solve linear inequalities			T3-7
Factor polynomials using a graph			T8-8
Graphs			
Bar, line, circle graphs	T8-13		
Box-and-whisker plots and histograms		T13-11	
Linear functions and inequalities			T5-9
Solve linear and literal equations		T3-7	T2-8
Families of lines			T5-10
Families of quadratic functions			T10-10
Graphs of nonlinear functions	T13-8	T11-9	
Systems of equations			T6-7
Systems of inequalities			T6-8
Sine and cosine functions			T11-8
Compare exponential growth and decay			T13-8
Geometry			
Relate perimeter and area	T10-12		
Use slope in coordinate geometry			T5-10

Geometry Software

Transformations using geometry software		T10-11	
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Spreadsheet

Organize data in spreadsheets	T8-3, E-p.236		
Scaling Solids using a spreadsheet		T12-9	