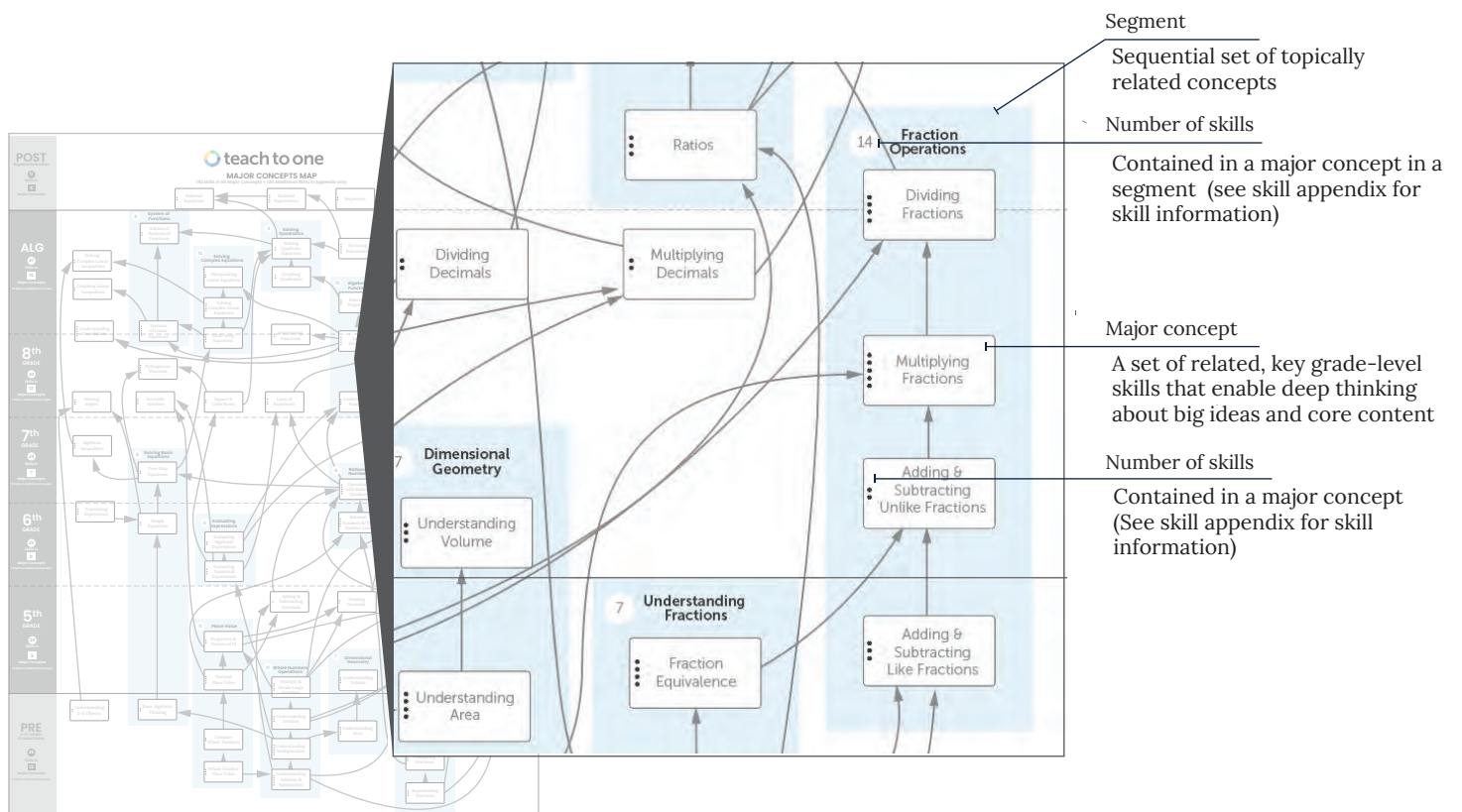




# Connecting the Dots

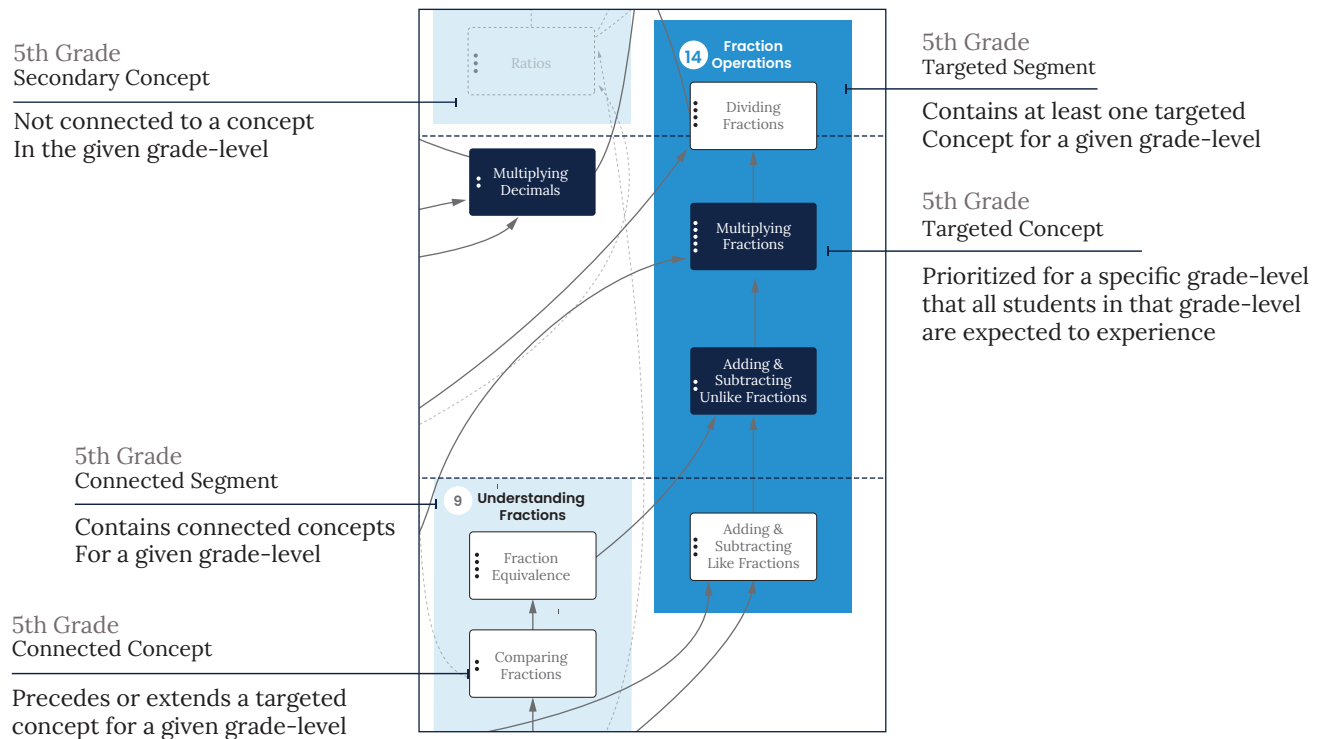
## An inside look at Teach to One's Major Concept Grade-Level Maps

Creating a learning experience tailored to each student begins with *Teach to One's* Major Concept Map. Aligned to rigorous college- and career-ready standards, the Major Concept Map defines the mathematical skills and concepts every middle school student should learn and how those skills relate to one another. To date, we have established relationships between 64 prioritized concepts and over 300 skills aligned from second grade to high school.



## Grade-Level Maps

The Grade-Level Maps below for middle and high school highlights concepts covered in each grade and prerequisite skills needed from prior grades. *Teach to One* diagnoses student understanding of these concepts and then creates a personalized yearlong learning plan, or Skill Library, for each student. The Skill Library is designed to meet students where they are and allow them to build up to targeted concepts and beyond.



### What are they?

A set of related, key grade-level skills that enable deep thinking about big ideas and core content.

### Why are they important?

Major Concepts are the centerpieces of the Map, covering standards as far back as second grade and all the way up to Geometry. Put together, the Major Concepts provide an expansive, nonlinear view of how skills build on each other.

### Did you know?

There are a total of 64 Major Concepts aligned to college- and career-ready math standards spanning 10 grades. Of those, 20 Major Concepts cover skills required for high school algebra and geometry; and 11 Major Concepts reach back into elementary grades 2-4.

The mathematical relationships reflected in TTO's skill map is very much aligned with the current state of educational research, as well as with my own experience. The map itself is a tremendous asset to the broader K-12 field and I encourage educators, policymakers, and researchers to use it to guide their practice and decision making.

– Dr. Neil Heffernan  
Director of Learning Sciences and Technologies  
Worcester Polytechnic Institute

## MAJOR CONCEPTS MAP

192 skills in 65 Major Concepts + 125 Additional Skills in Appendix only

11 Skills in  
4 Major Concepts

47 Skills in  
16 Major Concepts  
25 Skills in Additional Concepts

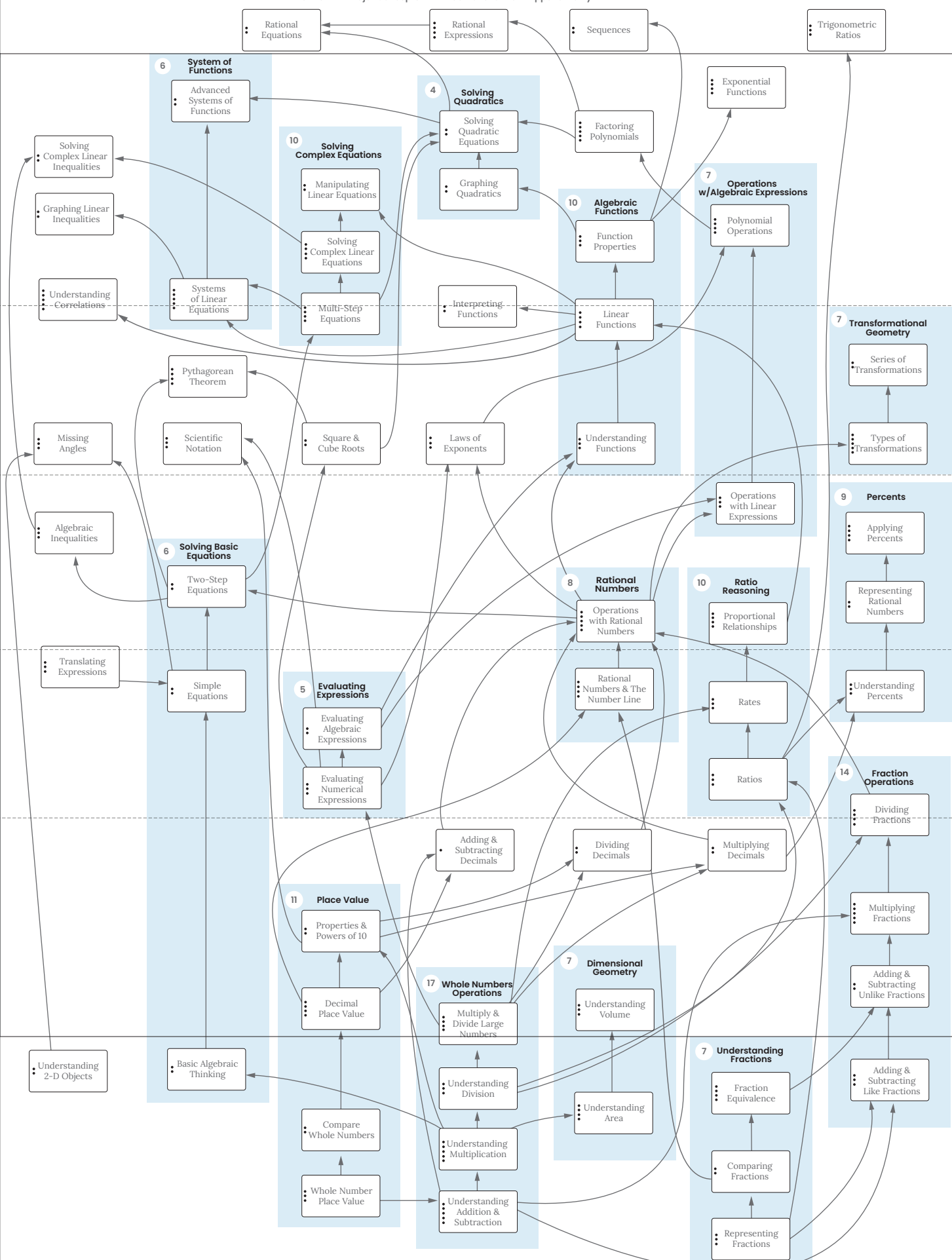
42 Skills in  
12 Major Concepts  
7 Skills in Additional Concepts

24 Skills in  
7 Major Concepts  
18 Skills in Additional Concepts

23 Skills in  
9 Major Concepts  
22 Skills in Additional Concepts

24 Skills in  
9 Major Concepts  
13 Skills in Additional Concepts

35 Skills in  
13 Major Concepts  
11 Skills in Additional Concepts







# POST

Algebra Extension

11 Skills in 4 Major Concepts

# ALG

47 Skills in 16 Major Concepts  
25 Skills in Additional Concepts

# 8th GRADE

42 Skills in 12 Major Concepts  
7 Skills in Additional Concepts

# 7th GRADE

24 Skills in 7 Major Concepts  
18 Skills in Additional Concepts

# 6th GRADE

23 Skills in 9 Major Concepts  
22 Skills in Additional Concepts

# 5th GRADE

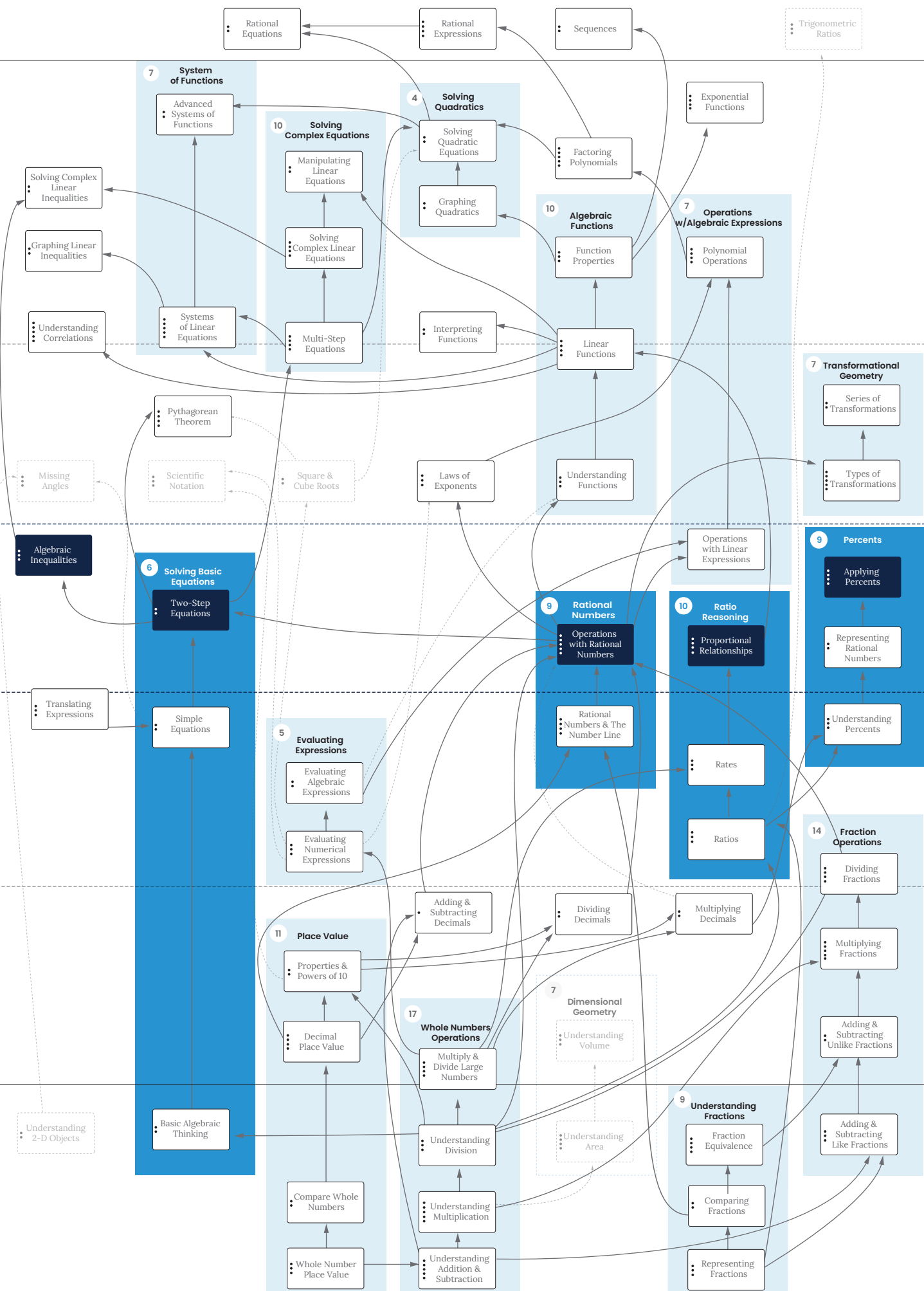
24 Skills in 9 Major Concepts  
13 Skills in Additional Concepts

# PRE

2-4th GRADE FOUNDATIONAL  
35 Skills in 13 Major Concepts  
11 Skills in Additional Concepts

# 7TH GRADE MAJOR CONCEPTS MAP

192 skills in 65 Major Concepts + 125 Additional Skills in Appendix only



# POST

Algebra Extension

11 Skills in  
4 Major Concepts

# ALG

47 Skills in  
16 Major Concepts

25 Skills in Additional Concepts

# 8th GRADE

42 Skills in  
12 Major Concepts

7 Skills in Additional Concepts

# 7th GRADE

24 Skills in  
7 Major Concepts

18 Skills in Additional Concepts

# 6th GRADE

23 Skills in  
9 Major Concepts

22 Skills in Additional Concepts

# 5th GRADE

24 Skills in  
9 Major Concepts

13 Skills in Additional Concepts

# PRE

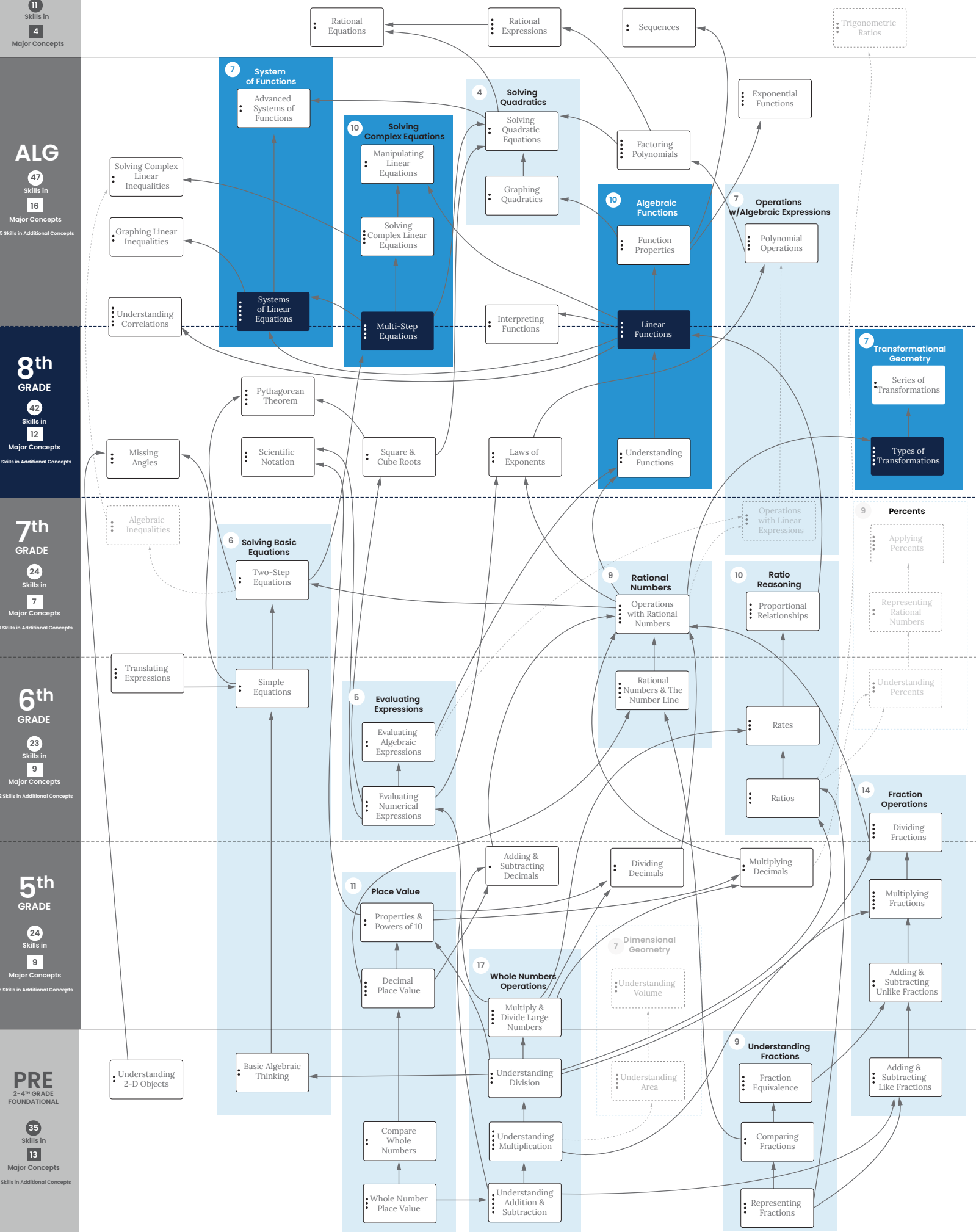
2-4th GRADE FOUNDATIONAL

35 Skills in  
13 Major Concepts

11 Skills in Additional Concepts

## 8TH GRADE MAJOR CONCEPTS MAP

192 skills in 65 Major Concepts + 125 Additional Skills in Appendix only



# POST

Algebra Extension

11 Skills in 4 Major Concepts

# ALG

47 Skills in 16 Major Concepts

25 Skills in Additional Concepts

# 8th GRADE

42 Skills in 12 Major Concepts

7 Skills in Additional Concepts

# 7th GRADE

24 Skills in 7 Major Concepts

18 Skills in Additional Concepts

# 6th GRADE

23 Skills in 9 Major Concepts

22 Skills in Additional Concepts

# 5th GRADE

24 Skills in 9 Major Concepts

13 Skills in Additional Concepts

# PRE

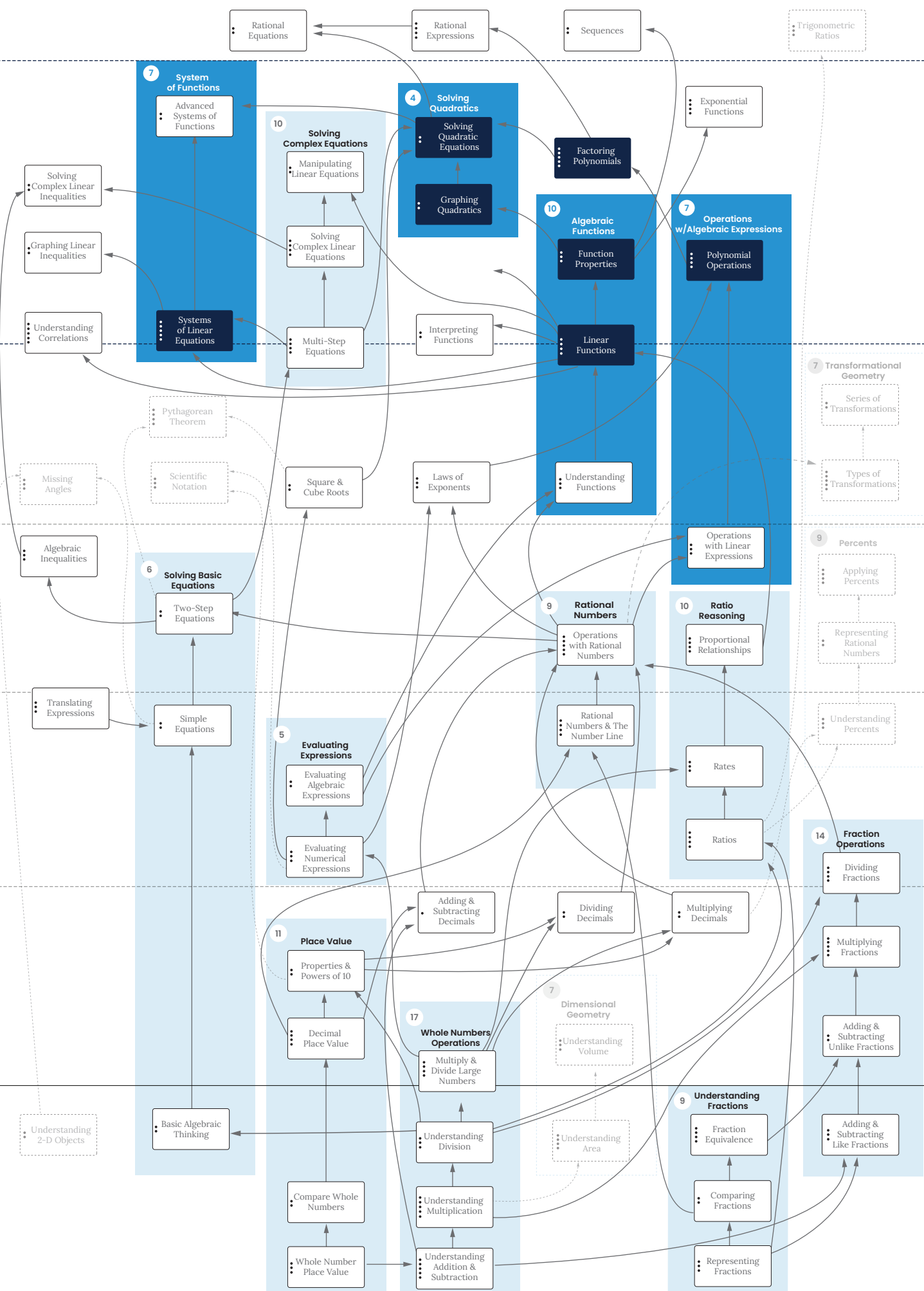
2-4th GRADE FOUNDATIONAL

35 Skills in 13 Major Concepts

11 Skills in Additional Concepts

# ALGEBRA MAJOR CONCEPTS MAP

192 skills in 65 Major Concepts + 125 Additional Skills in Appendix only





## Skills in Major Concepts

### Algebraic Functions

10 Skills in 3 Major Concepts

SEGMENT

#### ■ Function Properties:

Understanding the Multiple Characteristics of a Function  
Algebra 1

- **Function Notation** F548 I will use function notation and identify the domain and range of functions.
- **Avg. Rate of Change** F554 I will calculate and interpret the average rate of change of a function over a specified interval.
- **Compare Functions** F555 I will compare properties of two functions each represented in a different way.

#### ■ Linear Functions:

Recognizing Constant Change in a Scenario  
8th Grade

- **Slope & Y-Intercept** F145 I will determine the slope and y-intercept of a line from a graph, and explain what slope and y-intercept mean in real world and mathematical problems.
- **Construct Functions** F224 I will construct a function to model a linear relationship and describe the rate of change and initial value.
- **Linear Relationships** F232 I will represent, analyze, and compare linear relationships in graphs, equations, and tables.
- **Slope Given 2 Points** F322 I will determine the slope and the equation of a line given the coordinates of two points on the line.

#### ■ Understanding Functions:

Making Sense of When Two Variables are Connected  
8th Grade

- **Linear Functions** F167 I will use graphs to represent linear functions given by equations or linear data from a table.
- **Function Rules** F188 I will determine function rules of functions represented in tables.
- **Functions** F325 I will define and identify functions in tables, graphs, and ordered pairs.

## Dimensional Geometry

5 Skills in 2 Major Concepts

SEGMENT

### ■ Understanding Area:

Recognizing Attributes of 2-D Figures  
Pre: 2nd–4th Grade Foundational

- **Rectangular Area** G248 I will find the area of a rectangle by counting the number of square units needed to cover it and show this is the same as calculating the area by multiplying the length by the width.
- **Perimeter & Area** G153 I will explore the relationship between the perimeter and area of rectangles.
- **Additive Area** G589 I will recognize area as additive and find the area of polygons composed of rectangles.

### ■ Understanding Volume:

Recognizing Attributes of Solid Figures  
5th Grade

- **Rectangular Volume** G112 I will develop and use a volume formula for rectangular prisms by counting the cubic units needed to fill the rectangular prism without gaps or overlaps.
- **Additive Volume** G519 I will solve real world and mathematical problems involving additive volume and right rectangular prisms.

## Evaluating Expressions

5 Skills in 2 Major Concepts

SEGMENT

### ■ Evaluating Algebraic Expressions:

Grasping the Power of Substitution and Variables  
6th Grade

- **Substitution** A116 I will use substitution to evaluate algebraic expressions or formulas using the order of operations, including parentheses and exponents.
- **Substitution** A203 I will substitute values into algebraic expressions and evaluate the expressions.
- **Equal Expressions** A478 I will apply the properties of operations to generate equivalent expressions and check the equivalency using substitution.

### ■ Evaluating Numerical Expressions:

Unraveling How Operations Work Together  
6th Grade

- **Order of Operations** A138 I will evaluate numerical expressions using the order of operations, including parentheses and exponents.
- **Exponents** A265 I will translate between repeated multiplication and exponential form and find the value of a whole number raised to a power.

## Fraction Operations

13 Skills in 4 Major Concepts

SEGMENT

### ■ Adding and Subtracting Like Fractions:

Applying Basic Operations to Fractions  
Pre: 2nd–4th Grade Foundational

- **Rewrite Fractions** N109 I will decompose a fraction or mixed number into a sum of fractions with the same denominator in more than one way, recording each decomposition by an equation.
- **Add/Subtract Like Fractions** N171 I will add and subtract fractions with like denominators.
- **Add/Subtract Like Mixed Numbers** N515 I will add and subtract mixed numbers with like denominators.

### ■ Dividing Fractions:

Grappling With How Division Can Result in a Larger Answer  
5th, 6th Grade

- **Divide Fractions by Whole Numbers** N505 I will divide unit fractions by whole numbers in real world and mathematical problems.
- **Divide Whole Numbers by Fractions** N506 I will divide whole numbers by unit fractions in real world and mathematical problems.
- **Divide Fractions** N318 I will divide fractions.

### ■ Adding and Subtracting Unlike Fractions:

Making the Connection Between Equivalent Fractions and Addition  
5th Grade

- **Add/Subtract Unlike Mixed Numbers** N257 I will add and subtract mixed numbers with unlike denominators.
- **Add/Subtract Unlike Fractions** N283 I will add and subtract fractions with unlike denominators.

### ■ Multiplying Fractions:

Grappling with How Multiplication Can Result in a Smaller Answer  
5th Grade

- **Multiply Fractions** N107 I will multiply fractions.
- **Multiply Mixed Numbers** N187 I will multiply mixed numbers.
- **Multiply Whole Numbers by Fractions** N391 I will multiply whole numbers by fractions.
- **Fractional Area** N527 I will find the area of a rectangle with fractional side lengths.
- **Multiplication as Scaling** N617 I will interpret multiplication as scaling.

## Operations with Algebraic Expressions

7 Skills in 2 Major Concepts

SEGMENT

### ■ Operations with Linear Expressions:

Applying Integer Operation Rules to Algebraic Expressions  
7th Grade

- **Linear Expressions** A139 I will add and subtract linear algebraic expressions.
- **Expand Expressions** A541 I will expand linear expressions.
- **Factor Expressions** A546 I will factor linear algebraic expressions

### ■ Polynomial Operations:

Applying Basic Operations to Complex Algebraic Expressions  
Algebra 1

- **Add/Subtract Polynomials** A237 I will add and subtract polynomials.
- **Multiply Polynomials** A259 I will multiply a binomial by a monomial or a binomial.
- **Polynomials** A267 I will identify polynomials and represent them in standard form.
- **Multiple/Divide Monomials** A337 I will multiply and divide monomial expressions with a common base.

## Percents

9 Skills in 3 Major Concepts

SEGMENT

### ■ Applying Percents:

Making Sense of Percents and the World Around Us

7th Grade

- Simple Interest N243 I will solve real world and mathematical problems about simple interest.

Percent Change/Error N299 I will calculate percent of change and percent of error.

Multistep Percents N509 I will solve multistep percent problems.

Percent Increase/Decrease N584 I will solve problems involving percent increase/decrease.

### ■ Understanding Percents:

Recognizing Parts Per Hundred

6th Grade

- Find Percentages From Ratios N141 I will determine percents from ratios.

Real World Percents N292 I will solve real world and mathematical problems involving percents, including finding the whole, given a part and percent.

Represent Percents N588 I will represent percents as decimals to hundredths, fractions out of 100, and on a 100 grid.

### ■ Representing Rational Numbers:

Converting Between Multiple Forms of the Same Number

7th Grade

- Represent Fractions as Decimals N231 I will represent fractions as terminating or repeating decimals.

Rational Numbers A250 I will represent rational numbers in multiple ways.

## Place Value

11 Skills in 4 Major Concepts

SEGMENT

### ■ Compare Whole Numbers:

Applying Place Value to Evaluate Numerical Magnitude

Pre: 2nd–4th Grade Foundational

- Compare Whole Numbers N582 I will compare two three-digit numbers.

Compare Whole Numbers N169 I will compare whole numbers up to millions.

### ■ Properties and Powers of 10:

Conceiving How Place Value is Impacted

5th Grade

- Multiply/Divide by Powers of 10 N101 I will explain patterns about multiplying or dividing decimal numbers by powers of ten.

Multiply by powers of 10 N578 I will explain patterns in the number of zeros in the products when multiplying whole numbers by 10; 100; and 1,000.

### ■ Decimal Place Value:

Representing Parts Per Ten, Hundred, Thousand

5th Grade

- Compare Decimals N176 I will compare and order decimals using the math symbols  $<$ ,  $>$ , and  $=$ .

Rounding Decimals N196 I will use rounding rules to round numbers to the ones place and decimal place values.

Read/Write Decimals N277 I will read and write decimal numbers using base ten numerals, number names, and expanded form.

Decimal Place Value N616 | I will understand the value of a single digit in a multi-digit number and explain the relationship between digits.

### ■ Whole Number Place Value:

Making Sense of Our Numbers

Pre: 2nd–4th Grade Foundational

- Read/Write Whole Numbers N580 I will read and write numbers to 1,000 using base-ten numerals, number names, and expanded form.

Round Whole Numbers N142 I will round whole numbers to the nearest ten, hundred, or thousand.

Read/Write Whole Numbers N576 I will read and write whole numbers up to millions using base-ten numerals, number names, and expanded form.

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## Ratio Reasoning

10 Skills in 3 Major Concepts

SEGMENT

### ■ Proportional Relationships: Grappling With How Two Quantities are Related 7th, 8th Grade

- **Proportion Graphs** N161 I will graph a proportional relationship and explain what a point (x, y) on the graph means in terms of a situation.
- **Ratios/Proportions** N230 I will use ratio reasoning to decide if two quantities are in a proportional relationship.
- **Proportion Equations** N510 I will represent proportional relationships by equations.

**Compare Proportions** A513 I will graph proportional relationships, interpreting the unit rate as the slope of the graph and compare two different proportional relationships represented in different ways.

### ■ Ratios: Representing the Relationship Between Two Values 6th Grade

- **Equivalent Ratios** N117 I will make tables of equivalent ratios, find missing values in the tables, plot the pairs of values on a coordinate plane, and use tables to compare ratios.
- **Ratios** N213 I will know how ratios work and express ratios in different forms using ratio language.
- **Ratio/Rate Reasoning** N317 I will use ratio reasoning to convert measurement units and manipulate and transform units appropriately when multiplying or dividing quantities in real world and mathematical problems.

### ■ Rates: Understanding How Values Change in Relation to Each Other 6th, 7th Grade

- **Unit Rates** N226 I will understand the concept of rate and calculate and compare unit rates.
- **Constant Rates** N523 I will solve real world and mathematical problems involving constant rates.
- **Fractional Unit Rate** N501 I will compute unit rates associated with ratios of fractions.

## Rational Numbers

9 Skills in 2 Major Concepts

SEGMENT

### ■ Operations with Rational Numbers: Realizing Rules for Integer Operations 7th Grade

- **Multiply/Divide Rational Numbers** N106 I will multiply and divide integers and other rational numbers.
- **Subtract Rational Numbers** N152 I will subtract integers and other rational numbers with and without the use of a number line.
- **Add Rational Numbers** N182 I will add integers and other rational numbers with and without the use of a number line.
- **Add, Subtract, Multiply, Divide Rational Numbers** N522 I will solve real world and mathematical problems involving the four operations with rational numbers, especially negative numbers.
- **Add Opposites** N618 I will make sense of situations where an integer is combined with its opposite.

### ■ Rational Numbers and the Number Line: Making Sense of the Numbers Around Us 6th Grade

- **Coordinate Plane** N209 I will identify and plot points in all four quadrants of a coordinate plane.
- **Absolute Value** N304 I will find and interpret the absolute value of positive and negative rational numbers in mathematical and real world situations.
- **Order Rational Numbers** N499 I will write, interpret, and explain statements of order for rational numbers on the number line and in real world contexts.
- **Represent Integers** N567 I will use integers and other rational numbers to represent numerical situations and place them on a number line.

## Solving Basic Equations

6 Skills in 3 Major Concepts

SEGMENT

### ■ Basic Algebraic Thinking: Realizing the Connection Between Operations Pre: 2nd-4th Grade Foundational

- **Add/Subtract Equations** N133 I will determine an unknown whole number in an addition or subtraction equation.
- **Multiply/Divide Equations** A149 I will determine an unknown whole number in a multiplication or division equation.

### ■ Two-Step Equations: Making Sense of Balance When Solving for the Unknown 7th Grade

- **2-Step Equations** A179 I will solve two-step equations.
- **2-Step Equations** A389 I will solve two-step equations with positive and negative numbers.

### ■ Simple Equations: Understanding Equivalency to Solve for the Unknown 6th Grade

- **1-Step Equations** A222 I will solve one-step algebraic equations.
- **1-Step Equations** A524 I will solve problems by writing, solving, and interpreting one-step equations.

## Solving Complex Equations

9 Skills in 3 Major Concepts

SEGMENT

### ■ Manipulating Linear Equations: Grappling With Different Applications of Linear Functions Algebra 1

- **Linear Equations** A326 I will write the equation of a line, given its slope and the coordinates of a point on the line.
- **Slope Given Equation** F329 I will determine the slope of a line, given its equation in any form.

### ■ Solving Complex Linear Equations: Expanding on Inverse Operations to Solve for the Unknown Algebra 1

- **Algebraic Situations** A331 I will write algebraic equations or inequalities that represent a situation.
- **Literal Equations** A345 I will solve literal equations for a given variable.
- **Linear Equations** A358 I will analyze and solve verbal problems whose solution requires solving a linear equation in one variable.

### ■ Multi-Step Equations: Grappling With Complex Equations In Order to Solve for the Unknown 7th, 8th Grade

- **Distributive Property** A294 I will solve algebraic equations using the distributive property.
- **Multi-Step Equations** A204 I will solve multistep equations with rational numbers.
- **Variables Both Sides** A240 I will solve equations by moving variables to one side of an equation.
- **Solutions to Equations** A601 I will give examples of linear equations in one variable with one solution, infinitely many solutions, or no solutions.

## Solving Quadratics

6 Skills in 2 Major Concepts

SEGMENT

### ■ Graphing Quadratics:

Visualizing Non-Linear Functions  
Algebra 1

- **Parabola Aspects** F319 I will find the roots, vertex, and axis of symmetry of a parabola given its graph.
- **Quadratic Graphs** F547 I will graph quadratic relationships from equations or tables of values.

### ■ Solving Quadratic Functions:

Manipulating Equations to Solve for Certain Values  
Algebra 1

- **Solve Quadratics** A333 I will analyze and solve verbal problems that involve quadratic equations.
- **Multiplication Properties of Zero** A349 I will understand and apply the multiplication property of zero to solve quadratic equations by factoring.
- **Solve Quadratics** A549 I will solve quadratic equations by completing the square.
- **Quadratic Formula** A551 I will derive the quadratic formula and use it to solve quadratic equations.

## Systems of Functions

7 Skills in 2 Major Concepts

SEGMENT

### ■ Advanced Systems of Functions:

Solving for Overlap Across Multiple Types of Functions  
Algebra 1

- **Systems of Equations** A324 I will solve systems of linear and quadratic equations graphically.
- **Systems of Equations** A336 I will solve a system of one linear and one quadratic equation in two variables algebraically.

### ■ Systems of Linear Equations:

Grappling With How to Satisfy Multiple Functions  
8th Grade

- **Systems on Graphs** A236 I will solve systems of two linear equations graphically.
- **Systems of Equations** A332 I will analyze and solve verbal problems whose solution requires solving systems of linear equations in two variables.
- **Systems of Equations** A335 I will solve systems of two linear equations in two variables by using substitution.
- **Systems of Equations** A544 I will recognize systems of linear equations that have one solution, no solution, or infinitely many solutions.
- **Algebraic Systems** A553 I will solve systems of two linear equations in two variables by using elimination.

## Transformational Geometry

7 Skills in 2 Major Concepts

SEGMENT

### ■ Series of Transformations:

Making Sense of How Transformations Relate to Each Other  
8th Grade

- **Transformations** G114 I will use transformations to map a figure onto a congruent figure.
- **Transformations** N205 I will understand similarity and describe a sequence of transformations that exhibits similarity between two figures.

### ■ Types of Transformations:

Exploring How Objects Can Change Shape, Size and Direction  
8th Grade

- **Dilations** G173 I will draw the image of a figure under a dilation on a coordinate plane.
- **Reflections** G194 I will draw the image of a figure under a reflection on a coordinate plane.
- **Rotations** G242 I will draw the image of a figure under a rotation on a coordinate plane.
- **Transformations** G262 I will verify experimentally the properties of rotations, reflections, and translations.
- **Translations** G284 I will draw the image of a figure under a translation on a coordinate plane.

## Understanding Fractions

6 Skills in 2 Major Concepts

SEGMENT

### ■ Fraction Equivalence:

Realizing Multiple Representations of the Same Quantity  
Pre: 2nd-4th Grade Foundational, 5th Grade

- **Compare Fractions** N110 I will compare and order fractions using the math symbols  $<$ ,  $>$ , and  $=$ .
- **Equivalent Fractions** N126 I will create equivalent fractions and explain fraction equivalence.
- **Simplify Fractions** N239 I will simplify fractions to lowest terms.
- **Compare Fractions** N619 I will compare fractions with the same numerator or denominator.

### ■ Representing Fractions:

Understanding Parts of a Whole  
Pre: 2nd-4th Grade Foundational

- **Describe Fractions** N147 I will describe fractions using numbers, words, and pictures.
- **Represent Fractions** N579 I will represent fractions on a number line.
- **Understand Decimals** N295 I will understand decimals are part of a whole and express decimals as fractions to tenths or hundredths.

## Whole Number Operations

12 Skills in 4 Major Concepts

SEGMENT

### ■ Multiply and Divide Multi-Digit Whole Numbers:

Expanding on Arithmetic Operations  
5th Grade

- **Multiply Whole Numbers** N192 I will fluently multiply multi-digit whole numbers using the standard algorithm.
- **Divide Large Whole Numbers** N282 I will divide large whole numbers by whole numbers with two or more digits and explain remainders within context.

### ■ Understanding Addition and Subtraction:

Understanding How Numbers Grow and Reduce

Pre: 2nd-4th Grade Foundational

- **Add/Subtract on a Number Line** N581 I will find sums and differences within 100 and represent them on the number line.
- **Subtract Whole Numbers** N210 I will subtract large whole numbers.
- **Add Large Whole Numbers** N528 I will add large whole numbers.

### ■ Understanding Division:

Grasping the Idea of Sharing Equally  
Pre: 2nd-4th Grade Foundational, 5th Grade

- **Division Facts** A530 I will interpret division as equal shares and know division facts with one-digit numbers.
- **Divide Large Whole Numbers** N390 I will divide large whole numbers by one-digit whole numbers and explain remainders within context.
- **Fractions as Division** N518 I will interpret fractions as division of the numerator by the denominator and solve whole number division problems leading to answers in the form of fractions or mixed numbers.

### ■ Understanding Multiplication:

Making the Connection Between Multiplication and Addition

Pre: 2nd-4th Grade Foundational

- **Multiplication Facts** A272 I will understand multiplication and know multiplication facts up to 10 times 10.
- **Multiples of 10/100** N115 I will multiply one-digit whole numbers by multiples of 10.
- **Distributive Property** A185 I will identify and use the distributive property of multiplication over addition, relating it to area models.
- **Multiply Large Whole Numbers** N288 I will represent and analyze linear relationships in tables, equations, and graphs in the first quadrant of the coordinate plane.

## Additional Major Concepts

59 Skills in 21 Major Concepts

### ■ Adding and Subtracting Decimals: Applying Basic Operations to Decimals 5th Grade

- Add/Subtract Decimals N533 I will add and subtract decimals using a variety of strategies.

### ■ Dividing Decimals: Grappling with Division and Place Value 5th Grade

- Divide Decimals by Whole Numbers N535 I will divide a decimal by a whole number using a variety of strategies.
- Divide Decimals by Decimals N583 I will divide a decimal by a decimal using multiple strategies.

### ■ Algebraic Inequalities: Recognizing Constraints and Limitations 7th Grade

- 2-Step Inequalities A144 I will solve one and two-step inequalities and graph the solution set of an inequality on a number line.
- Translate Algebraic Inequalities A215 I will translate verbal sentences into algebraic inequalities.
- Equation/Inequality A526 I will write equations or inequalities to represent real world or mathematical problems using rational numbers and solve, comparing arithmetic solutions to algebraic solutions.

### ■ Exponential Functions: Grasping the Power of Rapid Growth and Decay Algebra 1

- Compound Interest F300 I will calculate compound interest and solve real world and mathematical problems involving interest.
- Exponential Growth A334 I will analyze and solve verbal problems that involve exponential growth and decay.
- Exponential Function F365 I will identify and graph exponential functions.
- Functions F622 I will distinguish between situations that can be modeled with linear and exponential functions.

### ■ Factoring Polynomials: Grasping How to Re-Arrange Complex Expressions Algebra 1

- GCF of Polynomials A200 I will factor polynomial expressions using the greatest common factor (GCF) of the terms.
- Factor Quadratics A285 I will factor quadratic expressions with three terms.
- Factor Quadratics A342 I will identify and factor the difference of two perfect squares.
- Factor Expressions A343 I will factor algebraic expressions completely.
- Factor Trinomials A550 I will factor trinomials where the leading coefficient is not equal to 1.

### ■ Interpreting Functions: Making Sense of Different Types of Functions 8th Grade

- Graphs in Context F129 I will create graphs to match given descriptions of situations involving a relationship between two variables or describe situations that could match given graphs.
- Linear vs Non-Linear A146 I will distinguish between linear and non-linear relationships.

### ■ Missing Angles: Understanding Special Angle Relationships 8th Grade

- Transversals G249 I will determine angle relationships when two lines (parallel or not) are cut by a transversal and use angle relationships to solve real world and mathematical problems.
- Triangle Similarity G316 I will explore and explain triangle similarity, especially the angle angle criterion.
- Exterior Angles G512 I will establish facts about the angle sum and exterior angles of triangles.

### ■ Graphing Linear Inequalities: Graphing Restrictions and Finding Solutions to Systems Algebra 1

- Graph Linear Inequalities A363 I will graph linear inequalities in two variables.
- Systems of Linear Inequalities A364 I will graph and solve systems of linear inequalities with rational coefficients in two variables.

### ■ Laws of Exponents: Grappling With How to Write Equivalent Exponent Expressions 8th Grade

- Laws of Exponents A111 I will develop and apply the laws of exponents for multiplication and division to generate equivalent numerical expressions.
- Laws of Exponents A552 I will generate equivalent expressions in which an exponent is raised to another exponent.
- Negative Exponents A620 I will understand and simplify expressions containing integer exponents.

### ■ Multiplying Decimals: Grappling with Multiplication and Place Value 5th Grade

- Multiply Decimals by Whole Numbers N534 I will multiply a decimal by a whole number using a variety of strategies.
- Multiply Decimals by Decimals N577 I will multiply a decimal by a decimal using a variety of strategies.

■ **Pythagorean Theorem:**  
Make Sense of the Relationship Between Sides of a Right Triangle  
8th Grade

- Pythagorean Theorem G261 I will explore and explain the Pythagorean Theorem.
- Pythagorean Theorem G275 I will use the Pythagorean Theorem to determine the unknown length of a side of a right triangle and explore Pythagorean triples.
- Distance Formula G308 I will use and explain the distance formula on a coordinate plane.
- Pythagorean Theorem G221 I will solve real world and mathematical problems using the Pythagorean Theorem.

■ **Rational Expressions:**  
Apply Fraction Operations to Complex Operations  
Post-Algebra

- Undefined Fractions A339 I will find values of a variable for which an algebraic fraction is undefined.
- Algebraic Fractions A340 I will add or subtract fractional expressions with monomial or like binomial denominators.
- Algebraic Fractions A341 I will multiply and divide algebraic fractions and express the product or quotient in simplest form.
- Polynomial Fractions A360 I will simplify fractions with polynomials in the numerator and denominator by factoring both and rewrite in simplest terms.

■ **Sequences:**  
Recognizing and Applying Complex Patterns  
Post-Algebra

- Geometric Sequences F560 I will recognize geometric sequences are functions and write them both recursively and explicitly.
- Arithmetic Sequences F564 I will recognize arithmetic sequences are functions and write them both recursively and explicitly.

■ **Square and Cube Roots:**  
Grappling with Radicals  
8th Grade

- Square Roots A178 I will recognize and state the value of the square root of a perfect square and estimate square roots of other whole numbers.
- Square & Cube Roots N313 I will calculate or estimate square and cube roots of numbers and understand the inverse relationship of powers and roots.

■ **Rational Equations:**  
Applying Concepts of Fraction Equivalence to Solve Complex Equations  
Post-Algebra

- Algebraic Fractions A347 I will solve equations involving fractional expressions which can be simplified to linear equations in one variable.
- Algebraic Proportion A348 I will solve algebraic proportions in one variable which result in linear or quadratic equations.

■ **Scientific Notation:**  
Making Sense of Exceedingly Large and Small Numbers  
8th Grade

- Scientific Notation A270 I will write and compare numbers in scientific notation.
- Scientific Notation A280 I will solve real world and mathematical problems involving numbers in scientific notation.
- Express Big/Small Numbers A542 I will use numbers expressed in the form of a single digit times a whole-number power of 10 to estimate very large or very small quantities, and to express how many times as much one is than the other.

■ **Solving Complex Linear Inequalities:**  
Expanding on Inverse Operations to Represent Limits and Restrictions  
Algebra 1

- Multi-step Linear Inequalities A273 I will solve multi-step inequalities and graph the solution set of an inequality on a number line.
- Solve Inequalities A346 I will analyze and solve verbal problems whose solution requires solving a linear inequality in one variable.

■ **Translating Expressions:**  
Representing Situations in Multiple Ways  
6th, 7th Grade

- Simple Inequalities A177 I will write an inequality to represent a condition or constraint and make sense of solutions on and off the number line.
- Variables A290 I will use variables to represent numbers and write expressions to represent a real world or mathematical problem.
- Creating Expressions A279 I will translate real world situations into algebraic expressions and equations.

■ **Understanding 2-D Objects:**  
Recognizing Attributes of Different Shapes  
Pre 2-4th Foundational

- Draw/Measure Angles G172 I will draw and measure angles and classify angles as acute, obtuse, right, and straight.
- Types of Lines G183 I will identify and draw intersecting, perpendicular, and parallel lines.

■ **Trigonometric Ratios:**  
Understand How Sides and Angles of Right Triangles Relate to Each Other  
Post-Algebra

- Sine/Cosine/Tangent G354 I will find and explain sine, cosine, and tangent ratios of right triangles.
- Sine/Cosine/Tangent G355 I will use inverse sine, cosine, and tangent functions to find the measures of angles in right triangles.
- Sine/Cosine/Tangent G356 I will use sine, cosine, and tangent functions to find side lengths of right triangles.

■ **Understanding Correlation:**  
Exploring the Relationship Between Two Variables  
8th Grade, Algebra 1

- Scatterplots S150 I will make and use lines of best fit on scatterplots and their equations to analyze data.
- Correlation and Causation S381 I will distinguish between correlation and causation.
- Corr. Coefficient S558 I will compute and interpret the correlation coefficient of a linear fit.
- Scatterplots S538 I will make and use scatterplots to analyze associations in bivariate data.
- Statistics & Probability: Data S623 I will use residuals to analyze how well a function fits data.

## Additional Skills 124 Skills

These skills not pictured in Major Concept Map

### Algebra

STRAND

#### Pre, 2nd-4th Grade Foundational

- **Generate Patterns** A108 I will generate a number or shape pattern that follows a given rule and identify features of the pattern.
- **Operation Properties** A212 I will define, identify, and use the commutative and associative properties of addition and multiplication.
- **Identify Factors** A220 I will identify all the factors of a given whole number and identify prime and composite numbers.
- **Find/List Multiples** A238 I will calculate and list multiples of whole numbers.
- **Add, Subtract, Multiply, Divide Whole Numbers** A529 I will solve word problems involving operations with whole numbers.

#### 5th Grade

- **Order of Operations** A274 I will use the order of operations, including parentheses, to evaluate numerical expressions involving whole numbers.
- **Number Sentences** A507 I will write expressions to record operations with numbers, and interpret numerical expressions without evaluating them.
- **Numerical Patterns** A516 I will generate two numerical patterns using two given rules, graph ordered pairs of corresponding terms on a coordinate plane, and identify apparent relationships between corresponding terms.

#### 6th Grade

- **Linear Relationships** A228 I will represent and analyze linear relationships in tables, equations, and graphs in the first quadrant of the coordinate plane.

#### 7th Grade

- **Distributive Property** A294 I will solve algebraic equations using the distributive property.

#### 8th Grade

- **Similar Triangles and Slope** A514 I will use similar triangles to explain constant slope and derive equations to describe lines.

#### Algebra 1

- **Histograms** A384 I will summarize, represent, and interpret data in histograms and cumulative frequency histograms.
- **Box & Whisker Plots** A385 I will summarize, represent, and interpret data in box plots, find percentiles, and use a five number summary.
- **Systems & Elimination** A553 I will solve systems of linear equations by eliminating variables.
- **Complete the Square** A556 I will complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines.

#### Algebra 2

- **Solve Exponentials** A621 I will solve exponential equations in one variable
- **Solve Radical Equations** A626 I will solve equations involving radicals.

#### Enrichment

- **Verbal Expressions** A168 I will write verbal expressions or sentences that match given mathematical expressions or equations.
- **Distance/Rate/Time** A180 I will know the relationships among distance, rate, and time and use it to solve real world and mathematical problems.
- **Compound Inequalities** A207 I will graph compound inequalities on a number line and explain their meaning in mathematical and real world problems.
- **Transversals** A241 I will apply algebra to determine the measure of angles formed by parallel lines cut by a transversal.
- **Angles & Algebra** A291 I will apply algebra to determine the measure of angles formed by intersecting lines.
- **Points on a Line** A323 I will determine whether a given point is on a line, given the equation of the line.

### Functions

STRAND

#### Algebra 1

- **Parabola Aspects** F320 I will determine the vertex and axis of symmetry of a parabola, given its equation.
- **Parallel Equations** F352 I will determine if two lines are parallel, given their equations in any form.
- **Effect on Quadratics** F366 I will identify the effects of transformations on equations and graphs of quadratic functions.
- **Inverse Functions** F559 I will explore the concept of inverse functions and find inverses of linear functions.
- **Piecewise Functions** F561 I will graph piecewise-defined functions including step functions and absolute value functions.
- **Linear vs. Exponential** F622 I will distinguish between situations that can be modeled with linear and exponential functions.

#### Algebra 2

- **Square Root Functions** F566 I will identify and graph square root functions.
- **Sum of Geometric Series** F624 I will develop and use a formula for finding the sum of a geometric series.
- **Polynomial Graphs** F625 I will find the zeros of polynomial functions and use them to sketch a graph.
- **Degrees & Radians** F627 I will measure angles in radians and convert between degrees and radians.
- **Trig Graphs** F628 I will model situations using trigonometric functions by adjusting period and amplitude.
- **Trig Graphs** F629 I will model situations using trigonometric functions using vertical and phase shifts.
- **Logarithms** F630 I will represent and solve exponential equations using logarithms.

### Geometry & Measurement

STRAND

#### Pre, 2nd-4th Grade Foundational

- **Ruler Measurements** G256 I will use a ruler to measure to the nearest inch or fraction of an inch.
- **Irregular Perimeter** G287 I will calculate the perimeter of regular or irregular polygons and solve problems involving perimeter.



## 5th Grade

- **Line Graphs** G124 I will make and use line graphs to represent and analyze data.
- **Quadrilaterals** G184 I will classify and draw quadrilaterals by their angles and sides.
- **Customary Units** G223 I will identify and convert among customary units of length, capacity, and mass/weight.
- **Metric Units** G229 I will identify and convert among metric units of length, capacity, and mass/weight.
- **Triangles** G301 I will classify and draw triangles by their angles and sides and find the missing measure of angles in triangles.
- **Fraction Line Plots** G504 I will make line plots to display a data set measured in fractions and use operations with fractions to solve problems involving the data set.
- **Coordinate Plane** G517 I will use a pair of perpendicular lines, called axes, to define a coordinate system and locate points using coordinates.

## 6th Grade

- **Triangle Area** G120 I will develop and use an area formula in order to determine the area of any triangle.
- **Nets of 3-D Shapes** G122 I will identify two-dimensional shapes that make up the faces and bases of three-dimensional objects and use nets to represent the objects.
- **Shapes on Graphs** G245 I will plot points and determine the area and/or perimeter of shapes drawn on all four quadrants of a coordinate plane.
- **Quadrilateral Area** G264 I will develop and use area formulas in order to determine the area of different types of quadrilaterals.
- **Fractional Volume** G487 I will find the volume of a right rectangular prism with fractional edge lengths and solve real world and mathematical problems using volume.
- **Nets & Surface Area** G508 I will represent figures using nets made up of rectangles and triangles and use the nets to find the surface area of these figures.
- **Complex Shapes** G543 I will find the area and/or perimeter of complex shapes composed of polygons on or off a coordinate plane.

## 7th Grade

- **Map Scale** G154 I will solve real world and mathematical problems using maps and scale drawings.
- **Circumference** G174 I will explore the relationship between the circumference and diameter of a circle in order to determine the circumference of a circle.
- **Area of 2-D Shapes** G181 I will use a variety of strategies to find the area of two-dimensional geometric shapes composed of polygons and circles.
- **Area of Circles** G198 I will determine the area of circles and the area of sectors of circles.
- **Angle Relationships** G211 I will use angle relationships of intersecting lines to solve mathematical and real world problems.
- **Similar Triangles** G271 I will solve real world and mathematical problems using similar triangles or other similar shapes.
- **Planes & 3-D Shapes** G315 I will explore how planes intersect with three-dimensional shapes.
- **Draw Triangles** G500 I will construct triangles from three measures of angles or sides, noticing when the conditions determine a unique triangle, more than one triangle, or no triangle.
- **Scale Drawings** G511 I will reproduce scale drawings at a different scale.
- **Surface Area & Volume** G600 I will solve problems involving volume and surface area of three-dimensional objects composed of triangles, quadrilaterals, polygons, cubes, and right prisms.

## 8th Grade

- **Volume of Cylinders** G613 I will develop and use a formula to determine the volume of cylinders.
- **Volume of Cones** G614 I will develop and use a formula to determine the volume of cones.
- **Volume of Spheres** G615 I will develop and use a formula to determine the volume of spheres.

## High School Geometry

- **Law of Sines** G602 I will understand the Law of Sines and use it to solve problems.
- **Find Midpoints** G603 I will solve problems involving midpoints on the coordinate plane.
- **Law of Cosines** G604 I will understand the Law of Cosines and use it to solve problems.
- **Line & Rotational Symmetry** G605 I will describe line and rotational symmetry.
- **Triangle Congruence** G606 I will determine when triangles are congruent and use congruence to solve problems.
- **Similarity** G607 I will identify similar triangles and other shapes using a variety of strategies and use them to solve problems.
- **Central and Inscribed Angles** G608 I will understand inscribed and central angles and use them to solve problems.
- **Tangents to Circles** G609 I will solve problems involving tangents to circles.
- **Arc Length** G610 I will develop and use the formula for finding arc length.
- **Sector Area** G611 I will develop and use the formula for finding the area of a sector.
- **Equations of Circles** G612 I will describe a circle on the coordinate plane using different representations.

## Enrichment

- **3-D Volume** G127 I will calculate the volume of prisms and cylinders using appropriate formulas.
- **3-D Shapes** G159 I will make and use top, front, and side views of three-dimensional shapes.
- **Surface Area** G191 I will determine the surface area of prisms and cylinders.
- **Fahrenheit/Celsius** G206 I will convert temperatures among measurement systems (Fahrenheit and Celsius).
- **Angles of Polygons** G244 I will use the relationship of the measures of the angles of polygons to solve real world and mathematical problems.
- **Circle Word Problems** G255 I will solve real world and mathematical problems involving circles.
- **Dimensional Measures** G309 I will explore and explain how perimeter, area, and volume are affected when the dimensions of three-dimensional objects are scaled.

## Number Sense

STRAND

## 5th Grade

- **Decimal Operations** N520 I will solve real world and mathematical problems involving operations with decimal numbers that require unit conversions.
- **Add, Subtract, Multiply Fractions** N521 I will solve real world and mathematical problems involving addition, subtraction, and multiplication of fractions including mixed numbers.
- **Order of Operations** N531 I will evaluate numerical expressions including decimals and fractions with parentheses using the order of operations or properties of operations.

## 6th Grade

- **LCM** N170 I will find common multiples and the least common multiple (LCM) of two or more whole numbers.
- **Multiply Decimals** N186 I will fluently multiply multi-digit decimals using the standard algorithm.
- **Divide Large Decimals** N216 I will fluently divide multi-digit decimals using the standard algorithm.
- **Add/Subtract Large Decimals** N233 I will fluently add and subtract multi-digit decimals using the standard algorithm.
- **GCF Whole Numbers** N247 I will find common factors and the greatest common factor (GCF) of two or more whole numbers and rewrite expressions using common factors and the distributive property.
- **Divide Whole Numbers** N532 I will fluently divide multi-digit whole numbers using the standard algorithm.

## 8th Grade

- **Irrational Numbers** N263 I will compare irrational numbers by approximating their value and placing them on a number line and estimate the value of expressions involving irrational numbers.
- **Rational/Irrational** N310 I will know that the numbers that are not rational are called irrational and understand the decimal expansions of different kinds of numbers, including converting repeating decimals into fractions.

## Algebra 1

- **Simplify Radicals** N371 I will simplify radical terms.
- **Add, Subtract, Multiply, Divide Radicals** N372 I will perform the four arithmetic operations using like and unlike radical terms and express the result in simplest form.
- **Add/Multiply (ir)rational Numbers** N557 I will explore and explain properties of sums and products of rational and irrational numbers.
- **Rational Exponents** N563 I will explain how the system of integer exponents extends to rational number exponents, including representing radicals in terms of rational exponents.

## Enrichment

- **Order Rational Numbers** N155 I will order positive and negative rational numbers in different forms and locate them on a number line.
- **Write/Identify Percents** N260 I will read, write, and identify percents less than 1% and greater than 100%.
- **Prime Factorization** N289 I will determine the prime factorization of a number and write it in exponential form.
- **Divisibility Rules** N314 I will explore divisibility rules.

# Statistics & Probability

## STRAND

## 6th Grade

- **Mean of Data Sets** S105 I will calculate the mean of a data set and use it to describe the data set.
- **Box & Whisker Plots** S123 I will make and use box plots to represent, analyze, and find the range of data.
- **Histograms** S140 I will record data in frequency tables and make and use histograms to represent and analyze data.
- **Dot/Line Plots** S225 I will make and use dot or line plots to represent and analyze data.
- **Median & Mode** S293 I will determine the median and mode of a data set and use these measures of center to describe the data set.
- **Measure of Center** S302 I will choose appropriate measures of center to describe data sets in real world and mathematical situations.
- **Mean Abs. Deviation** S536 I will calculate the mean absolute deviation of a data set and use it to describe the data set.
- **Describe Data Sets** S537 I will describe data sets and their overall shape.

## 7th Grade

- **Compound Probability** S102 I will recognize independent and dependent events and calculate the probabilities of compound events.
- **Simple Probability** S119 I will identify the outcomes of an event and determine the probability of an outcome represented by a ratio, fraction, decimal, or percent.
- **Compare Data Sets** S156 I will compare data sets by describing and summarizing the data.
- **Compound Events** S166 I will list the possible outcomes for compound events.
- **Sampling Methods** S199 I will explore and explain the validity of sampling methods.
- **Predict Outcomes** S219 I will interpret data to establish experimental probabilities and use probabilities to predict the outcome of an experiment.
- **Random Sample Data** S502 I will use data from random samples to draw inferences about a population and gauge variation in estimates or predictions using multiple samples.

## 8th Grade

- **2-Way Tables** S503 I will make and use two-way tables to understand and interpret bivariate data.

## Algebra 1

- **Relative Frequencies** S562 I will interpret relative frequencies in two-way tables in the context of the data and recognize possible associations and trends in the data.
- **Standard Deviation** S565 I will find the standard deviation of a data set and use it describe and compare data sets.
- **Residuals** A623 I will use residuals to analyze how well a function fits data.

## Enrichment

- **Venn Diagrams** S118 I will make and use Venn diagrams to represent and analyze data.
- **Interpret Graphs** S135 I will read and interpret different types of graphs.
- **Stem & Leaf Plots** S163 I will make and use stem and leaf plots to represent and analyze data.
- **Possible Outcomes** S234 I will understand and use the fundamental counting principle.
- **Misleading Stats** S251 I will identify and explain misleading statistics and graphs.
- **Circle Graphs** S266 I will make and use circle graphs to represent and analyze data.
- **Perms & Combs** S374 I will determine the number of possible combinations and permutations of a set of items.
- **Probability** S378 I will know the definition of and use conditional probability.
- **Complements of Sets** S379 I will calculate the probability of an event and its complement.
- **Probability** S380 I will calculate the probability of a series of independent events, two mutually exclusive events, or two events that are not mutually exclusive.