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
Skills in Major Concepts

Algebraic Functions
10 Skills in 3 Major Concepts

■ 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.

■ Understanding Functions:
Making Sense of When Two Variables are Connected
8th Grade

- Linear Functions: Recognizing Constant Change in a Scenario
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.

■ Linear Functions:
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.
Dimensional Geometry

5 Skills in 2 Major Concepts

- **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: G121 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: G589 I will solve real world and mathematical problems involving additive volume and right rectangular prisms.

Evaluating Expressions

5 Skills in 2 Major Concepts

- **Evaluating Algebraic Expressions:** Grasping the Power of Substitution and Variables
  6th Grade
  - Substitution: A186 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 equivalence using substitution.

- **Evaluating Numerical Expressions:** Unraveling How Operations Work Together
  6th Grade
  - Order of Operations: A318 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.

Operations with Algebraic Expressions

7 Skills in 2 Major Concepts

- **Operations with Linear Expressions:** Applying Integer Operation Rules to Algebraic Expressions
  7th Grade
  - Linear Expressions: A319 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.

- **Operations with Linear Expressions:** Applying Basic Operations to Linear Expressions
  7th Grade
  - Add/Subtract Polynomials: A237 I will add and subtract polynomials.
  - Multiply Polynomials: A257 I will multiply a binomial by a monomial or a binomial.
  - Multiply Whole Numbers by Fractions: N391 I will multiply whole numbers by fractions.
  - Fractional Area: N257 I will find the area of a rectangle with fractional side lengths.
  - Multiplication as Scaling: N617 I will interpret multiplication as scaling.

- **Polynomial Operations:** Applying Basic Operations to Complex Algebraic Expressions
  Algebra 1
  - Add/Subtract Polynomials: A237 I will add and subtract polynomials.
  - Multiply Polynomials: A257 I will multiply a binomial by a monomial or a binomial.
  - Polynomial Expressions: 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.

Fraction Operations

13 Skills in 4 Major Concepts

- **Adding and Subtracting Like Fractions:** Applying Basic Operations to Fractions
  Pre: 2nd–4th Grade Foundational
  - Add/Subtract Like Fractions: N171 I will add and subtract fractions with like denominators.
  - Add/Subtract Like Mixed Numbers: N315 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.

- **Multiplying Fractions:** Grappling With How Multiplication Can Result in a Smaller Answer
  5th Grade
  - Multiply Fractions: N307 I will multiply fractions.
  - Multiply Mixed Numbers: N357 I will multiply mixed numbers.
  - Multiply Whole Numbers by Fractions: N391 I will multiply whole numbers by fractions.
  - Fractional Area: N257 I will find the area of a rectangle with fractional side lengths.
  - Multiplication as Scaling: N617 I will interpret multiplication as scaling.

- **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.
### Percent Concepts

#### 7th Grade
- **Applying Percent Concepts:**
  - Recognizing Parts Per Hundred
  - Understanding Percent: Applying Percent to Evaluate Numerical Magnitude
- **Representing Rational Numbers:**
  - Converting Between Multiple Forms of the Same Number
  - Representing Fractions as Decimals
  - Representing Numbers as Decimals
  - Representing Numbers as Fractions
  - Representing Numbers as Percent
- **Properties and Powers of 10:**
  - Multiplying/Dividing by Powers of 10
  - Representing Parts Per Ten, Hundred, Thousand

#### 6th Grade
- **Understanding Percent Concepts:**
  - Recognizing Parts Per Hundred
  - Simple Interest
  - Percent Change/Error
  - Multistep Percents
- **Applying Percent Concepts:**
  - Representing Parts Per Hundred
  - Understanding Percent: Applying Percent to Evaluate Numerical Magnitude
- **Representing Rational Numbers:**
  - Converting Between Multiple Forms of the Same Number
  - Representing Fractions as Decimals
  - Representing Numbers as Decimals
  - Representing Numbers as Fractions
  - Representing Numbers as Percent
- **Properties and Powers of 10:**
  - Multiplying/Dividing by Powers of 10
  - Representing Parts Per Ten, Hundred, Thousand

#### 5th Grade
- **Understanding Place Value Concepts:**
  - Recognizing Place Value
  - Representing Parts Per Ten, Hundred, Thousand
- **Applying Place Value Concepts:**
  - Applying Place Value to Evaluate Numerical Magnitude
  - Representing Parts Per Ten, Hundred, Thousand
- **Representing Rational Numbers:**
  - Converting Between Multiple Forms of the Same Number
  - Representing Fractions as Decimals
  - Representing Numbers as Decimals
  - Representing Numbers as Fractions
  - Representing Numbers as Percent
- **Properties and Powers of 10:**
  - Multiplying/Dividing by Powers of 10
  - Representing Parts Per Ten, Hundred, Thousand

### Place Value Concepts

#### 7th Grade
- **Place Value Concepts:**
  - Conceiving How Place Value is Impacted
  - Properties and Powers of 10
  - Whole Number Place Value
- **Representing Rational Numbers:**
  - Converting Between Multiple Forms of the Same Number
  - Representing Fractions as Decimals
  - Representing Numbers as Decimals
  - Representing Numbers as Fractions
  - Representing Numbers as Percent
- **Properties and Powers of 10:**
  - Multiplying/Dividing by Powers of 10
  - Representing Parts Per Ten, Hundred, Thousand

#### 6th Grade
- **Understanding Place Value Concepts:**
  - Recognizing Place Value
  - Representing Parts Per Ten, Hundred, Thousand
- **Applying Place Value Concepts:**
  - Applying Place Value to Evaluate Numerical Magnitude
  - Representing Parts Per Ten, Hundred, Thousand
- **Representing Rational Numbers:**
  - Converting Between Multiple Forms of the Same Number
  - Representing Fractions as Decimals
  - Representing Numbers as Decimals
  - Representing Numbers as Fractions
  - Representing Numbers as Percent
- **Properties and Powers of 10:**
  - Multiplying/Dividing by Powers of 10
  - Representing Parts Per Ten, Hundred, Thousand

#### 5th Grade
- **Understanding Place Value Concepts:**
  - Recognizing Place Value
  - Representing Parts Per Ten, Hundred, Thousand
- **Applying Place Value Concepts:**
  - Applying Place Value to Evaluate Numerical Magnitude
  - Representing Parts Per Ten, Hundred, Thousand
- **Representing Rational Numbers:**
  - Converting Between Multiple Forms of the Same Number
  - Representing Fractions as Decimals
  - Representing Numbers as Decimals
  - Representing Numbers as Fractions
  - Representing Numbers as Percent
- **Properties and Powers of 10:**
  - Multiplying/Dividing by Powers of 10
  - Representing Parts Per Ten, Hundred, Thousand
Rational Numbers
9 Skills in 2 Major Concepts

- Operations with Rational Numbers: Realizing Rules for Integer Operations 7th Grade
  - Multiply/Divide Rational Numbers N061 I will multiply and divide integers and other rational numbers.
  - Subtract Rational Numbers N52 I will subtract integers and other rational numbers with and without the use of a number line.
  - Add Rational Numbers N52 I will add integers and other rational numbers with and without the use of a number line.
  - Add, Subtract, Multiply, Divide Rational Numbers N52 I will solve real world and mathematical problems involving the four operations with rational numbers, especially negative numbers.
  - Add Opposites N68 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 N49 I will write, interpret, and explain statements of order for rational numbers on the number line and in real world contexts.
  - Represent Integers N67 I will use integers and other rational numbers to represent numerical situations and place them on a number line.

Solving Complex Equations
9 Skills in 3 Major Concepts

- 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 A34 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.

Solving Basic Equations
6 Skills in 3 Major Concepts

- 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 A49 I will determine an unknown whole number in a multiplication or division equation.

- Simple Equations: Understanding Equivalency to Solve for the Unknown 6th Grade
  - 3-Step Equations A222 I will solve one-step algebraic equations.
  - 5-Step Equations A524 I will solve problems by writing, solving, and interpreting one-step equations.

- 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.

Solving Complex Equations
9 Skills in 3 Major Concepts

- 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 A34 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.
Solving Quadratics
6 Skills in 2 Major Concepts

Graphing Quadratics:
Visualizing Non-Linear Functions
Algebra 1

- Parabola Aspects: F329 will find the roots, vertex, and axis of symmetry of a parabola given its graph.
- Quadratic Graphs: F547 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 will analyze and solve verbal problems that involve quadratic equations.
- Multiplication Properties of Zero: A349 will understand and apply the multiplication property of zero to solve quadratic equations by factoring.
- Solve Quadratics: A549 will solve quadratic equations by completing the square.
- Quadratic Formula: A551 will derive the quadratic formula and use it to solve quadratic equations.

Systems of Functions
7 Skills in 2 Major Concepts

Advanced Systems of Functions:
Solving for Overlap Across Multiple Types of Functions
Algebra 1

- Systems of Equations: A324 will solve systems of linear and quadratic equations graphically.
- Systems of Equations: A336 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 will solve systems of two linear equations graphically.
- Systems of Equations: A332 will analyze and solve verbal problems whose solution requires solving systems of linear equations in two variables.
- Systems of Equations: A335 will solve systems of two linear equations in two variables by using substitution.
- Systems of Equations: A544 will recognize systems of linear equations that have one solution, no solution, or infinitely many solutions.
- Algebraic Systems: A553 will solve systems of two linear equations in two variables by using elimination.

Transformational Geometry
7 Skills in 2 Major Concepts

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

- Transformations: G141 will use transformations to map a figure onto a congruent figure.
- Transformations: N205 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 will draw the image of a figure under a dilation on a coordinate plane.
- Reflections: G194 will draw the image of a figure under a reflection on a coordinate plane.
- Rotations: G242 will draw the image of a figure under a rotation on a coordinate plane.
- Transformations: G284 will verify experimentally the properties of rotations, reflections, and translations.
- Transformations: G319 will draw the image of a figure under a translation on a coordinate plane.

Understanding Fractions
6 Skills in 2 Major Concepts

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

- Compare Fractions: N180 will compare and order fractions using the math symbols <, >, and =.
- Equivalent Fractions: N260 will create equivalent fractions and explain fraction equivalence.
- Simplify Fractions: N291 will simplify fractions to lowest terms.
- Compare Fractions: N691 will compare fractions with the same numerator or denominator.

Multiplying and Dividing Multi-Digit Whole Numbers:
Expanding on Arithmetic Operations
5th Grade

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

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

- Division Facts: A124 will interpret division as equal shares and know division facts with one-digit numbers.
- Divide Large Whole Numbers: N180 will divide large whole numbers by one-digit whole numbers and explain remainders within context.
- Fractions as Division: N588 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 Addition and Subtraction:
Understanding How Numbers Grow and Reduce Pre: 2nd–4th Grade Foundational

- Add/Subtract on a Number Line: N581 will find sums and differences within 100 and represent them on the number line.
- Subtract Whole Numbers: N210 will subtract large whole numbers.
- Add Large Whole Numbers: N281 will add large whole numbers.

Understanding Multiplication:
Making the Connection Between Multiplication and Addition
Pre: 2nd–4th Grade Foundational

- Multiplication Facts: A272 will understand multiplication and know multiplication facts up to 10 times 10.
- Multiples of 10/100: N185 will multiply one-digit whole numbers by multiples of 10.
- Distributive Property: A368 will identify and use the distributive property of multiplication over addition, relating it to area models.
- Multiply Large Whole Numbers: N288 will represent and analyze linear relationships in tables, equations, and graphs in the first quadrant of the coordinate plane.
### 5th Grade

#### Grappling with Division and Place Value

- **Divide Decimals by Whole Numbers** (N534) 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.

#### Applying Basic Operations to Decimals

- **Add/Subtract Decimals** (N533) I will add and subtract decimals using a variety of strategies.
- **Divide Decimals by Whole Numbers** (N534) 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.

### 7th Grade

#### Recognizing Constraints and Limitations

- **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** (A315) 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.

### 8th Grade

#### Making Sense of Different Types of Functions

- **Linear vs Non-Linear** (A146) I will distinguish between linear functions, two variables or describe situations that could match given descriptions of situations involving a relationship between two variables.
- **Graphs in Context** (A129) I will create graphs to match given descriptions of situations involving a relationship between two variables or describe situations that could match given graphs.
- **Laws of Exponents** (A111) I will develop and apply the laws of exponents for multiplication and division to generate equivalent numerical expressions.
- **Graphing 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.
- **Negative Exponents** (A620) I will understand and simplify expressions containing integer exponents.
- **Factorization of Polynomials** (A343) I will factor algebraic expressions completely.
- **Factor Trinomials** (A550) I will factor trinomials where the leading coefficient is not equal to 1.
- **Factor Quadtratics** (A342) I will identify and factor the leading coefficient is not equal to 1.
- **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.
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- **Factor Trinomials** (A550) I will factor trinomials where the leading coefficient is not equal to 1.
Square and Cube Roots:

Grappling with Radicals
8th Grade

Square Roots A278 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 A313 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 A541 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.

Trigonometric Ratios:

Understand How Sides and Angles of Right Triangles Relate to Each Other
Post-Algebra

Sine/Cosine/Tangent A354 I will find and explain sine, cosine, and tangent ratios of right triangles.

Sine/Cosine/Tangent A355 I will use inverse sine, cosine, and tangent functions to find the measures of angles in right triangles.

Sine/Cosine/Tangent G355 I will use sine, cosine, and tangent functions to find the side lengths of right triangles.

Understanding Correlation:

Exploring the Relationship Between Two Variables
8th Grade, Algebra 1

Scatterplots S550 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.

Con Coefficient S558 I will compute and interpret the correlation coefficient of a line 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.

Understanding 2-D Objects:

Recognizing Attributes of Different Shapes
Pre 2–4th Foundational

Draw/Measure Angles G372 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.

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 G321 I will solve real world and mathematical problems using the Pythagorean Theorem.

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.

Understanding Correlation:

Exploring the Relationship Between Two Variables
8th Grade, Algebra 1

Scatterplots S550 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.

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Understanding 2-D Objects:

Recognizing Attributes of Different Shapes
Pre 2–4th Foundational

Draw/Measure Angles G372 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.

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 G321 I will solve real world and mathematical problems using the Pythagorean Theorem.
## Algebra

### Pre, 2nd–4th Grade Foundational

- **Generate Patterns** A008 I will generate a number or shape pattern that follows a given rule and identify features of the pattern.
- **Operation Properties** A223 I will define, identify, and use the commutative and associative properties of addition and multiplication.
- **Identify Factors** A229 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** A212 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** A561 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.
- **Distributive Property** A244 I will solve algebraic equations using the distributive property.

### 7th Grade

- **Parallel Equations** A352 I will determine if two lines are parallel, given their equations in any form.

### 8th Grade

- **Parabola Aspects** A323 I will determine whether a given point is on a line, given the equation of the line.

## Functions

### Algebra 1

- **Parabola Aspects** F320 I will determine the vertex and axis of symmetry of a parabola, given its equation.
- **Effect on Quadratics** F566 I will identify the effects of transformations on equations and graphs of quadratic functions.
- **Piecewise Functions** F561 I will graph piecewise-defined functions including step functions and absolute value 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.

## Geometry & Measurement

### 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.

Mental Math G508 I will solve problems involving volume and surface area of three-dimensional objects composed of triangles, polygons, cubes, and right prisms.

Circles G174 I will explore the relationship between the circumference and diameter of a circle in order to determine the circumference of a circle.

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 G191 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 G632 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 G269 I will explore and explain how perimeter, area, and volume are affected when the dimensions of three-dimensional objects are scaled.

Number Sense

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

**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** S336 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.

**Statistics & Probability STRAND**

7th Grade

**Compound Probability** S802 I will recognize independent and dependent events and calculate the probabilities of compound events.

**Simple Probability** S189 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** S186 I will list the possible outcomes for compound events.

**Sampling Methods** S289 I will explore and explain the validity of sampling methods.

**Predict Outcomes** S293 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.

**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 to describe and compare data sets.

**Residuals** S375 I will use residuals to analyze how well a function fits data.

8th Grade

**Compound Probability** S802 I will recognize independent and dependent events and calculate the probabilities of compound events.

**Simple Probability** S189 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.

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**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.

**Rational Exponents** N372 I will perform the four arithmetic operations using like and unlike radical terms and express the result in simplest form.

**Dividing Large Decimals** N375 I will explore and explain properties of sums and products of rational and irrational numbers.

**Rational Exponents** N372 I will explain how the system of integer exponents extends to rational number exponents, including representing radicals in terms of rational exponents.

**Order Rational Numbers** N535 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%.

**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.

**Prime Factorization** N289 I will determine the prime factorization of a number and write it in exponential form.

**Divisibility Rules** N334 I will explore divisibility rules.