

## APPENDIX B

### **The Common Core State Standards: Overview of Content**

## Grades K–8

At each K–8 grade, the standards are grouped in clusters. The clusters are organized in mathematical domains, which may span multiple grade levels. This appendix lists the names of these domains and clusters.

Note that the same cluster name may occur at different grades. However, this does not indicate that the standards in those clusters are identical at different grade levels. For example, the cluster “Add and subtract within 20” at grade 1 includes “Add and subtract within 20, demonstrating fluency for addition and subtraction within 10.” At grade 2, the same cluster name includes “Fluently add and subtract within 20, using mental strategies.”

Grade	Counting and Cardinality	Operations and Algebraic Thinking	Number and Operations in Base Ten	Measurement and Data	Geometry
K	<ul style="list-style-type: none"> <li>Know number names and the count sequence.</li> <li>Count to tell the number of objects.</li> <li>Compare numbers.</li> </ul>	<ul style="list-style-type: none"> <li>Understand addition as putting together and adding to, and understand subtraction as taking apart and taking from.</li> </ul>	<ul style="list-style-type: none"> <li>Work with numbers 11–19 to gain foundations for place value.</li> </ul>	<ul style="list-style-type: none"> <li>Describe and compare measurable attributes.</li> <li>Classify objects and count the number of objects in categories.</li> </ul>	<ul style="list-style-type: none"> <li>Identify and describe shapes.</li> <li>Analyze, compare, create, and compose shapes.</li> </ul>
1		<ul style="list-style-type: none"> <li>Represent and solve problems involving addition and subtraction.</li> <li>Understand and apply properties of operations and the relationship between addition and subtraction.</li> <li>Add and subtract within 20.</li> <li>Work with addition and subtraction equations.</li> </ul>	<ul style="list-style-type: none"> <li>Extend the counting sequence.</li> <li>Understand place value.</li> <li>Use place value understanding and properties of operations to add and subtract.</li> </ul>	<ul style="list-style-type: none"> <li>Measure lengths indirectly and by iterating length units.</li> <li>Tell and write time.</li> <li>Represent and interpret data.</li> </ul>	<ul style="list-style-type: none"> <li>Reason with shapes and their attributes.</li> </ul>
2		<ul style="list-style-type: none"> <li>Represent and solve problems involving addition and subtraction.</li> <li>Add and subtract within 20.</li> <li>Work with equal groups of objects to gain foundations for multiplication.</li> </ul>	<ul style="list-style-type: none"> <li>Understand place value.</li> <li>Use place value understanding and properties of operations to add and subtract.</li> </ul>	<ul style="list-style-type: none"> <li>Measure and estimate lengths in standard units.</li> <li>Relate addition and subtraction to length.</li> <li>Work with time and money.</li> <li>Represent and interpret data.</li> </ul>	<ul style="list-style-type: none"> <li>Reason with shapes and their attributes.</li> </ul>

		<b>Number and Operations—Fractions</b>	<b>Operations and Algebraic Thinking</b>	<b>Number and Operations in Base Ten</b>	<b>Measurement and Data</b>	<b>Geometry</b>
<b>3</b>	• Develop understanding of fractions as numbers.	• Represent, and solve problems involving multiplication and division. • Understand properties of multiplication and the relationship between multiplication and division. • Multiply and divide within 100. • Solve problems involving the four operations, and identify and explain patterns in arithmetic.	• Use place value understanding and properties of operations to perform multi-digit arithmetic.	• Solve problems involving measurement and estimation of intervals of time, liquid volumes, and masses of objects. • Represent and interpret data. • Geometric measurement: understand concepts of area and relate area to multiplication and to addition. • Geometric measurement: recognize perimeter as an attribute of plane figures and distinguish between linear and area measures.	• Solve problems involving measurement and estimation of intervals of time, liquid volumes, and masses of objects. • Represent and interpret data. • Geometric measurement: understand concepts of area and relate area to multiplication and to addition.	• Reason with shapes and their attributes.
<b>4</b>	• Extend understanding of fraction equivalence and ordering. • Build fractions from unit fractions by applying and extending previous understandings of operations on whole numbers. • Understand decimal notation for fractions, and compare decimal fractions.	• Use the four operations with whole numbers to solve problems. • Gain familiarity with factors and multiples. • Generate and analyze patterns.	• Generalize place value understanding for multi-digit whole numbers. • Use place value understanding and properties of operations to perform multi-digit arithmetic.	• Solve problems involving measurement and conversion of measurements from a larger unit to a smaller unit. • Represent and interpret data. • Geometric measurement: understand concepts of angle and measure angles.	• Draw and identify lines and angles, and classify shapes by properties of their lines and angles.	
<b>5</b>	• Use equivalent fractions as a strategy to add and subtract fractions. • Apply and extend previous understandings of multiplication and division to multiply and divide fractions.	• Write and interpret numerical expressions. • Analyze patterns and relationships.	• Understand the place value system. • Perform operations with multi-digit whole numbers and with decimals to hundredths.	• Convert like measurement units within a given measurement system. • Represent and interpret data. • Geometric measurement: understand concepts of volume and relate volume to multiplication and to addition.	• Graph points on the coordinate plane to solve real-world and mathematical problems. • Classify two-dimensional figures into categories based on their properties.	

	<b>Ratios and Proportional Relationships</b>	<b>Expressions and Equations</b>	<b>The Number System</b>	<b>Statistics and Probability</b>	<b>Geometry</b>
<b>6</b>	<ul style="list-style-type: none"> <li>Understand ratio concepts and use ratio reasoning to solve problems.</li> </ul>	<ul style="list-style-type: none"> <li>Apply and extend previous understandings of arithmetic to algebraic expressions.</li> <li>Reason about and solve one-variable equations and inequalities.</li> <li>Represent and analyze quantitative relationships between dependent and independent variables.</li> </ul>	<ul style="list-style-type: none"> <li>Apply and extend previous understandings of multiplication and division to divide fractions by fractions.</li> <li>Compute fluently with multi-digit numbers and find common factors and multiples.</li> <li>Apply and extend previous understandings of numbers to the system of rational numbers.</li> </ul>	<ul style="list-style-type: none"> <li>Develop understanding of statistical variability.</li> <li>Summarize and describe distributions.</li> </ul>	<ul style="list-style-type: none"> <li>Solve real-world and mathematical problems involving area, surface area, and volume.</li> </ul>
<b>7</b>	<ul style="list-style-type: none"> <li>Analyze proportional relationships and use them to solve real-world and mathematical problems.</li> </ul>	<ul style="list-style-type: none"> <li>Use properties of operations to generate equivalent expressions.</li> <li>Solve real-life and mathematical problems using numerical and algebraic expressions and equations.</li> </ul>	<ul style="list-style-type: none"> <li>Apply and extend previous understandings of operations with fractions to add, subtract, multiply, and divide rational numbers.</li> </ul>	<ul style="list-style-type: none"> <li>Use random sampling to draw inferences about a population.</li> <li>Draw informal comparative inferences about two populations.</li> <li>Investigate chance processes and develop, use, and evaluate probability models.</li> </ul>	<ul style="list-style-type: none"> <li>Draw, construct and describe geometrical figures and describe the relationships between them.</li> <li>Solve real-life and mathematical problems involving angle measure, area, surface area, and volume.</li> </ul>
<b>8</b>	<ul style="list-style-type: none"> <li>Define, evaluate, and compare functions.</li> <li>Use functions to model relationships between quantities.</li> </ul>	<ul style="list-style-type: none"> <li>Work with radicals and integer exponents.</li> <li>Understand the connections between proportional relationships, lines, and linear equations.</li> <li>Analyze and solve linear equations and pairs of simultaneous linear equations.</li> </ul>	<ul style="list-style-type: none"> <li>Know that there are numbers that are not rational, and approximate them by rational numbers.</li> </ul>	<ul style="list-style-type: none"> <li>Investigate patterns of association in bivariate data.</li> </ul>	<ul style="list-style-type: none"> <li>Understand congruence and similarity using physical models, transparencies, or geometry software.</li> <li>Understand and apply the Pythagorean Theorem.</li> <li>Solve real-world and mathematical problems involving volume of cylinders, cones and spheres.</li> </ul>

## High School

The standards for high school are organized in conceptual categories, which may span multiple courses. Within these categories, related standards are grouped together. The categories and group headings are listed below. In the CCSS, additional mathematics that STEM-intended students should learn is indicated by (+) on individual standards. In the listing below, group headings for which all standards of this type are indicated by (+). Similarly, group headings for which all standards are modeling standards are indicated by (\*).

### Number and Quantity

#### The Real Number System

- Extend the properties of exponents to rational exponents
- Use properties of rational and irrational numbers

#### Quantities\*

- Reason quantitatively and use units to solve problems

#### The Complex Number System

- Perform arithmetic operations with complex numbers
- Represent complex numbers and their operations on the complex plane +
- Use complex numbers in polynomial identities and equations

#### Vector and Matrix Quantities +

- Represent and model with vector quantities
- Perform operations on vectors
- Perform operations on matrices and use matrices in applications

### Algebra

#### Seeing Structure in Expressions

- Interpret the structure of expressions
- Write expressions in equivalent forms to solve problems

#### Arithmetic with Polynomials and Rational Functions

- Perform arithmetic operations on polynomials
- Understand the relationship between zeros and factors of polynomials
- Use polynomial identities to solve problems
- Rewrite rational expressions

#### Creating Equations\*

- Create equations that describe numbers or relationships

#### Reasoning with Equations and Inequalities

- Understand solving equations as a process of reasoning and explain the reasoning
- Solve equations and inequalities in one variable
- Solve systems of equations
- Represent and solve equations and inequalities graphically

### Functions

#### Interpreting Functions

- Understand the concept of a function and use function notation
- Interpret functions that arise in applications in terms of the context
- Analyze functions using different representations

#### Building Functions

- Build a function that models a relationship between two quantities
- Build new functions from existing functions

#### Linear, Quadratic, and Exponential Models\*

- Construct and compare linear and exponential models and solve problems
- Interpret expressions for functions in terms of the situation they model

#### Trigonometric Functions

- Extend the domain of trigonometric functions using the unit circle
- Model periodic phenomena with trigonometric functions
- Prove and apply trigonometric identities

## Modeling

## Geometry

## Statistics and Probability\*

Modeling is best interpreted not as a collection of isolated topics but in relation to other standards. Making mathematical models is a Standard for Mathematical Practice, and specific modeling standards appear throughout the high school standards indicated by a star symbol (\*). The star symbol sometimes appears on the heading for a group of standards; in that case, it should be understood to apply to all standards in that group.

### Congruence

- Experiment with transformations in the plane
- Understand congruence in terms of rigid motions
- Prove geometric theorems
- Make geometric constructions

### Similarity, Right Triangles, and Trigonometry

- Understand similarity in terms of similarity transformations
- Prove theorems involving similarity
- Define trigonometric ratios and solve problems involving right triangles
- Apply trigonometry to general triangles +

### Circles

- Understand and apply theorems about circles
- Find arc lengths and areas of sectors of circles

### Expressing Geometric Properties with Equations

- Translate between the geometric description and the equation for a conic section
- Use coordinates to prove simple geometric theorems algebraically

### Geometric Measurement and Dimension

- Explain volume formulas and use them to solve problems
- Visualize relationships between two-dimensional and three-dimensional objects

### Modeling with Geometry\*

- Apply geometric concepts in modeling situations

### Interpreting Categorical and Quantitative Data

- Summarize, represent, and interpret data on a single count or measurement variable
- Summarize, represent, and interpret data on two categorical and quantitative variables
- Interpret linear models

### Making Inferences and Justifying Conclusions

- Understand and evaluate random processes underlying statistical experiments
- Make inferences and justify conclusions from sample surveys, experiments and observational studies

### Conditional Probability and the Rules of Probability

- Understand independence and conditional probability and use them to interpret data
- Use the rules of probability to compute probabilities of compound events in a uniform probability model

### Using Probability to Make Decisions +

- Calculate expected values and use them to solve problems
- Use probability to evaluate outcomes of decisions

Conceptual categories, headings, and description of modeling quoted from Common Core State Standards.

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