National Center and State Collaborative

# Core Content Connectors:
# Numbers and Operations 2

National Center and State Collaborative

The National Center and State Collaborative (NCSC) is applying the lessons learned from the past decade of research on alternate assessments based on alternate achievement standards (AA-AAS) to develop a multi-state comprehensive assessment system for students with significant cognitive disabilities. The project draws on a strong research base to develop an AA-AAS that is built from the ground up on powerful validity arguments linked to clear learning outcomes and defensible assessment results, to complement the work of the Race to the Top Common State Assessment Program (RTTA) consortia.

Our long-term goal is to ensure that students with significant cognitive disabilities achieve increasingly higher academic outcomes and leave high school ready for post-secondary options. A well-designed summative assessment alone is insufficient to achieve that goal. Thus, NCSC is developing a full system intended to support educators, which includes formative assessment tools and strategies, professional development on appropriate interim uses of data for progress monitoring, and management systems to ease the burdens of administration and documentation. All partners share a commitment to the research-to-practice focus of the project and the development of a comprehensive model of curriculum, instruction, assessment, and supportive professional development. These supports will improve the alignment of the entire system and strengthen the validity of inferences of the system of assessments.

IDEAs that Work
U.S. Office of Special Education Programs

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These materials and documents were developed under the National Center and State Collaborative (NCSC) General Supervision Enhancement Grant and are consistent with its goals and foundations. Any changes to these materials are to be consistent with their intended purpose and use as defined by NCSC.

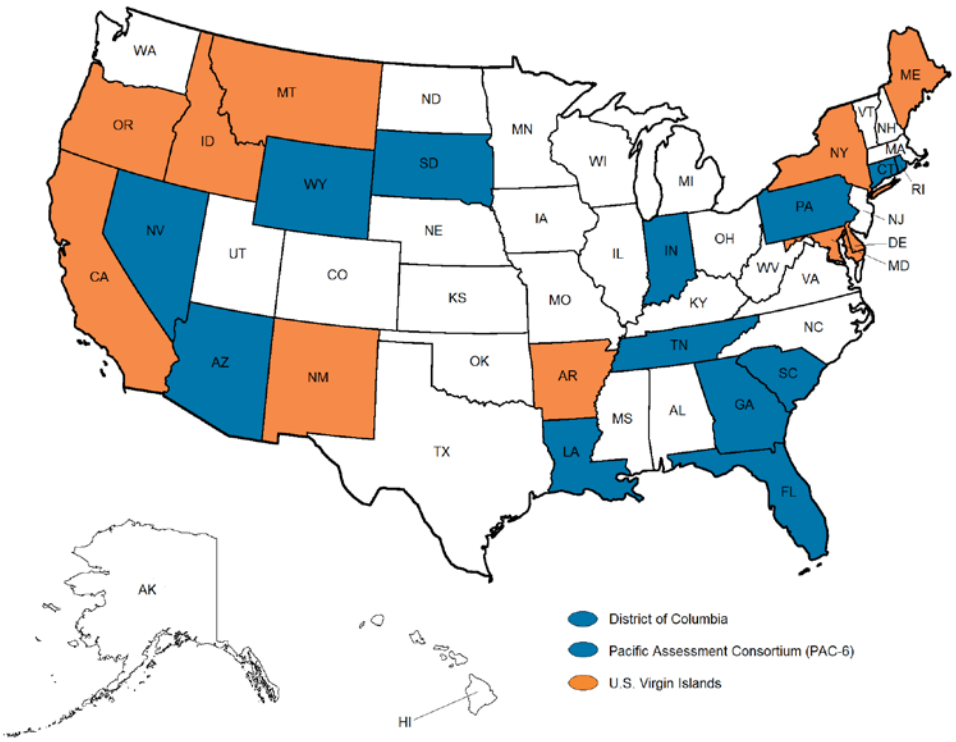
This document is available in alternative formats upon request.

National Center and State Collaborative

NCSC is a collaborative of 15 states and five organizations.

The states include (shown in blue on map): Arizona, Connecticut, District of Columbia, Florida, Georgia, Indiana, Louisiana, Nevada, Pacific Assessment Consortium (PAC-6)[1], Pennsylvania, Rhode Island, South Carolina, South Dakota, Tennessee, and Wyoming.

Tier II states are partners in curriculum, instruction, and professional development implementation but are not part of the assessment development work. They are (shown in orange on map): Arkansas, California, Delaware, Idaho, Maine, Maryland, Montana, New Mexico, New York, Oregon, and U.S. Virgin Islands.




*Core partner states are blue in color and Tier II states are orange in color.

[1] The Pacific Assessment Consortium (including the entities of American Samoa, Commonwealth of the Northern Mariana Islands, Federated States of Micronesia, Guam, Republic of Palau, and Republic of the Marshall Islands) partner with NCSC as one state, led by the University of Guam Center for Excellence in Developmental Disabilities Education, Research, and Service (CEDDERS).


The five partner organizations include: The National Center on Educational Outcomes (NCEO) at the University of Minnesota, The National Center for the Improvement of Educational Assessment (Center for Assessment), The University of North Carolina at Charlotte, The University of Kentucky, and edCount, LLC.



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National Center and State Collaborative

# Core Content Connectors: Numbers and Operations 2

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**Identifying the Core Content of the Learning Progressions Framework for the Common Core State Standards for Students Who Participate in AA-AAS**

### *Introduction*

The purpose of this paper is to describe the development and prioritization of the academic content for students with significant cognitive disabilities. This prioritized academic content is referred to as Core Content Connectors (CCCs). This work is part of the NCSC GSEG and provides the foundation for the development of curriculum resources, professional development, instructional resources, and alternate assessment based on alternate achievement standards (AA-AAS). A unique feature of the development and prioritization of academic content is the use of learning progressions framework (LPF), which is built to include relationships with the Common Core State Standards (CCSSs). The LPF does not provide details of grade-specific curriculum, but describes a path for student learning as an ongoing developmental progression and is a starting point for thinking about how students develop competency in an academic domain (Hess, 2010). The following sections describe the use of LPFs for identifying specific grade-level Common Core State Standards (CCSS), and the development of the CCCs for providing more specificity for teachers.

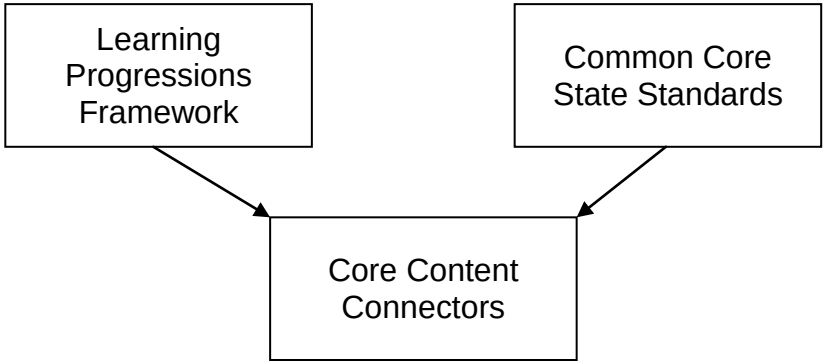
### *Learning Progression Framework*

The National Alternate Assessment Center, under the leadership of Karin Hess, developed LPFs. Hess's (2008) definition of LPs is based on four interrelated guiding principles: (a) LPs are developed and refined using available research and evidence, (b) LPs have clear binding threads that articulate the essential core concepts and processes of a discipline sometimes referred to as the "big ideas" of the discipline, (c) LPs articulate movement towards increased understanding, and (d) LPs go hand-in-hand with well-designed and aligned assessments.

The grade span learning targets of the LPF were identified by national content experts and are a broad description of the essential content and general sequencing for student learning and skill development. The LPF does not provide details of grade-specific curriculum, but describes a path for student learning as an ongoing developmental progression. The LPF is currently available at http://www.nciea.org/publications/Math_LPF_KH11.pdf

***Core Content Connectors***

The Core Content Connectors (CCCs) are the prioritized academic content designed to frame the instruction and assessment of students with significant cognitive disabilities. The CCCs create a connection between the Learning Progressions Framework (LPF) and Common Core State Standards (CCSS) for these students.




The purpose of the CCCs is to identify the most salient core academic content in ELA and math found in both the CCSS and the LPF Progress Indicators (LPF PIs) (i.e., observable learning along the learning continuum for each strand in the LPFs). The CCCs illustrate the necessary knowledge and skills students with significant cognitive disabilities need to reach the learning targets or critical big ideas within the Learning Progression Frameworks (LPF, Hess et al., 2010) and the Common Core State Standard. This identified core content serves as a connection or stage between the LPF (designed for typically developing students) and the CCSS (which define grade level content and achievement). The CCCs are intentionally dually aligned with both the LPFs and the CCSSs. The CCCs identify priorities for the instruction for students in this population, and the alternate assessment. CCCs are designed to contribute to a fully aligned system of content, instruction, and assessment.

| Progress Indicator: M.NO.1e describing, representing, and comparing absolute value relationships | | |
|---|---|---|
| **Core Content Connectors: 6** | **CCSS Domain/Cluster** | **Common Core State Standard** |
| **6.NO.1e1 Determine the meaning of absolute value** | **Expressions and Equations**<br>6 NS Apply and extend previous understandings of numbers to the system of rational numbers. | 6.NS.7c Understand ordering and absolute value of rational numbers.<br>a) Understand the absolute value of a rational number as its distance from 0 on the number line; interpret absolute value as magnitude for a positive or negative quantity in a real-world situation. For example, for an account balance of -30 dollars write \|-30\| = 30 to describe the size of the debt in dollars. |
| **Progress Indicator: M.NO.1f recognizing equivalence of representations using fractions, decimals, and percents and using them solve ratio problems** | | |
| **Core Content Connectors: 6** | **CCSS Domain/Cluster** | **Common Core State Standard** |
| **6.NO.1f1 Find a percent of a quantity as rate per 100** | **Ratios and Proportional Relationships**<br>6 RP Understand ratio concepts and use ratio reasoning to solve problems. | 6.RP.3c Use ratio and rate reasoning to solve real-world and mathematical problems, e.g., by reasoning about tables of equivalent ratios, tape diagrams, double number line diagrams, or equations.<br>c) Find a percent of a quantity as a rate per 100 (e.g., 30% of a quantity means 30/100 times the quantity); solve problems involving finding the whole, given a part and the percent. |
| **6.NO.1f2 Write or select a ratio to match a given statement and representation** | **Ratios and Proportional Relationships**<br>6 RP Understand ratio concepts and use ratio reasoning to solve problems. | 6.RP.1 Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities. For example, "The ratio of wings to beaks in the bird house at the zoo was 2:1, because for every 2 wings there was 1 beak." "For every vote candidate A received, candidate C received nearly three votes." |
| **6.NO.1f3 Select or make a statement to interpret a given ratio** | **Ratios and Proportional Relationships**<br>6 RP Understand ratio concepts and use ratio reasoning to solve problems. | 6.RP.1 Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities. For example, "The ratio of wings to beaks in the bird house at the zoo was 2:1, because for every 2 wings there was 1 beak." "For every vote candidate A received, candidate C received nearly three votes." |

The CCCs preserve the sequence of learning outlined in the LPFs to the extent possible while disaggregating the progress indicators (which describe concepts and skills along the learning continuum for each grade span in the learning progression) into teachable and assessable segments of content. The connectors and corresponding curriculum resource guides were written to help promote how students can engage in the CCSS while following the learning progression.

The CCCs have the following characteristics:

- Sequenced according to the LPFs to help guide meaningful instruction for students and lead to enduring skills in successive grades
- Written as outcome based, which provides a description of what students should know and do
- Written at high levels of expectations for students to eliminate potential ceiling effect for student learning
- Aligned to the grade-level CCSSs to provide access to the general curriculum
- Organized by the six major LPF strands (Symbolic Expression; Nature of Numbers & Operations; Measurement; Patterns, Relations, & Functions; Geometry; and Data Analysis, Probability, & Statistics)

In some grades, CCCs were developed that were considered important for student learning but were not aligned to the LPF. CCCs for some prerequisite skills were included in some of the grades, but these CCCs are for instructional purposes and not intended as a target for assessment.

At the high school level, where only one AA-AAS will be administered to students but many CCSSs and LPFs are provided, some subsets of LPF Progress Indicators were selected for developing CCCs.

All CCCs will be provided by the curriculum and instruction work group in NCSC. While states may add additional content standards as they deem necessary that is specific to the needs, states and teachers will NOT have to develop any further CCCs. The complete set will be disseminated upon completion and validation. It is anticipated that states who have adopted the Common Core State Standards can use the CCCs as the priorities for students who take AA-AAS and will not need to create other forms of translations or create extensions of the Common Core unless they choose to do so. Teachers will be able to use these, along with the various curriculum resources, to plan instruction.

***Uses of the document***

There are several potential uses for this document. The first is to demonstrate how the identified core content builds critical big ideas across the grades. The format is intended to show how students can grow within the linked content across the grades and the connections between the related content to help guide sequential and meaningful instructional efforts. The second potential use is to provide clarity and specificity of the content within each grade level. In the process of identifying the CCC within each of the PI, it was evident that some considerations were necessary related to the content. First, it is necessary to disaggregate the content within some of the PI to a finer grain size. As students with significant cognitive disabilities may require instruction on single concepts, PIs that include multiple concepts may need to be separated in the unpacked content. Additionally, identifying core content requires focusing on the critical big ideas within the content and the need for considering meaningful instructional context within the instruction of students who participate in the alternate assessment. The third use for this document is to demonstrate how the CCCs have direct links to the CCSS. The CCSS that are identified as having the closest match are listed beside the corresponding CCC. As these direct links indicate, the CCC are not weakly linked or “watered down” translations, but instead pinpoint the most salient content in the standard. The potential users of this document ranges from assessment designers to teachers. While the document is not intended to be a standalone instructional resource, it is intended to support teachers in their understanding of the content.

## References

Hess, K. (2010, December). *Learning progressions frameworks designed for use with the Common Core State Standards in mathematics K-12.* National Alternate Assessment Center at the University of Kentucky and the National Center for the Improvement of Educational Assessment, Dover, N.H.

Hess, K. (2008). Developing and using learning progressions as a schema for measuring progress [online]. Retrieved from http://www.nciea.org/publications/CCSSO2_KH08.pdf

| | (K-4) Elementary School Learning Targets | | (5-8) Middle School Learning Targets | | (9-12) High School Learning Targets |
|---|---|---|---|---|---|
| | ***E.NO-2*** *Build an understanding of computational strategies and algorithms:*<br>• *Fluently add, subtract, multiply, divide, and estimate;*<br>• *Perform and represent operations with whole numbers, fractions, and mixed numbers;*<br>• *Identify multiples and factors of whole numbers.* | | ***M.NO-2*** *Expand use of computational strategies and algorithms to rational numbers:*<br>• *Perform operations fluently with rational numbers, including fractions, decimals, and percents;*<br>• *Identify equivalence of indicated division and fractional parts.* | | ***H.NO-2*** *Build an understanding of computational strategies and algorithms including matrices and irrational and complex numbers:*<br>• *Use matrix operations and complex and irrational number operations;*<br>• *Apply exponential expressions (laws and properties).* |
| | **Grades K-2** | **Grades 3-4** | **Grades 5-6** | **Grades 7-8** | **HS** |
| **Number and Operations: Whole numbers, Ratios, Exponents** | **K.NO.2a1 Count 2 sets to find sums up to 10** | **3.NO.2b1 Use the relationships between addition and subtraction to solve problems** | **5.NO.2a1 Solve problems or word problems using up to three digit numbers and addition or subtraction** | **7.NO.2i1 Solve multiplication problems with positive/negative numbers** | **H.NO.2a1 Solve simple equations using rational numbers with one or more variables** |
| | **K.NO.2a2 Decompose a set of up to 10 objects into a group; count the quantity in each group** | **3.NO.2c1 Solve multi-step addition and subtraction problems up to 100** | **5.NO.2a2 Separate a group of objects into equal sets when given the number of sets to find the total in each set with the total number less than 50** | **7.NO.2i2 Solve division problems with positive/ negative numbers** | **H.NO.2b1 Explain the pattern for the sum or product for combinations of rational and irrational numbers** |
| | **K.NO.2a3 Solve word problems within 10** | **3.NO.2d1 Find the total number of objects when given the number of identical groups and the number of objects in each group neither number larger than 5** | **5.NO.2a3 Find whole number quotients up to two divendends and two divisors** | | **H.NO.2c1 Simplify expressions that include exponents** |

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| | **Grades K-2** | **Grades 3-4** | **Grades 5-6** | **Grades 7-8** | **HS** |
| | **1.NO.2a4 For any number from 1 to 9, find the number that makes 10 when added to the given number, e.g., by using objects or drawings, and record or select the answer** | **3.NO.2d2 Find total number inside an array with neither number in the columns or rows larger than 5** | **5.NO.2a4 Find whole number quotients up to four divendends and two divisors** | | **H.NO.2c2 Rewrite expressions that include rational exponents** |
| | **1.NO.2a5 Count 2 sets to find sums up to 10** | **3.NO.2d3 Solve multiplication problems with neither number greater than 5** | **5.NO.2a5 Solve word problems that require multiplication or division** | | |
| | **1.NO.2a6 Count 2 sets to find sums up to 20** | **3.NO.2d4 Determine how many objects go into each group when given the total number of objects and the number of groups where the number in each group or number of groups is not greater than 5** | **6.NO.2a6 Solve problems or word problems using up to three digit numbers and any of the four operations** | | |

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| | **Grades K-2** | **Grades 3-4** | **Grades 5-6** | **Grades 7-8** | **HS** |
| | **1.NO.2a7 Decompose a set of up to 10 objects into a group; count the quantity in each group** | **3.NO.2d5 Determine the number of groups given the total number of objects and the number of objects in each group where the number in each group and the number of groups is not greater than 5** | **6.NO.2e1 Determine the difference between two integers using a number line** | | |
| | **1.NO.2a8 Decompose a set of up to 20 objects into a group; count the quantity in each group** | **3.NO.2e1 Solve or solve and check one or two step word problems requiring addition, subtraction or multiplication with answers up to 100** | **6.NO.2e2 Compare two numbers on a number line (e.g., -2 > -9)** | | |

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| | **1.NO.2a9 Use manipulatives or representations to write simple addition or subtraction equations within 20 based upon a word problem** | **4.NO.2c2 Solve multi digit addition and subtraction problems up to 1000** | | | |
| | **1.NO.2a10 Use data presented in graphs (i.e., pictoral, object) to solve one step "how many more" or "how many less" word problems** | **4.NO.2d6 Find total number inside an array with neither number in the columns or rows larger than 10** | | | |

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| | **1.NO.2a11 Solve word problems within 20** | **4.NO.2d7 Determine how many objects go into each group when given the total number of objects and the number of groups where the number in each group or number of groups is not greater than 10** | | | |
| | **1.NO.2c1 Identify and apply addition and equal signs** | **4.NO.2d8 Match an accurate addition and multiplication equation to a representation** | | | |
| | **2.NO.2a12 Model addition and subtraction with base 10 blocks within 20** | **4.NO.2e2 Solve or solve and check one or two step word problems requiring addition, subtraction or multiplication with answers up to 100** | | | |

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| | **Grades K-2** | **Grades 3-4** | **Grades 5-6** | **Grades 7-8** | **HS** |
| | **2.NO.2a13 Model addition and subtraction with base 10 blocks within 50** | **4.NO.2f1 Identify multiples for a whole number (e.g., 2= 2, 4, 6, 8, 10)** | | | |
| | **2.NO.2a14 Model addition and subtraction with base 10 blocks within 100** | **4.NO.2f2 Solve multiplication problems up to two digits by one digit** | | | |
| | **2.NO.2a15 Remove objects from a set in a subtraction situation to find the amount remaining up to a minend of 20** | | | | |
| | **2.NO.2a16 Solve word problems within 20** | | | | |
| | **2.NO.2a17 Solve word problems within 100** | | | | |

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| | **2.NO.2a18 Use diagrams and number lines to solve addition or subtraction problems** | | | | |
| | **2.NO.2a19 Combine up to 3 sets of 20 or less** | | | | |
| | **2.NO.2b1 Use commutative properties to solve addition problems with sums up to 20 (e.g., 3+8=11 therefore 8+3=__)** | | | | |
| | **2.NO.2b2 Use associative property to solve addition problems with sums up to 20** | | | | |
| | **2.NO.2c2 Identify and apply addition, subtraction, and equal signs** | | | | |

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| | **2.NO.2c3 Compose ones into tens and/or tens into hundreds in addition situation** | | | | |
| | **2.NO.2c4 Decompose tens into ones and/or hundreds into tens in subtraction situations** | | | | |
| **Number and Operations: Fractions and Decimals** | | **4.NO.2g1 Using a representation, decompose a fraction into multiple copies of a unit fraction (e.g., ¾ = ¼ + ¼ + ¼ )** | **5.NO.2b1 Add and subtract fractions with unlike denominators by replacing fractions with equivalent fractions (identical denominators)** | **7.NO.2f1 Identify the proportional relationship between two quantities** | |
| | | **4.NO.2h1 Add and subtract fractions with like denominators of (2,3,4, or 8)** | **5.NO.2b2 Add or subtract fractions with unlike denominators** | **7.NO.2f2 Determine if two quantities are in a proportional relationship using a table of equivalent ratios or points graphed on a** | |

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| | **Grades K-2** | **Grades 3-4** | **Grades 5-6** | **Grades 7-8** | **HS** |
| | | | | **coordinate plane** | |
| | | **4.NO.2h2 Add and subtract fractions with like denominators (2,3,4, or 8) using representations** | **5.NO.2b3 Multiply or divide fractions** | **7.NO.2f3 Find unit rates given a ratio** | |
| | | **4.NO.2h3 Solve word problems involving addition and subtraction of fractions with like denominators (2, 3, 4, or 8)** | **5.NO.2c1 Solve 1 step problems using decimals** | **7.NO.2f4 Use a rate of change or proportional relationship to determine the points on a coordinate plane** | |
| | | | **5.NO.2c2 Solve word problems involving the addition, subtraction, multiplication or division of fractions** | **7.NO.2f5 Use proportions to solve ratio problems** | |

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|---|---|---|---|---|---|
| | ***E.NO-2*** *Build an understanding of computational strategies and algorithms:*<br>• *Fluently add, subtract, multiply, divide, and estimate;*<br>• *Perform and represent operations with whole numbers, fractions, and mixed numbers;*<br>• *Identify multiples and factors of whole numbers.* | | ***M.NO-2*** *Expand use of computational strategies and algorithms to rational numbers:*<br>• *Perform operations fluently with rational numbers, including fractions, decimals, and percents;*<br>• *Identify equivalence of indicated division and fractional parts.* | | ***H.NO-2*** *Build an understanding of computational strategies and algorithms including matrices and irrational and complex numbers:*<br>• *Use matrix operations and complex and irrational number operations;*<br>• *Apply exponential expressions (laws and properties).* |
| | **Grades K-2** | **Grades 3-4** | **Grades 5-6** | **Grades 7-8** | **HS** |
| | | | **6.NO.2c3 Solve one step, addition, subtraction, multiplcation, or division problems with fractions or decimals** | **7.NO.2f6 Solve word problems involving ratios** | |
| | | | **6.NO.2c4 Solve word problems involving the addition, subtraction, multiplication or division of fractions** | **7.NO.2h2 Solve one step percentage increase and decrease problems** | |
| | | | | **8.NO.2i3 Solve one step addition, subtraction, multiplication, division problems with fractions, decimals, and positive/negative numbers** | |

| | (K-4) Elementary School Learning Targets | | (5-8) Middle School Learning Targets | | (9-12) High School Learning Targets |
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| | ***E.NO-2*** *Build an understanding of computational strategies and algorithms:*<br>• *Fluently add, subtract, multiply, divide, and estimate;*<br>• *Perform and represent operations with whole numbers, fractions, and mixed numbers;*<br>• *Identify multiples and factors of whole numbers.* | | ***M.NO-2*** *Expand use of computational strategies and algorithms to rational numbers:*<br>• *Perform operations fluently with rational numbers, including fractions, decimals, and percents;*<br>• *Identify equivalence of indicated division and fractional parts.* | | ***H.NO-2*** *Build an understanding of computational strategies and algorithms including matrices and irrational and complex numbers:*<br>• *Use matrix operations and complex and irrational number operations;*<br>• *Apply exponential expressions (laws and properties).* |
| | **Grades K-2** | **Grades 3-4** | **Grades 5-6** | **Grades 7-8** | **HS** |
| | | | | **8.NO.2i4 Solve two step addition, subtraction, multiplication, and division problems with fractions, decimals, or positive/negative numbers** | |
| **Number and Operations: Application** | | | | **7.NO.2h1 Find percents in real world contexts** | |

**Number and Operations 2 Grade Differentiation**

| **Progress Indicator: E.NO.2a representing addition and subtraction in multiple ways (composing/ decomposing numbers, diagrams, using objects, arrays, equations, number lines), including regrouping** | | |
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| **Core Content Connectors: K** | **CCSS Domain/Cluster** | **Common Core State Standard** |
| **K.NO.2a1 Count 2 sets to find sums up to 10** | **Operations and Algebraic Thinking**<br>K OA Understand addition as putting together and adding to, and understand subtraction as taking apart and taking from. | K.OA.2 Solve addition and subtraction word problems, and add and subtract within 10, e.g., by using objects or drawings to represent the problem. |
| **K.NO.2a2 Decompose a set of up to 10 objects into a group; count the quantity in each group** | **Operations and Algebraic Thinking**<br>K OA Understand addition as putting together and adding to, and understand subtraction as taking apart and taking from. | K.OA.3 Decompose numbers less than or equal to 10 into pairs in more than one way, e.g., by using objects or drawings, and record each decomposition by a drawing or equation (e.g., 5 = 2 + 3 and 5 = 4 + 1). |
| **K.NO.2a3 Solve word problems within 10** | **Operations and Algebraic Thinking**<br>K OA Understand addition as putting together and adding to, and understand subtraction as taking apart and taking from. | K.OA.2 Solve addition and subtraction word problems, and add and subtract within 10, e.g., by using objects or drawings to represent the problem. |

| **Progress Indicator: E.NO.2a representing addition and subtraction in multiple ways (composing/ decomposing numbers, diagrams, using objects, arrays, equations, number lines), including regrouping** | | |
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| **Core Content Connectors: 1** | **CCSS Domain/Cluster** | **Common Core State Standard** |
| **1.NO.2a4 For any number from 1 to 9, find the number that makes 10 when added to the given number, e.g., by using objects or drawings, and record or select the answer** | **Operations and Algebraic Thinking**<br>K OA Understand addition as putting together and adding to, and understand subtraction as taking apart and taking from. | K.OA.4 For any number from 1 to 9, find the number that makes 10 when added to the given number, e.g., by using objects or drawings, and record the answer with a drawing or equation |

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| **1.NO.2a5 Count 2 sets to find sums up to 10** | **Operations and Algebraic Thinking**<br>K OA Understand addition as putting together and adding to, and understand subtraction as taking apart and taking from. | K.OA.2 Solve addition and subtraction word problems, and add and subtract within 10, e.g., by using objects or drawings to represent the problem.<br>K.OA.5 Fluently add and subtract within 5. |
| **1.NO.2a6 Count 2 sets to find sums up to 20** | **Operations and Algebraic Thinking**<br>1 OA Add and subtract within 20. | 1.OA.5 Relate counting to addition and subtraction (e.g., by counting on 2 to add 2).<br><br>1.OA.6 Add and subtract within 20, demonstrating fluency for addition and subtraction within 10. Use strategies such as counting on; making ten (e.g., 8 + 6 = 8 + 2 + 4 = 10 + 4 = 14); decomposing a number leading to a ten (e.g., 13 – 4 = 13 – 3 – 1 = 10 – 1 = 9); using the relationship between addition and subtraction (e.g., knowing that 8 + 4 = 12, one knows 12 – 8 = 4); and creating equivalent but easier or known sums (e.g., adding 6 + 7 by creating the known equivalent 6 + 6 + 1 = 12 + 1 = 13). |
| **1.NO.2a7 Decompose a set of up to 10 objects into a group; count the quantity in each group** | **Operations and Algebraic Thinking**<br>K OA Understand addition as putting together and adding to, and understand subtraction as taking apart and taking from. | K.OA.3 Decompose numbers less than or equal to 10 into pairs in more than one way, e.g., by using objects or drawings, and record each decomposition by a drawing or equation (e.g., 5 = 2 + 3 and 5 = 4 + 1).<br>K.OA.5 Fluently add and subtract within 5. |
| **1.NO.2a8 Decompose a set of up to 20 objects into a group; count the quantity in each group** | **Operations and Algebraic Thinking**<br>1 OA Add and subtract within 20. | 1.OA.5 Relate counting to addition and subtraction (e.g., by counting on 2 to add 2).<br><br>1.OA.6 Add and subtract within 20, demonstrating fluency for addition and subtraction within 10. Use strategies such as counting on; making ten (e.g., 8 + 6 = 8 + 2 + 4 = 10 + 4 = 14); decomposing a number leading to a ten (e.g., 13 – 4 = 13 – 3 – 1 = 10 – 1 = 9); using the relationship between addition and subtraction (e.g., knowing that 8 + 4 = 12, one knows 12 – 8 = 4); and creating equivalent but easier or known sums (e.g., adding 6 + 7 by creating the known equivalent 6 + 6 + 1 = 12 + 1 = 13). |
| **1.NO.2a9 Use manipulatives or** | **Operations and Algebraic** | 1.OA.1 Use addition and subtraction within 20 to solve word |

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| **representations to write simple addition or subtraction equations within 20 based upon a word problem** | **Thinking**<br>1 OA Represent and solve problems involving addition and subtraction. | problems involving situations of adding to, taking from, putting together, taking apart, and comparing, with unknowns in all positions, e.g., by using objects, drawings, and equations with a symbol for the unknown number to represent the problem. |
| **1.NO.2a10 Use data presented in graphs (i.e., pictoral, object) to solve one step "how many more" or "how many less" word problems** | **Operations and Algebraic Thinking**<br>1 OA Represent and solve problems involving addition and subtraction. | 1.OA.1 Use addition and subtraction within 20 to solve word problems involving situations of adding to, taking from, putting together, taking apart, and comparing, with unknowns in all positions, e.g., by using objects, drawings, and equations with a symbol for the unknown number to represent the problem. |
| **1.NO.2a11 Solve word problems within 20** | **Operations and Algebraic Thinking**<br>1 OA Represent and solve problems involving addition and subtraction. | 1.OA.1 Use addition and subtraction within 20 to solve word problems involving situations of adding to, taking from, putting together, taking apart, and comparing, with unknowns in all positions, e.g., by using objects, drawings, and equations with a symbol for the unknown number to represent the problem.<br>1.OA.2 Solve word problems that call for addition of three whole numbers whose sum is less than or equal to 20, e.g., by using objects, drawings, and equations with a symbol for the unknown number to represent the problem. |
| **Progress Indicator: E.NO.2c working flexibly with common addition and subtraction situations** | | |
| **Core Content Connectors: 1** | **CCSS Domain/Cluster** | **Common Core State Standard** |
| **1.NO.2c1 Identify and apply addition and equal signs** | **Operations and Algebraic Thinking**<br>1 OA Work with addition and subtraction equations. | 1.OA.7 Understand the meaning of the equal sign, and determine if equations involving addition and subtraction are true or false. For example, which of the following equations are true and which are false? 6 = 6, 7 = 8 – 1, 5 + 2 = 2 + 5, 4 + 1 = 5 + 2. |

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| **Progress Indicator: E.NO.2a representing addition and subtraction in multiple ways (composing/ decomposing numbers, diagrams, using objects, arrays, equations, number lines), including regrouping** | | |
| **Core Content Connectors: 2** | **CCSS Domain/Cluster** | **Common Core State Standard** |
| **2.NO.2a12 Model addition and subtraction with base 10 blocks within 20** | **Number and Operations in Base Ten**<br>2 NBT Use place value understanding and properties of operations to add and subtract. | 2.NBT.5 Fluently add and subtract within 100 using strategies based on place value, properties of operations, and/or the relationship between addition and subtraction |
| **2.NO.2a13 Model addition and** | **Number and Operations in Base** | 2.NBT.5 Fluently add and subtract within 100 using strategies |

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| **subtraction with base 10 blocks within 50** | **Ten**<br>2 NBT Use place value understanding and properties of operations to add and subtract. | based on place value, properties of operations, and/or the relationship between addition and subtraction |
| **2.NO.2a14 Model addition and subtraction with base 10 blocks within 100** | **Number and Operations in Base Ten**<br>2 NBT Use place value understanding and properties of operations to add and subtract. | 2.NBT.5 Fluently add and subtract within 100 using strategies based on place value, properties of operations, and/or the relationship between addition and subtraction |
| **2.NO.2a15 Remove objects from a set in a subtraction situation to find the amount remaining up to a minuend of 20** | **Operations and Algebraic Thinking**<br>1 OA Represent and solve problems involving addition and subtraction. | 1.OA.1 Use addition and subtraction within 20 to solve word problems involving situations of adding to, taking from, putting together, taking apart, and comparing, with unknowns in all positions, e.g., by using objects, drawings, and equations with a symbol for the unknown number to represent the problem.<br>1.0A.4 Relate counting to addition and subtraction (e.g., by counting on 2 to add 2). |
| **2.NO.2a16 Solve word problems within 20** | **Number and Operations in Base Ten**<br>2 OA Represent and solve problems involving addition and subtraction. | 2.OA.1 Use addition and subtraction within 100 to solve one- and two-step word problems involving situations of adding to, taking from, putting together, taking apart, and comparing, with unknowns in all positions |
| **2.NO.2a17 Solve word problems within 100** | **Operations and Algebraic Thinking**<br>2 OA Represent and solve problems involving addition and subtraction. | 2.OA.1 Use addition and subtraction within 100 to solve one- and two-step word problems involving situations of adding to, taking from, putting together, taking apart, and comparing, with unknowns in all positions |
| **2.NO.2a18 Use diagrams and number lines to solve addition or subtraction problems** | **Number and Operations in Base Ten**<br>2 NBT Use place value understanding and properties of operations to add and subtract. | 2.NBT.7 Add and subtract within 1000, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method. Understand that in adding or subtracting three-digit numbers, one adds or subtracts hundreds and hundreds, tens and tens, ones and ones; and sometimes it is necessary to compose or decompose tens or hundreds.<br>2.MD.6 Represent whole numbers as lengths from 0 on a number line diagram with equally spaced points corresponding to the numbers 0, 1, 2, ..., and represent whole-number sums and differences within 100 on a number line diagram. |

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| **2.NO.2a19 Combine up to 3 sets of 20 or less** | **Number and Operations in Base Ten**<br>2 NBT Use place value understanding and properties of operations to add and subtract. | 2.NBT.6 Add up to four two-digit numbers using strategies based on place value and properties of operations. |
| **Progress Indicator: E.NO.2b explaining or modeling the relationship between addition and subtraction** | | |
| **Core Content Connectors: 2** | **CCSS Domain/Cluster** | **Common Core State Standard** |
| **2.NO.2b1 Use commutative properties to solve addition problems with sums up to 20 (e.g., 3+8=11 therefore 8+3=__)** | **Operations and Algebraic Thinking**<br>1 OA Understand and apply properties of operations and the relationship between addition and subtraction. | 1.OA.3 Apply properties of operations as strategies to add and subtract. *Examples: If 8 + 3 = 11 is known, then 3 + 8 = 11 is also known. (Commutative property of addition.) To add 2 + 6 + 4, the second two numbers can be added to make a ten, so 2 + 6 + 4 = 2 + 10 = 12. (Associative property of addition.)* |
| **2.NO.2b2 Use associative property to solve addition problems with sums up to 20** | **Operations and Algebraic Thinking**<br>1 OA Understand and apply properties of operations and the relationship between addition and subtraction. | 1.OA.3 Apply properties of operations as strategies to add and subtract. *Examples: If 8 + 3 = 11 is known, then 3 + 8 = 11 is also known. (Commutative property of addition.) To add 2 + 6 + 4, the second two numbers can be added to make a ten, so 2 + 6 + 4 = 2 + 10 = 12. (Associative property of addition.)* |
| **Progress Indicator: E.NO.2c working flexibly with common addition and subtraction situations** | | |
| **Core Content Connectors: 2** | **CCSS Domain/Cluster** | **Common Core State Standard** |
| **2.NO.2c2 Identify and apply addition, subtraction, and equal signs** | **Number and Operations in Base Ten**<br>1 OA Work with addition and subtraction equations. | 1.OA.7 Understand the meaning of the equal sign, and determine if equations involving addition and subtraction are true or false. For example, which of the following equations are true and which are false? 6 = 6, 7 = 8 – 1, 5 + 2 = 2 + 5, 4 + 1 = 5 + 2. |
| **2.NO.2c3 Compose ones into tens and/or tens into hundreds in addition situation** | **Number and Operations in Base Ten**<br>1 NBT;2 NBT Use place value understanding and properties of operations to add and subtract. | 1.NBT.4 Add within 100, including adding a two-digit number and a one-digit number, and adding a two-digit number and a multiple of 10, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method and explain the reasoning used. Understand that in adding two-digit numbers, one adds tens and tens, ones and ones; and sometimes it is necessary to compose a ten.<br>2.NBT.7 Add and subtract within 1000, using concrete models |

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| | | or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method. Understand that in adding or subtracting three-digit numbers, one adds or subtracts hundreds and hundreds, tens and tens, ones and ones; and sometimes it is necessary to compose or decompose tens or hundreds. |
| **2.NO.2c4 Decompose tens into ones and/or hundreds into tens in subtraction situations** | **Number and Operations in Base Ten**<br>1 NBT; 2 NBT Use place value understanding and properties of operations to add and subtract. | 1.NBT.6 Subtract multiples of 10 in the range 10-90 from multiples of 10 in the range 10-90 (positive or zero differences), using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method and explain the reasoning used.<br>2.NBT.7 Add and subtract within 1000, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method. Understand that in adding or subtracting three-digit numbers, one adds or subtracts hundreds and hundreds, tens and tens, ones and ones; and sometimes it is necessary to compose or decompose tens or hundreds. |

| **Progress Indicator: E.NO.2b explaining or modeling the relationship between addition and subtraction** | | |
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| **Core Content Connectors: 3** | **CCSS Domain/Cluster** | **Common Core State Standard** |
| **3.NO.2b1 Use the relationships between addition and subtraction to solve problems** | **Number and Operations in Base Ten**<br>3 NBT Use place value understanding and properties of operations to perform multi-digit arithmetic. | 3.NBT.2 Fluently add and subtract within 1000 using strategies and algorithms based on place value, properties of operations, and/or the relationship between addition and subtraction. |
| **Progress Indicator: E.NO.2c working flexibly with common addition and subtraction situations** | | |
| **Core Content Connectors: 3** | **CCSS Domain/Cluster** | **Common Core State Standard** |
| **3.NO.2c1 Solve multi-step addition and subtraction problems up to 100** | **Number and Operations in Base Ten**<br>3 NBT Use place value | 3.NBT.2 Fluently add and subtract within 1000 using strategies and algorithms based on place value, properties of operations, and/or the relationship between addition and subtraction. |

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| | understanding and properties of operations to perform multi-digit arithmetic. | |
| **Progress Indicator: E.NO.2d modeling multiplication (equal-sized groups, arrays, area models, equal-sized jumps on number lines, multiplicative comparisons) and division (successive subtraction, partitioning, sharing) of whole numbers** | | |
| **Core Content Connectors: 3** | **CCSS Domain/Cluster** | **Common Core State Standard** |
| **3.NO.2d1 Find the total number of objects when given the number of identical groups and the number of objects in each group neither number larger than 5** | **Operations and Algebraic Thinking**<br>2 OA Work with equal groups of objects to gain foundations for multiplication.<br><br>3 OA Represent and solve problems involving multiplication and division. | 2.OA.4 Use addition to find the total number of objects arranged in rectangular arrays with up to 5 rows and up to 5 columns; write an equation to express the total as a sum of equal addends.<br>2.G.2 Partition a rectangle into rows and columns of same-size squares and count to find the total number of them.<br>3.OA.1 Interpret products of whole numbers, e.g., interpret 5 × 7 as the total number of objects in 5 groups of 7 objects each. *For example, describe a context in which a total number of objects can be expressed as 5 × 7* |
| **3.NO.2d2 Find total number inside an array with neither number in the columns or rows larger than 5** | **Operations and Algebraic Thinking**<br>2 OA Work with equal groups of objects to gain foundations for multiplication.<br><br>3 OA Represent and solve problems involving multiplication and division. | 2.OA.4 Use addition to find the total number of objects arranged in rectangular arrays with up to 5 rows and up to 5 columns; write an equation to express the total as a sum of equal addends.<br>3.OA.1 Interpret products of whole numbers, e.g., interpret 5 × 7 as the total number of objects in 5 groups of 7 objects each. *For example, describe a context in which a total number of objects can be expressed as 5 × 7* |
| **3.NO.2d3 Solve multiplication problems with neither number greater than 5** | **Operations and Algebraic Thinking**<br>3 OA Represent and solve problems involving multiplication and division. | 3.OA.1 Interpret products of whole numbers, e.g., interpret 5 × 7 as the total number of objects in 5 groups of 7 objects each. *For example, describe a context in which a total number of objects can be expressed as 5 × 7* |
| **3.NO.2d4 Determine how many objects go into each group when given the total number of objects and the number of groups where the number in each group or number of groups is not greater than 5** | **Operations and Algebraic Thinking**<br>3 OA Represent and solve problems involving multiplication and division. | 3.OA.2 Interpret whole-number quotients of whole numbers, e.g., interpret 56 ÷ 8 as the number of objects in each share when 56 objects are partitioned equally into 8 shares, or as a number of shares when 56 objects are partitioned into equal shares of 8 objects each. *For example, describe a context in which a number of shares or a number of groups can be expressed as 56 ÷ 8.* |

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| | | 3.OA.6 Understand division as an unknown-factor problem. For example, find 32 ÷ 8 by finding the number that makes 32 when multiplied by 8. |
| **3.NO.2d5 Determine the number of groups given the total number of objects and the number of objects in each group where the number in each group and the number of groups is not greater than 5** | **Operations and Algebraic Thinking**<br>3 OA Represent and solve problems involving multiplication and division. | 3.OA.2 Interpret whole-number quotients of whole numbers, e.g., interpret 56 ÷ 8 as the number of objects in each share when 56 objects are partitioned equally into 8 shares, or as a number of shares when 56 objects are partitioned into equal shares of 8 objects each. *For example, describe a context in which a number of shares or a number of groups can be expressed as 56 ÷ 8.*<br>3.OA.6 Understand division as an unknown-factor problem. For example, find 32 ÷ 8 by finding the number that makes 32 when multiplied by 8. |
| **Progress Indicator: E.NO.2e describing relationships between addition-multiplication; multiplication-division; addition-subtraction; why commutative property does not apply to subtraction or division** | | |
| **Core Content Connectors: 3** | **CCSS Domain/Cluster** | **Common Core State Standard** |
| **3.NO.2e1 Solve or solve and check one or two step word problems requiring addition, subtraction or multiplication with answers up to 100** | **Operations and Algebraic Thinking**<br>3 OA Solve problems involving the four operations, and identify and explain patterns in arithmetic. | 3.OA.3 Use multiplication and division within 100 to solve word problems in situations involving equal groups, arrays, and measurement quantities, e.g., by using drawings and equations with a symbol for the unknown number to represent the problem.<br>3.OA.8 Solve two-step word problems using the four operations. Represent these problems using equations with a letter standing for the unknown quantity. Assess the reasonableness of answers using mental computation and estimation strategies including rounding. |

| **Progress Indicator: E.NO.2c working flexibly with common addition and subtraction situations** | | |
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| **Core Content Connectors: 4** | **CCSS Domain/Cluster** | **Common Core State Standard** |
| **4.NO.2c2 Solve multi digit addition and subtraction problems up to 1000** | **Number and Operations in Base Ten**<br>3 NBT Use place value understanding and properties of operations to perform multi-digit arithmetic. | 3.NBT.2 Fluently add and subtract within 1000 using strategies and algorithms based on place value, properties of operations, and/or the relationship between addition and subtraction.<br>4.NBT.4 Fluently add and subtract multi-digit whole numbers using the standard algorithm. |

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| **Progress Indicator: E.NO.2d modeling multiplication (equal-sized groups, arrays, area models, equal-sized jumps on number lines, multiplicative comparisons) and division (successive subtraction, partitioning, sharing) of whole numbers** | | |
| **Core Content Connectors: 4** | **CCSS Domain/Cluster** | **Common Core State Standard** |
| **4.NO.2d6 Find total number inside an array with neither number in the columns or rows larger than 10** | **Operations and Algebraic Thinking**<br>3 OA Represent and solve problems involving multiplication and division. | 3.OA.1 Interpret products of whole numbers, e.g., interpret 5 × 7 as the total number of objects in 5 groups of 7 objects each. *For example, describe a context in which a total number of objects can be expressed as 5 × 7.* |
| **4.NO.2d7 Determine how many objects go into each group when given the total number of objects and the number of groups where the number in each group or number of groups is not greater than 10** | **Operations and Algebraic Thinking**<br>4 OA Use the four operations with whole numbers to solve problems. | 3.OA.4 Determine the unknown whole number in a multiplication or division equation relating three whole numbers. For example, determine the unknown number that makes the equation true in each of the equations 8 × ? = 48, 5 = _ ÷ 3, 6 × 6 = ?.4.OA.2 Mulitply or divide to solve word problem involving multiplicative comparison, e.g., by using drawings and equations with a symbol for the unknown number to represent the problem distinguishing multiplicative comparison from additive comparison. |
| **4.NO.2d8 Match an accurate addition and multiplication equation to a representation** | **Operations and Algebraic Thinking**<br>3 OA Represent and solve problems involving multiplication and division. | 3.OA.1 Interpret products of whole numbers, e.g., interpret 5 × 7 as the total number of objects in 5 groups of 7 objects each. *For example, describe a context in which a total number of objects can be expressed as 5 × 7.* |

| Progress Indicator: E.NO.2e describing relationships between addition-multiplication; multiplication-division; addition-subtraction; why commutative property does not apply to subtraction or division | | |
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| **Core Content Connectors: 4** | **CCSS Domain/Cluster** | **Common Core State Standard** |
| **4.NO.2e2 Solve or solve and check one or two step word problems requiring addition, subtraction or multiplication with answers up to 100** | **Operations and Algebraic Thinking**<br>4 OA Use the four operations with whole numbers to solve problems. | 4.OA.3 Solve multistep word problems posed with whole numbers and having whole-number answers using the four operations, including problems in which remainders must be interpreted. Represent these problems using equations with a letter standing for the unknown quantity. Assess the reasonableness of answers using mental computation and estimation strategies including rounding. |
| **Progress Indicator: E.NO.2f identifying factors and multiples of numbers** | | |
| **Core Content Connectors: 4** | **CCSS Domain/Cluster** | **Common Core State Standard** |
| **4.NO.2f1 Identify multiples for a whole number (e.g., 2= 2, 4, 6, 8, 10)** | **Operations and Algebraic Thinking**<br>4 OA Gain familiarity with factors and multiples. | 4.OA.4 Find all factor pairs for a whole number in the range 1–100. Recognize that a whole number is a multiple of each of its factors. Determine whether a given whole number in the range 1–100 is a multiple of a given one-digit number. Determine whether a given whole number in the range 1–100 is prime or composite. |
| **4.NO.2f2 Solve multiplication problems up to two digits by one digit** | **Number and Operations in Base Ten**<br>4 NBT Use place value understanding and properties of operations to perform multi-digit arithmetic. | 3.NBT.3 . Multiply one-digit whole numbers by multiples of 10 in the range 10–90 (e.g., 9 × 80, 5 × 60) using strategies based on place value and properties of operations.<br><br>4.NBT.5 Multiply a whole number of up to four digits by a one-digit whole number, and multiply two two-digit numbers, using strategies based on place value and the properties of operations. Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models. |
| **Progress Indicator: E.NO.2g recognizing fractions as one number/one quantity, rather than two numbers (numerator and denominator) and using number lines to represent magnitude of fractions** | | |
| **Core Content Connectors: 4** | **CCSS Domain/Cluster** | **Common Core State Standard** |
| **4.NO.2g1 Using a representation, decompose a fraction into multiple copies of a unit fraction** | **Numbers and Operations – Fractions**<br>3 NF Develop understanding of | 3.NF.1 Understand a fraction 1/*b* as the quantity formed by 1 part when *a* whole is partitioned into *b* equal parts; understand a fraction *a*/*b* as the quantity formed by a parts of size 1/*b* |

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| **(e.g., ¾ = ¼ + ¼ + ¼ )** | fractions as numbers.<br>**Numbers and Operations – Fractions**<br>4 NF Build fractions from unit fractions by applying and extending previous understandings of operations on whole numbers. | 4.NF.3 Understand a fraction *a*/*b* with *a* > 1 as a sum of fractions 1/*b*.<br>a) Understand addition and subtraction of fractions as joining and separating parts referring to the same whole.<br>b) Decompose a fraction into a sum of fractions with the same denominator in more than one way, recording each decomposition by an equation. Justify decompositions, e.g., by using a visual fraction model. *Examples: 3/8 = 1/8 + 1/8 + 1/8 ; 3/8 = 1/8 + 2/8 ; 2 1/8 = 1 + 1 + 1/8 = 8/8 + 8/8 + 1/8.* |

| **Progress Indicator: E.NO.2h adding, subtracting, and multiplying fractions, including mixed numbers** | | |
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| **Core Content Connectors: 4** | **CCSS Domain/Cluster** | **Common Core State Standard** |
| **4.NO.2h1 Add and subtract fractions with like denominators of (2,3,4, or 8)** | **Numbers and Operations – Fractions**<br>4 NF Build fractions from unit fractions by applying and extending previous understandings of operations on whole numbers. | 4.NF.3 Understand a fraction *a*/*b* with *a* > 1 as a sum of fractions 1/*b*.<br>a) Understand addition and subtraction of fractions as joining and separating parts referring to the same whole.<br>b) Decompose a fraction into a sum of fractions with the same denominator in more than one way, recording each decomposition by an equation. Justify decompositions, e.g., by using a visual fraction model. *Examples: 3/8 = 1/8 + 1/8 + 1/8 ; 3/8 = 1/8 + 2/8 ; 2 1/8 = 1 + 1 + 1/8 = 8/8 + 8/8 + 1/8.* |
| **4.NO.2h2 Add and subtract fractions with like denominators (2,3,4, or 8) using representations** | **Numbers and Operations – Fractions**<br>4 NF Build fractions from unit fractions by applying and extending previous understandings of operations on whole numbers. | 4.NF.3 Understand a fraction *a*/*b* with *a* > 1 as a sum of fractions 1/*b*.<br>a) Understand addition and subtraction of fractions as joining and separating parts referring to the same whole.<br>b) Decompose a fraction into a sum of fractions with the same denominator in more than one way, recording each decomposition by an equation. Justify decompositions, e.g., by using a visual fraction model. *Examples: 3/8 = 1/8 + 1/8 + 1/8 ; 3/8 = 1/8 + 2/8 ; 2 1/8 = 1 + 1 + 1/8 = 8/8 + 8/8 + 1/8.* |
| **4.NO.2h3 Solve word problems involving addition and subtraction of fractions with like** | **Numbers and Operations – Fractions**<br>3 NF Develop understanding of | 3.NF.3 Explain equivalence of fractions in special cases, and compare fractions by reasoning about their size.<br>d) Compare two fractions with the same numerator or the |

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| **denominators (2, 3, 4, or 8)** | fractions as numbers.<br><br>4 NF Build fractions from unit fractions by applying and extending previous understandings of operations on whole numbers. | same denominator by reasoning about their size. Recognize that comparisons are valid only when the two fractions refer to the same whole. Record the results of comparisons with the symbols >, =, or <, and justify the conclusions, e.g., by using a visual fraction model.<br>4.NF.3 Understand a fraction *a*/*b* with *a* > 1 as a sum of fractions 1/*b*.<br>d) Solve word problems involving addition and subtraction of fractions referring to the same whole and having like denominators, e.g., by using visual fraction models and equations to represent the problem. |

| **Progress Indicator: M.NO.2a working flexibility with common addition, subtraction, multiplication, and division situations** | | |
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| **Core Content Connectors: 5** | **CCSS Domain/Cluster** | **Common Core State Standard** |
| **5.NO.2a1 Solve problems or word problems using up to three digit numbers and addition or subtraction or multiplication** | **Operations and Algebraic Thinking**<br>4 OA Use the four operations with whole numbers to solve problems.<br>**Number and Operations in Base Ten**<br>5 NBT Perform operations with multi-digit whole numbers and with decimals to hundredths. | 4.OA.3 Solve multistep word problems posed with whole numbers and having whole-number answers using the four operations, including problems in which remainders must be interpreted. Represent these problems using equations with a letter standing for the unknown quantity. Assess the reasonableness of answers using mental computation and estimation strategies including rounding.<br>5.NBT.5 Fluently multiply multi-digit whole numbers using the standard algorithm. |
| **5.NO.2a2 Separate a group of objects into equal sets when given the number of sets to find the total in each set with the total number less than 50** | **Number and Operations in Base Ten**<br>4 NBT Use place value understanding and properties of operations to perform multi-digit arithmetic. | 4.NBT.6 Find whole-number quotients and remainders with up to four-digit dividends and one-digit divisors, using strategies based on place value, the properties of operations, and/or the relationship between multiplication and division. Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models. |
| **5.NO.2a3 Find whole number quotients up to two divendends and two divisors.** | **Number and Operations in Base Ten**<br>5 NBT Perform operations with multi-digit whole numbers and with decimals to hundredths. | 5.NBT.6 Find whole-number quotients of whole numbers with up to four-digit dividends and two-digit divisors, using strategies based on place value, the properties of operations, and/or the relationship between multiplication and division. Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models. |
| **5.NO.2a4 Find whole number** | **Number and Operations in Base** | 5.NBT.6 Find whole-number quotients of whole numbers with up |

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| **quotients up to four divendends and two divisors** | **Ten**<br>5 NBT Perform operations with multi-digit whole numbers and with decimals to hundredths. | to four-digit dividends and two-digit divisors, using strategies based on place value, the properties of operations, and/or the relationship between multiplication and division. Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models. |
| **5.NO.2a5 Solve word problems that require multiplication or division** | **Number and Operations in Base Ten**<br>5 NBT Perform operations with multi-digit whole numbers and with decimals to hundredths. | 5.NBT.6 Find whole-number quotients of whole numbers with up to four-digit dividends and two-digit divisors, using strategies based on place value, the properties of operations, and/or the relationship between multiplication and division. Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models. |

| **Progress Indicator: M.NO.2b recognizing fractions as one number/one quantity, rather than two numbers (numerator and denominator) and using number lines to represent magnitude of fractions and equivalent /non-equivalent fractions** | | |
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| **Core Content Connectors: 5** | **CCSS Domain/Cluster** | **Common Core State Standard** |
| **5.NO.2b1 Add and subtract fractions with unlike denominators by replacing fractions with equivalent fractions (identical denominators)** | **Numbers and Operations – Fractions**<br>5 NF Use equivalent fractions as a strategy to add and subtract fractions. | 5.NF.1 Add and subtract fractions with unlike denominators by replacing given fractions with equivalent fractions in such a way as to produce equivalent sum or difference of fractions with like denominators. *For example, 2/3 + 5/4 = 8/12 + 15/12 = 23/12. (In general, a/b + c/d = (ad + bc)/bd).* |
| **5.NO.2b2 Add or subtract fractions with unlike denominators** | **Numbers and Operations – Fractions**<br>5 NF Use equivalent fractions as a strategy to add and subtract fractions. | 5.NF.1 Add and subtract fractions with unlike denominators (including mixed numbers) by replacing given fractions with equivalent fractions in such a way as to produce an equivalent sum or difference of fractions with like denominators. *For example, 2/3 + 5/4 = 8/12 + 15/12 = 23/12. (In general, a/b + c/d = (ad + bc)/bd).* |
| **5.NO.2b3 Multiply a fraction by a whole or mixed number** | **Numbers and Operations – Fractions**<br>4 NF Build fractions from unit fractions by applying and extending previous understandings of operations on whole numbers.<br>**Numbers and Operations – Fractions**<br>5 NF Apply and extend previous | 4NF.4. Apply and extend previous understandings of multiplication to multiply a fraction by a whole number.<br>5.NF.4 Apply and extend previous understandings of multiplication to multiply a fraction or whole number by a fraction.<br>*a)* Interpret the product ($a/b$) × $q$ as a parts of a partition of $q$ into $b$ equal parts; equivalently, as the result of a sequence of operations $a \times q \div b$. *For example, use a visual fraction model to show (2/3) × 4 = 8/3, and create* |

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| | understandings of multiplication and division to multiply and divide fractions. | *a story context for this equation. Do the same with (2/3) × (4/5) = 8/15. (In general, (a/b) × (c/d) = ac/bd.)*<br>a) 5.NF.6 Solve real world problems involving multiplication of fractions and mixed numbers, e.g., by using visual fraction models or equations to represent the problem. |
| **5.NO.2b4** Divide unit fractions by whole numbers and whole numbers by unit fractions. | **Numbers and Operations – Fractions**<br>5 NF Apply and extend previous understandings of multiplication and division to multiply and divide fractions. | 5.NF.3. Interpret a fraction as division of the numerator by the denominator (a/b = a ÷ b). Solve word problems involving division of whole numbers leading to answers in the form of fractions or mixed numbers, e.g., by using visual fraction models or equations to represent the problem. For example, interpret 3/4 as the result of dividing 3 by 4, noting that 3/4 multiplied by 4 equals 3, and that when 3 wholes are shared equally among 4 people each person has a share of size 3/4. If 9 people want to share a 50-pound sack of rice equally by weight, how many pounds of rice should each person get? Between what two whole numbers does your answer lie?<br>5.NF.7 Apply and extend previous understandings of division to divide unit fractions by whole numbers and whole numbers by unit fractions.<br>a) Interpret division of a unit fraction by a non-zero whole number, and compute such quotients. *For example, create a story context for (1/3) ÷ 4, and use a visual fraction model to show the quotient. Use the relationship between multiplication and division to explain that (1/3) ÷ 4 = 1/12 because (1/12) × 4 = 1/3.*<br>b) Interpret division of a whole number by a unit fraction, and compute such quotients. *For example, create a story context for 4 ÷ (1/5), and use a visual fraction model to show the quotient. Use the relationship between multiplication and division to explain that 4 ÷ (1/5) = 20 because 20 × (1/5) = 4.*<br>Solve real world problems involving division of unit fractions by non-zero whole numbers and division of whole numbers by unit fractions, e.g., by using visual fraction models and equations to represent the problem. *For example, how much chocolate will each person get if 3 people share 1/2 lb of chocolate equally? How many 1/3-cup servings are in 2 cups of raisins?* |
| **Progress Indicator: M.NO.2c using operations and standard algorithms with whole numbers, fractions (unlike denominators), and** | | |

| decimals (to hundredths) | | |
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| **Core Content Connectors: 5** | **CCSS Domain/Cluster** | **Common Core State Standard** |
| **5.NO.2c1 Solve 1 step problems using decimals** | **Number and Operations in Base Ten**<br>5 NBT Perform operations with multi-digit whole numbers and with decimals to hundredths. | 5.NBT.7 Add, subtract, multiply, and divide decimals to hundredths, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method and explain the reasoning used. |
| **5.NO.2c2 Solve word problems involving the addition, subtraction, multiplication or division of fractions** | **Numbers and Operations – Fractions**<br>5 NF Use equivalent fractions as a strategy to add and subtract fractions. | 5.NF.2 Solve word problems involving addition and subtraction of fractions referring to the same whole, including cases of unlike denominators, e.g., by using visual fraction models or equations to represent the problem. Use benchmark fractions and number sense of fractions to estimate mentally and assess the reasonableness of answers. *For example, recognize an incorrect result 2/5 + 1/2 = 3/7, by observing that 3/7 < 1/2.* |
| **Explanations and clarifications: Not included: M.NO.2d contrasting situations as additive or multiplicative** | | |

| **Progress Indicator: M.NO.2a working flexibility with common addition, subtraction, multiplication, and division situations** | | |
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| **Core Content Connectors: 6** | **CCSS Domain/Cluster** | **Common Core State Standard** |
| **6.NO.2a6 Solve problems or word problems using up to three digit numbers and any of the four operations** | **Expressions and Equations**<br>6 EE Reason about and solve one-variable equations and inequalities. | 6.EE.7 Solve real world and mathematical problems by writing and solving equations of the form x = p = q and px = q for cases in which p, q, and x are all non negative rational numbers. |
| **Progress Indicator: M.NO.2c using operations and standard algorithms with whole numbers, fractions (unlike denominators), and decimals (to hundredths)** | | |
| **Core Content Connectors: 6** | **CCSS Domain/Cluster** | **Common Core State Standard** |
| **6.NO.2c3 Solve one step, addition, subtraction, multiplcation, or division problems with fractions or decimals** | **The Number System**<br>6 NS Apply and extend previous understandings of multiplications and division to divide fractions by fractions.<br><br>6 NS Compute fluently with multi-digit numbers and find common factors and multiples | 6.NS.1 Interpret and compute quotients of fractions, and solve word problems involving division of fractions by fractions, e.g., by using visual fraction models and equations to represent the problem. *For example, create a story context for (2/3) ÷ (3/4) and use a visual fraction model to show the quotient; use the relationship between multiplication and division to explain that (2/3) ÷ (3/4) = 8/9 because 3/4 of 8/9 is 2/3. (In general, (a/b) ÷ (c/d) = ad/bc). How much chocolate will each person get if 3 people share 1/2 lb of chocolate equally? How many 3/4-cup* |

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| | | *servings are in 2/3 of a cup of yogurt? How wide is a rectangular strip of land with length 3/4 mi and area 1/2 square mi? Compute fluently with multi-digit numbers and find common factors and multiples.*<br>6.NS.3 Fluently add, subtract, multiply, and divide multi-digit decimals using the standard algorithm for each operation. |
| **6.NO.2c4 Solve word problems involving the addition, subtraction, multiplication or division of fractions** | **Numbers and Operations – Fractions**<br>5 NF Apply and extend previous understandings of multiplication and division to multiply and divide fractions.<br>**The Number System**<br>6 NS Apply and extend previous understandings of multiplication and division to divide fractions by fractions. | 5.NF.7c Apply and extend previous understandings of division to divide unit fractions by whole numbers and whole numbers by unit fractions.<br>c) Solve real world problems involving division of unit fractions by non-zero whole numbers and division of whole numbers by unit fractions, e.g., by using visual fraction models and equations to represent the problem. *For example, how much chocolate will each person get if 3 people share 1/2 lb of chocolate equally? How many 1/3-cup servings are in 2 cups of raisins?*<br>6.NS.1 Interpret and compute quotients of fractions, and solve word problems involving division of fractions by fractions, e.g., by using visual fraction models and equations to represent the problem. *For example, create a story context for (2/3) ÷ (3/4) and use a visual fraction model to show the quotient; use the relationship between multiplication and division to explain that (2/3) ÷ (3/4) = 8/9 because 3/4 of 8/9 is 2/3. (In general, (a/b) ÷ (c/d) = ad/bc). How much chocolate will each person get if 3 people share 1/2 lb of chocolate equally? How many 3/4-cup servings are in 2/3 of a cup of yogurt? How wide is a rectangular strip of land with length 3/4 mi and area 1/2 square mi? Compute fluently with multi-digit numbers and find common factors and multiples.* |
| **6.NO.2c5 Divide multi-digit whole numbers** | **The Number System**<br>6 NS Compute fluently with multi-digit numbers and find common factors and multiples | 6.NS.2 Fluently divide multi-digit numbers using standard algorithm. |
| **Progress Indicator: M.NO.2e ordering/comparing integers and representing them on the number line** | | |
| **Core Content Connectors: 6** | **CCSS Domain/Cluster** | **Common Core State Standard** |
| **6.NO.2e1 Determine the difference between two integers** | **The Number System**<br>6 NS Apply and extend previous | 6.NS.6 Understand a rational number as a point on the number line. Extend number line diagrams and coordinate axes familiar |

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| **using a number line** | understandings of numbers to the system of rational numbers. | from previous grades to represent points on the line and in the plane with negative number coordinates.<br>a) Recognize opposite signs of numbers as indicating locations on opposite sides of 0 on the number line; recognize that the opposite of the opposite of a number is the number itself, e.g., –(–3) = 3, and that 0 is its own opposite. |
| **6.NO.2e2 Compare two numbers on a number line (e.g., -2 > -9)** | **The Number System**<br>6 NS Apply and extend previous understandings of numbers to the system of rational numbers. | 6.NS.7 Understand ordering and absolute value of rational numbers.<br>a) Interpret statements of inequality as statements about the relative position of two numbers on a number line diagram. *For example, interpret –3 > –7 as a statement that –3 is located to the right of –7 on a number line oriented from left to right.* |

| Progress Indicator: M.NO.2f describing proportional relationships and solving related problems | | |
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| **Core Content Connectors: 7** | **CCSS Domain/Cluster** | **Common Core State Standard** |
| **7.NO.2f1 Identify the proportional relationship between two quantities** | **Ratios and Proportional Relationships**<br>7 RP Analyze proportional relationships and use them to solve real-world and mathematical problems. | 7.RP.2 Recognize and represent proportional relationships between quantities.<br>a) Decide whether two quantities are in a proportional relationship, e.g., by testing for equivalent ratios in a table or graphing on a coordinate plane and observing whether the graph is a straight line through the origin.<br>b) Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships.<br>*c)* Represent proportional relationships by equations. *For example, if total cost t is proportional to the number n of items purchased at a constant price p, the relationship between the total cost and the number of items can be expressed as t = pn.*<br>a) Explain what a point (*x*, *y*) on the graph of a proportional relationship means in terms of the situation, with special attention to the points (0, 0) and (1, *r*) where r is the unit rate. |
| **7.NO.2f2 Determine if two quantities are in a proportional relationship using a table of equivalent ratios or points graphed on a coordinate plane** | **Ratios and Proportional Relationships**<br>7 RP Analyze proportional relationships and use them to solve real-world and mathematical problems. | 7.RP.2 Recognize and represent proportional relationships between quantities.<br>a) Decide whether two quantities are in a proportional relationship, e.g., by testing for equivalent ratios in a table or graphing on a coordinate plane and observing whether the graph is a straight line through the origin.<br>b) Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships. |
| **7.NO.2f3 Find unit rates given a ratio** | **Ratios and Proportional Relationships**<br>7 RP Analyze proportional relationships and use them to solve real-world and mathematical problems. | 7.RP.1 Compute unit rates associated with ratios of fractions, including ratios of lengths, areas and other quantities measured in like or different units |

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| **7.NO.2f4 Use a rate of change or proportional relationship to determine the points on a coordinate plane** | **The Number System**<br>6 NS Apply and extend previous understandings of numbers to the system of rational numbers<br><br>**Ratios and Proportional Relationships**<br>7 RP Analyze proportional relationships and use them to solve real-world and mathematical problems. | 6.NS.8 Solve real-world and mathematical problems by graphing points in all four quadrants of the coordinate plane. Include use of coordinates and absolute value to find distances between points with the same first coordinate or the same second coordinate.<br>7.RP.2 Recognize and represent proportional relationships between quantities.<br>d) Explain what a point (*x*, *y*) on the graph of a proportional relationship means in terms of the situation, with special attention to the points (0, 0) and (1, *r*) where r is the unit rate. |
| **7.NO.2f5 Use proportions to solve ratio problems** | **Ratios and Proportional Relationships**<br>7 RP Analyze proportional relationships and use them to solve real-world and mathematical problems. | 7.RP.3 Use proportional relationships to solve multistep ratio and percent problems. Examples: simple interest, tax, markups and markdowns, gratuities and commissions, fees, percent increase and decrease, percent error. |
| **7.NO2.f6 Solve word problems involving ratios** | **Ratios and Proportional Relationships**<br>6 RP Understand ratio concepts and use ratio reasoning to solve problems. | 7.RP.3 Use proportional relationships to solve multistep ratio and percent problems. Examples: simple interest, tax, markups and markdowns, gratuities and commissions, fees, percent increase and decrease, percent error. |
| **Progress Indicator: M.NO.2h using operations involving percents and percent increase/decrease** | | |
| **Core Content Connectors: 7** | **CCSS Domain/Cluster** | **Common Core State Standard** |
| **7.NO.2h1 Find percents in real world contexts** | **Ratios and Proportional Relationships**<br>7 RP Analyze proportional relationships and use them to solve real-world and mathematical problems. | 7.RP.3 Use proportional relationships to solve multistep ratio and percent problems. Examples: simple interest, tax, markups and markdowns, gratuities and commissions, fees, percent increase and decrease, percent error. |
| **7.NO.2h2 Solve one step percentage increase and decrease problems** | **Ratios and Proportional Relationships**<br>7 RP Analyze proportional relationships and use them to solve real-world and mathematical problems. | 7.RP.3 Use proportional relationships to solve multistep ratio and percent problems. Examples: simple interest, tax, markups and markdowns, gratuities and commissions, fees, percent increase and decrease, percent error. |

| Progress Indicator: M.NO.2i using operations with rational numbers; representing rational numbers and approximations of irrational numbers on a number line | | |
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| **Core Content Connectors: 7** | **CCSS Domain/Cluster** | **Common Core State Standard** |
| **7.NO.2i1 Solve multiplication problems with positive/negative numbers** | **The Number System**<br>7 NS Apply and extend previous understandings of operations with fractions to add, subtract, multiply, and divide rational numbers. | 7.NS.2 Apply and extend previous understandings of multiplication and division and of fractions to multiply and divide rational numbers.<br>a) Understand that multiplication is extended from fractions to rational numbers by requiring that operations continue to satisfy the properties of operations, particularly the distributive property, leading to products such as (–1)(–1) = 1 and the rules for multiplying signed numbers. Interpret products of rational numbers by describing real-world contexts.<br>b) Understand that integers can be divided, provided that the divisor is not zero, and every quotient of integers (with non-zero divisor) is a rational number. If $p$ and $q$ are integers, then $–(p/q) = (–p)/q = p/(–q)$. Interpret quotients of rational numbers by describing real-world contexts.<br>c) Apply properties of operations as strategies to multiply and divide rational numbers.<br>d) Convert a rational number to a decimal using long division; know that the decimal form of a rational number terminates in 0s or eventually repeats. |
| **7.NO.2i2 Solve division problems with positive/negative numbers** | **The Number System**<br>7 NS Apply and extend previous understandings of operations with fractions to add, subtract, multiply, and divide rational numbers. | 7.NS.2 Apply and extend previous understandings of multiplication and division and of fractions to multiply and divide rational numbers.<br>a) Understand that multiplication is extended from fractions to rational numbers by requiring that operations continue to satisfy the properties of operations, particularly the distributive property, leading to products such as (–1)(–1) = 1 and the rules for multiplying signed numbers. Interpret products of rational numbers by describing real-world contexts.<br>b) Understand that integers can be divided, provided that the divisor is not zero, and every quotient of integers (with non-zero divisor) is a rational number. If $p$ and $q$ |

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| | | are integers, then $-(p/q) = (-p)/q = p/(-q)$. Interpret quotients of rational numbers by describing real-world contexts.<br>c) Apply properties of operations as strategies to multiply and divide rational numbers.<br>d) Convert a rational number to a decimal using long division; know that the decimal form of a rational number terminates in 0s or eventually repeats. |
| **Explanations and clarifications: Not included: M.NO.2g using operations with complex fractions** | | |
| **Progress Indicator: M.NO.2i using operations with rational numbers; representing rational numbers and approximations of irrational numbers on a number line** | | |
| **Core Content Connectors: 8** | **CCSS Domain/Cluster** | **Common Core State Standard** |
| **8.NO.2i3 Solve one step addition, subtraction, multiplication, division problems with fractions, decimals, and positive/negative numbers** | **The Number System**<br>7 NS Apply and extend previous understandings of operations with fractions to add, subtract, multiply, and divide rational numbers. | 7.NS.1 Apply and extend previous understandings of addition and subtraction to add and subtract rational numbers; represent addition and subtraction on a horizontal or vertical number line diagram.<br>d) Apply properties of operations as strategies to add and subtract rational numbers.<br>7.NS.3 Solve real-world and mathematical problems involving the four operations with rational numbers. |
| **8.NO.2i4 Solve two step addition, subtraction, multiplication, and division problems with fractions, decimals, or positive/negative numbers** | **The Number System**<br>7 NS Apply and extend previous understandings of operations with fractions to add, subtract, multiply, and divide rational numbers. | 7.NS.1 Apply and extend previous understandings of addition and subtraction to add and subtract rational numbers; represent addition and subtraction on a horizontal or vertical number line diagram.<br>d) Apply properties of operations as strategies to add and subtract rational numbers.<br>7.NS.3 Solve real-world and mathematical problems involving the four operations with rational numbers. |
| **Progress Indicator: H.NO.2a using operations with rational numbers; representing rational numbers and approximations of irrational numbers on a number line** | | |
| **Core Content Connectors: 9-12** | **CCSS Domain/Cluster** | **Common Core State Standard** |
| **H.NO.2a1 Solve simple equations using rational numbers with one or more variables** | **Reasoning with Equations and Inequalities**<br>A REI Understand solving equations as a process of reasoning and explain the | A.REI.2 Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise. |

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| | reasoning. | |

| **Progress Indicator: H.NO.2b operating with irrational and complex numbers** | | |
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| **Core Content Connectors: 9-12** | **CCSS Domain/Cluster** | **Common Core State Standard** |
| **H.NO.2b1 Explain the pattern for the sum or product for combinations of rational and irrational numbers** | **The Real Number System**<br>N RN Use properties of rational irrational numbers. | N.RN.3 Explain why the sum or product of two rational numbers is rational; that the sum of a rational number and an irrational number is irrational; and that the product of a non-zero rational number and an irrational number is irrational. |
| **Progress Indicator: H.NO.2c identifying exponential situations and applying the laws and properties of exponents in simplifying expressions and solving equations** | | |
| **Core Content Connectors: 9-12** | **CCSS Domain/Cluster** | **Common Core State Standard** |
| **H.NO.2c1 Simplify expressions that include exponents** | **Seeing Structure in Expressions**<br>A SSE Interpret the structures of expressions. | A.SSE.2 Use the structure of an expression to identify ways to rewrite it. *For example, see $x^4 – y^4$ as $(x^2)^2 – (y^2)^2$, thus recognizing it as a difference of squares that can be factored as $(x^2 – y^2)(x^2 + y^2)$.* |
| **H.NO.2c2 Rewrite expressions that include rational exponents** | **The Real Number System**<br>N RN Extend the properties of exponents to rational exponents.<br><br>**Seeing Structure in Expressions**<br>A SSE Interpret the structures of expressions. | N.RN.2 Rewrite expressions involving radicals and rational exponents using the properties of exponents.<br>A.SSE.2 Use the structure of an expression to identify ways to rewrite it. *For example, see $x^4 – y^4$ as $(x^2)^2 – (y^2)^2$, thus recognizing it as a difference of squares that can be factored as $(x^2 – y^2)(x^2 + y^2)$.* |
| **Explanations and clarifications: Not included: H.PRF.1d recognizing that there limitations in mathematics models A.CE-3 S.IC-2** | | |