



National Center and State Collaborative

# **Core Content Connectors: Patterns, Relations, and Functions 1**

All materials in this resource have been approved for public distribution with all necessary permissions. Selected excerpts are accompanied by annotated links to related media freely available online at the time of the publication of this document.



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.



The contents of this entry point draft were developed as part of the National Center and State Collaborative under a grant from the Department of Education (PR/Award #: H373X100002, Project Officer, [Susan.Weigert@Ed.gov](mailto:Susan.Weigert@Ed.gov)). However, the contents do not necessarily represent the policy of the Department of Education and no assumption of endorsement by the Federal government should be made.

The University of Minnesota is committed to the policy that all persons shall have equal access to its programs, facilities, and employment without regard to race, color, creed, religion, national origin, sex, age, marital status, disability, public assistance status, veteran status, or sexual orientation.

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.

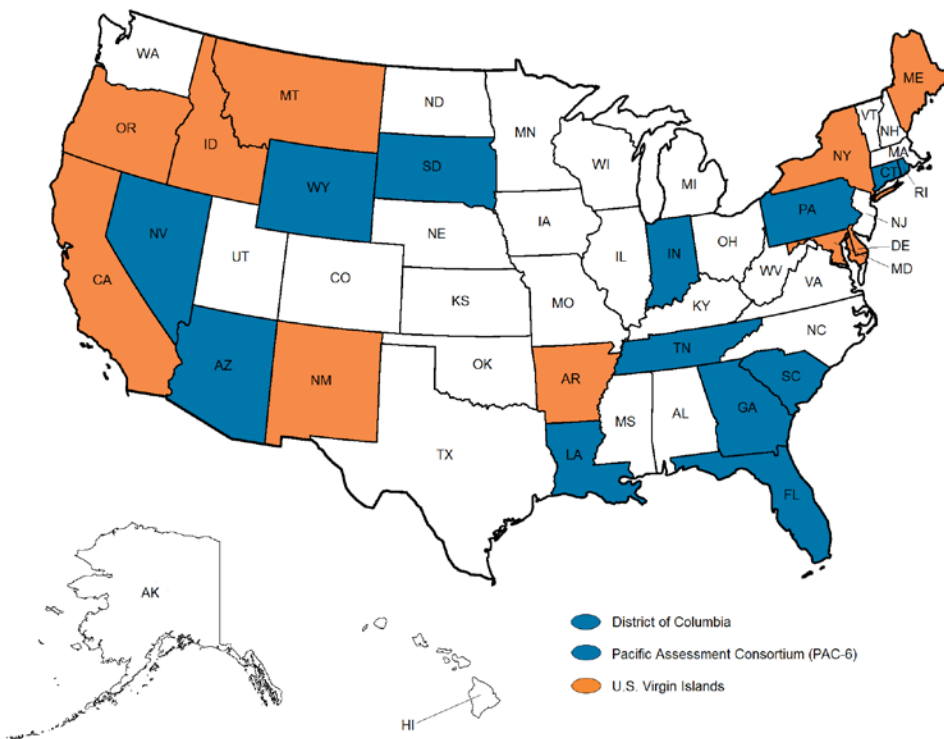


National Center and State Collaborative

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)<sup>1</sup>, 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.

<sup>1</sup> 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).



National Center and State Collaborative

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.



150 Pillsbury Drive SE  
207 Pattee Hall  
Minneapolis, MN 55455  
Phone: 612-708-6960  
Fax: 612-624-0879  
[www.ncscpartners.org](http://www.ncscpartners.org)



National Center and State Collaborative

# **Core Content Connectors: Patterns, Relations, and Functions 1**

Shawnee Y. Wakeman  
Angel Lee

For their support:

Karin Hess  
Brian Kissel  
Adriana Medina  
Chandra Orrill  
Drew Polly  
Bob Rickelman  
Jeri Thompson  
Jean Vintinner  
NCSC State Partners

April 2013

# 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.

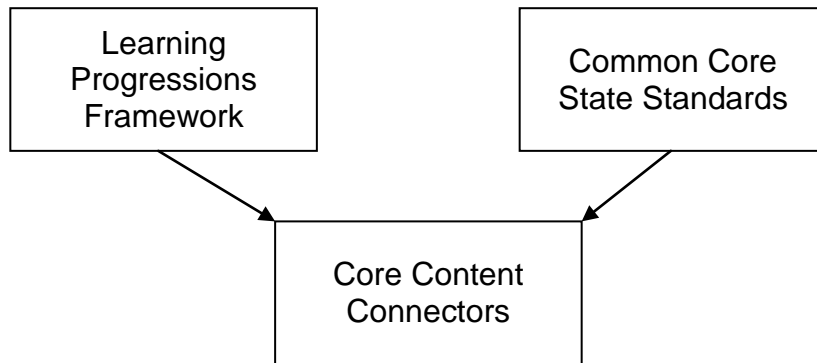
## *Learning Progression Framework*

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](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 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. 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 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. 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 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 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](http://www.nciea.org/publications/CCSSO2_KH08.pdf)

	<b>(K-4) Elementary School Learning Targets</b>		<b>(5-8) Middle School Learning Targets</b>		<b>(9-12) High School Learning Targets</b>
	<i><b>E.PRF-1</b> Use concrete, pictorial, and symbolic representations to identify, describe, compare, and model situations that involve change.</i>		<i><b>M.PRF-1</b> Describe and compare situations that involve change and use the information to draw conclusions:</i> <ul style="list-style-type: none"> <li>• Model contextual situations using multiple representations;</li> <li>• Calculate rates of change for real-world situations (constant).</li> </ul>		<i><b>H.PRF-1</b> Approximate, calculate, model, and interpret change:</i> <ul style="list-style-type: none"> <li>• Use graphical and numerical data resulting from complex situations;</li> <li>• Model complex real-world phenomena to make predictions and provide explanations.</li> </ul>
	Grades K-2	Grades 3-4	Grades 5-6	Grades 7-8	HS
<b>Arithmetic Patterns</b>			<b>5.PRF.1a1</b> Determine whether the product will increase or decrease based on the multiplier	<b>7.PRF.1e1</b> Determine unit rates associated with ratios of lengths, areas, and other quantities measured in like units	<b>H.PRF.1a1</b> Interpret the rate of change using graphical representations
	<b>K.PRF.1b1</b> Using objects or pictures respond appropriately to “add ___” and “take away ___”	<b>3.PRF.1d1</b> Use objects to model multiplication and division situations involving up to 5 groups with up to 5 objects in each group and interpret the results	<b>5.PRF.1b1</b> Given 2 patterns involving the same context (e.g., collecting marbles) determine the 1 <sup>st</sup> 5 terms and compare the values	<b>7.PRF.1e2</b> Represent proportional relationships on a line graph	<b>H.PRF.1b1</b> In a linear situation using graphs or numbers, predicts the change in rate based on a given change in one variable (e.g., If I have been adding sugar at a rate of 1T per cup of water. What happens to my rate if I switch to 2T of sugar for every cup of water?)
	<b>K.PRF.1b2</b> Communicate answer after adding or taking away	<b>3.PRF.1e1</b> Describe the rule for a numerical pattern (e.g., increase by 2, 5 or 10)	<b>5.PRF.1b2</b> When given a line graph representing two arithmetic patterns, identify the relationship between the two	<b>7.PRF.1f1</b> Use proportional relationships to solve multistep percent problems in real world situations	<b>H.PRF.1c1</b> Select the appropriate graphical representation of a linear model based on real world events

	<b>(K-4) Elementary School Learning Targets</b>		<b>(5-8) Middle School Learning Targets</b>		<b>(9-12) High School Learning Targets</b>
	<i>E.PRF-1 Use concrete, pictorial, and symbolic representations to identify, describe, compare, and model situations that involve change.</i>		<i>M.PRF-1 Describe and compare situations that involve change and use the information to draw conclusions:</i> <ul style="list-style-type: none"> <li>• Model contextual situations using multiple representations;</li> <li>• Calculate rates of change for real-world situations (constant).</li> </ul>		<i>H.PRF-1 Approximate, calculate, model, and interpret change:</i> <ul style="list-style-type: none"> <li>• Use graphical and numerical data resulting from complex situations;</li> <li>• Model complex real-world phenomena to make predictions and provide explanations.</li> </ul>
	Grades K-2	Grades 3-4	Grades 5-6	Grades 7-8	HS
		<b>3.PRF.1e2</b> Select or name the 3 next terms in a numerical pattern where numbers increase by 2, 5 or 10	<b>6.PRF.1a2</b> Determine whether or not the quotient will increase or decrease based on the divisor	<b>8.PRF.1e2</b> Represent proportional relationships on a line graph	
	<b>1.PRF.1b3</b> Using objects or pictures respond appropriately to “add ___” and “take away ___”	<b>4.PRF.1d2</b> Use objects to model multiplication and division situations involving up to 10 groups with up to 5 objects in each group		<b>8.PRF.1f2</b> Describe or select the relationship between the two quantities given a line graph of a situation	
			<b>6.PRF.1c1</b> Describe the ratio relationship between two quantities for a given situation		
		<b>3.PRF.1f 1</b> Determine the equivalence between number of minutes and the fraction of the hour (e.g., 30 minutes = $\frac{1}{2}$ hour)	<b>6.PRF.1c2</b> Represent proportional relationships on a line graph		

	<b>(K-4) Elementary School Learning Targets</b>		<b>(5-8) Middle School Learning Targets</b>		<b>(9-12) High School Learning Targets</b>
	<i><b>E.PRF-1</b> Use concrete, pictorial, and symbolic representations to identify, describe, compare, and model situations that involve change.</i>		<i><b>M.PRF-1</b> Describe and compare situations that involve change and use the information to draw conclusions:</i> <ul style="list-style-type: none"> <li>• Model contextual situations using multiple representations;</li> <li>• Calculate rates of change for real-world situations (constant).</li> </ul>		<i><b>H.PRF-1</b> Approximate, calculate, model, and interpret change:</i> <ul style="list-style-type: none"> <li>• Use graphical and numerical data resulting from complex situations;</li> <li>• Model complex real-world phenomena to make predictions and provide explanations.</li> </ul>
	Grades K-2	Grades 3-4	Grades 5-6	Grades 7-8	HS
Expressions and Equations	<b>K.PRF.1c1</b> Solve one step addition and subtraction word problems where the result is unknown, and add and subtract within 10 using objects, drawings, pictures	<b>3.PRF.1f 2</b> Determine the equivalence between the number of minutes and the number of hours (e.g., 60 minutes = 1 hour)	<b>6.PRF.1d1</b> Solve real world single step linear equations	<b>7.PRF.1g1</b> Solve real world multi step equations using whole numbers	
	<b>1.PRF.1c2</b> Solve one step addition and subtraction word problems where the change or result is unknown ( $4 + \_ = 7$ ) or ( $4 + 3 = \_$ ), within 20 using objects, drawings, pictures	<b>4.PRF.1e3</b> Solve multiplicative comparisons with an unknown using up to 2-digit numbers with information presented in a graph or word problem (e.g., an orange hat cost \$3. A purple hat cost 2 times as much. How much does the purple hat cost? [ $3 \times 2 = p$ ])		<b>7.PRF.1g2</b> Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities	

	<b>(K-4) Elementary School Learning Targets</b>		<b>(5-8) Middle School Learning Targets</b>		<b>(9-12) High School Learning Targets</b>
	<i>E.PRF-1 Use concrete, pictorial, and symbolic representations to identify, describe, compare, and model situations that involve change.</i>		<i>M.PRF-1 Describe and compare situations that involve change and use the information to draw conclusions:</i> <ul style="list-style-type: none"> <li>• <i>Model contextual situations using multiple representations;</i></li> <li>• <i>Calculate rates of change for real-world situations (constant).</i></li> </ul>		<i>H.PRF-1 Approximate, calculate, model, and interpret change:</i> <ul style="list-style-type: none"> <li>• <i>Use graphical and numerical data resulting from complex situations;</i></li> <li>• <i>Model complex real-world phenomena to make predictions and provide explanations.</i></li> </ul>
	Grades K-2	Grades 3-4	Grades 5-6	Grades 7-8	HS
	<b>2.PRF.1c3 Solve one or two step addition and subtraction problems, and add and subtract within 100, using objects, drawings, pictures</b>	<b>4.PRF.1f3 Apply the distributive property to solve problems with models</b>		<b>8.PRF.1g3 Solve linear equations with 1 variable</b>	
	<b>2.PRF.1c4 Use pictures, drawings or objects to represent the steps of a problem</b>	<b>4.PRF.1f4 Solve a 2-digit by 1-digit multiplication problem using 2 different strategies</b>			
	<b>2.PRF.1c5 Write or select an equation representing the problem and its solution</b>				

<b>Progress Indicator: E.PRF.1b exploring and describing how addition or subtraction changes a quantity</b>		
<b>Core Content Connectors: K</b>	<b>CCSS Domain/Cluster</b>	<b>Common Core State Standard</b>
<b>K.PRF.1b1 Use objects or pictures to respond appropriately to “add ___” and “take away ___”</b>	<b>Operations and Algebraic Thinking</b> K OA Understand addition as putting together and adding to, and understand subtraction as taking apart and taking from.	K.OA.1 Represent addition and subtraction with objects, fingers, mental images, drawings <sup>1</sup> , sounds (e.g., claps), acting out situations, verbal explanations, expressions, or equations. (1 Drawings need not show details, but should show the mathematics in the problem. (This applies wherever drawings are mentioned in the Standards.))
<b>K.PRF.1b2 Communicate answer after adding or taking away</b>	<b>Operations and Algebraic Thinking</b> K OA Understand addition as putting together and adding to, and understand subtraction as taking apart and taking from.	K.OA.1 Represent addition and subtraction with objects, fingers, mental images, drawings <sup>1</sup> , sounds (e.g., claps), acting out situations, verbal explanations, expressions, or equations. (1 Drawings need not show details, but should show the mathematics in the problem. (This applies wherever drawings are mentioned in the Standards.))
<b>Progress Indicator: E.PRF.1c modeling problem solving situations that involve addition and subtraction of whole numbers using objects, diagrams, and symbols</b>		
<b>Core Content Connectors: K</b>	<b>CCSS Domain/Cluster</b>	<b>Common Core State Standard</b>
<b>K.PRF.1c1 Solve one step addition and subtraction word problems, and add and subtract within 10 using objects, drawings, pictures</b>	<b>Operations and Algebraic Thinking</b> 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.
<b>Explanations and clarifications:</b>		

<b>Progress Indicator: E.PRF.1b exploring and describing how addition or subtraction changes a quantity</b>		
<b>Core Content Connectors: 1</b>	<b>CCSS Domain/Cluster</b>	<b>Common Core State Standard</b>
<b>1.PRF.1b3 Using objects or pictures respond appropriately to “add ___” and “take away ___”</b>	<b>Operations and Algebraic Thinking</b> 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.

<b>Progress Indicator: E.PRF.1c modeling problem solving situations that involve addition and subtraction of whole numbers using objects, diagrams, and symbols</b>		
<b>Core Content Connectors: 1</b>	<b>CCSS Domain/Cluster</b>	<b>Common Core State Standard</b>
<b>1.PRF.1c2 Solve one step addition and subtraction word problems where the change or result is unknown (<math>4 + \_ = 7</math>) or (<math>4 + 3 = \_</math>), within 20 using objects, drawings, pictures</b>	<b>Operations and Algebraic Thinking</b> 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.
<b>Explanations and clarifications:</b>		

<b>Progress Indicator: E.PRF.1c modeling problem solving situations that involve addition and subtraction of whole numbers using objects, diagrams, and symbols</b>		
<b>Core Content Connectors: 2</b>	<b>CCSS Domain/Cluster</b>	<b>Common Core State Standard</b>
<b>2.PRF.1c3 Solve one or two step addition and subtraction problems, and add and subtract within 100, using objects, drawings, pictures</b>	<b>Operations and Algebraic Thinking</b> 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, e.g., by using drawings and equations with a symbol for the unknown number to represent the problem.
<b>2.PRF.1c4 Use pictures, drawings or objects to represent the steps of a problem</b>	<b>Operations and Algebraic Thinking</b> 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, e.g., by using drawings and equations with a symbol for the unknown number to represent the problem.
<b>2.PRF.1c5 Write or select an equation representing the problem and its solution</b>	<b>Operations and Algebraic Thinking</b> 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, e.g., by using drawings and equations with a symbol for the unknown number to represent the problem.



<b>Progress Indicator: E.PRF.1d describing and modeling how addition, subtraction, multiplication, or division changes a quantity, including with fractions</b>		
<b>Core Content Connectors: 3</b>	<b>CCSS Domain/Cluster</b>	<b>Common Core State Standard</b>
<b>3.PRF.1d1 Use objects to model multiplication and division situations involving up to 5 groups with up to 5 objects in each group and interpret the results</b>	<b>Operations and Algebraic Thinking</b> 3 OA Represent and solve problems involving multiplication and division.	3.OA.1 Interpret products of whole numbers, e.g., interpret $5 \times 7$ as the total number of objects in 5 groups of 7 objects each. <i>For example, describe a context in which a total number of objects can be expressed as <math>5 \times 7</math>.</i> 3.OA.2 Interpret whole-number quotients of whole numbers, e.g., interpret $56 \div 8$ 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. <i>For example, describe a context in which a number of shares or a number of groups can be expressed as <math>56 \div 8</math>.</i>
<b>Progress Indicator: E.PRF.1e using representations (tables, graphs, equations) to show how values of one quantity are related to values of another and to draw conclusions</b>		
<b>Core Content Connectors: 3</b>	<b>CCSS Domain/Cluster</b>	<b>Common Core State Standard</b>
<b>3.PRF.1e1 Describe the rule for a numerical pattern (e.g., increase by 2, 5 or 10)</b>	<b>Operations and Algebraic Thinking</b> 3 OA Solve problems involving the four operations, and identify and explain patterns in arithmetic.	3.OA.9 Identify arithmetic patterns (including patterns in the addition table or multiplication table), and explain them using properties of operations. <i>For example, observe that 4 times a number is always even, and explain why 4 times a number can be decomposed into two equal addends.</i>
<b>3.PRF.1e2 Select or name the 3 next terms in a numerical pattern where numbers increase by 2, 5 or 10</b>	<b>Operations and Algebraic Thinking</b> 3 OA Solve problems involving the four operations, and identify and explain patterns in arithmetic.	3.OA.9 Identify arithmetic patterns (including patterns in the addition table or multiplication table), and explain them using properties of operations. <i>For example, observe that 4 times a number is always even, and explain why 4 times a number can be decomposed into two equal addends.</i>
<b>Progress Indicator: E.PRF.1f representing and explaining equivalence concretely, graphically, and symbolically (equations, rules)</b>		
<b>Core Content Connectors: 3</b>	<b>CCSS Domain/Cluster</b>	<b>Common Core State Standard</b>
<b>3.PRF.1f 1 Determine the equivalence between number of minutes and the fraction of the hour (e.g., 30 minutes = <math>\frac{1}{2}</math> hour)</b>	<b>Measurement and Data</b> 3 MD Solve problems involving measurement and estimation of intervals of time, liquid volumes and masses of objects.	3.MD.1 Tell and write time to the nearest minute and measure time intervals in minutes. Solve word problems involving addition and subtraction of time intervals in minutes, e.g., by representing the problem on a number line diagram.

<b>3.PRF.1f 2 Determine the equivalence between the number of minutes and the number of hours (e.g., 60 minutes = 1 hour)</b>	<b>Measurement and Data</b> 3 MD Solve problems involving measurement and estimation of intervals of time, liquid volumes and masses of objects.	3.MD.1 Tell and write time to the nearest minute and measure time intervals in minutes. Solve word problems involving addition and subtraction of time intervals in minutes, e.g., by representing the problem on a number line diagram.
---	---	--

<b>Progress Indicator: E.PRF.1d describing and modeling how addition, subtraction, multiplication, or division changes a quantity, including with fractions</b>		
<b>Core Content Connectors: 4</b>	<b>CCSS Domain/Cluster</b>	<b>Common Core State Standard</b>
<b>4.PRF.1d2 Use objects to model multiplication and division situations involving up to 10 groups with up to 5 objects in each group and interpret the results</b>	<b>Operations and Algebraic Thinking</b> 3 OA Represent and solve problems involving multiplication and division.	3.OA.1 Interpret products of whole numbers, e.g., interpret $5 \times 7$ as the total number of objects in 5 groups of 7 objects each. <i>For example, describe a context in which a total number of objects can be expressed as <math>5 \times 7</math>.</i>
<b>Progress Indicator: E.PRF.1e using representations (tables, graphs, equations) to show how values of one quantity are related to values of another and to draw conclusions</b>		
<b>Core Content Connectors: 4</b>	<b>CCSS Domain/Cluster</b>	<b>Common Core State Standard</b>
<b>4.PRF.1e3 Solve multiplicative comparisons with an unknown using up to 2-digit numbers with information presented in a graph or word problem (e.g., an orange hat cost \$3. A purple hat cost 2 times as much. How much does the purple hat cost? [<math>3 \times 2 = p</math>])</b>	<b>Operations and Algebraic Thinking</b> 4 OA Use the four operations with whole numbers to solve problems.	4.OA.2 Multiply or divide to solve word problems 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.
<b>Progress Indicator: E.PRF.1f representing and explaining equivalence concretely, graphically, and symbolically (equations, rules)</b>		
<b>Core Content Connectors: 4</b>	<b>CCSS Domain/Cluster</b>	<b>Common Core State Standard</b>
<b>4.PRF.1f3 Apply the distributive property to solve problems with models</b>	<b>Measurement and Data</b> 3 MD Geometric measurement: understand concepts of area and relate to multiplication and to addition.	3.MD.7c Relate area to the operations of multiplication and addition. c) Use tiling to show in a concrete case that the area of a rectangle with whole-number side lengths $a$ and $b + c$ is the sum of $a \times b$ and $a \times c$ . Use area models to represent the distributive property in mathematical

		reasoning.
<b>4.PRF.1f4 Solve a 2-digit by 1-digit multiplication problem using 2 different strategies</b>	<b>Number and Operations in Base Ten</b> 4 NBT Use place value understanding and properties of operations to perform multi-digit arithmetic.	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: M.PRF.1a describing how multiplication or division changes a quantity, including with fractions or decimals**

<b>Core Content Connectors: 5</b>	<b>CCSS Domain/Cluster</b>	<b>Common Core State Standard</b>
<b>5.PRF.1a1 Determine whether the product will increase or decrease based on the multiplier</b>	<b>Number and Operations – Fractions</b> 5 NF Apply and extend previous understandings of multiplication and division to multiply and divide fractions.	5.NF.5 Interpret multiplication as scaling (resizing), by: <ul style="list-style-type: none"> <li>a) Comparing the size of a product to the size of one factor on the basis of the size of the other factor, without performing the indicated multiplication.</li> <li>b) Explaining why multiplying a given number by a fraction greater than 1 results in a product greater than the given number (recognizing multiplication by whole numbers greater than 1 as a familiar case); explaining why multiplying a given number by a fraction less than 1 results in a product smaller than the given number; and relating the principle of fraction equivalence <math>a/b = (n \times a)/(n \times b)</math> to the effect of multiplying <math>a/b</math> by 1.</li> </ul>

**Progress Indicator: M.PRF.1b distinguishing linear from nonlinear relationships as represented in graphical and tabular representations**

<b>Core Content Connectors: 5</b>	<b>CCSS Domain/Cluster</b>	<b>Common Core State Standard</b>
<b>5.PRF.1b1 Given 2 patterns involving the same context (e.g., collecting marbles) determine the 1<sup>st</sup> 5 terms and compare the values</b>	<b>Operations and Algebraic Thinking</b> 5 OA Analyze patterns and relationships.	5.OA.3 Generate two numerical patterns using two given rules. Identify apparent relationships between corresponding terms. Form ordered pairs consisting of corresponding terms from the two patterns, and graph the ordered pairs on a coordinate plane. <i>For example, given the rule “Add 3” and the starting number 0, and given the rule “Add 6” and the starting number 0, generate terms in the resulting sequences, and observe that the terms in one sequence are twice the corresponding terms in the other sequence. Explain informally why this is so.</i>

<b>Day</b>	<b>Joe</b>	<b>Kim</b>
<b>1</b>	<b>2</b>	<b>4</b>
<b>2</b>	<b>4</b>	<b>8</b>
<b>3</b>	<b>6</b>	<b>12</b>
<b>4</b>	<b>8</b>	<b>16</b>

<p><b>5.PRF.1b2 When given a line graph representing two arithmetic patterns, identify the relationship between the two</b></p>	<p><b>Operations and Algebraic Thinking</b> 5 OA Analyze patterns and relationships.</p>	<p>5.OA.3 Generate two numerical patterns using two given rules. Identify apparent relationships between corresponding terms. Form ordered pairs consisting of corresponding terms from the two patterns, and graph the ordered pairs on a coordinate plane. <i>For example, given the rule “Add 3” and the starting number 0, and given the rule “Add 6” and the starting number 0, generate terms in the resulting sequences, and observe that the terms in one sequence are twice the corresponding terms in the other sequence. Explain informally why this is so.</i></p>
---	--	--

<b>Progress Indicator: M.PRF.1a describing how multiplication or division changes a quantity, including with fractions or decimals</b>		
<b>Core Content Connectors: 6</b>	<b>CCSS Domain/Cluster</b>	<b>Common Core State Standard</b>
<p><b>6.PRF.1a2 Determine whether or not the quotient will increase or decrease based on the divisor</b></p>	<p><b>Number and Operations – Fractions</b> 5 NF Apply and extend previous understandings of multiplication and division to multiply and divide fractions.</p>	<p>5.NF.5 Interpret multiplication as scaling (resizing), by:</p> <ul style="list-style-type: none"> <li>a) Comparing the size of a product to the size of one factor on the basis of the size of the other factor, without performing the indicated multiplication.</li> <li>b) Explaining why multiplying a given number by a fraction greater than 1 results in a product greater than the given number (recognizing multiplication by whole numbers greater than 1 as a familiar case); explaining why multiplying a given number by a fraction less than 1 results in a product smaller than the given number; and relating the principle of fraction equivalence <math>a/b = (n \times a)/(n \times b)</math> to the effect of multiplying <math>a/b</math> by 1.</li> </ul>
<b>Progress Indicator: M.PRF.1c comparing two rates and evaluating them for a given situation (e.g., best value)</b>		
<b>Core Content Connectors: 6</b>	<b>CCSS Domain/Cluster</b>	<b>Common Core State Standard</b>
<p><b>6.PRF.1c1 Describe the ratio relationship between two quantities for a given situation</b></p>	<p><b>Ratios and Proportional Relationships</b> 6 RP Understand ratio concepts and use ratio reasoning to solve problems.</p>	<p>6.RP.1 Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities. <i>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.”</i></p>

<b>6.PRF.1c2 Represent proportional relationships on a line graph</b>	<b>Ratios and Proportional Relationships</b> 6 RP Understand ratio concepts and use ratio reasoning to solve problems.	6.RP.2 Understand the concept of a unit rate $a/b$ associated with a ratio $a:b$ with $b \neq 0$ , and use rate language in the context of a ratio relationship. <i>For example, "This recipe has a ratio of 3 cups of flour to 4 cups of sugar, so there is <math>3/4</math> cup of flour for each cup of sugar." "We paid \$75 for 15 hamburgers, which is a rate of \$5 per hamburger."</i>
<b>Progress Indicator: M.PRF.1d using symbolic equations to summarize how the quantity of something changes</b>		
<b>Core Content Connectors: 6</b>	<b>CCSS Domain/Cluster</b>	<b>Common Core State Standard</b>
<b>6.PRF.1d1 Solve real world single step linear equations</b>	<b>Expressions and Equations</b> 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 nonnegative rational numbers.

<b>Progress Indicator: M.PRF.1e representing and computing unit rates associated with ratios of lengths, areas, and other quantities measured in like or different units</b>		
<b>Core Content Connectors: 7</b>	<b>CCSS Domain/Cluster</b>	<b>Common Core State Standard</b>
<b>7.PRF.1e1 Determine unit rates associated with ratios of lengths, areas, and other quantities measured in like units</b>	<b>Ratios and Proportional Relationships</b> 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. <i>For example, if a person walks <math>1/2</math> mile in each <math>1/4</math> hour, compute the unit rate as the complex fraction <math>1/2 / 1/4</math> miles per hour, equivalently 2 miles per hour.</i>
<b>7.PRF.1e2 Represent proportional relationships on a line graph</b>	<b>Ratios and Proportional Relationships</b> 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. b) Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships.

<b>Progress Indicator: M.PRF.1f identifying essential quantitative relationship(s) in a situation and using symbolic expressions to represent it and draw reasonable conclusions from it</b>		
<b>Core Content Connectors: 7</b>	<b>CCSS Domain/Cluster</b>	<b>Common Core State Standard</b>
<b>7.PRF.1f1 Use proportional relationships to solve multistep percent problems in real world situations</b>	<b>Ratios and Proportional Relationships</b> 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. <i>Examples: simple interest, tax, markups and markdowns, gratuities and commissions, fees, percent increase and decrease, percent error.</i>
<b>Progress Indicator: M.PRF.1g modeling, solving, and explaining contextualized problems using various representations such as graphs, tables, functions, and equations</b>		
<b>Core Content Connectors: 7</b>	<b>CCSS Domain/Cluster</b>	<b>Common Core State Standard</b>
<b>7.PRF.1g1 Solve real world multi step problems using whole numbers</b>	<b>Expressions and Equations</b> 7 EE Solve real-life and mathematical problems using numerical and algebraic expressions and equations.	7.EE.3 Solve multi-step real-life and mathematical problems posed with positive and negative rational numbers in any form (whole numbers, fractions, and decimals), using tools strategically. Apply properties of operations to calculate with numbers in any form; convert between forms as appropriate; and assess the reasonableness of answers using mental computation and estimation strategies. <i>For example: If a woman making \$25 an hour gets a 10% raise, she will make an additional 1/10 of her salary an hour, or \$2.50, for a new salary of \$27.50. If you want to place a towel bar 9 ¾ inches long in the center of a door that is 27 ½ inches wide, you will need to place the bar about 9 inches from each edge; this estimate can be used as a check on the exact computation.</i>
<b>7.PRF.1g2 Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities</b>	<b>Expressions and Equations</b> 7 EE Solve real-life and mathematical problems using numerical and algebraic expressions and equations.	7.EE.4 Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities. <ol style="list-style-type: none"> <li>Solve word problems leading to equations of the form <math>px + q = r</math> and <math>p(x + q) = r</math>, where <math>p</math>, <math>q</math>, and <math>r</math> are specific rational numbers. Solve equations of these forms fluently. Compare an algebraic solution to an arithmetic solution, identifying the sequence of the operations used in each approach. <i>For example, the perimeter of a rectangle is 54 cm. Its length is 6 cm. What is its width?</i></li> <li>Solve word problems leading to inequalities of the form</li> </ol>

		$px + q > r$ or $px + q < r$ , where $p$ , $q$ , and $r$ are specific rational numbers. Graph the solution set of the inequality and interpret it in the context of the problem. <i>For example: As a salesperson, you are paid \$50 per week plus \$3 per sale. This week you want your pay to be at least \$100. Write an inequality for the number of sales you need to make, and describe the solutions.</i>
--	--	--

**Progress Indicator: M.PRF.1e representing and computing unit rates associated with ratios of lengths, areas, and other quantities measured in like or different units**

Core Content Connectors: 8	CCSS Domain/Cluster	Common Core State Standard
<b>8.PRF.1e2 Represent proportional relationships on a line graph</b>	<b>Expressions and Equations</b> 8 EE Understand the connections between proportional relationships, lines, and linear equations.	8.EE.5 Graph proportional relationships, interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways. <i>For example, compare a distance-time graph to a distance-time equation to determine which of two moving objects has greater speed.</i>

**Progress Indicator: M.PRF.1f identifying essential quantitative relationships in a situation and using symbolic expressions to represent it and draw reasonable conclusions from it**

Core Content Connectors: 8	CCSS Domain/Cluster	Common Core State Standard
<b>8.PRF.1f 2 Describe or select the relationship between the two quantities given a line graph of a situation</b>	<b>Functions</b> 8 F Use functions to model relationships between quantities.	8.F.5 Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear). Sketch a graph that exhibits the qualitative features of a function that has been described verbally.

**Progress Indicator: M.PRF.1g modeling, solving, and explaining contextualized problems using various representations such as graphs, tables, functions, and equations**

Core Content Connectors: 8	CCSS Domain/Cluster	Common Core State Standard
<b>8.PRF.1g3 Solve linear equations with 1 variable</b>	<b>Expressions and Equations</b> 8 EE Analyze and solve linear equations and pairs of simultaneous linear equations.	8.EE.7 Solve linear equations in one variable. <ol style="list-style-type: none"> <li>a) Give examples of linear equations in one variable with one solution, infinitely many solutions, or no solutions. Show which of these possibilities is the case by successively transforming the given equation into simpler forms, until an equivalent equation of the form <math>x</math></li> </ol>

		<p><math>= a</math>, <math>a = a</math>, or <math>a = b</math> results (where <math>a</math> and <math>b</math> are different).</p> <p>b) Solve linear equations with rational number coefficients, including equations whose solutions require expanding expressions using the distributive property and collecting like terms.</p>
--	--	--

<b>Progress Indicator: H.PRF.1a approximating, calculating, and interpreting rates of change using graphical and numerical data</b>		
<b>Core Content Connectors: 9-12</b>	<b>CCSS Domain/Cluster</b>	<b>Common Core State Standard</b>
<b>H.PRF.1a1 Interpret the rate of change using graphical representations</b>	<b>Interpreting Categorical and Quantitative Data</b> S.ID Interpret linear models.	S.ID.7 Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of data.
<b>Progress Indicator: H.PRF.1b exploring how the rate of change of something depends on how much there is of something else (as the rate of change of speed is proportional to the amount of force acting)</b>		
<b>Core Content Connectors: 9-12</b>	<b>CCSS Domain/Cluster</b>	<b>Common Core State Standard</b>
<b>H.PRF.1b1 In a linear situation using graphs or numbers, predicts the change in rate based on a given change in one variable (e.g., If I have been adding sugar at a rate of 1T per cup of water. What happens to my rate if I switch to 2T of sugar for every cup of water?)</b>	<b>Linear, Quadratic, and Exponential Models</b> F.LE Construct and compare linear, quadratic, and exponential models and solve problems.	F.LE.1 Distinguish between situations that can be modeled with linear functions and with exponential functions. b) Recognize situations in which one quantity changes at a constant rate per unit interval relative to one another.
<b>Progress Indicator: H.PRF.1c creating mathematical models, using rules and relationships to describe and predict objects and events in the real world</b>		
<b>Core Content Connectors: 9-12</b>	<b>CCSS Domain/Cluster</b>	<b>Common Core State Standard</b>
<b>H.PRF.1c1 Select the appropriate graphical representation of a linear model based on real world events</b>		F.LE.1 Distinguish between situations that can be modeled with linear functions and with exponential functions.