**For this afternoon's session, please sit at a table with colleagues who work at a similar grade level to your own.**



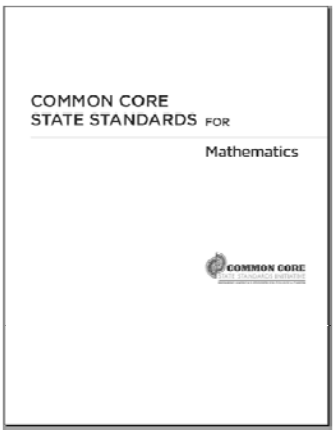
# Key Features of CCSS Assessment in Mathematics

December 11, 2012

## Features of CCSSM and Implications for Assessment

***Three shifts review***

- **Focus** strongly where the standards focus
- **Coherence Think** across grades and **link** to major topics within grades
- **Rigor** In major topics, pursue **conceptual understanding**, procedural skill and **fluency**, and **application** with equal intensity






## Features of CCSSM and Implications for Assessment

*Implications of the three shifts for assessment design*

- ***FOCUS: Assessments focus where the standards focus.***
  Major content represents the majority of points and problems on assessments.
- ***COHERENCE: Assessments honor the coherence in the standards.***
  Balance of tasks assessing individual standards and related standards within the context of the grade and, as relevant, the progressions.
- ***RIGOR: Assessments reflect the rigor of the standards.***
  Balance of tasks assessing conceptual understanding, procedural skill and fluency, and application of mathematics to solve problems.

## Features of CCSSM and Implications for Assessment

*Overview of the CCSS Assessment Consortia*

PARCC
Partnership for Assessment of Readiness for College and Careers

**Two summative assessments for grades 3-8 and each HS course**

Optional formative assessments at each grade/course

K-2 formative assessments

Resources available: Model Content Frameworks*, Item and Task Prototypes

www.parcconline.org

Smarter Balanced
Assessment Consortium

**Computer adaptive summative assessments for grade 3-8 and 11**

Optional interim assessments

Resources available: Content Specifications, Sample Items and Performance Tasks

www.smarterbalanced.org



## Features of CCSSM and Implications for Assessment

*The standards' implications for assessment tasks*

**The Common Core changes the problems we ask students to solve.**

***How?***

## Features of CCSSM and Implications for Assessment

*The standards' implications for assessment tasks*

**The structure of the standards reveals the ways problems will shift.**

- Problems will arise from:
  - individual content standards or parts of standards
  - all levels of the hierarchy, including the domain and cluster
  - authentic combinations of content and practices
- Student expectations can be better understood by taking into consideration the context:
  - the cluster, domain, and grade
  - neighboring grades and progressions



## Features of CCSSM and Implications for Assessment

*The standards' implications for assessment tasks*

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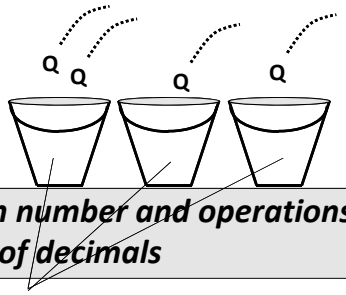
## Features of CCSSM and Implications for Assessment

**How Standards and Tests Used To Be Designed: Tossing Items Into Buckets**



***Standards in number and operations that involve place value of decimals***

*Items requiring procedural skill in expanded form, reading/writing, and comparing decimals, and rounding*

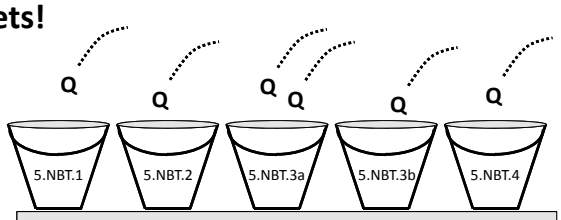


## Features of CCSSM and Implications for Assessment

**Using the Design of CCSSM to Make Better Assessments**

**Step 1: Better Buckets!**

*1) Standards include explicit expectations for procedural skill, conceptual understanding of specific content, and connections to practices.*




5.NBT.A Number and Operations in Base Ten—Understand the Place Value System

*2) Individual standards make important connections.*

*3) Standards are given a coherent context through cluster headings.*

## Features of CCSSM and Implications for Assessment

*Assessing individual content standards or parts of standards*

**7.G.4** Know the formulas for the area and circumference of a circle and use them to solve problems; give an informational derivation of the relationship between the circumference and area of a circle.

A circular field with diameter 100 meters is planted with soybeans. How many square meters are planted with soybeans?

Give your answer to two decimal places. See the formula sheet.

__ .__ __ square meters

Formula Sheet
- $p \approx 3.14$
- Area of circle with radius $r$ : $A = pr^2$

Source: Hypothetical example by Jason Zimba



## Features of CCSSM and Implications for Assessment

*The standards' implications for assessment tasks*

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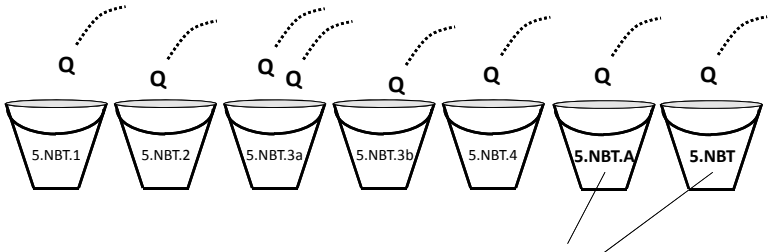
## Features of CCSSM and Implications for Assessment

*Assessing at all levels of the content hierarchy*

**Using the Design of CCSSM to Make Better Tests**
**Step 2: Where Appropriate, Treat Headings As Buckets**




*Where appropriate, assessment tasks are developed at the **cluster** and the **domain***



## Features of CCSSM and Implications for Assessment

*Assessing at all levels of the content hierarchy*

*Let's look at a PARCC illustrative task that assesses at the domain level*

9 large trucks are carrying ½ ton of lumber each. 7 small trucks are carrying ¼ ton of lumber each. How many total tons are being carried by all of the trucks?

*Note, the answer would not need to be reduced to lowest terms. An answer of 9/2 + 7/4 would earn some partial credit*

Source: PARCC Item Development ITN, Appendix F

## Features of CCSSM and Implications for Assessment

*Assessing at all levels of the content hierarchy*

*Here's an illustrative grade-level task assessing 6.RP.3 and 6.G.1-4.*

### *Painting a Barn*

Alexis needs to paint the four exterior walls of a large rectangular barn. The length of the barn is 80 feet, the width is 50 feet, and the height is 30 feet. The paint costs $28 per gallon, and each gallon covers 420 square feet. How much will it cost Alexis to paint the barn? Explain your work.

Source: Illustrative Mathematics (http://illustrativemathematics.org/)



## Features of CCSSM and Implications for Assessment

*The standards' implications for assessment tasks*

**The structure of the standards reveals the ways problems will shift.**

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## Features of CCSSM and Implications for Assessment

*Assessing through authentic connections of content and practices*

*"Designers of curricula, assessments, and professional development should all* ***attend to the need to connect the mathematical practices to mathematical content in mathematics instruction****." (CCSSM, pg. 8)*



## Features of CCSSM and Implications for Assessment

*Assessing through authentic connections of content and practices*

**MP.1: Make sense of problems and persevere in solving them.**

*What if the standard had instead said….*

**MP.1. Solve problems.**

**MP.1. Make sense of problems.**

**MP.1. Make sense of problems and solve them.**

**MP.1. Make sense of problems and persevere in solving them.**

## Features of CCSSM and Implications for Assessment

*Assessing through authentic connections of content and practices*

**MP.5: Use appropriate tools strategically.**

*What if the standard had instead said….*

**MP.5. Use calculators for everything.**

**MP.5. Use calculators strategically.**

**MP.5. Use tools strategically.**

**MP.5. Use appropriate tools strategically.**

*The single most important word is probably "strategically." (And "tools" is not code for "calculators.")*



## Features of CCSSM and Implications for Assessment

*Assessing through authentic connections of content and practices*

**MP.7: Look for and make use of structure**

*What if the standard had instead said….*

**MP.7. Work on problems where structure is present.**

**MP.7. See structure.**

**MP.7. Look for and make use of structure.**

*It is best if tasks targeting MP.7 put the structure to some real-world or mathematical purpose.*

## Features of CCSSM and Implications for Assessment

*Assessing through authentic connections of content and practices*

**MP.8: Look for and express regularity in repeated reasoning.**

*What if the standard had instead said….*

**MP.8. Perform repeated reasoning.**

**MP.8. Express regularity in repeated reasoning.**

**MP.8. Look for and express regularity in repeated reasoning.**

*(If a task matches the first version, it is a non-example of MP.8. If it matches the second, it is at least a partial example.)*



## Features of CCSSM and Implications for Assessment

*The standards' implications for assessment tasks*

**The structure of the standards reveals the ways problems will shift.**

- Problems will arise from:
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# Features of CCSSM and Implications for Assessment

*Considering the context: Cluster, Domain, and Grade*

**3.NF.2**

Understand a fraction as a number on the number line; represent fractions on a number line diagram.

a. Represent a fraction 1/*b* on a number line diagram by defining the interval from 0 to 1 as the whole and partitioning it into *b* equal parts. Recognize that each part has size 1/*b* and that the endpoint of the part based at 0 locates the number 1/*b* on the number line.

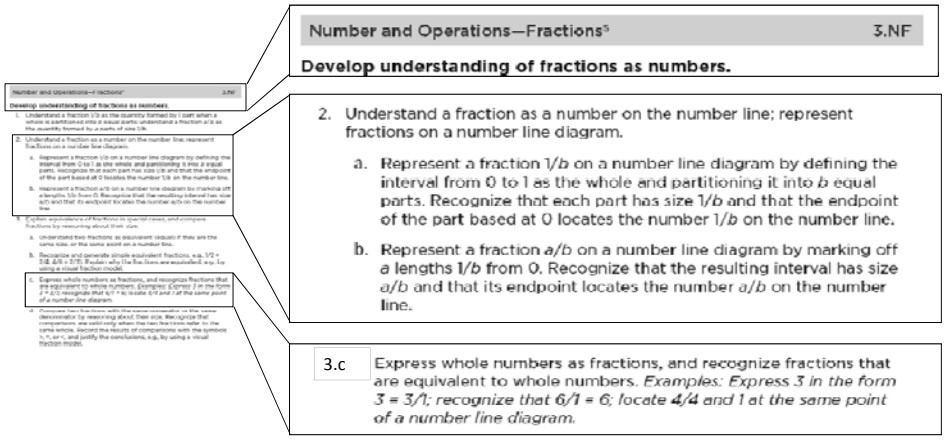
b. Represent a fraction *a*/*b* on a number line diagram by marking off *a* lengths 1/*b* from 0. Recognize that the resulting interval has size *a*/*b* and that its endpoint locates the number *a*/*b* on the number line.

***Can problems for part (b) include fractions like 6/3 that are equal to whole numbers?***



# Features of CCSSM and Implications for Assessment

*Building understanding through context: Cluster, Domain, and Grade*



Number and Operations—Fractions[5] 3.NF

**Develop understanding of fractions as numbers.**

2. Understand a fraction as a number on the number line; represent fractions on a number line diagram.

   a. Represent a fraction 1/*b* on a number line diagram by defining the interval from 0 to 1 as the whole and partitioning it into *b* equal parts. Recognize that each part has size 1/*b* and that the endpoint of the part based at 0 locates the number 1/*b* on the number line.

   b. Represent a fraction *a*/*b* on a number line diagram by marking off *a* lengths 1/*b* from 0. Recognize that the resulting interval has size *a*/*b* and that its endpoint locates the number *a*/*b* on the number line.

3.c Express whole numbers as fractions, and recognize fractions that are equivalent to whole numbers. *Examples: Express 3 in the form 3 = 3/1; recognize that 6/1 = 6; locate 4/4 and 1 at the same point of a number line diagram.*

For an essay on similar themes, see http://commoncoretools.me/2012/02/16/the-structure-is-the-standards/

## Features of CCSSM and Implications for Assessment

*The standards' implications for assessment tasks*

**The structure of the standards reveals the ways problems will shift.**

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## Features of CCSSM and Implications for Assessment

*Alignment in Context: Neighboring Grades and Progressions*

Consider the following task:

> Locate $-(-5)$ on the number line.

What grade level is this task in CCSSM?

What does $-(-5)$ mean in CCSSM?

Source: Hypothetical example by Jason Zimba

## Features of CCSSM and Implications for Assessment

*Alignment in Context: Neighboring Grades and Progressions*

**6.NS.6.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.NS.6.c.** Find and position integers and other rational numbers on a horizontal or vertical number line diagram; find and position pairs of integers and other rational numbers on a coordinate plane.

Locate −(−5) on the number line.

**7.NS.2.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.

−(−5) doesn't *mean* (−1)(−5), even though it *equals* (−1)(−5).



## Features of CCSSM and Implications for Assessment

*Building understanding through context: Neighboring Grades and Progressions*

***What are progressions?***

Many or most of the content standards in K-8 represent steps or stages along a progression of learning and performance.

***Why are progressions important?***

They are context for alignment questions. Progression-sensitive tasks will help teachers implement the standards with fidelity.

***Where can I find more information?***

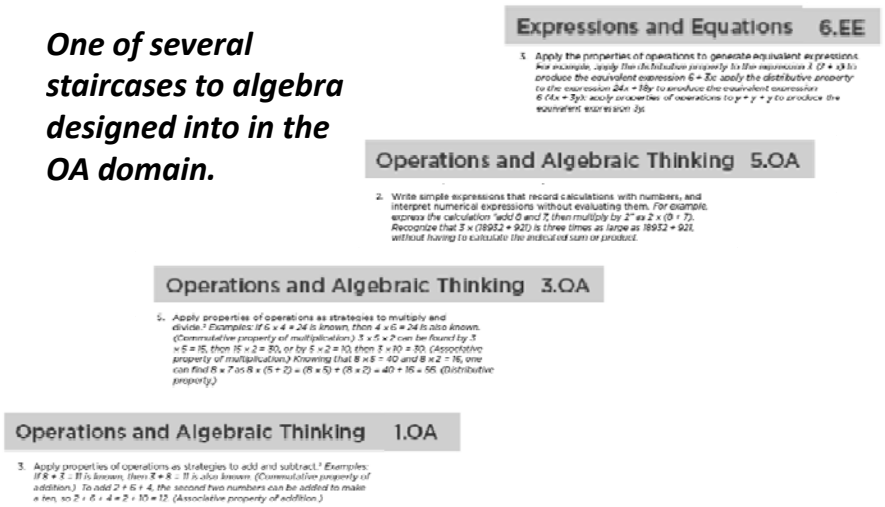
*Progressions* documents are narratives of the standards across grade levels, informed by research on children's cognitive development and by the logical structure of mathematics.

http://math.arizona.edu/~ime/progressions/#products

## Features of CCSSM and Implications for Assessment

*Building understanding through context: Neighboring Grades and Progressions*

***One of several staircases to algebra designed into in the OA domain.***



**Expressions and Equations 6.EE**

3. Apply the properties of operations to generate equivalent expressions. For example, apply the distributive property to the expression $3 \cdot (2 + x)$ to produce the equivalent expression $6 + 3x$; apply the distributive property to the expression $24x + 18y$ to produce the equivalent expression $6 \cdot (4x + 3y)$; apply properties of operations to $y + y + y$ to produce the equivalent expression $3y$.

**Operations and Algebraic Thinking 5.OA**

2. Write simple expressions that record calculations with numbers, and interpret numerical expressions without evaluating them. For example, express the calculation "add 8 and 7, then multiply by 2" as $2 \times (8 + 7)$. Recognize that $3 \times (18932 + 921)$ is three times as large as $18932 + 921$, without having to calculate the indicated sum or product.

**Operations and Algebraic Thinking 3.OA**

5. Apply properties of operations as strategies to multiply and divide.[2] Examples: If $6 \times 4 = 24$ is known, then $4 \times 6 = 24$ is also known. (Commutative property of multiplication.) $3 \times 5 \times 2$ can be found by $3 \times 5 = 15$, then $15 \times 2 = 30$, or by $5 \times 2 = 10$, then $3 \times 10 = 30$. (Associative property of multiplication.) Knowing that $8 \times 5 = 40$ and $8 \times 2 = 16$, one can find $8 \times 7$ as $8 \times (5 + 2) = (8 \times 5) + (8 \times 2) = 40 + 16 = 56$. (Distributive property.)

**Operations and Algebraic Thinking 1.OA**

3. Apply properties of operations as strategies to add and subtract.[2] 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.)



## Features of CCSSM and Implications for Assessment

*Building understanding through context: Neighboring Grades and Progressions*

**Certain cluster headings use language with a sense of motion from grade to grade. Some examples:**

**Grade 2**

Work with equal groups of objects to **gain foundations for** multiplication.

**Grade 4**

**Generalize** place value understanding for multi-digit whole numbers.
**Extend** understanding of fraction equivalence and ordering.
Build fractions from unit fractions by **applying and extending previous understandings** of operations on whole numbers.

**Grade 5**

**Apply and extend previous understandings of** multiplication and division **to** multiply and divide fractions.

## Features of CCSSM and Implications for Assessment

*Reviewing sample assessment items*

**Table Activity: Reviewing Sample Items**

**Guiding questions for item review**

- What standard or cluster does this problem align to? What part(s) of the standard or cluster does this problem assess?
- Which of the aspect(s) of rigor does this address?
- What math practices are required by a student to successfully answer this question? What other math practices might a student use to solve this problem?
- Was there anything surprising or unique about this problem? In what ways does this problem demonstrate the shifts required by the CCSSM?
- How could you improve this problem? In what ways would the revision be better?



## Features of CCSSM and Implications for Assessment

*Reviewing sample assessment items*

**Table Activity: Reviewing Sample Items**

Take the next 30 minutes to examine and analyze 2 sample items from the packet provided.

Make sure to answer the questions provided to help guide your analysis.

After the break, we will come back together as a group to share the analysis on each of these questions.