# Waterbury Public Schools Roll Out Presentation of The Common Core State Standards for Mathematics

Developed by William A. Rice
Supervisor of Math
Waterbury Public Schools

# Criteria Used to Develop the CCSS

- Research and evidence based
- Aligned with college and work expectations
- Rigorous
- Internationally benchmarked.

# Lessons Learned from the Past

- TIMSS: math performance is being compromised by a lack of focus and coherence in the "**mile wide. Inch deep" curriculum.**
- Hong Kong students outscore US students in the grade 4 TIMSS, even though Hong Kong only teaches about **half the tested topics. US covers over 80% of the tested topics.**
- High-performing countries spend more time on **mathematically central concepts: greater depth and coherence. Singapore: "Teach less, learn more."**

# Mathematics

- FOCUS
- FOCUS
- FOCUS
- Coherence
- Fluency
- Deep Understanding
- Application
- Intensity

# Focus and Coherence

- **Focus** is meant to **allow time for students and teachers to master the intricate, challenging, and necessary things** in each grade that open the way to a variety of applications even as they form the prerequisite study for future grades' learning. (SBAC 2011)
- **Coherence** means structuring learning so that math makes sense. It also **implies that the standards are more than a mere checklist of disconnected statements**; the cluster headings, domains, and other text in the standards all organize the content in ways that highlight the unity of the subject. (SBAC 2011)

# Direct Quotes from the Math Writers

- "These standards are not intended to be new names for old ways of doing business." (Bill McCallum)
- "It is time to recognize that standards are not promises to our children, but promises we intend to keep." (Jason Zimba)

# Paradigm Shifts for Mathematics

- Bid Adieu to CMT Strand Land
- Bid Guten Tag to standards-based focused, coherent instruction
- Put the practice standards into practice
- CCSSM is built on Mastery. Content will end and will not be taught explicitly again.
  (Ex. Counting & Cardinality only in K)
- It is no longer acceptable for students to only be able to solve a problem in only one way.

# K–8 Content Standards by Domain

| DOMAINS | Counting & Cardinality | Operations & Algebraic Thinking | Number & Operations in Base Ten | Measurement & Data | Geometry | Number & Operations: Fractions | Ratios & Proportional Relationships | The Number System | Expressions & Equations | Statistics & Probability | Functions |
|---|---|---|---|---|---|---|---|---|---|---|---|
| K | X | X | X | X | X | | | | | | |
| 1 | | X | X | X | X | | | | | | |
| 2 | | X | X | X | X | | | | | | |
| 3 | | X | X | X | X | X | | | | | |
| 4 | | X | X | X | X | X | | | | | |
| 5 | | X | X | X | X | X | | | | | |
| 6 | | | | | X | | X | X | X | X | |
| 7 | | | | | X | | X | X | X | X | |
| 8 | | | | | X | | | X | X | X | X |


- Making Sense of the CT Mathematics Standards

**Mathematics Content and Practice Standards**
**Adopted July 2010**
**(Two years old!)**

# The Mathematics Standards

Description of the Common Core State Standards for Mathematics (CCSSM)

Page Layout & Formatting

# Acronyms and Abbreviations and Domain Coding

- **CCSSM** – Common Core State Standards for Mathematics.
- **SBAC** – Smarter Balanced Assessment Consortium (Group who will be writing the tests for 2014-15)

K-5 Domains

- CC = Counting and Cardinality
- OA = Operations and Algebraic Thinking
- NBT = Number Operations in Base Ten
- NF = Number and Operations – Fractions
- MD = Measurement and Data
- G = Geometry

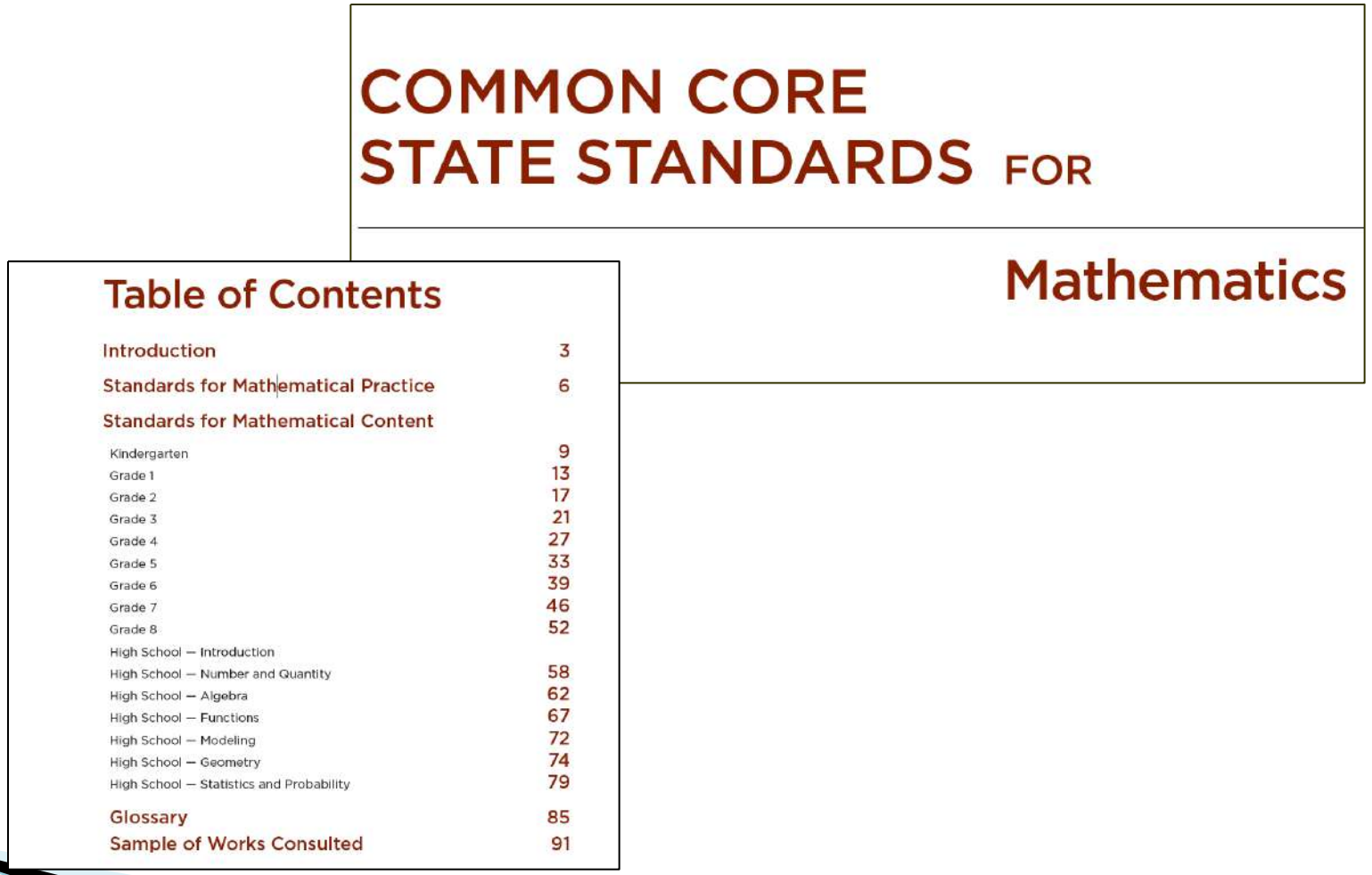
6-8 Domains

- RP = Ratios and Proportional Relationships
- NS = The Number system
- EE = Expressions and Equations
- F = Functions
- G = Geometry
- SP = Statistics and Probability

9-12 Conceptual Categories

- N = Number and Quantity
- A = Algebra
- F = Functions
- G = Geometry
- M = Modeling
- SP = Statistics and Probability

# Mathematics Common Core Layout

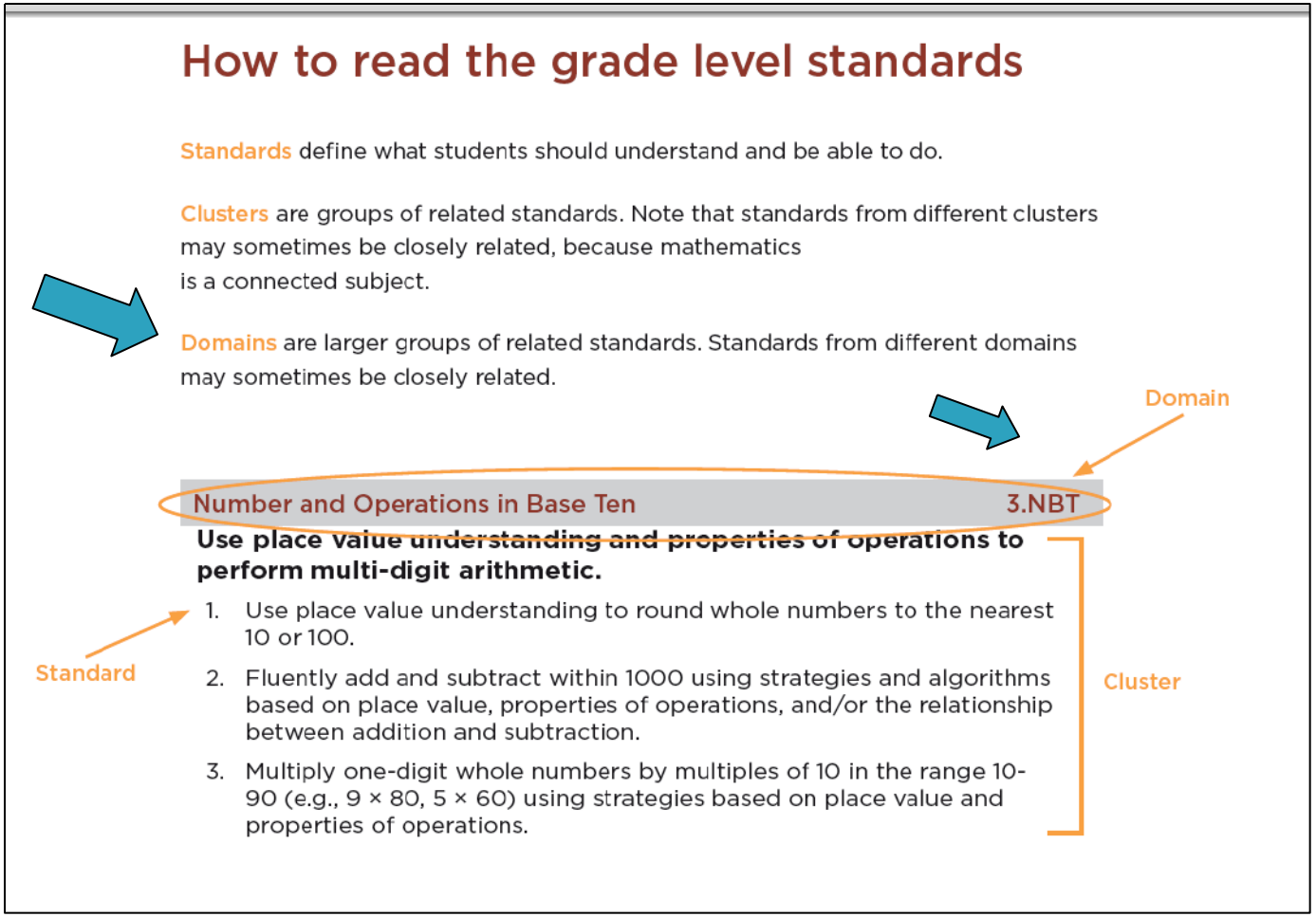


COMMON CORE
STATE STANDARDS FOR

Mathematics

## Table of Contents

# Mathematics Common Core Layout



# Organization of Standards

- **Clusters** are groups of related standards.
- **Domains** or **conceptual categories** are larger groups of related standards.
- Each grade level begins with a brief narrative describing the focus on **critical areas of instruction**.

# Grade 8 Critical Areas of Focus

## Mathematics | Grade 8

In Grade 8, instructional time should focus on three critical areas: (1) formulating and reasoning about expressions and equations, including modeling an association in bivariate data with a linear equation, and solving linear equations and systems of linear equations; (2) grasping the concept of a function and using functions to describe quantitative relationships; (3) analyzing two- and three-dimensional space and figures using distance, angle, similarity, and congruence, and understanding and applying the Pythagorean Theorem.

(1) Students use linear equations and systems of linear equations to represent, analyze, and solve a variety of problems. Students recognize equations for proportions ($y/x = m$ or $y = mx$) as special linear equations ($y = mx + b$), understanding that the constant of proportionality ($m$) is the slope, and the graphs are lines through the origin. They understand that the slope ($m$) of a line is a constant rate of change, so that if the input or $x$-coordinate changes by an amount $A$, the output or $y$-coordinate changes by the amount $m \cdot A$. Students also use a linear equation to describe the association between two quantities in bivariate data (such as arm span vs. height for students in a classroom). At this grade, fitting the model, and assessing its fit to the data are done informally. Interpreting the model in the context of the data requires students to express a relationship between the two quantities in question and to interpret components of the relationship (such as slope and $y$-intercept) in terms of the situation.

# Key Fluencies

| Grade | Required Fluency |
|---|---|
| K | Add/subtract within 5 |
| 1 | Add/subtract within 10 |
| 2 | Add/subtract within 20<br>Add/subtract within 100 (pencil and paper) |
| 3 | Multiply/divide within 100<br>Add/subtract within 1000 |
| 4 | Add/subtract within 1,000,000 |
| 5 | Multi-digit multiplication |
| 6 | Multi-digit division<br>Multi-digit decimal operations |
| 7 | Solve $px + q = r$, $p(x + q) = r$ |
| 8 | Solve simple 2×2 systems by inspection |

# Priorities in Mathematics

| Grade | Priorities in Support of Rich Instruction and Expectations of Fluency and Conceptual Understanding |
|---|---|
| K–2 | Addition and subtraction, measurement using whole number quantities |
| 3–5 | Multiplication and division of whole numbers and fractions |
| 6 | Ratios and proportional reasoning; early expressions and equations |
| 7 | Ratios and proportional reasoning; arithmetic of rational numbers |
| 8 | Linear algebra |

# CCSS for Mathematics
# High School Conceptual Categories

- Number and Quantity - NQ
- Algebra - A
- Functions - F
- Modeling - M
- Geometry - G
- Statistics and Probability - SP

LOCATED ON PAGE 57

# Mathematics Standards for High School

The high school standards specify the mathematics that all students should study in order to be college and career ready. Additional mathematics that students should learn in order to take advanced courses such as calculus, advanced statistics, or discrete mathematics is indicated by (+), as in this example:

> (+) Represent complex numbers on the complex plane in rectangular and polar form (including real and imaginary numbers).

All standards without a (+) symbol should be in the common mathematics curriculum for all college and career ready students. Standards without a (+) symbol may also appear in courses intended for [illegible] school standards are listed in conceptual categories

6 CONCEPTUAL CATEGORIES

- Number and Quantity
- Algebra
- Functions
- Modeling
- Geometry
- Statistics and Probability

Conceptual categories portray a coherent view of high school mathematics; a student's work with functions, for example, crosses a number of traditional course boundaries, potentially up through and including calculus.

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

# Narrative

## Mathematics | High School—Number and Quantity

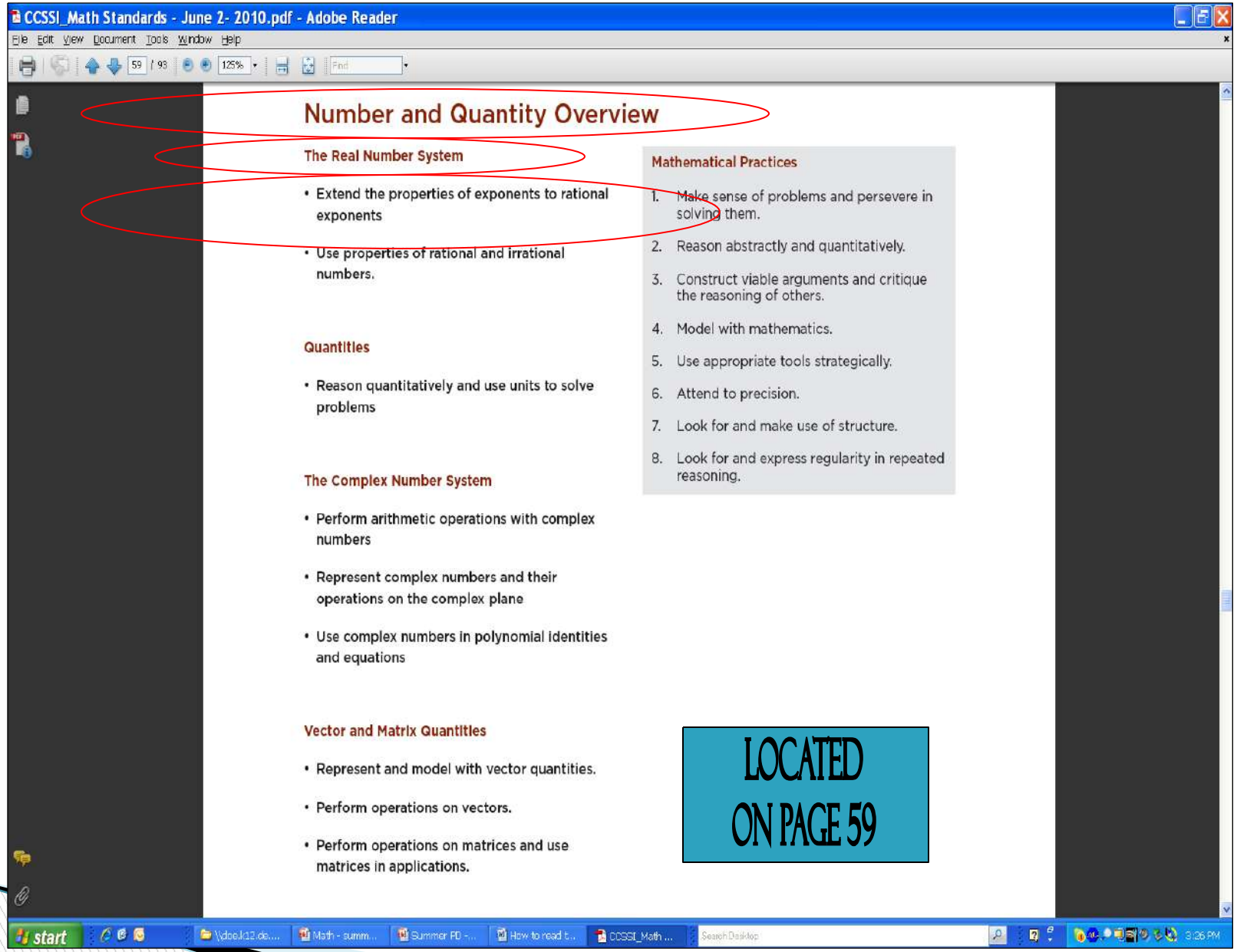
**Numbers and Number Systems.** During the years from kindergarten to eighth grade, students must repeatedly extend their conception of number. At first, "number" means "counting number": 1, 2, 3... Soon after that, 0 is used to represent "none" and the whole numbers are formed by the counting numbers together with zero. The next extension is fractions. At first, fractions are barely numbers and tied strongly to pictorial representations. Yet by the time students understand division of fractions, they have a strong concept of fractions as numbers and have connected them, via their decimal representations, with the base-ten system used to represent the whole numbers. During middle school, fractions are augmented by negative fractions to form the rational numbers. In Grade 8, students extend this system once more, augmenting the rational numbers with the irrational numbers to form the real numbers. In high school, students will be exposed to yet another extension of number, when the real numbers are augmented by the imaginary numbers to form the complex numbers.

With each extension of number, the meanings of addition, subtraction, multiplication, and division are extended. In each new number system—integers, rational numbers, real numbers, and complex numbers—the four operations stay the same in two important ways: They have the commutative, associative, and distributive properties and their new meanings are consistent with their previous meanings.

Extending the properties of whole-number exponents leads to new and productive notation. For example, properties of whole-number exponents suggest that $(5^{1/3})^3$ should be $5^{(1/3)3} = 5^1 = 5$ and that $5^{1/3}$ should be the cube root of 5.

Calculators, spreadsheets, and computer algebra systems can provide ways for students to become better acquainted with these new number systems and their notation. They can be used to generate data for numerical experiments, to help understand the workings of matrix, vector, and complex number algebra, and to experiment with non-integer exponents.

**Quantities.** In real world problems, the answers are usually not numbers but quantities: numbers with units, which involves measurement. In their work in measurement up through Grade 8, students primarily measure commonly used attributes such as length, area, and volume. In high school, students encounter a wider variety of units in modeling, e.g., acceleration, currency conversions, derived


CCSSI_Math Standards - June 2- 2010.pdf - Adobe Reader
File Edit View Document Tools Window Help
59 / 93
125%
Find
Number and Quantity Overview
The Real Number System
• Extend the properties of exponents to rational exponents
• Use properties of rational and irrational numbers.
Quantities
• Reason quantitatively and use units to solve problems
The Complex Number System
• Perform arithmetic operations with complex numbers
• Represent complex numbers and their operations on the complex plane
• Use complex numbers in polynomial identities and equations
Vector and Matrix Quantities
• Represent and model with vector quantities.
• Perform operations on vectors.
• Perform operations on matrices and use matrices in applications.
Mathematical Practices
1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.
LOCATED ON PAGE 59
start
Math - summ...
Summer PD -...
How to read t...
CCSSI_Math ...
Search Desktop
3:26 PM

# Activities

- Exploring Waterbury **Draft** Mathematics Curriculum Documents
  - Grade Level Articulation Document
  - Unit Instructional Tool

# Exploring Waterbury Mathematics Curriculum Documents

**Curriculum Articulation by Grade Level**

- Includes:
  - Philosophy of WPS Mathematics Department
  - Standards Overview
  - Math Practice Standards
  - Lists all the standards in that grade level.
  - Aligns standards with the Mathematical Practices that are most inherent to the standard.
  - Aligns standards with an Example and/or Explanation that illustrates the meaning of the standard.
  - Aligns standard with the Connecticut Unit it is located within.
  - Aligns standards with instructional resources teachers can use to teach the standard. (some resources have hyperlinks that link them directly to the lesson or activity ideas)
  - Aligns standards with **minimum** required strategies for teachers (meaning teachers can use other strtegies but they must utilize the identified strategies first).
  - Aligns standards with technology lessons/activities that can be used to teach the standard.
  - Identifies whether a standard has a CMT/CAPT correlation.

Allow teachers 15 -20 minutes to review the documents.

Full documents will be sent electronically and be available on the WPS Mathematics Department Webpage

# Exploring Waterbury Mathematics Curriculum Documents

## Unit Instructional Tool

- Developed based on the Instructional Unit Shells created by the CSDE using Rigorous Curriculum design Protocols.
- Includes:
  - Pacing- Days/periods
  - Identifies **Priority** vs. Supporting Standards within the unit. (All standards are important and fair game for testing but all standards are not created equal. More time must be spent on some standards than others. Those standards are in **bold** and are priority standards.)
  - Identifies the Performance Objectives that are aligned to the standards in the unit.
  - Identifies instructional strategies that are aligned to the performance objectives. (Some strategies are hyperlinked to samples and examples of the strategy)
  - Identifies the resources that are aligned to the performance objectives. (Some resources are hyperlinked to the lesson/activity/webpage associated with the resource)
  - Identifies pre-requisite knowledge the performance objectives were built upon.

Allow teachers 10 -15 minutes to review the documents.

Full documents will be sent electronically and be available on the WPS Mathematics Department Webpage

# Focus, Focus, Focus

- Marzano ETS Strategies
  - Identifying Similarities and Differences
  - *Note Taking
  - *Summarizing
  - Cooperative Learning
  - Nonlinguistic Representations
  - *Vocabulary Development

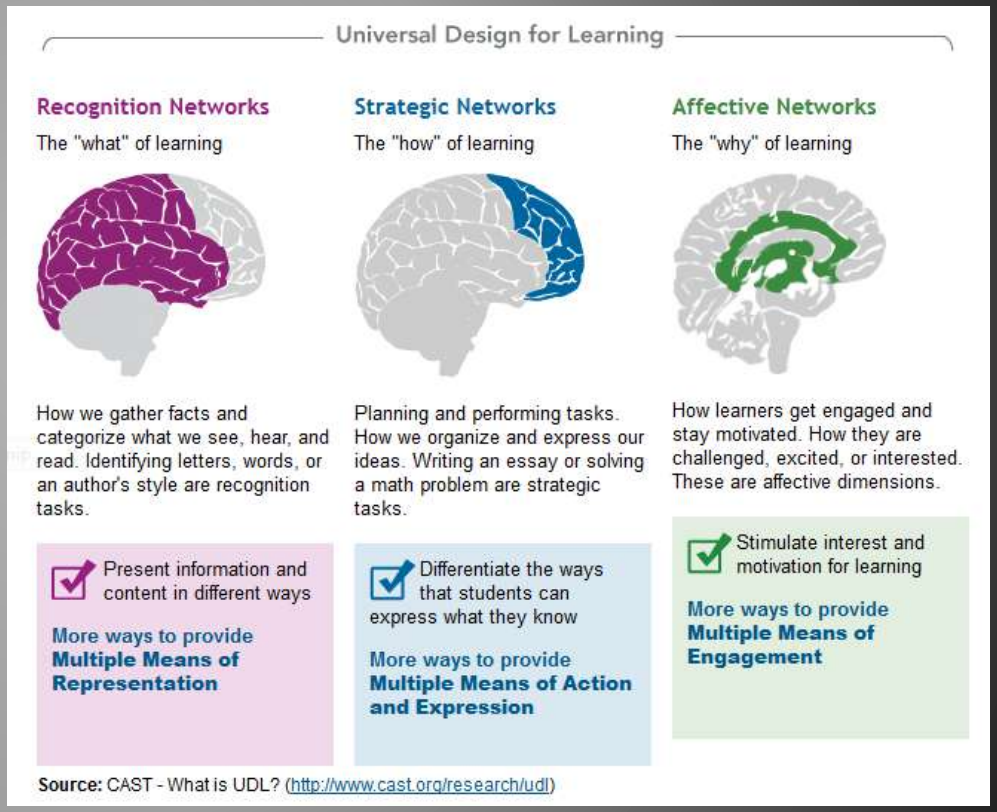
# Lesson Planning

*Leinwand*, S. (2009). *Accessible mathematics*: ***10 instructional shifts that raise student achievement.*** *Portsmouth, NH: Heinemann.*

1. Incorporate ongoing cumulative review into every day's lesson.
2. Adapt what we know works in our reading programs and apply it to mathematics instruction.
3. Use multiple representations of mathematical entities.
4. Create language-rich classroom routines.
5. Take every available opportunity to support the development of number sense.
6. Build from graphs, charts, and tables.
7. Tie the math to such questions as How big? How much? How far? to increase the natural use of measurement throughout the curriculum.
8. Minimize what is no longer important, and teach what is important when it is appropriate to do so.
9. Embed the mathematics in realistic problems and real-world contexts.
10. Make "Why?" "How do you know?" "Can you explain?" classroom mantras.

# Universal Design for Learning

- 3 Principals that Guide the Development of Expert Learners
  - Principle I: Provide Multiple Means of Representation (the “what” of learning)
  - Principle II: Provide Multiple Means of Action and Expression (the “how” of learning)
  - Principle III: Provide Multiple Means of Engagement (the “why” of learning)



# UDL Lesson Design Template

- Handout 1 – UDL Guidelines Sample
- Handout 2 – Completed Plan Algebra 1
- Handout 3 – Competed Plan Geometry
- Handout 4 – Template

# Resources

- Boardworks Middle School Math CC – SharePoint
- Grade 6, 7 and 8 Math Station Activities
- Expeditions Middle School Math – Performance Tasks
- Daily Warm-Ups – Pre-Algebra
- Boardworks Algebra 1 CC – SharePoint
- Algebra/Geometry and Algebra 2 Station Activities Book-1 per HS/MS
- Lesson Starters Algebra CC
- Daily Warm-Ups Algebra 1
- Daily Warm-Ups Algebra 2
- Expeditions – Geometry

# Connecticut Standards for Mathematics (Same as CCSSM)

- Have Two Components:
  - **Math Content Standards** – which identify what should be taught.
  - **Math Practice Standards** – identify how the content should be taught.

We will now learn more about the

Math Practice Standards

# Standards for Mathematical Practice

"The Standards for Mathematical Practice describe varieties of expertise that mathematics educators at all levels should seek to develop in their students. These practices rest on important "processes and proficiencies" with longstanding importance in mathematics education."

(CCSS, 2010)

# Mathematically Proficient Students Will…

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

2. Reason abstractly and quantitatively.

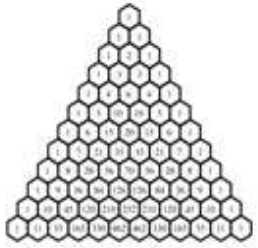
3. Construct viable arguments and critique the reasoning of others.

4. Model with mathematics.

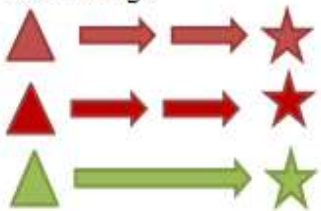
5. Use appropriate tools strategically.

6. Attend to precision.


7. Look for and make use of structure.



8. Look for and express regularity in repeated reasoning.



Adapted from *Inside Mathematics*

# Make sense of problems and persevere in solving them

***When presented with a problem, I can make a plan, carry out my plan, and evaluate its success.***

## BEFORE...

**EXPLAIN** the problem to myself.

- *Have I solved a problem like this before?*

**ORGANIZE** information...

- *What is the question I need to answer?*
- *What is given?*
- *What is not given?*
- *What are the relationships between known and unknown quantities?*
- *What tools will I use?*
- *What prior knowledge do I have to help me?*

## DURING...

**PERSEVERE**

**MONITOR** my work

**CHANGE** my plan if it isn't working out

**ASK** myself, "Does this make sense?"

## AFTER...

**CHECK**

- *Is my answer correct?*
- *How do my representations connect to my algorithms?*

**EVALUATE**

- *What worked?*
- *What didn't work?*
- *What other strategies were used?*
- *How was my solution similar to or different from my classmates'?*

# Reason abstractly and quantitatively

***I can use reasoning habits to help me contextualize and decontexualize problems.***

## CONTEXTUALIZE

I can take numbers and put them in a real-world context.

For example, if given
3 x 2.5 = 7.5
I can create a context:

*I walked 2.5 miles per day for 3 days. I walked a total of 7.5 miles.*

## DECONTEXTUALIZE

I can take numbers out of context and work mathematically with them.

For example, if given
'I walked 2.5 miles per day for 3 days. How far did I walk?',
I can write and solve

*3 x 2.5 = 7.5*

Reasoning Habits include *1) creating an understandable representation of the problem solved, 2) considering the units involved, 3) attending to the meaning of quantities,* and *4) using properties to help solve problems.*

# Construct viable arguments and critique the reasoning of others

***I can make conjectures and critique the mathematical thinking of others.***

I can ***construct***, ***justify***, and ***communicate*** arguments by...

- considering context
- using examples and non-examples
- using objects, drawings, diagrams and actions

I can ***critique the reasoning of others*** by...

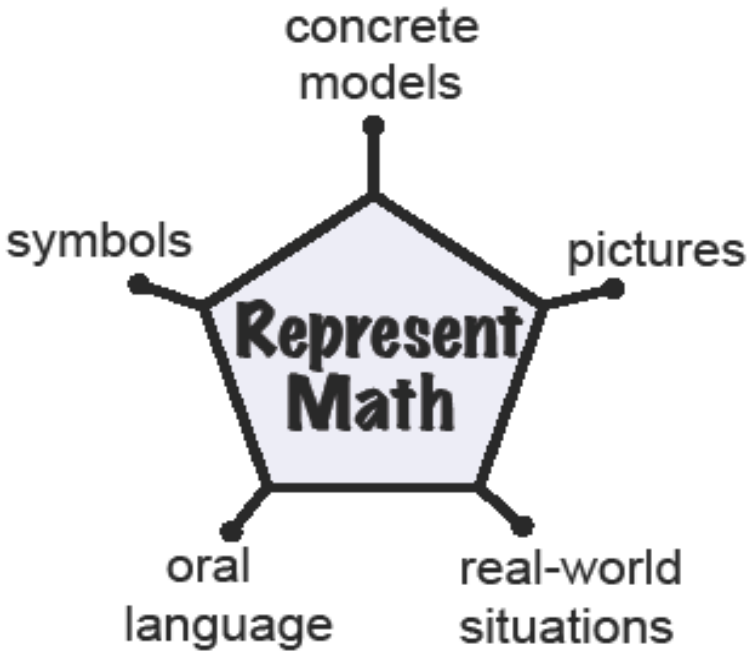
- listening
- comparing arguments
- identifying flawed logic
- asking questions to *clarify* or *improve arguments*

# Model with mathematics

***I can recognize math in everyday life and use math I know to solve everyday problems.***

**I can...**

- make assumptions and estimate to make complex problems easier
- identify important quantities and use tools to show their relationships
- evaluate my answer and make changes if needed

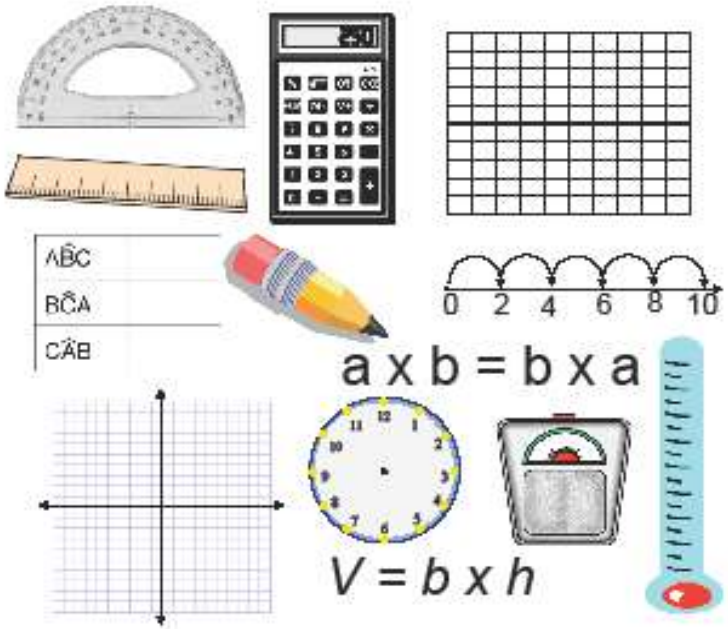


# Use appropriate tools strategically

***I know when to use certain tools to help me explore and deepen my math understanding.***

I have a <u>math toolbox</u>.


- I know *HOW* to use math tools.
- I know *WHEN* to use math tools.
- I can reason: *"Did the tool I used give me an answer that makes sense?"*



# Attend to precision

***I can use precision when solving problems and communicating my ideas.***

## Problem Solving

- I can calculate *accurately*.
- I can calculate *efficiently*.
- My answer matches what the problem asked me to do – *estimate* or find an *exact answer*.

## Communicating

- I can SPEAK, READ, WRITE, and LISTEN mathematically.
- I can correctly use...
  - math symbols
  - math vocabulary
  - units of measure

# Look for and make use of structure

***I can see and understand how numbers and spaces are organized and put together as parts and wholes.***

## Numbers

For Example:

- Base 10 structure
- operations and properties
- terms, coefficients, exponents

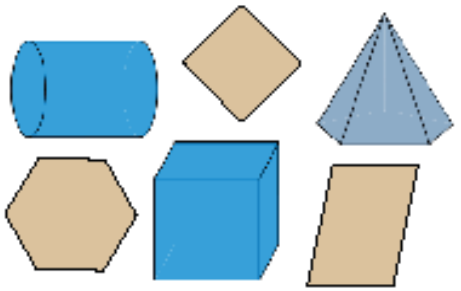
| | 10 | + 3 |
|---|---|---|
| 10 | 100 | 30 |
| + | | |
| 5 | 50 | 15 |

13 x 15
(10 + 3) x (10 + 5)
100 + 30 + 50 + 15
195

## Spaces

For Example:

- dimension
- location
- attributes
- transformation



# Look for and express regularity in repeated reasoning

***I can notice when calculations are repeated. Then, I can find more efficient methods and short cuts.***

For example: $25 \div 11$

$$
\begin{array}{r}
2.2727 \\
11\overline{)25.0000} \\
-22 \\
\hline
30 \\
-22 \\
\hline
80 \\
-77 \\
\hline
30 \\
-22 \\
\hline
80 \\
-77 \\
\hline
30
\end{array}
$$

I am repeating this calculation. The quotient is a repeating decimal.

# TEACHER'S ROLE IN IMPLEMENTING THE PRACTICE STANDARDS

Teachers will need to provide:

- Rich problems and tasks for students to consider.
- Time for students to reflect on their own thinking.
- Opportunities for students to dialogue with other students.
- A safe environment for students to share their solutions with other students.

# JigSaw

- Split into 8 Groups – Not by grade level this time.
- Assign each group a Mathematical Practice Standard – (Assign a scribe for each group)
- Each group will read their practice Standard and discuss what implications does this practice standard have for teaching and learning in math at my grade level or in my discipline. (i.e. what should I have students engaged in during class if I want to see students "**Attending to Precision"** in class. – MP6")
- Give each group 10 min then share out.

# Practice Standards In Action

- Click on a Practice Standard to go to see video vignettes and commentary of the Mathematical Practice Standards in Action. There will be videos at multiple grade levels.

**Practice Standards are "Standards" Meaning that a student's level of performance on a practice standard will be tested by the assessment.**

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

# Algebra 1 Teachers – Model Algebra Curriculum

- Teachers in **Cohort 3C** will be able to participate in one of two summer workshops to attend in **2013**:
  - A two-week half-day program in July of 2013 that will meet July 8-12 and July 15-18 from 1:30 p.m. to 5:00 p.m. each day.
    - OR
  - An intensive one-week program in August of 2013 that will meet August 12-15 from 9:00 a.m. to 5:00 p.m. daily and August 16 from 9:00 a.m. to 1:00 p.m.
- During the 2013-2014 academic year they will also attend monthly training and mentoring sessions. Details of these sessions will be provided during the summer workshops.

# Algebra 1 Teachers – Model Algebra Curriculum

As participants in the comparative study of the Model Curriculum, teachers from both the intervention and comparison cohorts will be asked to complete the following data collection tasks in coordination with our external evaluators from Education Development Center (EDC):

| Instrument | Format | Cohort 3I teachers | Cohort 3C teachers |
|---|---|---|---|
| Fall Semester 2012 | | | |
| Teacher algebra pre-test | paper | Day 1 of summer PD | Before start of school year |
| Teacher instructional practices | online | Day 1 of summer PD | Before start of school year |
| Teacher curriculum implementation summary | online | Online, complete after each unit | NA |
| Student Algebra pre-test | paper | Administer to students within first 2 weeks of class | |
| Spring Semester 2012 | | | |
| Teacher curriculum implementation summary | online | Online, complete after each unit | NA |
| Teacher algebra post-test | paper | May 2013 | |
| Teacher instructional practices | online | May 2013 | |
| Student Algebra post-test | paper | Administer to students in May 2013 | |

# ASSESSMENT

## Where We Are and Where We Are Going?

# Assessment

- CMT and CAPT will remain in place for accountability purposes through 2013-2014. (But we **will not** wait until 2014 to prepare our students. These are not standards to try to catch up to.)
- School year 2014/2015, SMARTER Balanced Assessment Consortium (SBAC) assessment system operational for students in Grades 3-8 and 11.
- CMT/CAPT Practice will be included weekly on CMT/CAPT Wednesdays.

# CMT/CAPT WEDNESDAYS

- Math lesson/activity each Wednesday from Sept. 2012 thru Feb 28, 2013 devoted to CMT/CAPT math strands/categories.
- Lessons/activities must be done within CCSS framework meaning the teacher **cannot** just provide worksheets and sit back and the teacher **cannot** be the sole source of learning.
- Lessons must be interactive and student focused where students are sharing, explaining and proving their knowledge of CMT Math in multiple ways. Lessons/activities must be **planned**. Teachers are to facilitate learning.

# Examples (Use CMT/CAPT materials already in your school or go to CREC.org website for materials. Teacher Login: Username: twaterbury Password: 13waterb)

- **CMT/CAPT Centers**
  - Set up centers in your classroom with different CMT/CAPT problems.
  - Group the students by ability, mixed ability, etc.
  - Very weak students stay with you while others go around with notebooks and work out the problems. Be sure to tell them they will have to explain and prove their answer somehow. You may need to have manipulatives available.
  - When you bring all students back together call on some to provide answers and explain. The student may call on other group members to help.
- **CMT/CAPT JigSaw**
  - Set up groups
  - Give each group a set of problems from a particular strand or set of strands. Each group should have problems from a different strand or set of strands.
  - Let the students work on the problems and then have them share out. They should state the problem, the answer and how they solved the problem.
  - Each group should be asked at least 2 questions from the class. Give the other groups question prompts to ask until they can start to come up with their own questions: like "Can you solve that problem another way?" or why did you use that method? Etc.
- **CMT/CAPT "I Can Prove it"**
  - Can be whole group.
  - Teacher places a problem on the board or Smartboard and the students have to work on the problem at their desk.
  - The teacher chooses student 1to provide the answer.
  - The teacher then picks student 2 and that student says "I can prove it."
  - Student 2 must come up and prove whether student 1 was correct or not.
  - If student 2 gets stuck he or she can use a life line and call another student up to help.

# Examples continued….

- **CMT/CAPT "Is he/she right?"**
  - Can be a group or whole class activity.
  - Students must remove all paper and pencils from their desk. This is a mind training activity.
  - The teacher puts a problem up on the board with either the correct or incorrect problem solving steps.
  - The teacher asks is he or she right?
  - Students must explain whether the process is correct or incorrect verbally.
- **CMT/CAPT "Come up with a problem…"**
  - Can be a group or in pairs.
  - Teacher will identify the strands or conceptual categories they will use for content.
  - Teacher asks the students to come up with a problem and the solution to the problem.
  - E.g. the teacher will says "**come up with a problem"** where a student has to:
    - find the sum of two numbers
    - draw a line of symmetry through a polygon.
    - write a story problem using 2/3 x 5
    - rind the volume of a prism
    - find the slope of line given 2 points
  - The students will exchange problems with another student and have them solve it.
  - Students will check their answers and discuss.
- **CMT/CAPT "Restate the Question"**
  - Teacher will place several open-ended questions on the board and ask the students to restate the question in a form so you know what answer you are looking for.
  - Students will write restatements in their notebooks.
  - Students will share out and critique each others restatements of the problems.
- **CMT/CAPT "Pick a Strategy"**
  - Can be group or whole class activity..
  - Teacher will place a problem on the board or Smartboard.
  - Below the problem will list multiple strategies to solve the problem.
  - Students will decide which strategy to use and then use that strategy to solve the problem. If using groups; groups must discuss and come to consensus on which problem to solve.
  - Students will then share their answer, strategy chosen and why they chose that strategy.

# Assessment

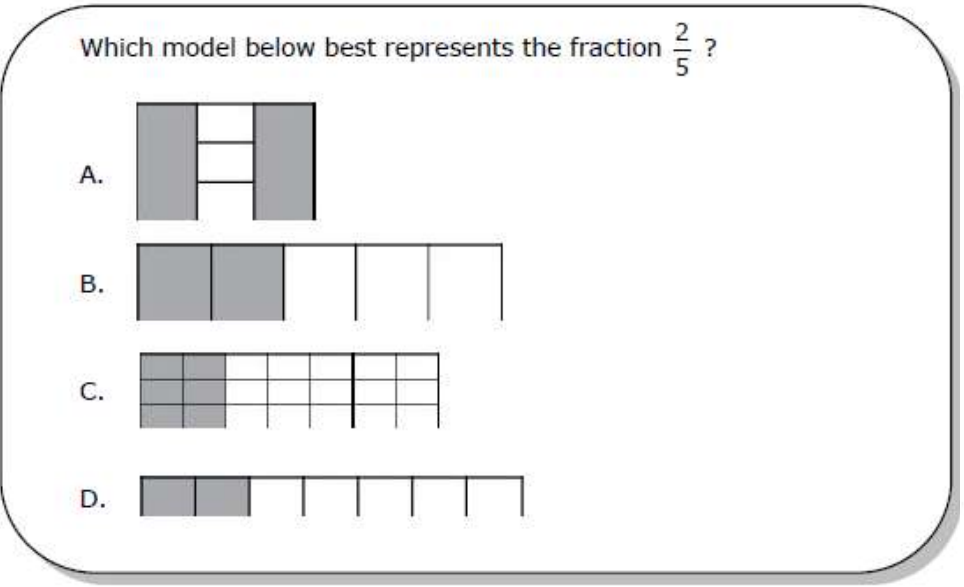
- Designed by the Smarter Balanced Assessment Consortium (SBAC)
- Given in last 12 weeks of school.
- **Will be Computer Adaptive**
- **2 Overall Claims**
  - Students can demonstrate progress toward college and career readiness in mathematics.
  - Students can demonstrate college and career readiness in mathematics.
- **4 Claims for Math Content and Practice Standards**
  - **Concepts & Procedures —**Students can explain and apply mathematical concepts and interpret and carry out mathematical procedures with precision and fluency.
  - **Problem Solving —**Students can solve a range of complex well-posed problems in pure and applied mathematics, making productive use of knowledge and problem solving strategies.
  - **Communicating Reasoning —**Students can clearly and precisely construct viable arguments to support their own reasoning and to critique the reasoning of others.
  - **Modeling and Data Analysis —**Students can analyze complex, real-world scenarios and can construct and use mathematical models to interpret and solve problems.

# Assessment Item Types

- **Selected Response**
  - Traditionally, selected-response (SR) items include a stimulus and stem followed by three to five options from which a student is directed to choose only one or best answer. By redesigning some SR items, it is often possible to both increase the complexity of the item and yield more useful information regarding the level of understanding about the mathematics that a student's response demonstrates.
- **Constructed Response**
  - The main purpose of a constructed-response (CR) item/task is to address targets and claims that are of greater complexity, requiring more analytical thinking and reasoning than an SR item can typically elicit. Additionally, fill-in-the-blank type CR items (CRs) can markedly increase the discrimination factor and reliability of comparable SR items (SRs) by virtually eliminating the "guessing" element of those items.
- **Technology Enhanced**
  - Technology-enhanced (TE) items/tasks are desirable when they can provide evidence for mathematical practices that could not be as reliably obtained from SR and CR items.
- **Performance Tasks**
  - Integrate knowledge and skills across multiple claims and targets.
  - Measure capacities such as depth of understanding, research skills, and/or complex analysis with relevant evidence.
  - Require student-initiated planning, management of information/data and ideas, and/or interaction with other materials.
  - Reflect a real-world task and/or scenario-based problem.
  - Allow for multiple approaches.
  - PTs may require up to 135 minutes to administer. This administration time includes a 45 or 90 minute classroom portion and a 45 minute computer-based portion.

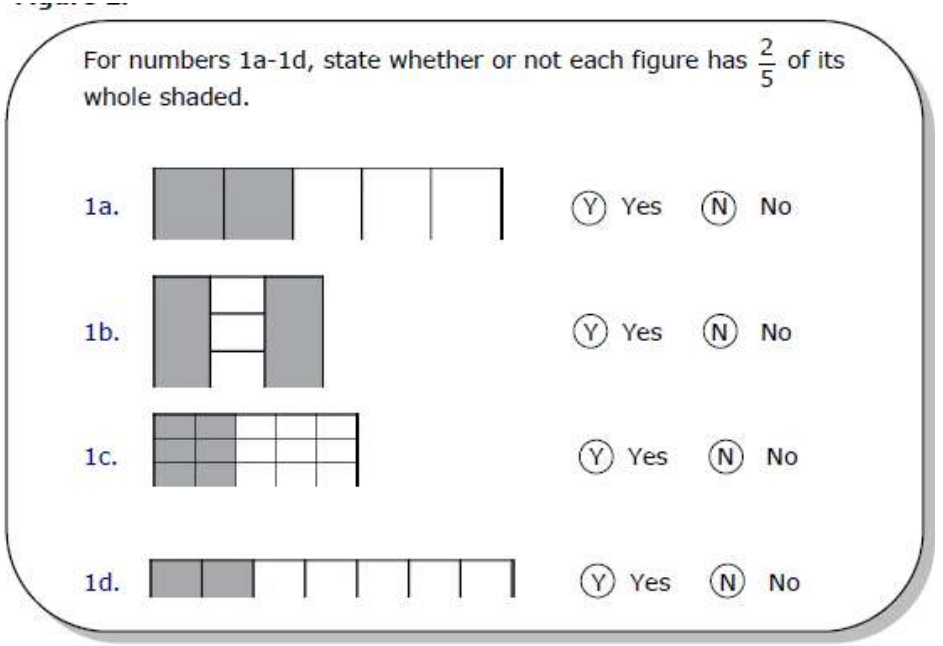
# Selected Response Examples

## CMT Selected Response




Even if a student does not truly have a deep understanding of what 2/5 means, he or she is likely to choose option B over the rest of the options because it looks to be a more traditional way of representing fractions.

## Common Core Selected Response




This item is more complex in that a student now has to look at each part separately and decide whether 2/5 can take different forms. Score with a (0-2) Rubric.

# Constructed Response

**Grade 1 - Assessment Items**

**Unit 4 - Exploring Addition and Subtraction within 100**

Write a number sentence and solve the problem. Use manipulatives (base-ten blocks, hundreds chart, number lines) or a drawing to show how to solve this problem.

Mrs. Jones needs 42 cupcakes for the class picnic.
She has 32 cupcakes.

How many more cupcakes does she need to buy?

This is how Joe found the answer to $29 + 30 + 1$

$29 + 30 + 1 = 30 + 30 = 60$

What did Joe do to solve the problem?

# Technology Enhanced Items–MS/HS

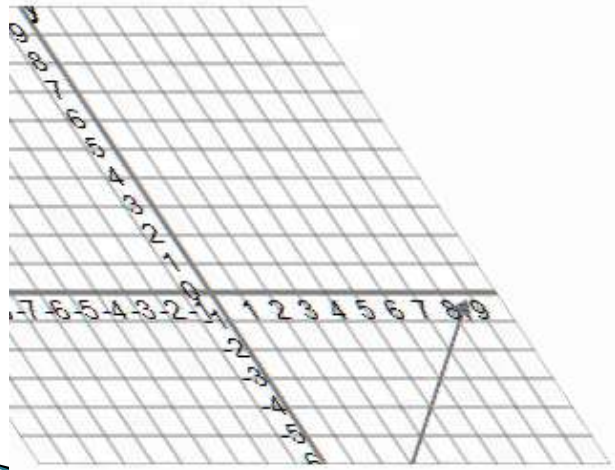
(Click Screen to start animation)

Construct line b on the graph so that:

tem of linear equations with a solution of (7 ,-2).

than -1 and less than 0

s positive.



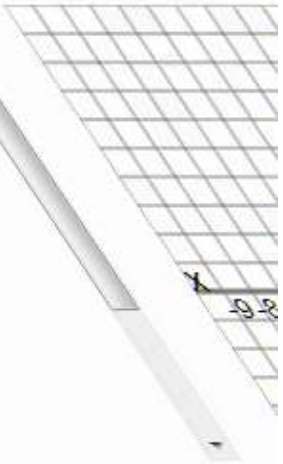
Line a is shown on the graph below.

Line a and line b represent a sys

The slope of line b is greater

The y-intercept of line b

16.



# Performance Tasks Items (Click on Text to go to Performance Task Examples)

- Grade 3 Cookie Dough
- Grade 7 Proportional Reasoning
- High School Geometry – Logo Design

# Common Core Math Teaching Tips

- Current Paradigm – **Answer Getting**
- New Paradigm – **Understanding and Transferability.**
- How do I pose problems to the class?
- What Problems do I use?
- What is Conceptual Coherence?
- What is evidence of student growth we cannot get from rubrics or test scores?

# Three Responses to a Math Problem

1. Answer getting – **Current Paradigm**
   - Getting the answer one way or another and then stopping
   - Learning a specific method for solving a specific kind of problem (100 kinds a year)

**New Paradigm**

2. Making sense of the problem situation
3. Making sense of the mathematics you can learn from working on the problem

# Answers Are a Black Hole: Hard to Escape the Pull

- Answer getting short circuits mathematics, **especially making mathematical sense.**
- Very habituated in US teachers versus Japanese teachers.
- High-achieving countries **devise methods for slowing down, postponing answer getting.**

# How do I pose problems to the class?

- Whole class: pose problem, make sure students understand the language, **no hints at solution.**
- Focus students on the problem situation, **not the question/answer game**. Hide question and ask them to formulate questions that make situation into a word problem.
- Ask 3-6 questions about the same problem situation; **ramp questions up toward key mathematics** that transfers to other problems.

# What Problems do I use?

- Problems that draw thinking toward the mathematics you want to teach. **NOT too routine**, right after learning how to solve the problem.
- Ask about a chapter: what is the most important mathematics students should take with them? **Find problems that draw attention to this math**.
- Begin chapter with this problem or type of problem. This has diagnostic power. Also shows you where time has to go.
- Near end of chapter, external problems needed, e.g. Shell Centre

# What Do We Mean by Conceptual Coherence?

- **Apply one important concept in 100 situations rather than memorizing 100 procedures that do not transfer to other situations:**
  - **Typical practice** is to opt for short-term efficiencies, rather than teach for general application throughout mathematics.
  - **Result:** typical students can get B's on chapter tests, **but don't remember what they 'learned' later** when they need to learn more mathematics
- Use basic "rules of arithmetic" or "rules of Algebra" or "rules of Geometry" instead of clutter of specific named methods
- Curriculum is a **'mile deep'** instead of a **'mile wide'**

# Evidence of Student Growth
## (Information we can't get from rubric scores alone)

- **Use of a different solution strategy from pre- to post-assessment** (e.g., student uses visual models in pre but applies formulas or uses division of fractions to support work in post)

  **Pre-assessment** - Much support needed to complete the task independently

  **Post-assessment** - Minimal or no support needed to complete the task

- **Pre-assessment** - Student uses manipulatives to model the entire task

  **Post-assessment** – Student uses manipulatives to model only parts of the task.

# Evidence of Student Growth
## (Information we can't get from rubric scores alone)

- Ability to apply a similar solution strategy at post-assessment, but to a more complex version of the problem.
- Ability to explain the reasoning of steps employed in a solution strategy more sophisticated and precise at post-assessment.

- Other evidence that represents
  - a change in the student's approach to the task.
  - general ability to solve a problem of this type.
  - change in the efficiency with which the student carries out the necessary steps.

# Resources
# Moving Forward Professionally

NCSM Illustrating Mathematical Practices

- Diving Deeper into the Common Core Standards for Mathematics: Leading with the Mathematical Practices -A webinar that introduces Mathematical Practices. http://ncsmonline.org/docs/events/webinars/NCSMCCSSWebinar2011-02-23Presentation.pdf
- These ready-to-use PD materials are designed to help teachers understand the Standards for Mathematical Practice and implement them in their classrooms. Each module supports a 1.5- to 3-hour session that focuses on one or two mathematical practices. http://www.ncsmonline.org/ccss/materials.html

# Moving Forward Professionally

- The Hunt Institute videos are vignettes that explain the Standards in far greater depth.
  - Several of the key Standards writers were asked, in their own words, to talk about how the Standards were developed and the goals they set for all students.

CCSSO video vignettes were developed to help diverse groups – educators, policymakers, parents – better understand the breadth and depth of the Standards and how they will improve teaching, make classrooms better, create shared expectations, and cultivate lifelong learning for all students.

# Moving Forward Professionally

- The Illustrative Mathematics Project will provide guidance to states, assessment consortia, testing companies, and curriculum developers by illustrating the range and types of mathematical work that students will experience in a faithful implementation of the Common Core State Standards, and by publishing other tools that support implementation of the standards.
- Achieve the Core
- The Mathematics Assessment Project

# Moving Forward Professionally

- **Explore RIGOR by Connecting the Standards for Mathematical Practice to the Content Standards:** Participants examine content standards to see how they connect with the Standards for Mathematical Practice and how in tandem they form the basis of a rigorous curriculum. (Appropriate for Pre-K-12.)
  http://www.doe.mass.edu/candi/commoncore/mathexplore/

- Inside Mathematics a professional resource for educators passionate about improving students' mathematics learning and performance. This site features classroom examples of innovative teaching methods and insights into student learning, tools for mathematics instruction that teachers can use immediately, and video tours of the ideas and materials on the site.

- The Teaching Channel, a resource featuring videos, lesson plans and strategies that demonstrate inspired teaching design to inspire teaching.

# Other States…

- Alaska Standards
- Kentucky materials
- Georgia materials
- Hawaii materials
- NY materials