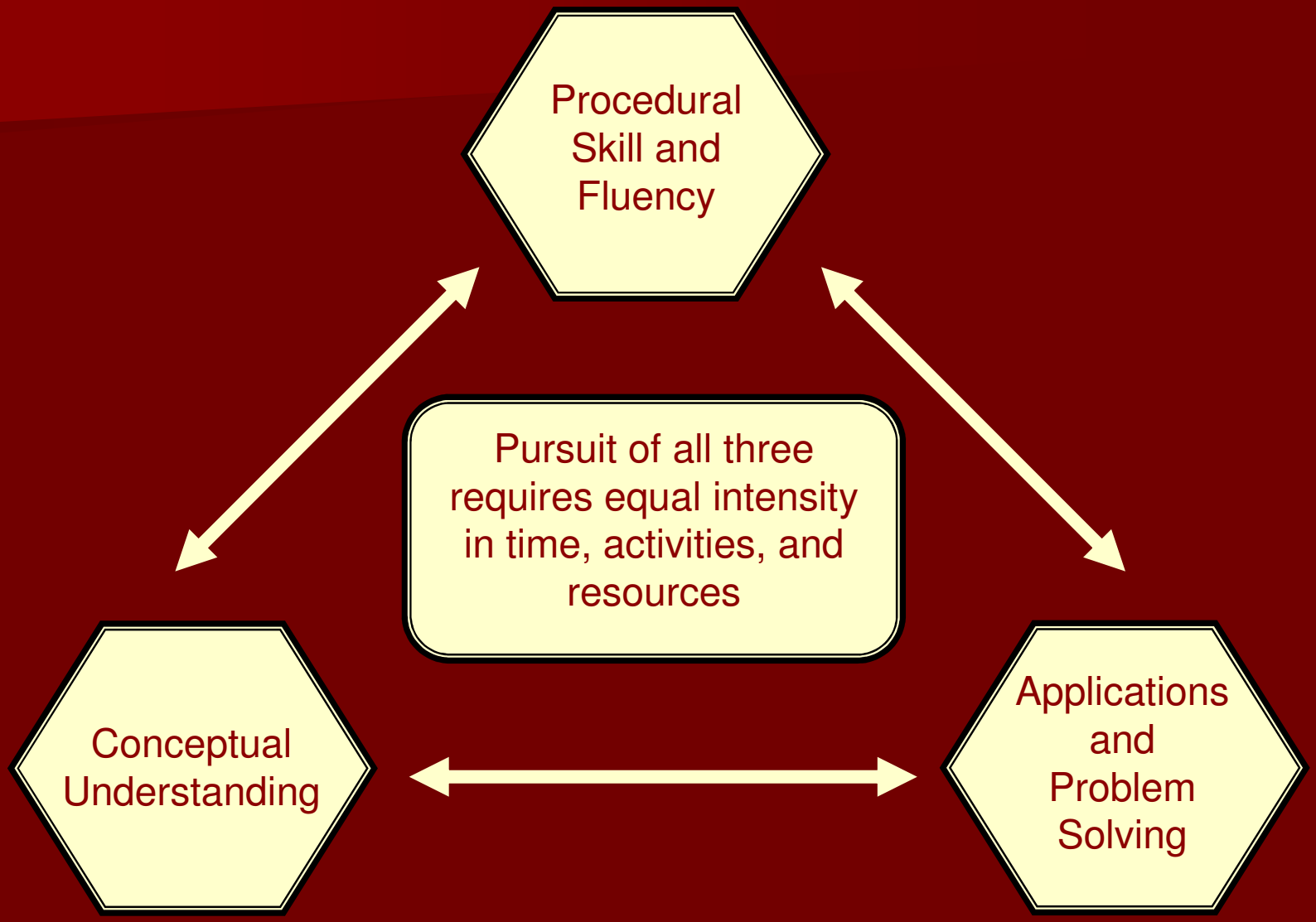
Common Core State Standards Mathematics

Developing Conceptual Understanding

Middle School

The Common Core State Standards in Mathematics require a balance of:



Knowing vs. Understanding

Show Grade 7

What is the difference between knowing and understanding?

Students know 14 + -26 = -12

Students understand 14 + -26 = -12

What does -14 + -26 = ?

What is Conceptual Understanding?

Students demonstrate conceptual understanding in mathematics when they provide evidence that they can recognize, label, and **generate examples of concepts**; **use** and interrelate **models, diagrams, manipulatives**, and varied representations of concepts; identify and apply principles; know and apply facts and definitions; compare, contrast, and integrate related concepts and principles; recognize, interpret, and apply the signs, symbols, and terms used to represent concepts.

Balka, Hull, and Miles
http://www.mathleadership.com/sitebuildercontent/sitebuilderfiles/conceptualUnderstanding.pdf

Activity

In your Group how can you generate conceptual understanding in our problem 14 + -26 so students could extend it to -14 + - 26 ?

Activity II

- In your groups generate a “lesson” that will develop conceptual understanding of solving one step equations using addition and subtraction.
- Your lesson will be tested using examples on the next page.

Activity II Examples

$x + 6 = 7$

$x + 6 = -7$

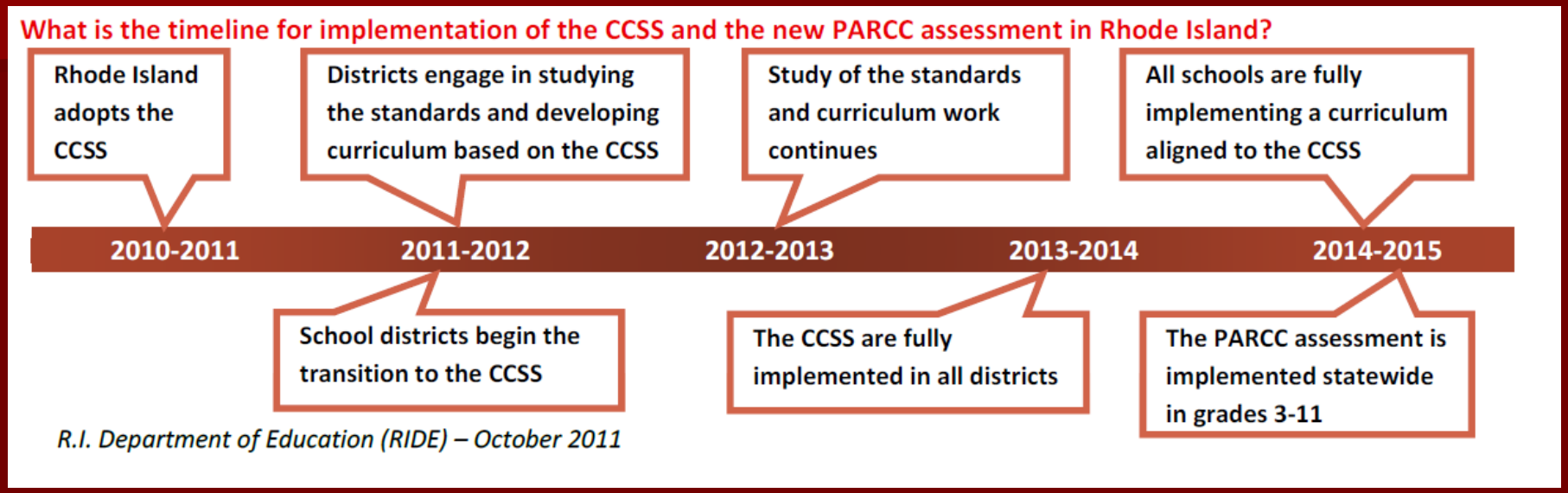
$x - 6 = 7$

$x - 6 = -7$

$6 + x = 7$

$6 - x = 7$

Rhode Island



The PARCC Assessment

The PARCC Partnership will begin field testing the new assessments in the 2012-2013 school year, with full operational administration scheduled to begin in 2014-15. This is an aggressive timeline that will require a strategy that draws on state policymakers, district and school officials, and classroom teachers to ensure a successful and efficient implementation and transition.

2010-11 School Year: Launch and design phase
2011-12 School Year: Development begins
2012-13 School Year: First year pilot/field testing and related research and data collection
2013-14 School Year: Second year pilot/field testing and related research and data collection
2014-15 School Year: Full operational administration of PARCC assessments
Summer 2015: Set achievement levels, including college-ready performance levels

The 3-8 PARCC assessments will be delivered at each grade level and will be based directly on the Common Core State Standards. The distributed PARCC design includes four components

1. Optional Diagnostic assessments in reading, writing and mathematics.

2. Optional Mid-year assessments in ELA/literacy and mathematics.

3. **Performance-Based Assessment (PBA) Administered after 3rd quarter**

   All students participating in the PARCC assessments will take a performance-based assessment in which they will apply their knowledge to a complex problem and produce a product. It will be administered as close to the end of the school year as possible, and the results will be factored into a student's summative assessment score.

   In mathematics, students will address a range of tasks focusing on application of concepts, skills and understandings. Students will be asked to solve problems involving the key knowledge and skills for their grade-level (as identified by the CCSS); express mathematical reasoning and construct a mathematical argument; and apply concepts to solve model real-world problems.

4. **End-of-Year Assessment (EOY) Administered after approximately 90% of the school year.**

For all grades and subjects, this component will be administered at the end of the school year to all students participating in the PARCC assessments, with the results combined with the performance-based assessment results to produce a student's summative assessment score. The students will respond to computer-based machine-scorable questions to demonstrate their acquired skills and knowledge.

In Grades 3-8, the end-of-year assessments will focus on reading and comprehending complex texts in ELA/literacy. In mathematics, the assessments will focus on demonstrating conceptual understanding of the content of the grade/course, and demonstrating mathematical fluency, when applicable to the grade.

Grades		Performance-Based Component						End-of-Year Component					Summative Total
		ELA/Literacy			Math		Total	ELA/Literacy		Math		Total	
		Literary Analysis	Research	Narrative	Session 1	Session 2		Session 1	Session 2	Session 1	Session 2		
9 -10 Alg I/ Math I Geo/ Math II	Estimated Time on Task (minutes)	80	85	50	50	50	**315**	70	70	65	65	**270**	9 hours, 45 minutes

Grade		Performance-Based Component						End-of-Year Component					Summative Total
		ELA/Literacy			Math		Total	ELA/Literacy		Math		Total	
		Literary Analysis	Research	Narrative	Session 1	Session 2		Session 1	Session 2	Session 1	Session 2		
11 Alg II / Math III	Estimated Time on Task (minutes)	80	85	50	65	65	**345**	70	70	55	55	**250**	9 hours, 55 minutes

Types of PARCC Tasks

Task Type	Description of Task Type
I. Tasks assessing *concepts, skills and procedures*	• Balance of conceptual understanding, fluency, and application • Can involve any or all mathematical practice standards • Machine scorable including innovative, computer-based formats • Will appear on the End of Year and Performance Based Assessment components
II. Tasks assessing *expressing mathematical reasoning*	• Each task calls for written arguments / justifications, **critique of reasoning, or precision in mathematical statements (MP.3, 6).** • Can involve other mathematical practice standards • May include a mix of machine scored and hand scored responses • Included on the Performance Based Assessment component
III. Tasks assessing *modeling / applications*	• **Each task calls for modeling/application in a real-world context or scenario (MP.4)** • Can involve other mathematical practice standards. • May include a mix of machine scored and hand scored responses • Included on the Performance Based Assessment component

PARCC Assessment II

II. Tasks assessing *expressing mathematical reasoning*	•Each task calls for written arguments / justifications, **critique of reasoning, or precision in mathematical statements (MP.3, 6).** •Can involve other mathematical practice standards •May include a mix of machine scored and hand scored responses •Included on the Performance Based Assessment component

Standards of 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.

Standards of Mathematical Practices

When you ask ...	Students ...
• What is the problem asking? • How will you use that information? • What other information do you need? • Why did you choose that operation? • What is another way to solve that problem? • Have you solved a problem similar to this one? • When did you realize your first method would not work for this problem? • How do you know your answer makes sense?	Make sense of problems and persevere in solving them.
• What is a situation that could be represented by this equation? • Why does that operation represent this situation? • What is another operation you could have used to represent the situation? • What properties did you use to find the answer? • How do you know your answer is reasonable?	Reason abstractly and quantitatively
• Will that method always work? • How do you know? • What do you think about what she said? • Who can tell us about a different method? • What do you think will happen if ...? • When would that not be true? • Why do you agree/disagree with what he said? • What do you want to ask her about her work? • How does that drawing support your work? • Justify your solution.	Construct viable arguments and critique the reasoning of others.

Standards of Mathematical Practices

When you ask ...	Students ...
• Why is that a good model for this problem? • How can you use a simpler problem to help you find the answer? • What conclusions can you make from your model? • How would you change your model if ...?	Model with mathematics.
• What could you use to help you solve the problem? • What strategy could you use to make that calculation easier? • How would estimation help you solve the problem? • Why did you decide to use ...	Use appropriate tools strategically.
• How do you know your answer is reasonable? • How can you use math vocabulary in your explanation? • How do you know those answers are equivalent? • What does that mean?	Attend to Precision
• How did you discover that pattern? • What other patterns can you find? • What rule did you use to make this group? • Why can you use that property in this problem? • How is this like ...?	Look for and make use of structure.
• What do you remember about ...? • What happens when ....? • What if you ... instead of ....? • What might be a shortcut for ....?	Look for and express regularity in repeated reasoning.

Grouping the practice standards

1. Make sense of problems and persevere in solving them
6. Attend to precision

2. Reason abstractly and quantitatively

3. Construct viable arguments and critique the reasoning of others

Reasoning and explaining

4. Model with mathematics

5. Use appropriate tools strategically

Modeling and using tools

7. Look for and make use of structure.

8. Look for and express regularity in repeated reasoning.

Seeing structure and generalizing

Pick at least 2 SMP and explain how you would implement them for the following scenario.

Kim drove 186 miles in 3 hours, how long will it take complete her 341 mile trip?

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.

Why?

How do you know?

Can you explain?

Give them TIME!

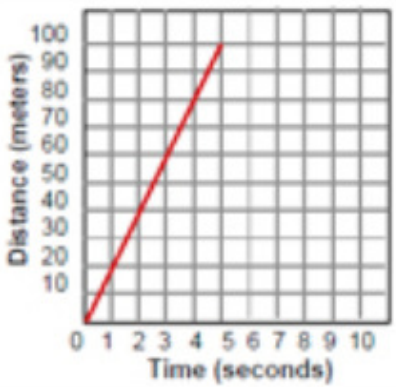
(we are working to make it available)

PARCC Assessment III

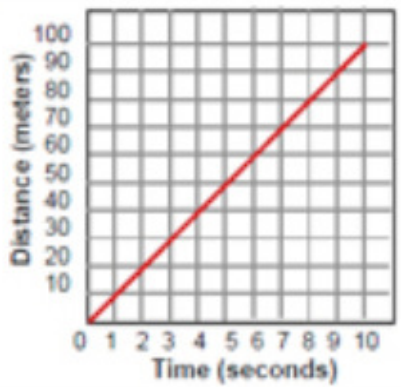
III. Tasks assessing *modeling / applications*	**•Each task calls for modeling/application in a real-world context or scenario (MP.4)** •Can involve other mathematical practice standards. •May include a mix of machine scored and hand scored responses •Included on the Performance Based Assessment component

Grade 7 - Speed

Object A



Object B



Object C

Time (seconds)	Distance (meters)
0	0
3	10
6	20
9	30

Object C moves at constant speed.

Object D

Time (seconds)	Distance (meters)
0	0
1.5	10
3	20
4.5	30

Object D moves at constant speed.

The speed of an object is defined as the change in distance divided by the change in time.

Information about objects A, B, C and D are shown. Objects C and D both have constant speed.

Based on the information given, drag and drop the object names in order from greatest speed to least speed in the table provided.

Object A	Greatest Speed	
Object B		
Object C	Least Speed	
Object D		

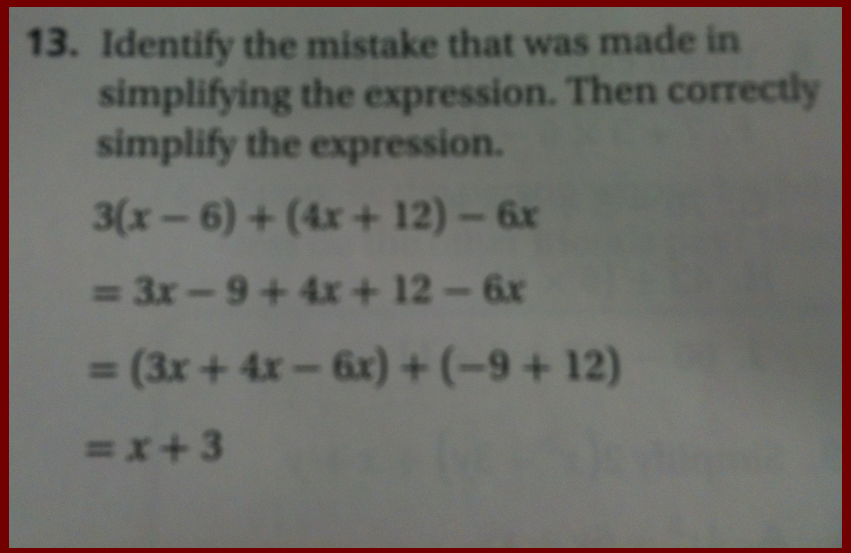
Tape Measure Activity

Graphing Stories

PARCC Quadratic Task
Desmos.com

What can I do Tomorrow?

- **Implement the Standards of Mathematical Practice Daily**
- **Provide opportunities for your students to build conceptual understanding.**
- **Be on the lookout for Rich Problems and use them! (WHY EXPLAIN)**
- **Use Student Errors as a Teaching Tool**



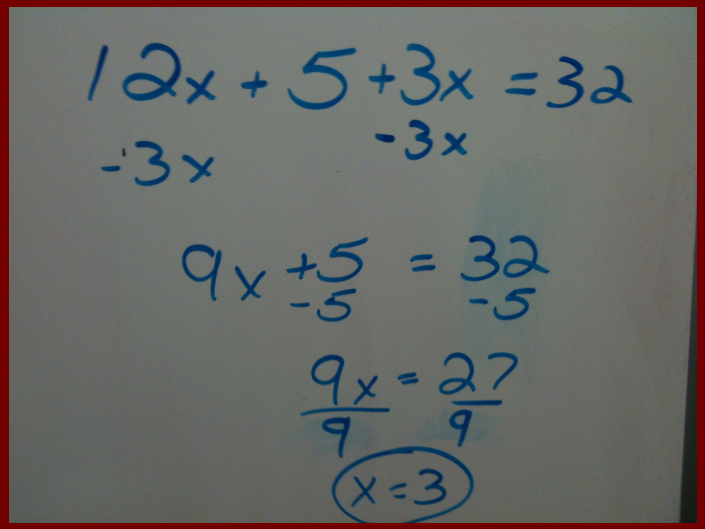
13. Identify the mistake that was made in simplifying the expression. Then correctly simplify the expression.

$3(x-6)+(4x+12)-6x$

$=3x-9+4x+12-6x$

$=(3x+4x-6x)+(-9+12)$

$=x+3$



$12x+5+3x=32$

$-3x \qquad -3x$

$9x+5=32$

$\quad -5 \qquad -5$

$\frac{9x}{9}=\frac{27}{9}$

$x=3$

Ask

Why? How do you Know? Can you Explain?

and provide TIME

Additional Resources

PARCC Prototypes
http://parcconline.org

Transforming Graphs of Linear Functions
http://www.desmos.com

Interpreting Graphs
http://graphingstories.com/