TeachFest Connecticut: Principals Academy

Improving Math Learning Opportunities through Worthwhile Tasks

December 2, 2014

CONNECTICUT STATE DEPARTMENT OF EDUCATION

LearnZillion

Table meet and greet

- Your name
- Your role
- In three words: Biggest *challenge* you've faced in the last year in your position
- In three words: Biggest *success* you've had in the last year in your position

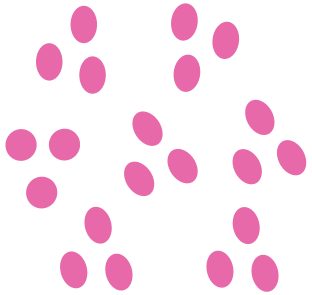
Our goals for Principals Academy

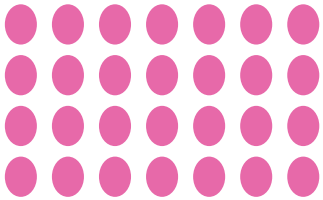
- Know how to identify rigorous math tasks and understand why they're important
- Engage in the process of analyzing a task
- Use practical tools and materials
- Develop an eye for noticing learning opportunities in tasks
- Create a Guided Action Plan for next steps

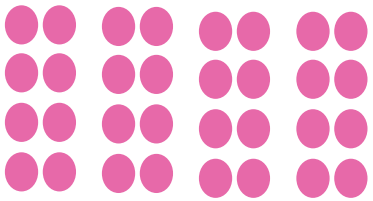
Hats you'll wear today

Leadership & Instructional Support

Teacher | Teacher | Teacher

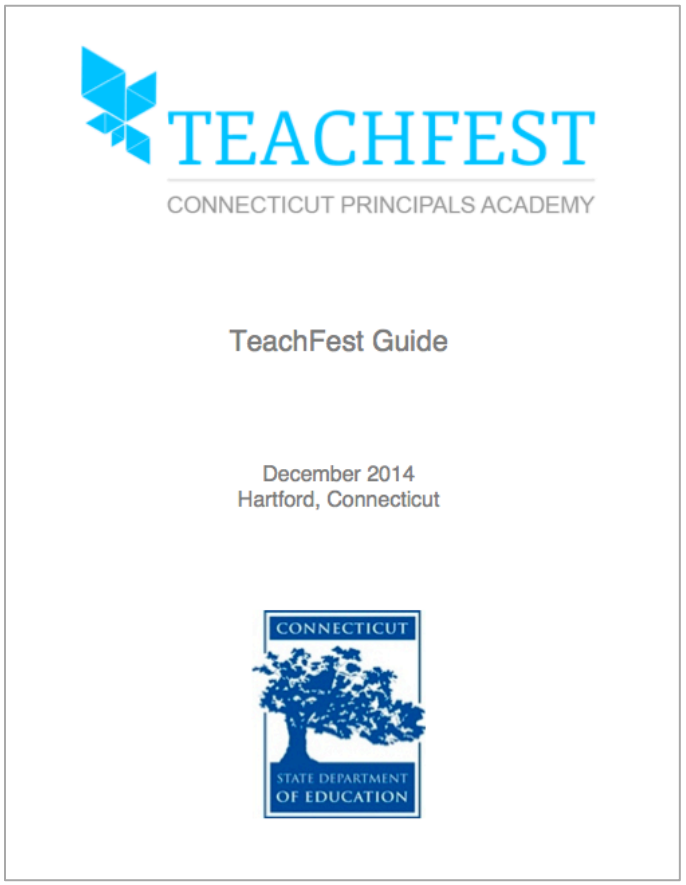


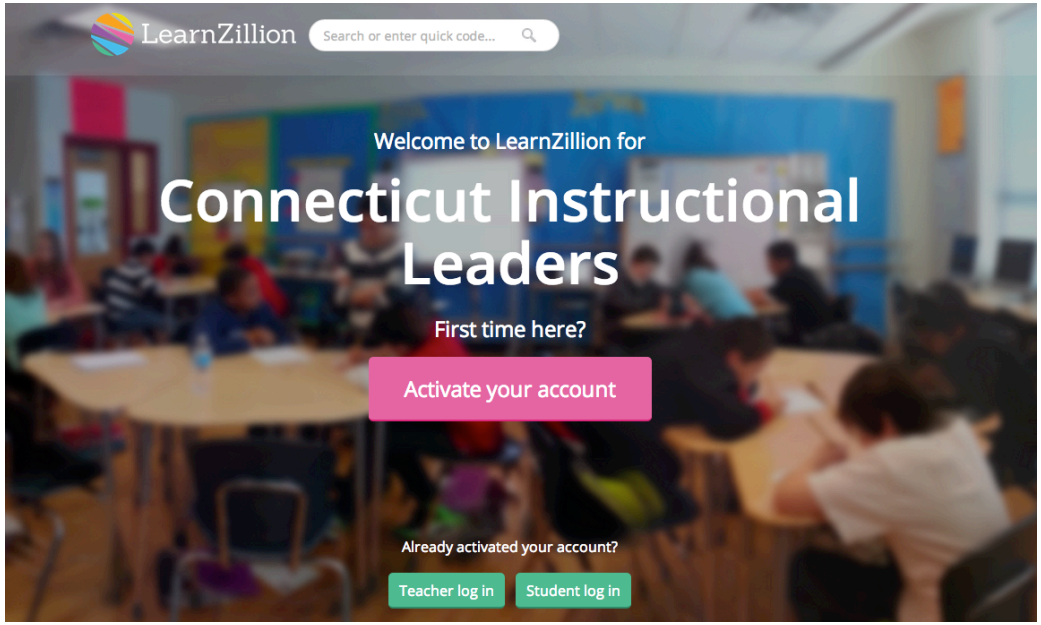




Students | Students | Students

TeachFest Connecticut: Principals Academy Guides





ctleaders.learnzillion.com

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Agenda

- How do we create learning opportunities?
- Recognize the qualities of a worthwhile task
- Do some math
- Examine task types and structures
- What does this mean for my teachers and me?

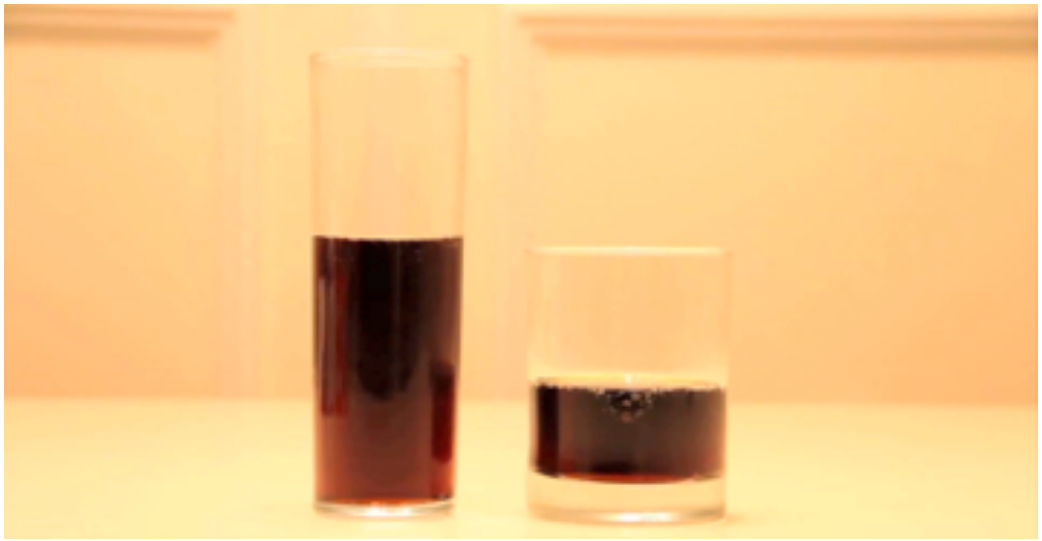
“You Pour, I Choose”

From http://threeacts.mrmeyer.com/youpourichoose/

Sketch the glasses.

Make a mark on each glass to show where the soda would reach if each glass has half the soda.

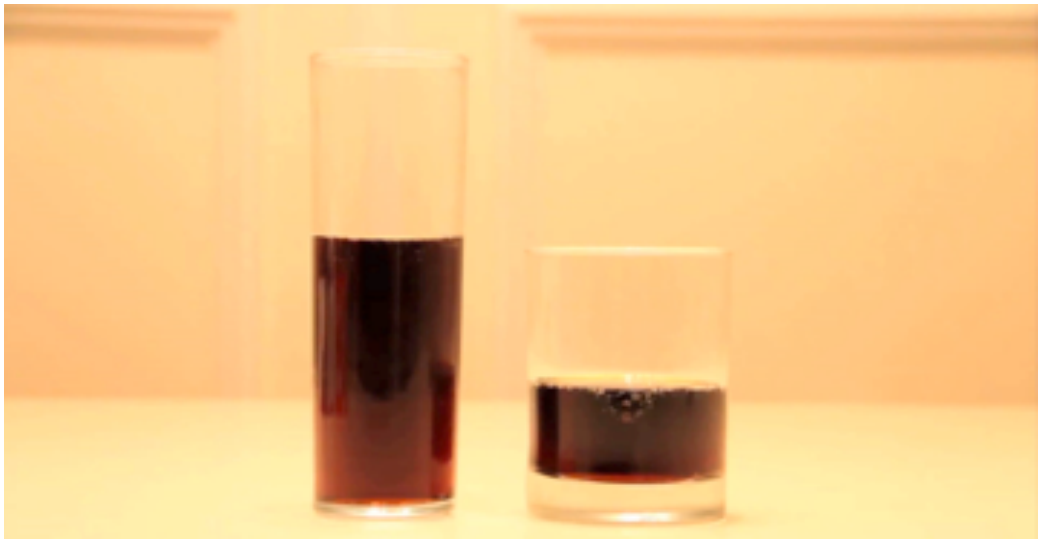
(There are 12 oz of soda altogether, but we don't know yet how his sister did with her fair pouring.)



You can have ONE piece of information about the glasses.

What would you like to know?

Write it on a sticky and toss it into the center of the table.

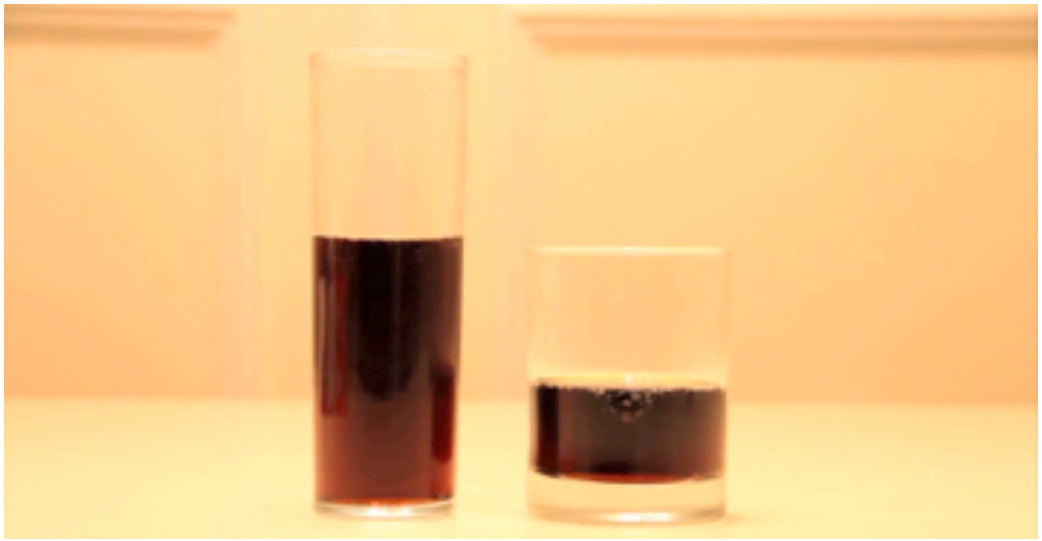


You can have ONE piece of information about the glasses.

What would you like to know?

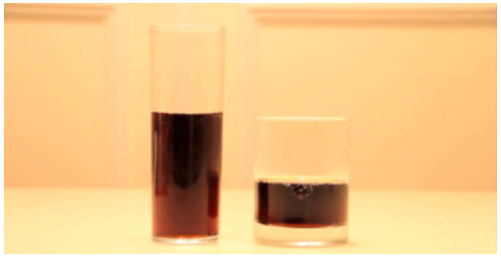
Write it on a sticky and toss it into the center of the table.

Choose a sticky and discuss how that piece of information would be helpful.



Most desired pieces of information...

Volume of both glasses
Volume of taller glass
Volume of shorter glass
Ounces of soda in taller glass
Radius of both glasses
Height of both glasses
Diameter of shorter glass
Relationship of radii



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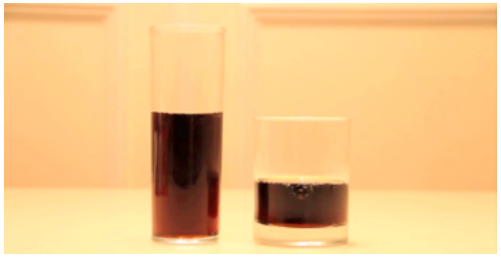


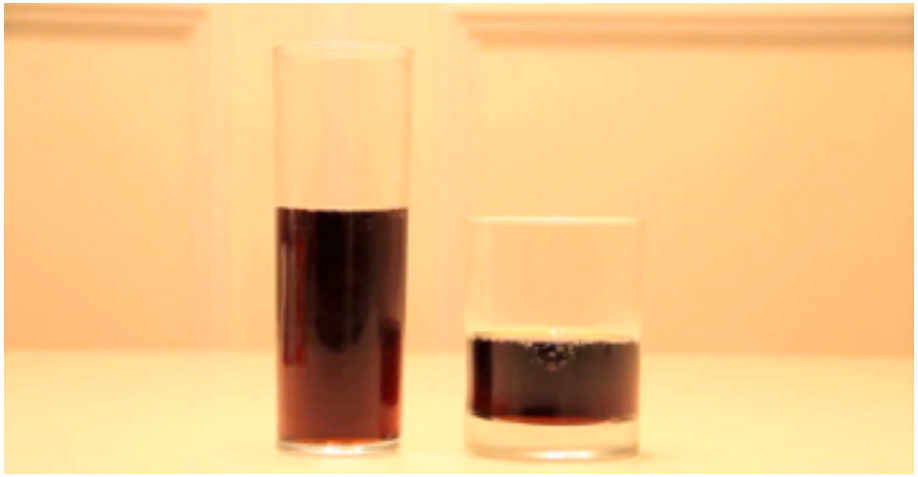
Standards the task might address

K.MD.A.1
K.MD.A.2
3.MD.2
3.NF.A
3.OA.A.3
4.MD.A.2
5.MD.C.3
5.NF.3
5.NF.4
5.MD.4
6.RP.A.3
7.G.B.4
8.G.C.9
G.GMD.A.3
G.GC.A.2
N.Q.A.1
N.Q.A.2

Sorry, not sorry...

What if the information you want is the one thing we will NOT tell you?

What else would you ask about?

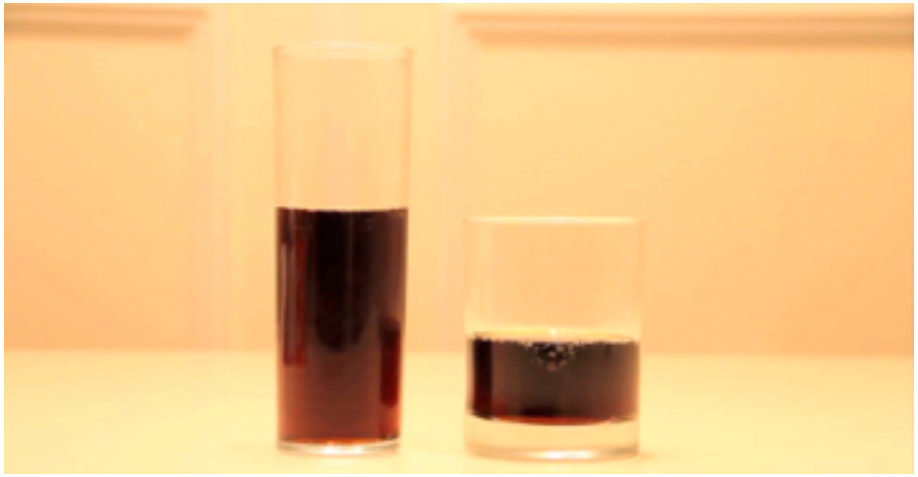


Sorry, not sorry...

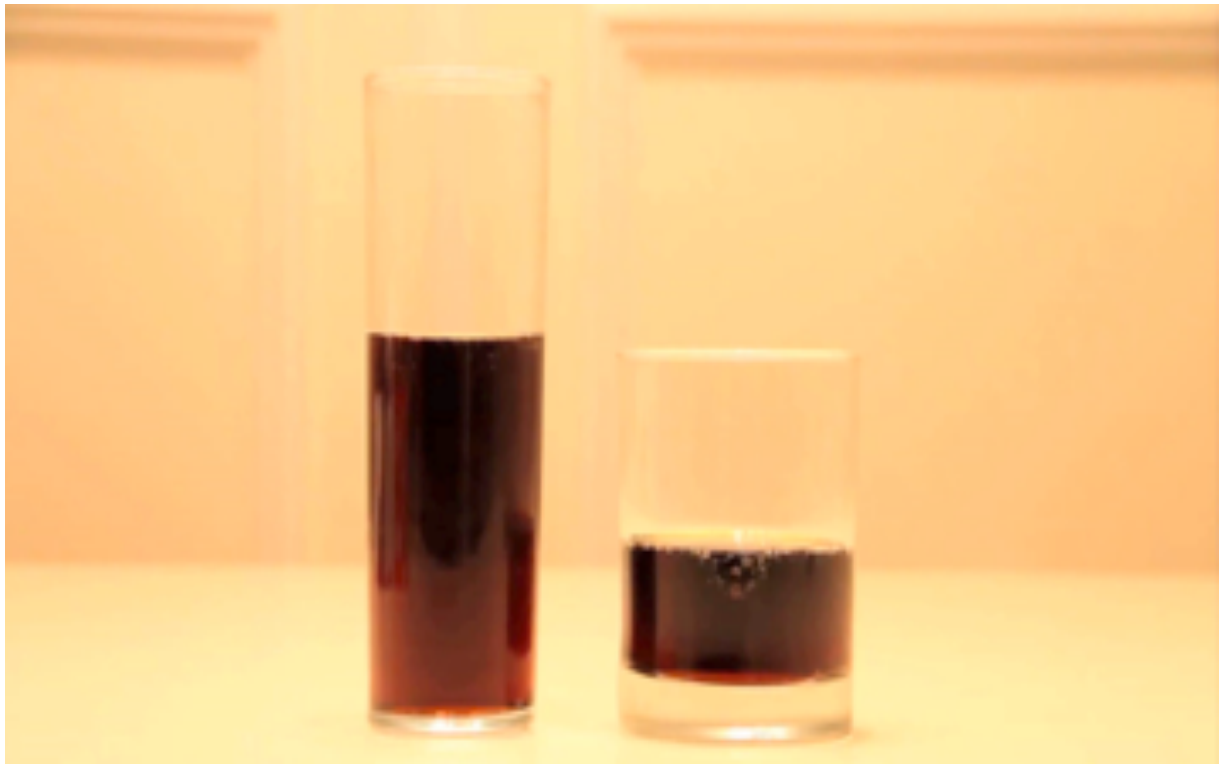
What if the information you want is the one thing we will NOT tell you?

What else would you ask about?

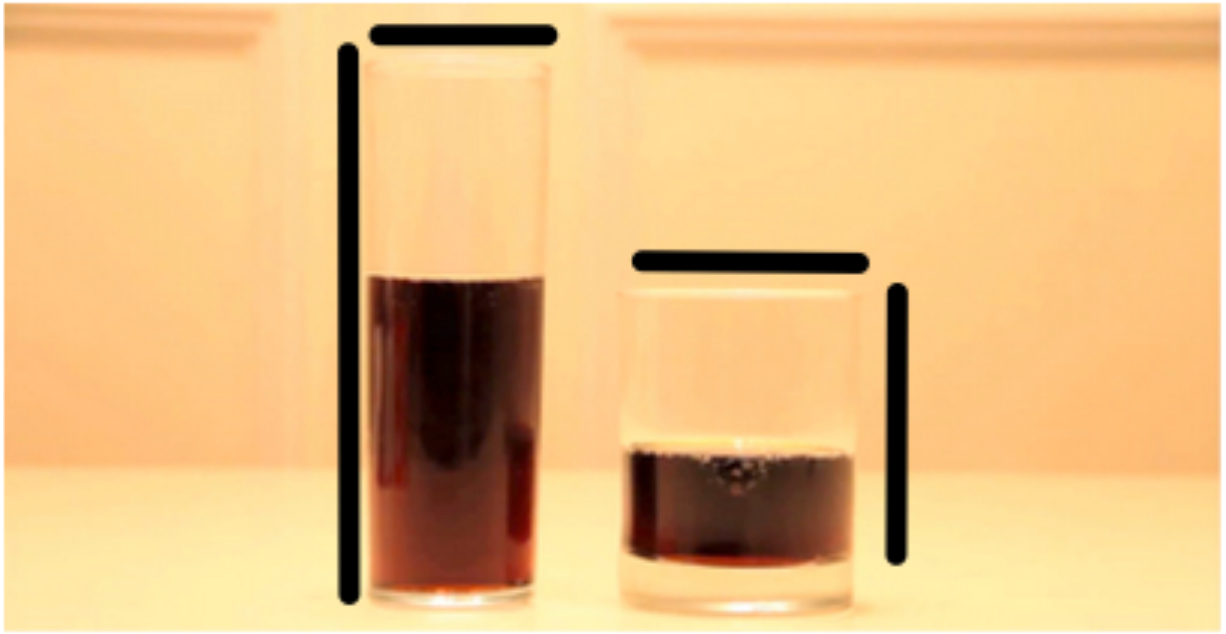
AND...we will give you EITHER one piece of information about each glass OR two pieces of information about one of the glasses.



Which linear measurements are necessary to determine how much soda each glass holds?

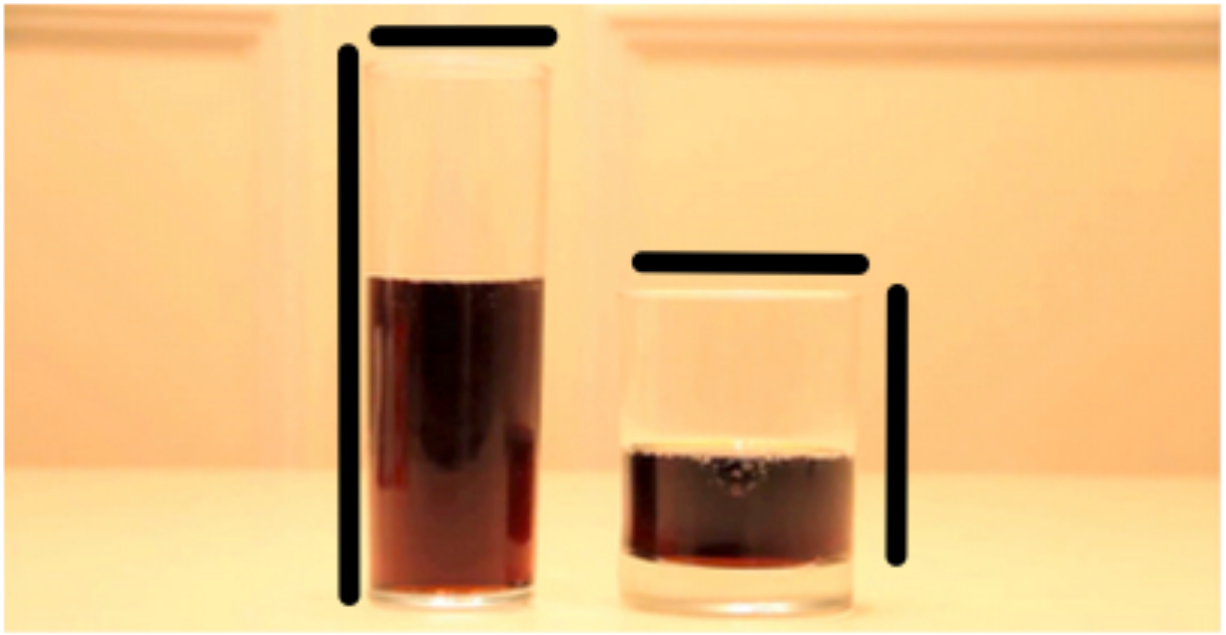


Which linear measurements are necessary to determine how much soda each glass holds?

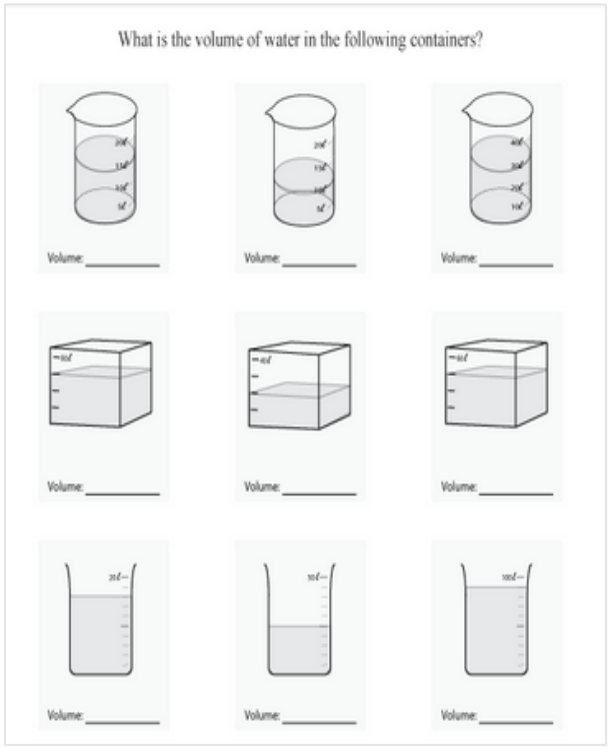


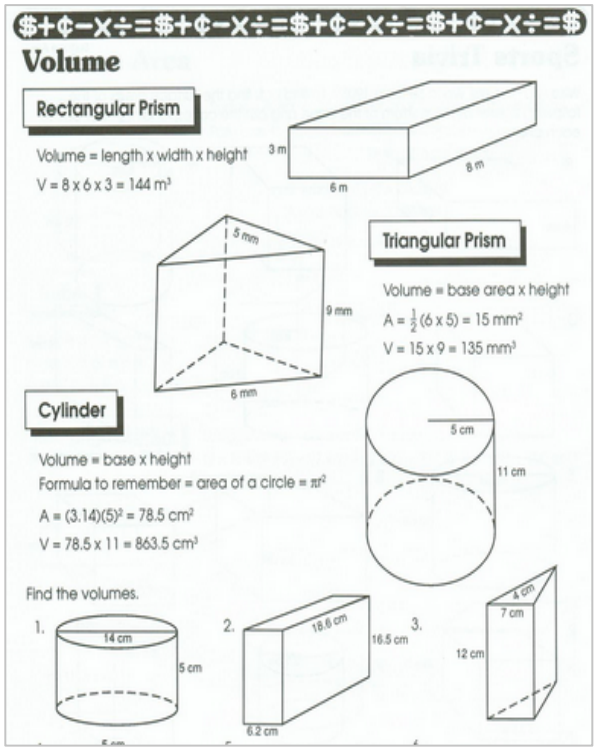
Which linear measurements are necessary to determine how much soda each glass holds?

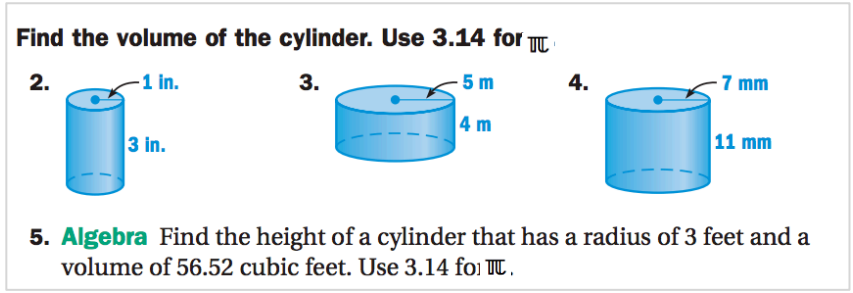
$$V = \pi r^2 h$$



Here are some different ways to ask students to work on volume.







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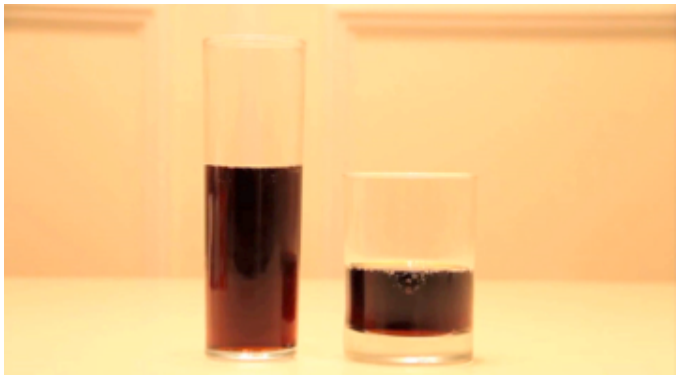
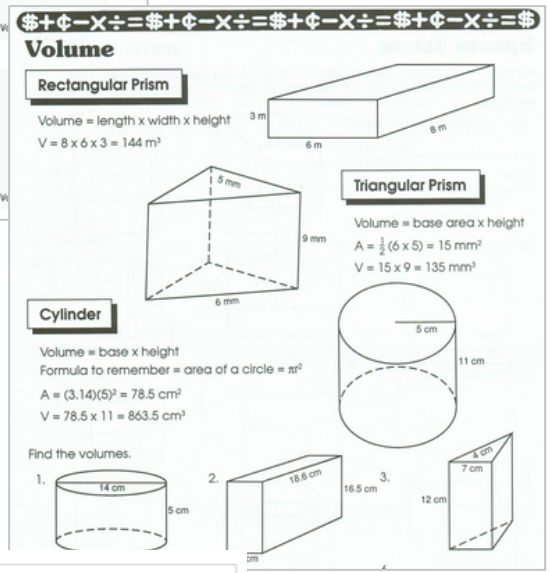
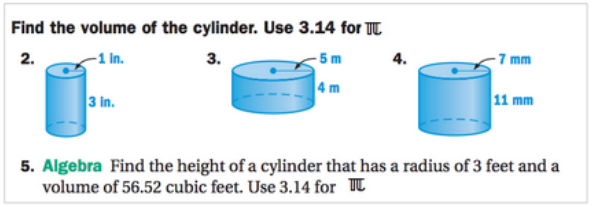
Why did we do this?



vs.





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What are the components of a Task-Based Lesson?

Present the task

Set students off to work

Discuss work publicly

Deliver instruction

Formalize the Big Idea

Assess understanding

What teaching looks like

Present the task

- Clarify directions
- Confirm that students know what they are being asked to figure out

Set students off to work

- Monitor progress
- Ask questions
- Look for and record solution paths

Discuss work publicly

- Sequence work thoughtfully
- Reference the learning goal

Deliver instruction

- Introduce conventions, notations, definitions, procedures, etc.

Formalize the Big Idea

- State the learning goal, supported by math work

After the lesson

Assess understanding

- Analyze the work
- Make instructional decisions

Planning to teach

What teaching looks like

Write an understanding goal based on the targeted standard

Choose a rigorous task

Know the task inside and out

Anticipate student responses, misconceptions, and questions

Plan an ideal sequence and explicit connections

Present the task

- Clarify directions
- Confirm that students know what they are being asked to figure out

Set students off to work

- Monitor progress
- Ask questions
- Look for and record solution paths

Discuss work publicly

- Sequence work thoughtfully
- Reference the learning goal

Plan the explicit instruction needed

Determine appropriate practice exercises

Write the ideal lesson closing

Deliver instruction

- Introduce conventions, notations, definitions, procedures, etc.

Formalize the Big Idea

- State the learning goal, supported by math work

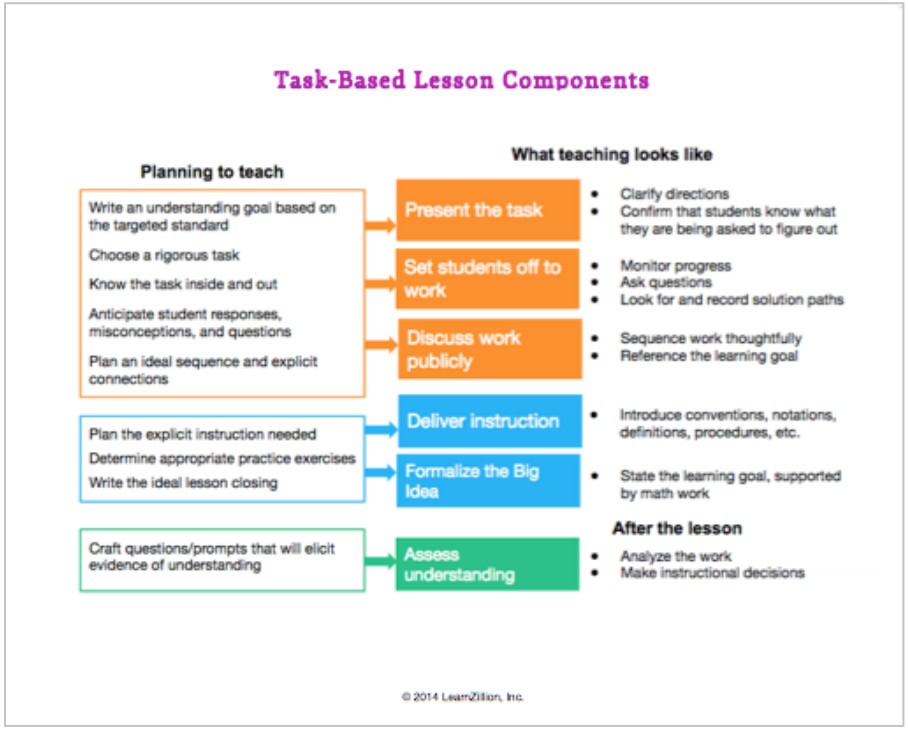
After the lesson

Craft questions/prompts that will elicit evidence of understanding

Assess understanding

- Analyze the work
- Make instructional decisions

Stop and jot



Page 7

- What do you want to remember about this?
- What questions do you have?

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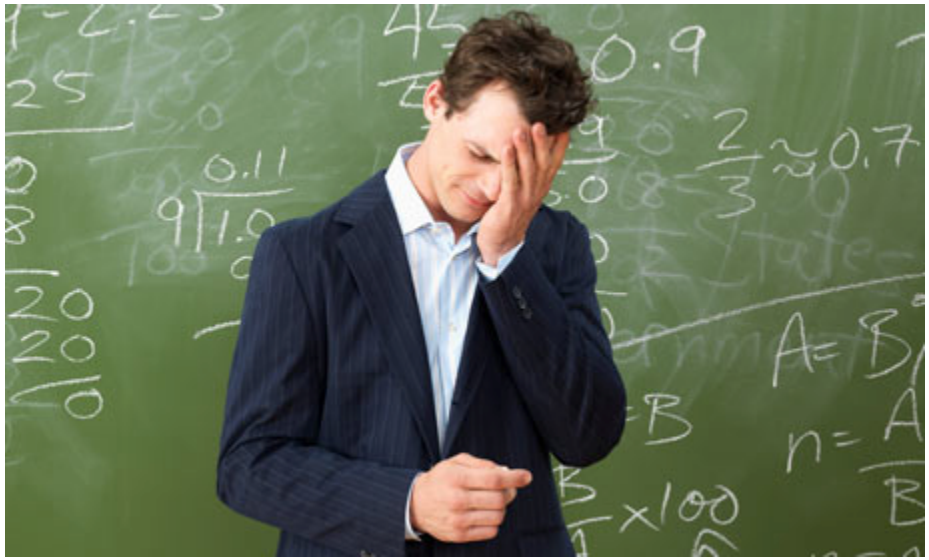
Agenda

- How do we create learning opportunities?
- Recognize the qualities of a worthwhile task
- Do some math
- Examine task types and structures
- What does this mean for my teachers and me?

Inquiry-based learning

Learning centers

Standards for Mathematical Practice



Formative assessment

Writing about math

EQuIP rubric

Eight Mathematics Teaching Practices

Common Core State Standards

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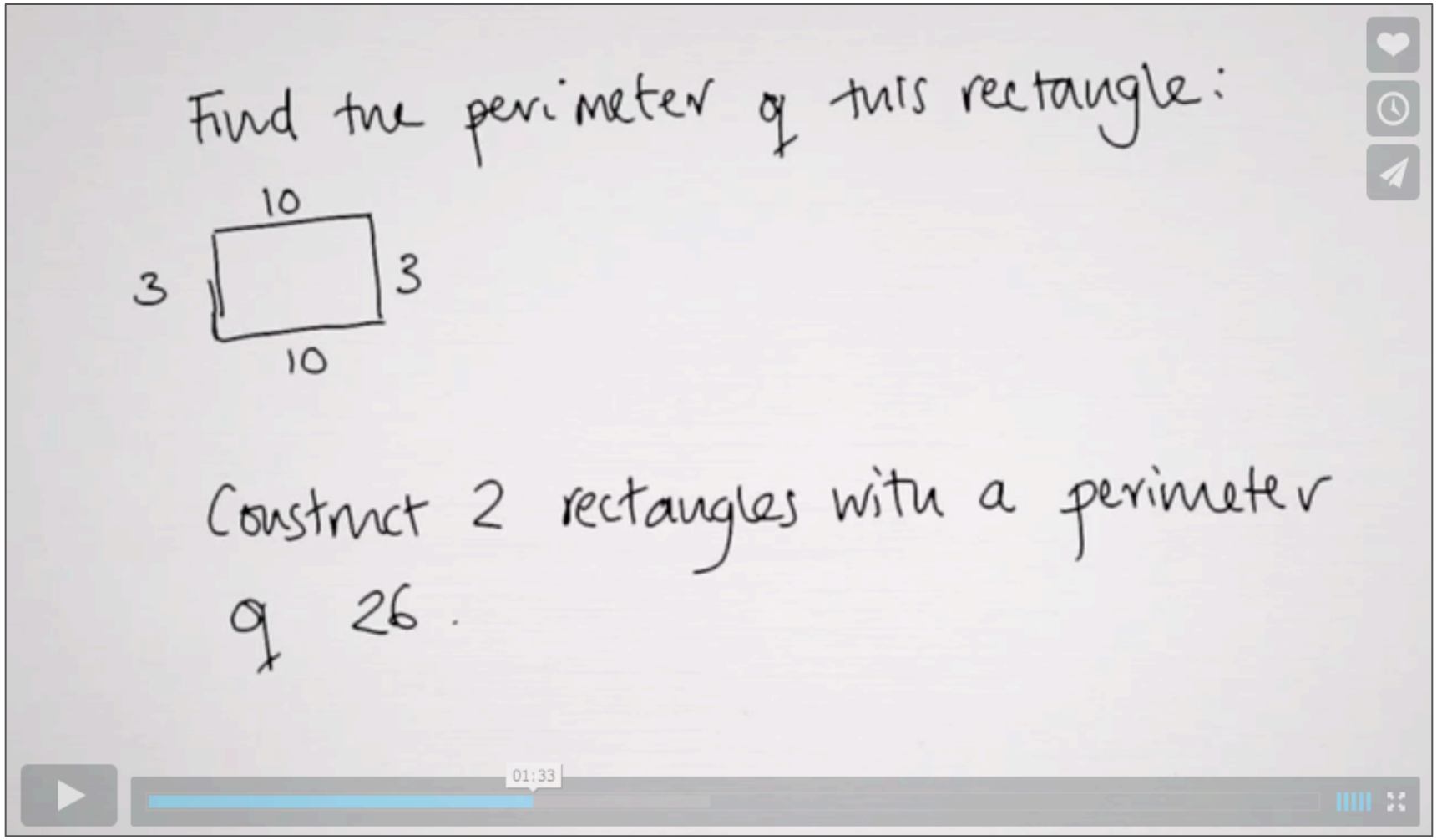
What is a worthwhile task?

A worthwhile task is a project, question, problem, construction, application, or exercise that engages students to **reason** about **mathematical ideas**, **make connections**, **solve problems**, and develop **mathematical skills.**

- National Council for Teachers of Mathematics

What learning opportunities can tasks provide?



Jo Boaler, “Opening up Math”, YouCubed.com

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Discuss in table groups

Dr. Boaler changed the question from:

“How many cubes in the 100th case?”

to

“How do you see this shape growing?”

How did this small change in wording provide more learning opportunities?

What do we mean when we say “task” today?

Goal:

Scope:

Design:

What do we mean when we say “task” today?

Goal: Learning opportunities
Not performance or assessment

Scope:

Design:

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What do we mean when we say “task” today?

Goal:

Learning opportunities

Not performance or assessment

Scope:

Bigger than a word problem

Smaller than a project

Design:

What do we mean when we say “task” today?

Goal:

Learning opportunities

Not performance or assessment

Scope:

Bigger than a word problem

Smaller than a project

Design:

Not immediately obvious what to do

Requires a bit of “productive struggle”

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Why would we want students to “struggle”?

	Destructive Struggle	Productive Struggle
Leads to…	frustration.	
Learning goals feel…	hazy and out of reach.	
Efforts...	feel fruitless.	
Students feel…	abandoned and on their own.	
Creates a sense of...	inadequacy.	

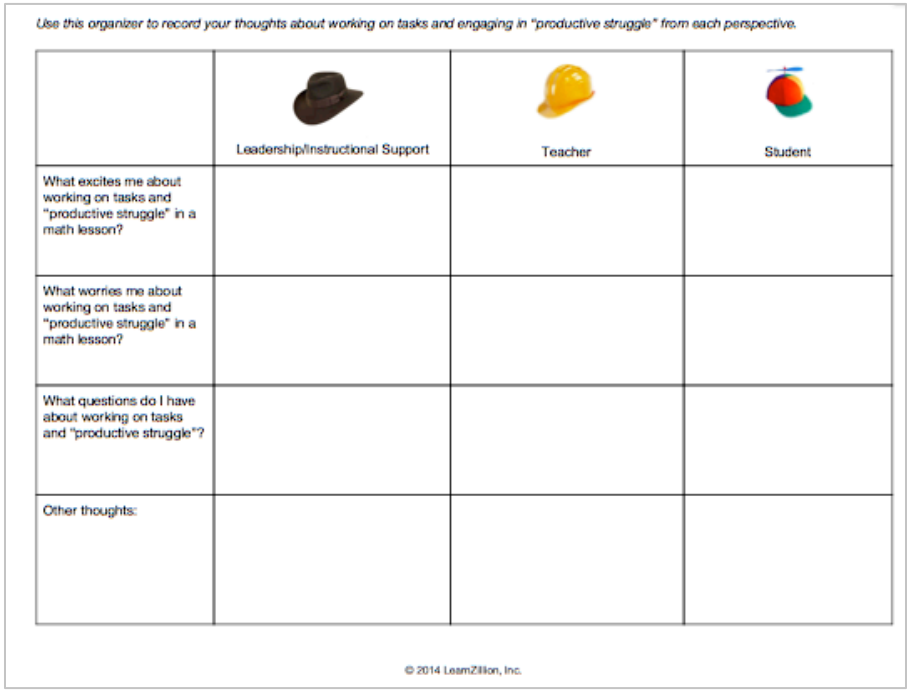
From How to Support Struggling Students by Robyn Jackson and Claire Lambert

Why would we want students to “struggle”?

	Destructive Struggle	Productive Struggle
Leads to…	frustration.	understanding.
Learning goals feel…	hazy and out of reach.	attainable and worth working toward.
Efforts...	feel fruitless.	yield results.
Students feel…	abandoned and on their own.	empowerment and efficacy.
Creates a sense of...	inadequacy.	hope.

From How to Support Struggling Students by Robyn Jackson and Claire Lambert

Take some time to process what you've heard.



Use this organizer to record your thoughts about working on tasks and engaging in "productive struggle" from each perspective.

	Leadership/Instructional Support	Teacher	Student
What excites me about working on tasks and "productive struggle" in a math lesson?			
What worries me about working on tasks and "productive struggle" in a math lesson?			
What questions do I have about working on tasks and "productive struggle"?			
Other thoughts:			

- Take each perspective
- What excites you?
- What worries you?
- What questions do you have?

Agenda

- How do we create learning opportunities?
- Recognize the qualities of a worthwhile task
- Do some math
- Examine task types and structures
- What does this mean for my teachers and me?

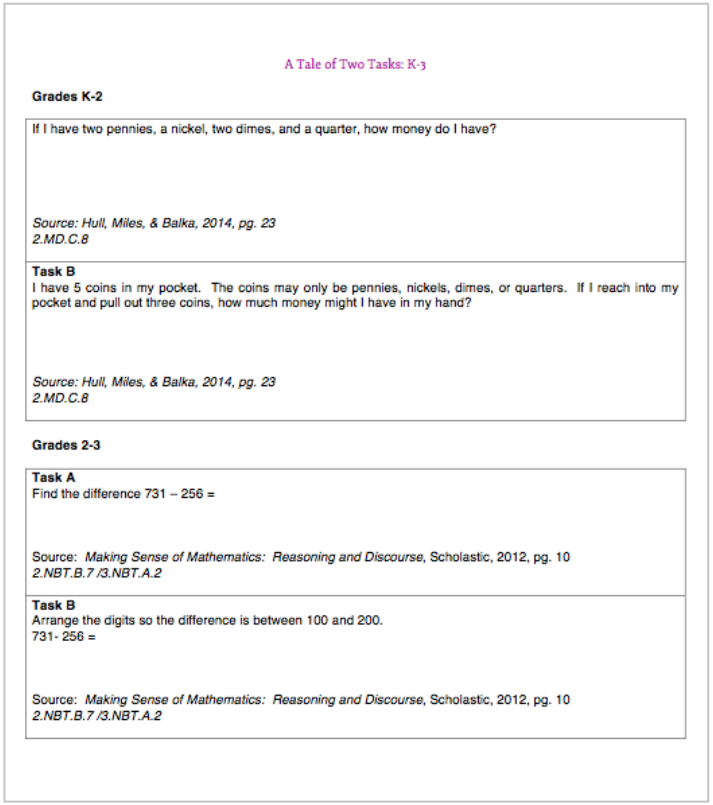
Let's review what we mean when we say "task" today

Goal:
Learning opportunities
Not performance or assessment

Scope:
Bigger than a word problem
Smaller than a project

Design:
Not immediately obvious what to do
Requires a bit of "productive struggle"

Tale of two tasks



A Tale of Two Tasks: K-3

Grades K-2

If I have two pennies, a nickel, two dimes, and a quarter, how money do I have?

Source: Hull, Miles, & Balka, 2014, pg. 23
2.MD.C.8

Task B
I have 5 coins in my pocket. The coins may only be pennies, nickels, dimes, or quarters. If I reach into my pocket and pull out three coins, how much money might I have in my hand?

Source: Hull, Miles, & Balka, 2014, pg. 23
2.MD.C.8

Grades 2-3

Task A
Find the difference 731 – 256 =

Source: *Making Sense of Mathematics: Reasoning and Discourse*, Scholastic, 2012, pg. 10
2.NBT.B.7 /3.NBT.A.2

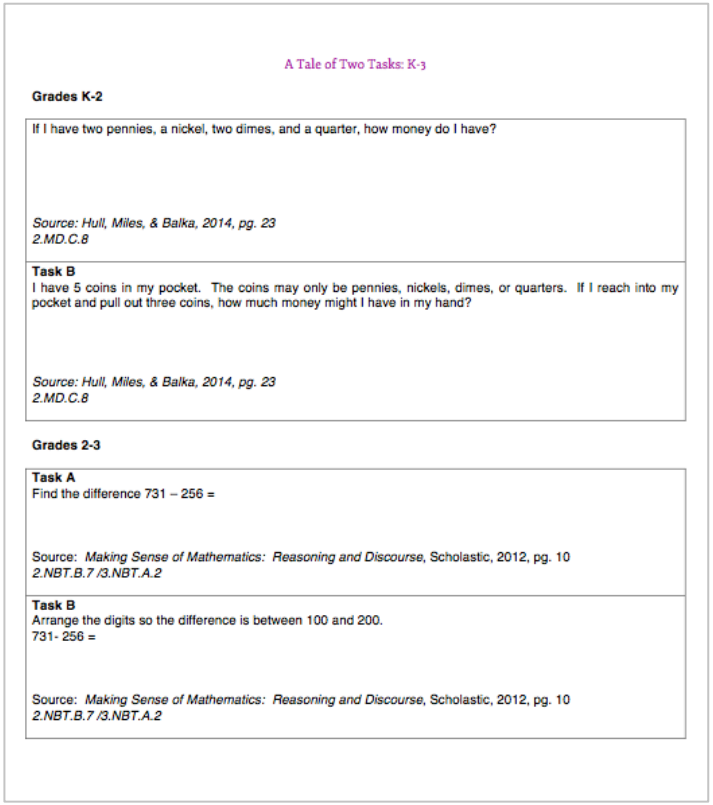
Task B
Arrange the digits so the difference is between 100 and 200.
731- 256 =

Source: *Making Sense of Mathematics: Reasoning and Discourse*, Scholastic, 2012, pg. 10
2.NBT.B.7 /3.NBT.A.2

- Work out both tasks (A and B)

Pages 11-15

Tale of two tasks



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Pages 11-15

- Work out both tasks (A and B)
- As a table, share your approaches to each task.

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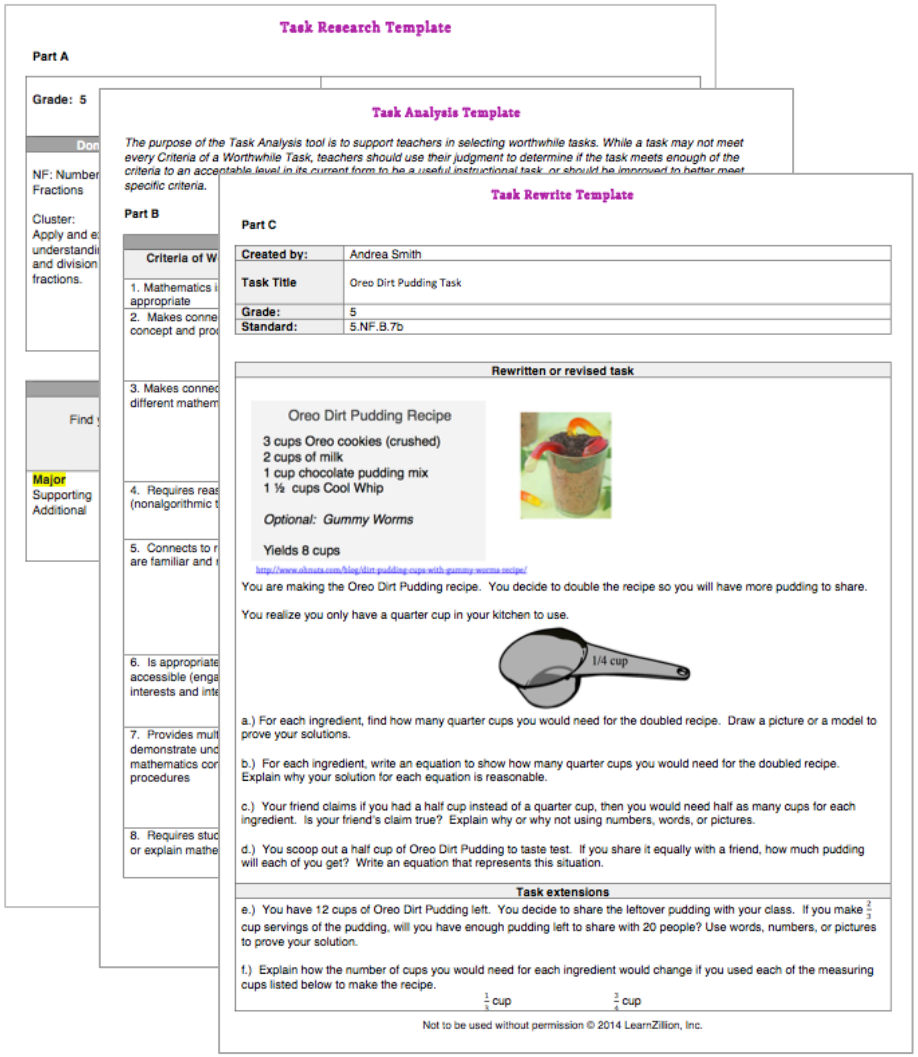
Tools for looking at tasks



Task Research Template

Part A

Grade: 5

Task Analysis Template

The purpose of the Task Analysis tool is to support teachers in selecting worthwhile tasks. While a task may not meet every Criteria of a Worthwhile Task, teachers should use their judgment to determine if the task meets enough of the criteria to an acceptable level in its current form to be a useful instructional task, or should be improved to better meet specific criteria.

Part B

Criteria of W

1. Mathematics i appropriate
2. Makes conne concept and pro
3. Makes connec different mathem
4. Requires reas (nonalgorithmic t
5. Connects to r are familiar and t
6. Is appropriate accessible (enga interests and inte
7. Provides mult demonstrate und mathematics cor procedures
8. Requires stud or explain mathe

NF: Number Fractions

Cluster: Apply and e understandi and division fractions.

Find

Major
Supporting
Additional

Task Rewrite Template

Part C

Created by:	Andrea Smith
Task Title	Oreo Dirt Pudding Task
Grade:	5
Standard:	5.NF.B.7b

Rewritten or revised task

Oreo Dirt Pudding Recipe

3 cups Oreo cookies (crushed)
2 cups of milk
1 cup chocolate pudding mix
1 ½ cups Cool Whip

Optional: Gummy Worms

Yields 8 cups

http://www.ehowta.com/blog/dirt-pudding-cups-with-gummy-worms-recipe/

You are making the Oreo Dirt Pudding recipe. You decide to double the recipe so you will have more pudding to share.

You realize you only have a quarter cup in your kitchen to use.

a.) For each ingredient, find how many quarter cups you would need for the doubled recipe. Draw a picture or a model to prove your solutions.

b.) For each ingredient, write an equation to show how many quarter cups you would need for the doubled recipe. Explain why your solution for each equation is reasonable.

c.) Your friend claims if you had a half cup instead of a quarter cup, then you would need half as many cups for each ingredient. Is your friend's claim true? Explain why or why not using numbers, words, or pictures.

d.) You scoop out a half cup of Oreo Dirt Pudding to taste test. If you share it equally with a friend, how much pudding will each of you get? Write an equation that represents this situation.

Task extensions

e.) You have 12 cups of Oreo Dirt Pudding left. You decide to share the leftover pudding with your class. If you make $\frac{2}{3}$ cup servings of the pudding, will you have enough pudding left to share with 20 people? Use words, numbers, or pictures to prove your solution.

f.) Explain how the number of cups you would need for each ingredient would change if you used each of the measuring cups listed below to make the recipe.

$\frac{1}{3}$ cup $\frac{3}{4}$ cup

Task research, analysis, and rewrite

- Part A: Research
- Part B: Task Analysis
- Part C: Transformed Task

Pages 8-10

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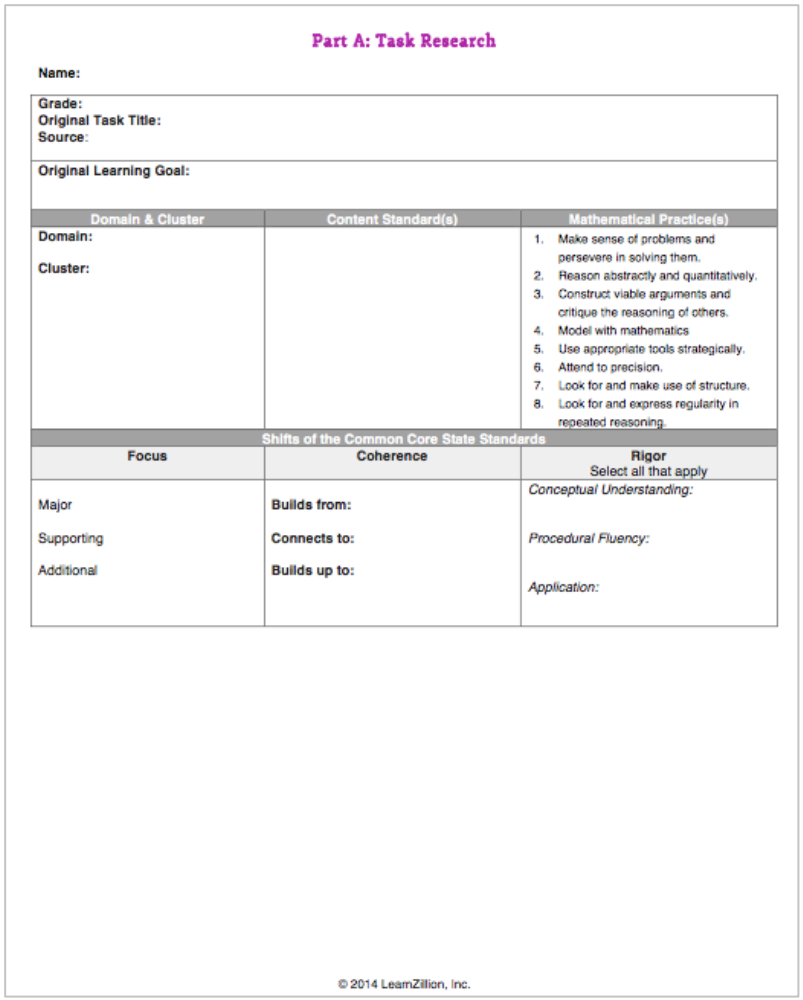
Let's think about the background for these tasks



Part A: Task Research

Name:

Grade: **Original Task Title:** **Source:**		
Original Learning Goal:		
Domain & Cluster	**Content Standard(s)**	**Mathematical Practice(s)**
Domain: **Cluster:**		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.
Shifts of the Common Core State Standards		
Focus	**Coherence**	**Rigor** Select all that apply
Major Supporting Additional	**Builds from:** **Connects to:** **Builds up to:**	*Conceptual Understanding:* *Procedural Fluency:* *Application:*

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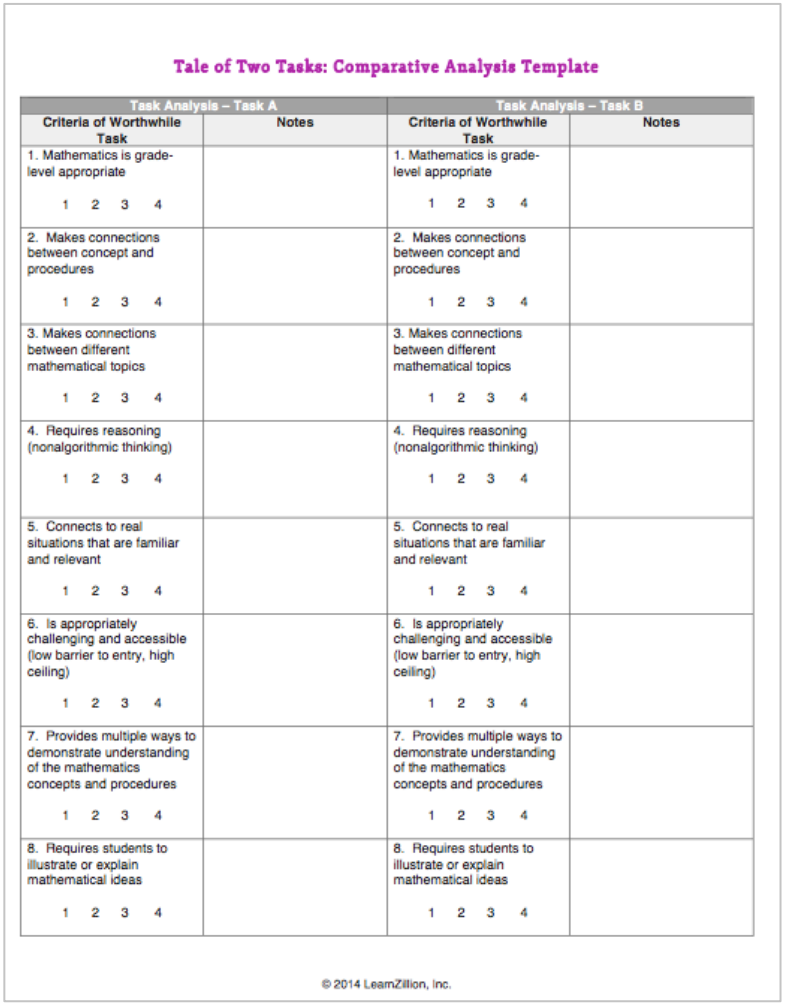
Task Background

- What should students understand as a result of working on the task?
- What standard is addressed?
- What mathematical practices might be elicited?
- What shifts are evident?

Let's compare these tasks



Tale of Two Tasks: Comparative Analysis Template

Task Analysis – Task A		Task Analysis – Task B	
Criteria of Worthwhile Task	**Notes**	**Criteria of Worthwhile Task**	**Notes**
1. Mathematics is grade-level appropriate 1 2 3 4		1. Mathematics is grade-level appropriate 1 2 3 4	
2. Makes connections between concept and procedures 1 2 3 4		2. Makes connections between concept and procedures 1 2 3 4	
3. Makes connections between different mathematical topics 1 2 3 4		3. Makes connections between different mathematical topics 1 2 3 4	
4. Requires reasoning (nonalgorithmic thinking) 1 2 3 4		4. Requires reasoning (nonalgorithmic thinking) 1 2 3 4	
5. Connects to real situations that are familiar and relevant 1 2 3 4		5. Connects to real situations that are familiar and relevant 1 2 3 4	
6. Is appropriately challenging and accessible (low barrier to entry, high ceiling) 1 2 3 4		6. Is appropriately challenging and accessible (low barrier to entry, high ceiling) 1 2 3 4	
7. Provides multiple ways to demonstrate understanding of the mathematics concepts and procedures 1 2 3 4		7. Provides multiple ways to demonstrate understanding of the mathematics concepts and procedures 1 2 3 4	
8. Requires students to illustrate or explain mathematical ideas 1 2 3 4		8. Requires students to illustrate or explain mathematical ideas 1 2 3 4	

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Task Analysis

Use the "Criteria for a Worthwhile Task" and the "Comparative Analysis Template" to compare Task A and Task B.

- What opportunities for learning does each task provide?
- What changes were made to Task A to improve it?

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What did you notice?

- What opportunities for learning does each task provide?
- What changes were made to Task A to improve it?

Consider the scope

Identify each shape with its most specific name.

Use geometry to design a playground.

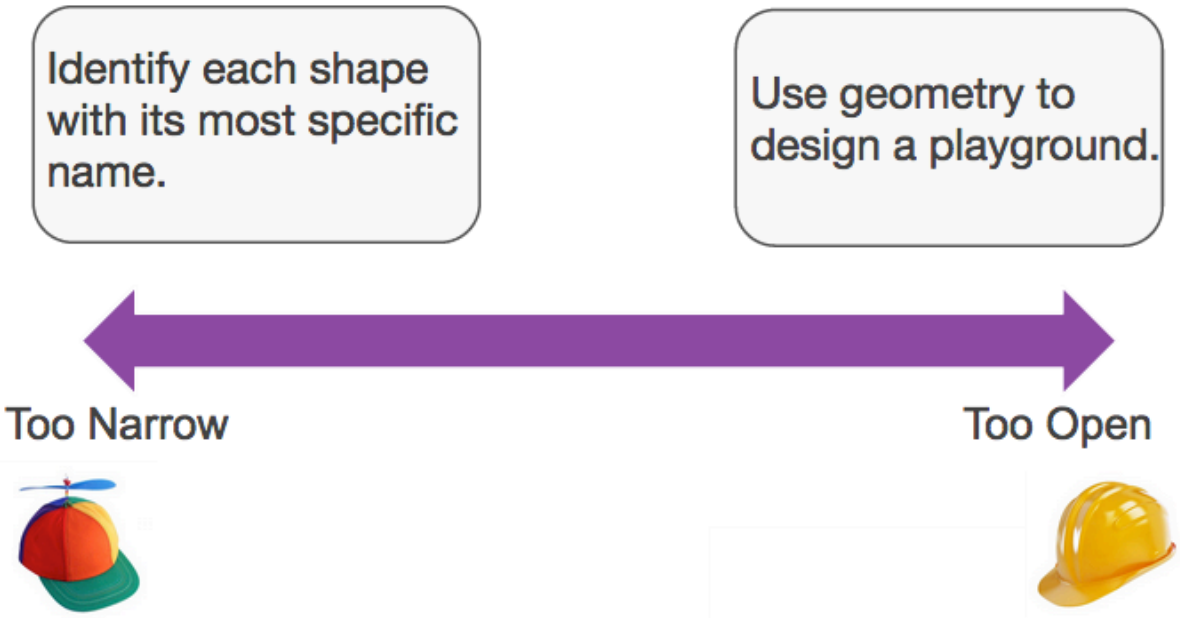
Too Narrow

Too Open

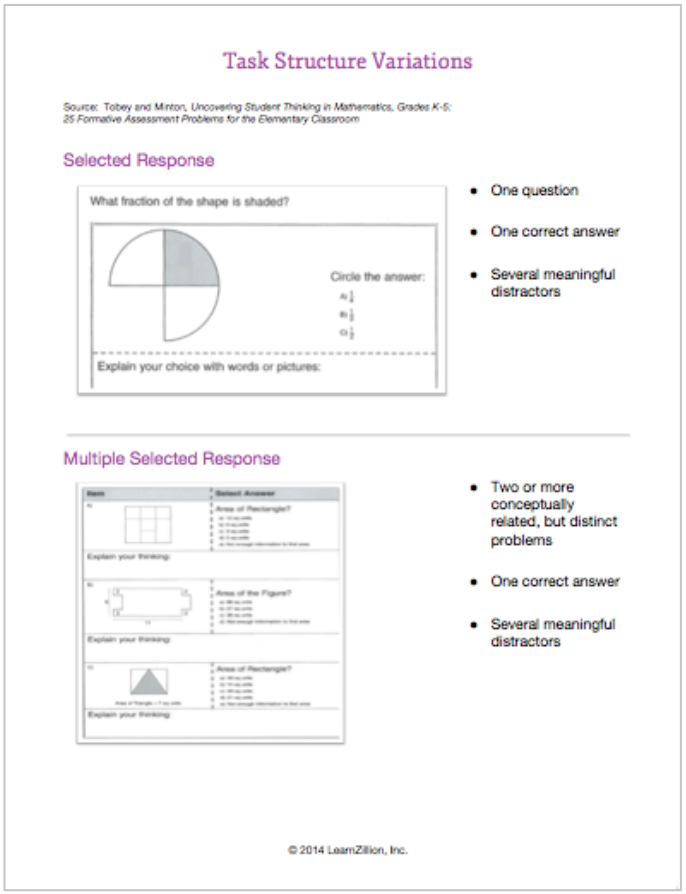
Table discussion

What might be some of the pitfalls if…

- the task is too open?
- the task is too closed?



Steps for tweaking tasks



Task Structure Variations

Source: Tobey and Minton, *Uncovering Student Thinking in Mathematics, Grades K-5: 25 Formative Assessment Problems for the Elementary Classroom*

Selected Response

What fraction of the shape is shaded?

Circle the answer:

a. $\frac{1}{4}$
b. $\frac{1}{3}$
c. $\frac{1}{2}$

Explain your choice with words or pictures:

- One question
- One correct answer
- Several meaningful distractors

Multiple Selected Response

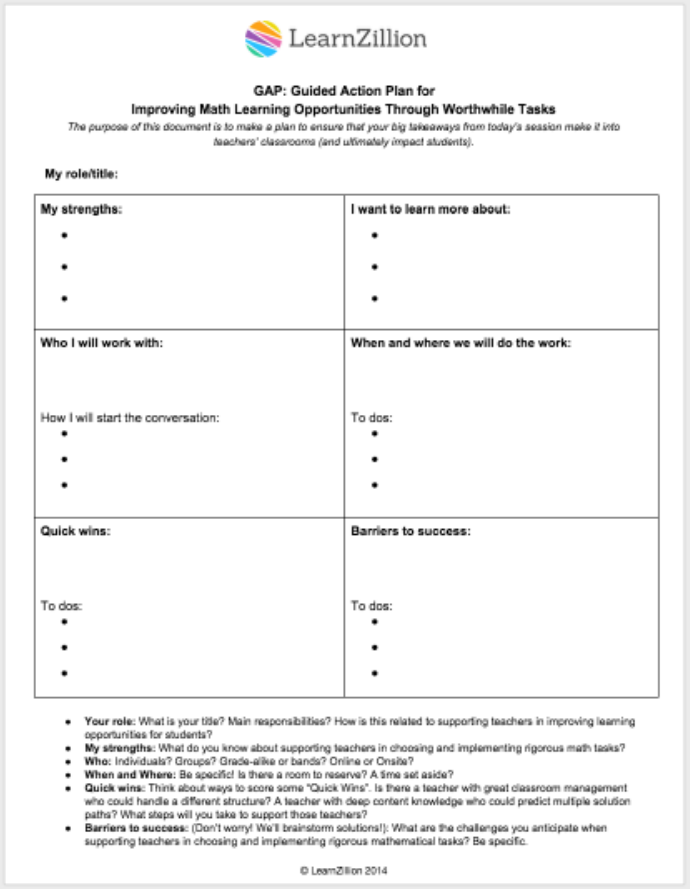
- Two or more conceptually related, but distinct problems
- One correct answer
- Several meaningful distractors

- Start with an existing resource
- Work it out
- Analyze its potential for learning opportunities
- Revise or restructure
- Work it out again

Agenda

- How do we create learning opportunities?
- Recognize the qualities of a worthwhile task
- Do some math
- Examine task types and structures
- What does this mean for my teachers and me?

Next steps: The GAP



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GAP: Guided Action Plan for
Improving Math Learning Opportunities Through Worthwhile Tasks

The purpose of this document is to make a plan to ensure that your big takeaways from today's session make it into teachers' classrooms (and ultimately impact students).

My role/title:

My strengths:	**I want to learn more about:**
Who I will work with: How I will start the conversation:	**When and where we will do the work:** To dos:
Quick wins: To dos:	**Barriers to success:** To dos:

- **Your role:** What is your title? Main responsibilities? How is this related to supporting teachers in improving learning opportunities for students?
- **My strengths:** What do you know about supporting teachers in choosing and implementing rigorous math tasks?
- **Who:** Individuals? Groups? Grade-alike or bands? Online or Onsite?
- **When and Where:** Be specific! Is there a room to reserve? A time set aside?
- **Quick wins:** Think about ways to score some "Quick Wins". Is there a teacher with great classroom management who could handle a different structure? A teacher with deep content knowledge who could predict multiple solution paths? What steps will you take to support those teachers?
- **Barriers to success:** (Don't worry! We'll brainstorm solutions!): What are the challenges you anticipate when supporting teachers in choosing and implementing rigorous mathematical tasks? Be specific.

- What's your role?

- What are your strengths?
- Questions?

- Who will you work with?
- When and where?

- What are some "quick wins"?
- What are some barriers to success?

Your fantastic colleagues will help with brilliant solutions!

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Final reflection: Think, pair, share

- What ideas do you have for “quick wins” and overcoming barriers?
- What seems like the right next step for you and the teachers you support?

Continue your learning in 2015!

How to turn-key this workshop into powerful PD for your teachers: Bringing worthwhile math tasks into the classroom

- January 14th, 2015, 1:00pm-2:00pm

Spotlight on Success

- Date TBD

Look-fors in the classroom: Math lessons

- February 4, 2015, 1:00pm-2:00pm

Spotlight on Success

- Date TBD

Thank you for a great session!

CONNECTICUT STATE DEPARTMENT OF EDUCATION

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TeachFest Connecticut: Principals Academy

Improving Math Learning Opportunities through Worthwhile Tasks

December 2, 2014

CONNECTICUT STATE DEPARTMENT OF EDUCATION

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Final reflection: Think, pair, share

- What did you learn or think about today that you'll still be thinking about on the way home?
- What ideas do you have for "quick wins" and overcoming barriers?
- What seems like the right next step for you and the teachers you support?