Multnomah Education Service District

ROBERT KAPLINSKY

@robertkaplinsky

Goals

- ❑ Change and Transition
- ❑ #ObserveMe
- ❑ Fire Maps vs. Fire Drills
- ❑ Lesson Study
- ❑ Intellectual Autonomy
- ❑ Depth of Knowledge

- Change
- Transition
- Ending

- Change
- Transition
- Ending
- Neutral Zone

- Change
- Transition
- Ending
- Neutral Zone
- New Beginning

What does this mean for math education?

- Change
- Transition
- Ending

- People may not stop doing anything. They may try to do all the old things **and** the new things. Soon they burn out with the overload.
- People make their own decisions about what to discard and what to keep, and the result is inconsistency and chaos.
- People toss out everything that was done in the past.

- Change
- Transition
- Ending
- Neutral Zone

- Change
- Transition
- Ending
- Neutral Zone
- New Beginning

Goals

- [x] Change and Transition
- [ ] #ObserveMe
- [ ] Fire Maps vs. Fire Drills
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WITH AVEC
CLENZAIRE
Eliminates Odors and Freshens
Élimine les odeurs et rafraîchit
febreze
FABRIC
refresher
désodorisant
TEXTILE
original
500 mL
16.9 FL OZ LIQ.


febreze
meadows & rain • bruine et pluie des prés
ELIMINATES ODORS
AND FRESHENS FABRICS
ÉLIMINE LES ODEURS
ET RAFRAÎCHIT LES TISSUS
Fabric Refresher • Désodorisant textile • Desodorizante textil


Wish

- Issue: Smell
- Solution: Febreze
- Cause: Perspective


SARGENT

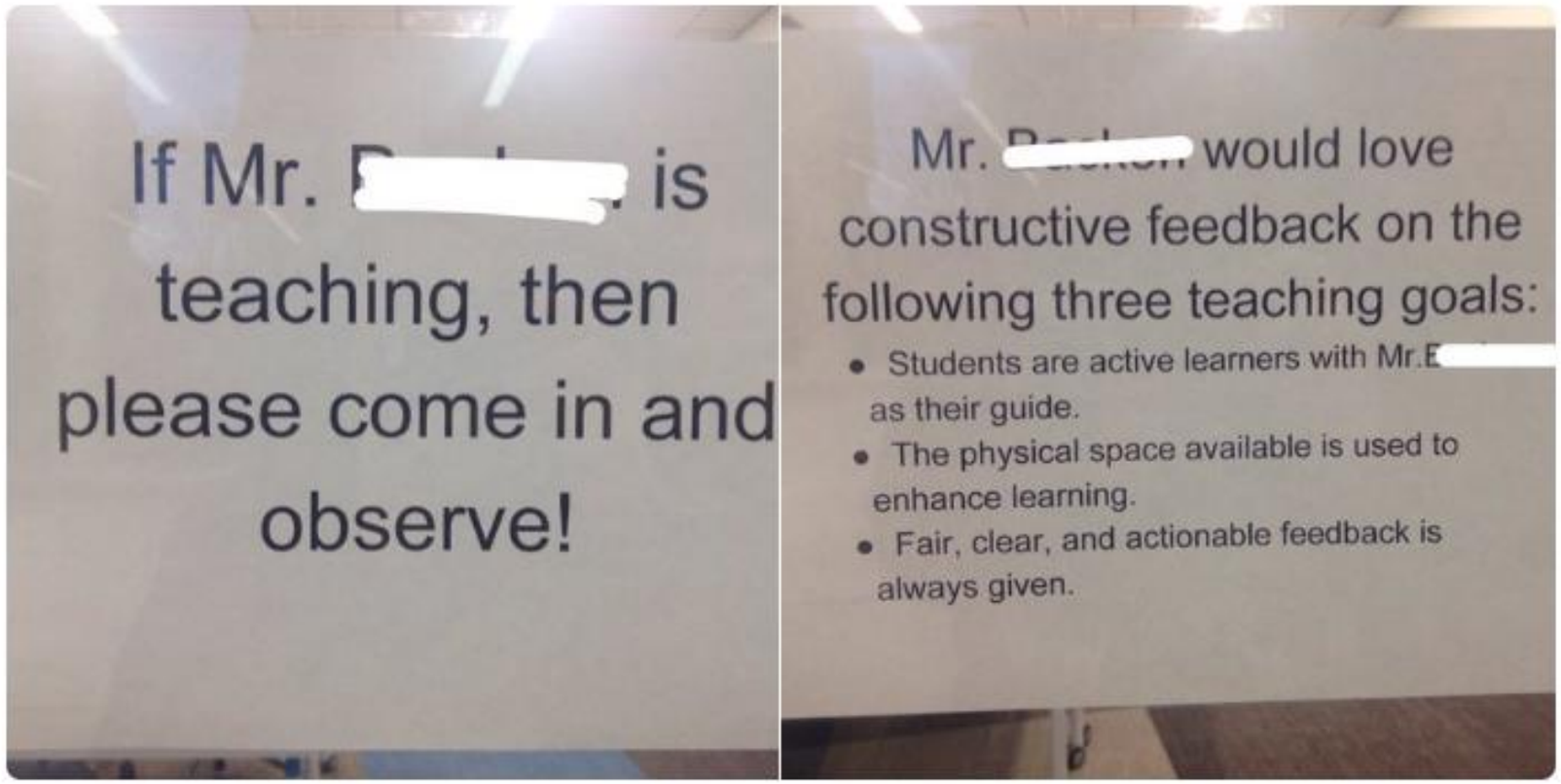
- Issue: ???
- Solution: Training
- Cause: Perspective


NON-STAGGERED
STAGGERED

Heather Kohn
@heather_kohn

Following

Found on a classroom door at St Marks... Wish more teachers were this open to feedback! #pcmiTLP



RETWEETS 181 LIKES 251

1:40 PM - 5 Dec 2015

181 251

Welcome! Please come inside and observe me. I'd love feedback on:

- How can I improve the way I set up a problem to allow students to become engaged without immediately becoming overwhelmed?
- How can I improve the questions I ask students to further the problem solving process?
- What other opportunities do you see for students getting to be the classroom thought leaders?

#ObserveMe

bit.ly/rkfeedback

Welcome! Please come inside and observe me. I'd love feedback on:

- classroom community
- student thinking
- student collaboration
- rubrics in the envelope, feel free to leave comments

#ObserveMe

Welcome! Please come inside and observe me. I'd love feedback on:

- student engagement
- formative assessment

Rubrics are on the clipboard, feel free to add comments!

#ObserveMe

Welcome! Please come inside and observe me. I'd love feedback on:

- Classroom environment
- Learner engagement
- Lesson design

#ObserveMe

Ms. Kohn – Observation Rubric

Student Engagement

II-A-2. Student Engagement	Uses instructional practices that leave most students uninvolved and/or passive participants.	Uses instructional practices that motivate and engage some students but leave others uninvolved and/or passive participants.	**Consistently uses instructional practices that are likely to motivate and engage most students during the lesson.**	Consistently uses instructional practices that typically motivate and engage most students both during the lesson and during independent work and home work. Is able to model this element.

Feedback:

Welcome! I'm Ms. Kohn and I teach STEM Honors Algebra 1 (Periods A-B-E), SEI Algebra 1 (Period C) and CP Precalculus (Period F). Please come inside and observe me. I'd love feedback on:

- Student Engagement and Collaboration
- Formative Assessment
- ELL Strategies

Rubrics can be found inside the folder, or online at bit.ly/observekohn

#ObserveMe

Welcome! My name is Ms. Rani and I teach G5 Math and Science. Please come inside and observe me. I'd love feedback on:

- Student understanding
- Student engagement
- Student interaction

Feedback Forms →

Or

#ObserveMe

Feedback Forms! Thank You


EXIT
Fanta
GRAPE

Goals

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- [x] #ObserveMe
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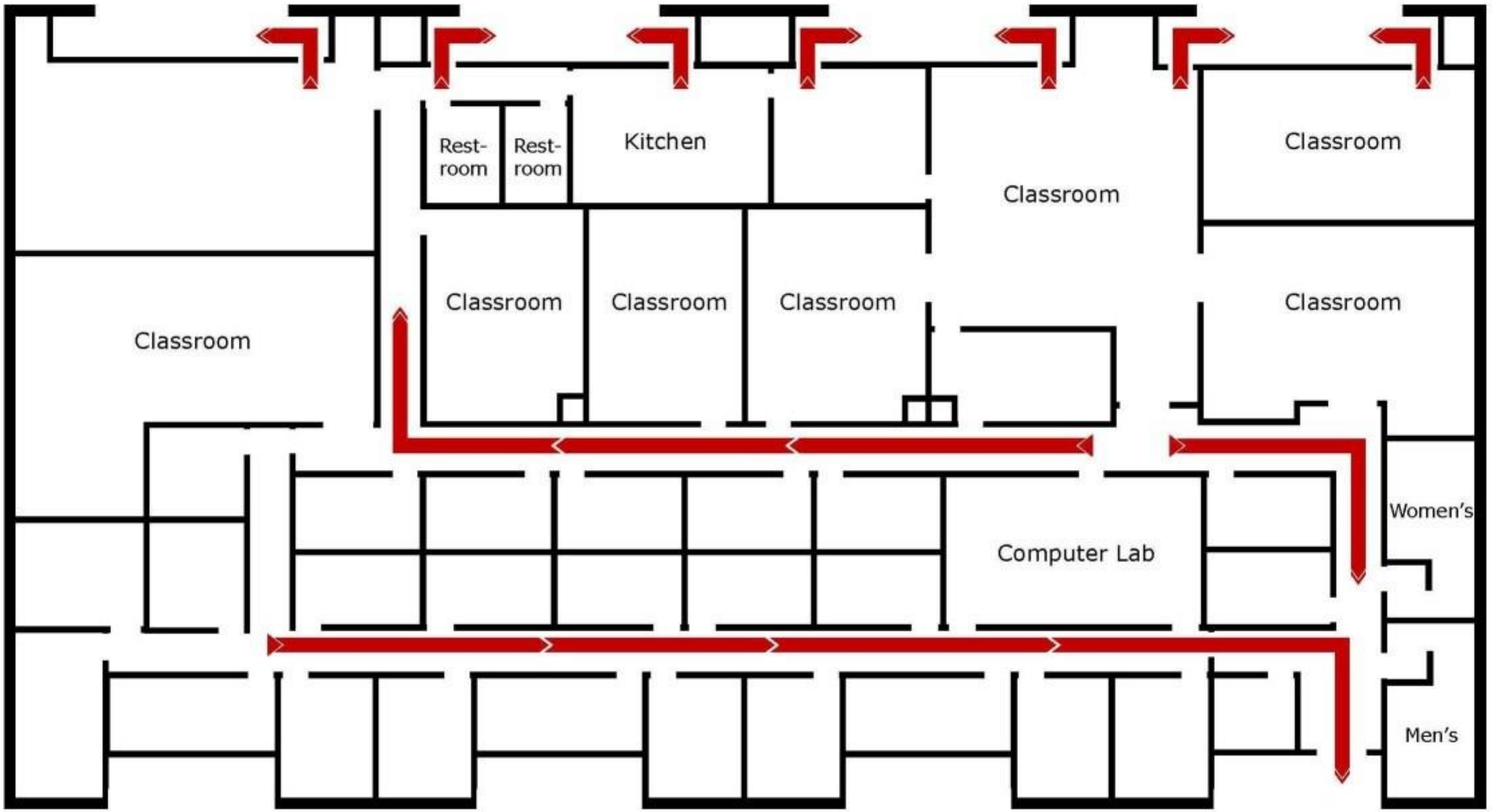
- [ ] Lesson Study
- [ ] Intellectual Autonomy
- [ ] Depth of Knowledge



55 Eureka St.
Exit Plan

Exit in case of Emergency

Goals

- [x] Change and Transition
- [x] #ObserveMe
- [x] Fire Maps vs. Fire Drills
- [ ] Lesson Study
- [ ] Intellectual Autonomy
- [ ] Depth of Knowledge

Lessons Learned from Lesson Study

- What is Lesson Study?
- Why would you want to do it?
- How does it work?
- Lessons learned
  - Source of PD ideas
  - Questioning matters

Goals

- [x] Change and Transition
- [x] #ObserveMe
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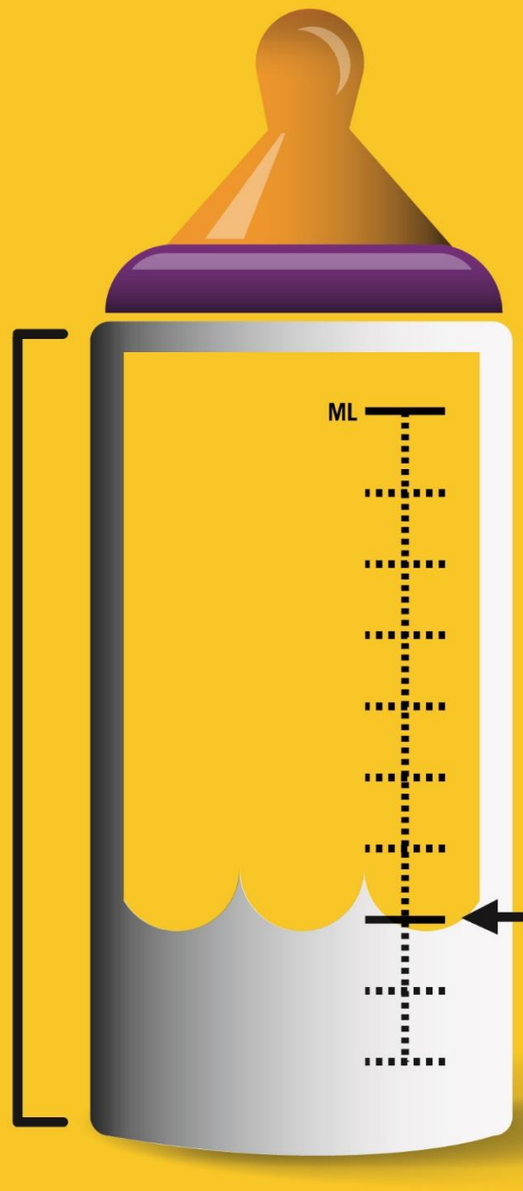
- [x] Lesson Study
- [ ] Intellectual Autonomy
- [ ] Depth of Knowledge

CHOOSE CAR SEAT:
BY AGE & SIZE

THE NUMBER OF PEOPLE **WHO THINK** THEY HAVE THEIR CHILD IN THE RIGHT SEAT.



THE ONES **WHO ACTUALLY DO.**

KNOW FOR SURE

IF YOUR CHILD IS IN THE RIGHT CAR SEAT.

VISIT SAFERCAR.GOV/THERIGHTSEAT

Ad Council

NHTSA www.nhtsa.gov

Child Car Safety

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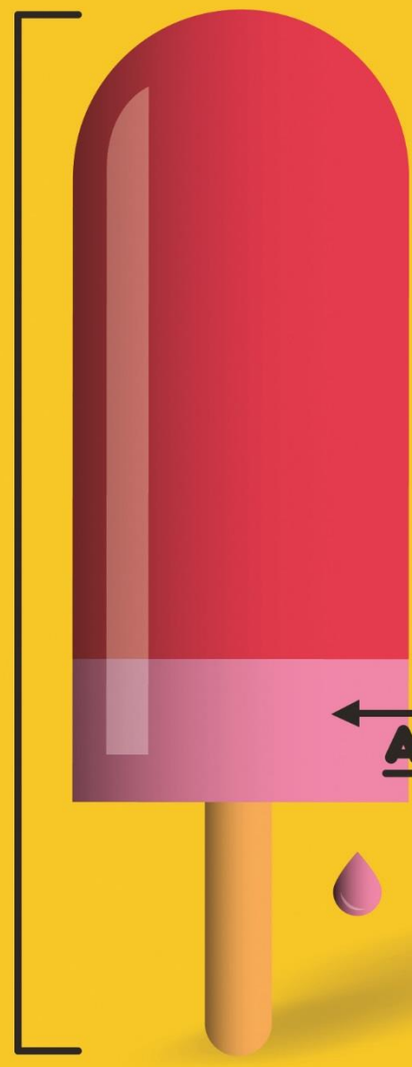

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Child Car Safety

There are 125 sheep and 5 dogs in a flock. How old is the shepherd?

Of the 32 students I interviewed…

- 75% of them gave me numerical responses
- 2 students calculated the answer to be 130 (125 + 5)
- 2 students calculated the answer to be 120 (125 – 5)
- 12 students calculated the answer to be 25 (125 ÷ 5)
- 0 students calculated the answer to be 625 (125 x 5)
- 4 students stated that they guessed their answer (90, 5, 42, and 50)
- 4 students tried to divide 125 by 5 but could not correctly implement the procedure

Takeaways

- Making sense of mathematics
- Intellectual autonomy
  - Intellectual autonomy is about being able to think for yourself and not being dependent on others for the direction and control of one's thinking.

What Does the NHTSA Say?

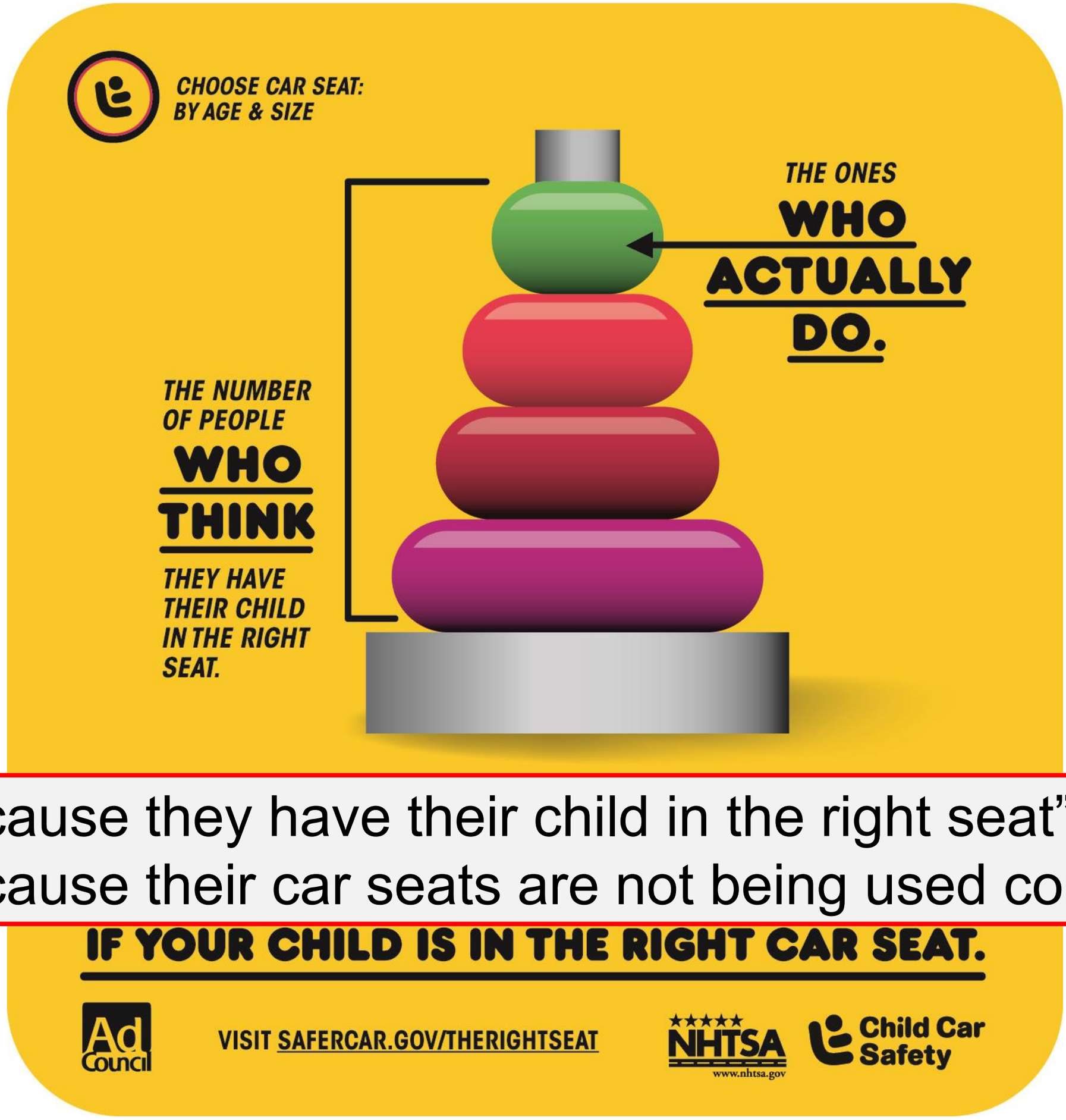
Key Statistics and Consumer Insights:

- Motor vehicle crashes are the leading cause of death for children age 1 through 12 years old.[1]

According to a NHTSA study, 3 out of 4 kids are not as secure in the car as they should be because their car seats are not being used correctly.

be reduced by about half if the correct child safety seats were always used.

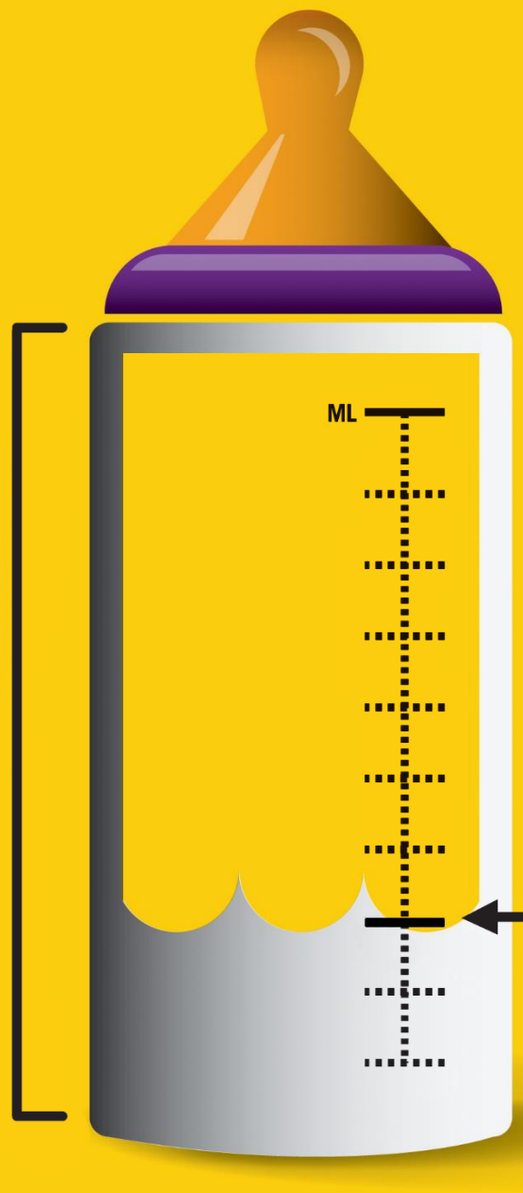
[1] Source: Based on the latest mortality data currently available from the CDC's National Center for Health Statistics.



- “because they have their child in the right seat”
- “because their car seats are not being used correctly”

CHOOSE CAR SEAT:
BY AGE & SIZE

THE NUMBER OF PEOPLE **WHO THINK** THEIR CAR SEATS ARE BEING USED CORRECTLY.



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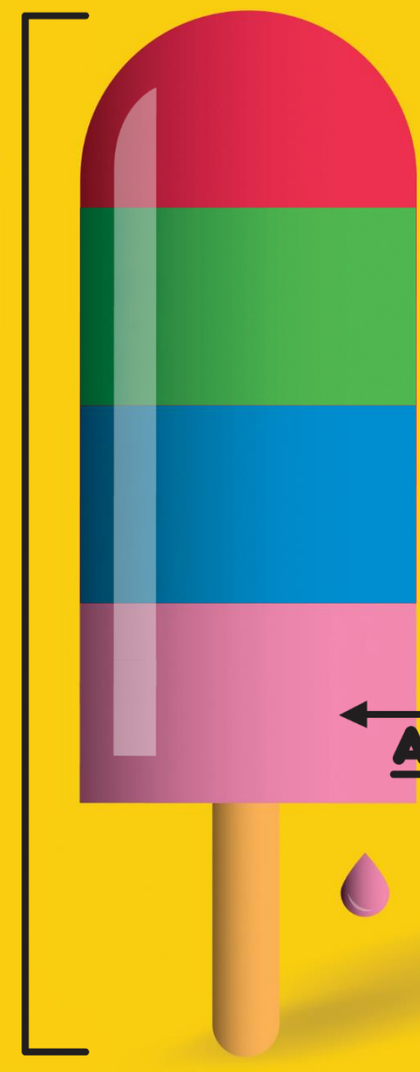

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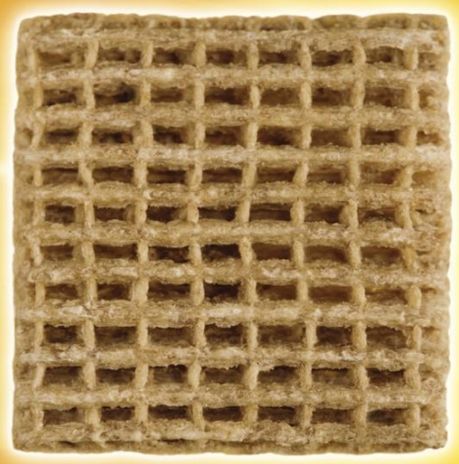

NEW

Diamond Shreddies

Cereal

OLD
(Boring)

NEW
(Exciting!)


Shreddies
SQUARE OR DIAMOND?
Vote for your Favourite at DiamondShreddies.com
Post
Diamond
Shreddies
Combo Pack
ENLARGED TO SHOW TEXTURE
Square
Diamond
Made with 100% Whole Grain Wheat
620 g Cereal
SERVING SUGGESTION
COR 114
Limited Edition
Sensible Solution
• Very High Source of Fibre
• Good Source of 8 Essential Nutrients
• Low in Fat

"Kraft Foods saw an immediate 18% increase in baseline sales of Shreddies within the first month alone, and for months thereafter."

Source: http://www.visualtargeting.com/diamondshreddies.html

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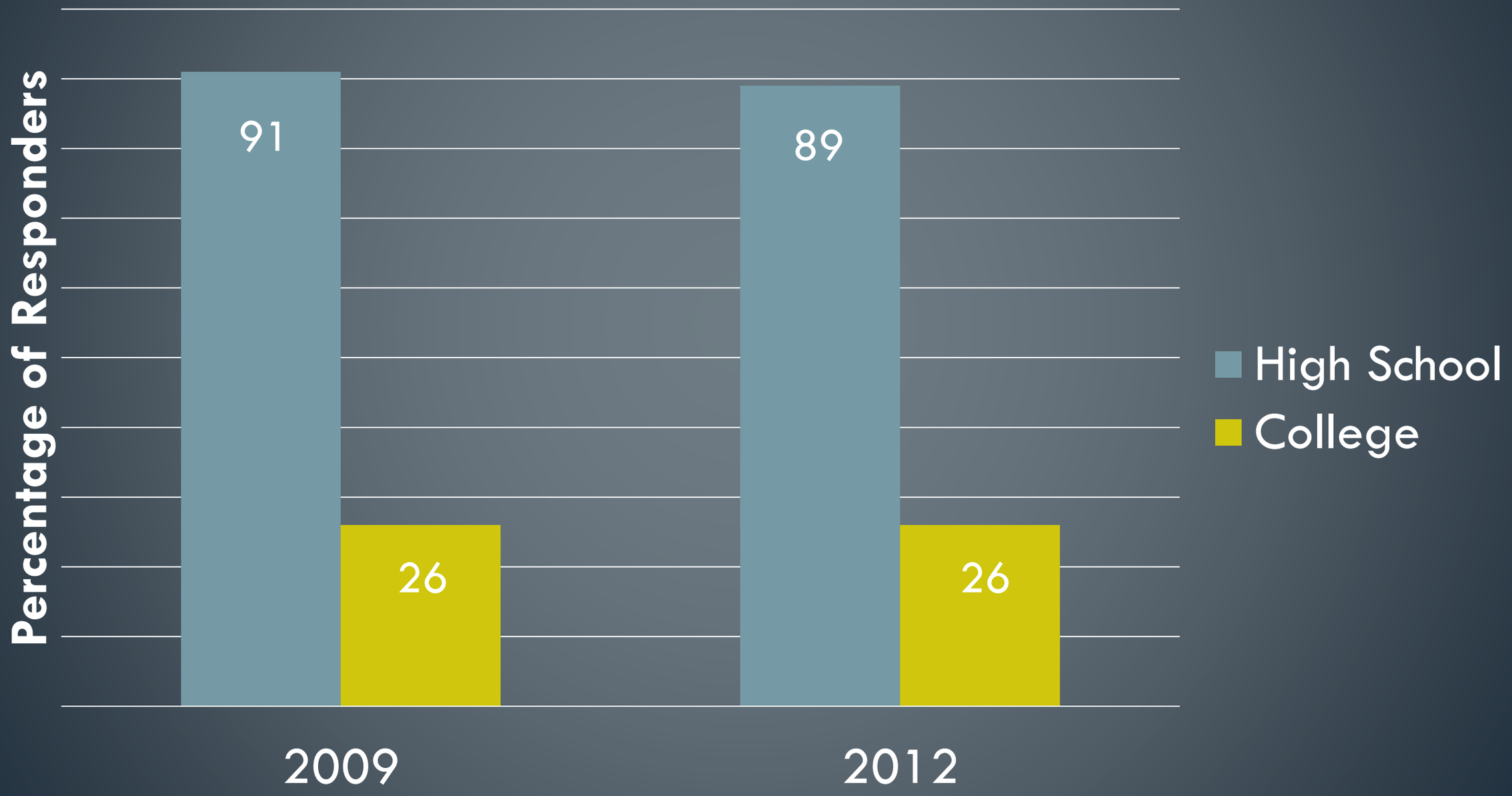
- [ ] Depth of Knowledge

WHAT IS THE PURPOSE OF A K-12 EDUCATION?

- *College readiness*
  - *ACT National Curriculum Survey*
  - *Surveyed 9,937 educators*

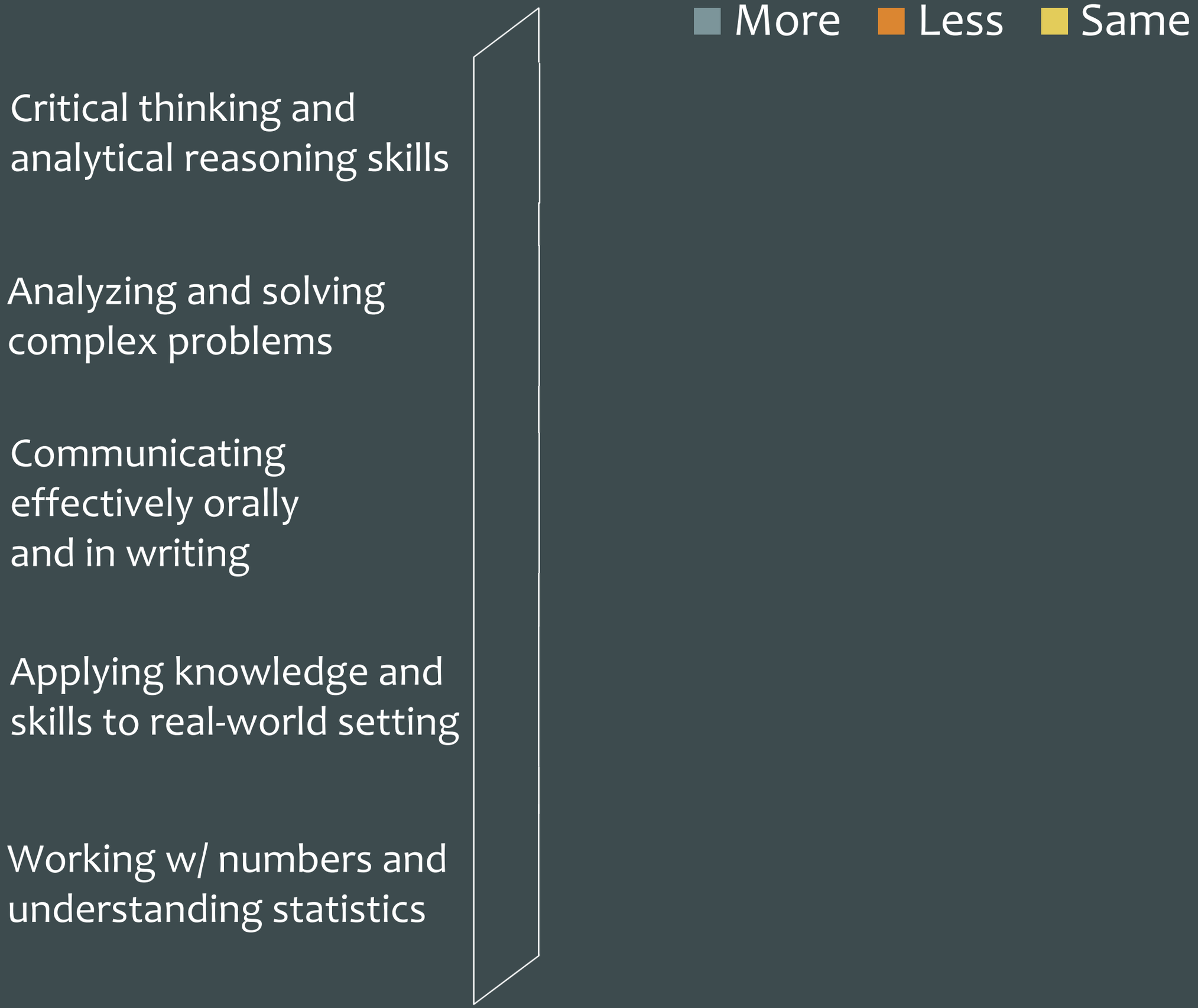
“Well” or “Very Well” Prepared for College



Source: http://www.act.org/research/policymakers/pdf/NCS-PolicySummary2012.pdf

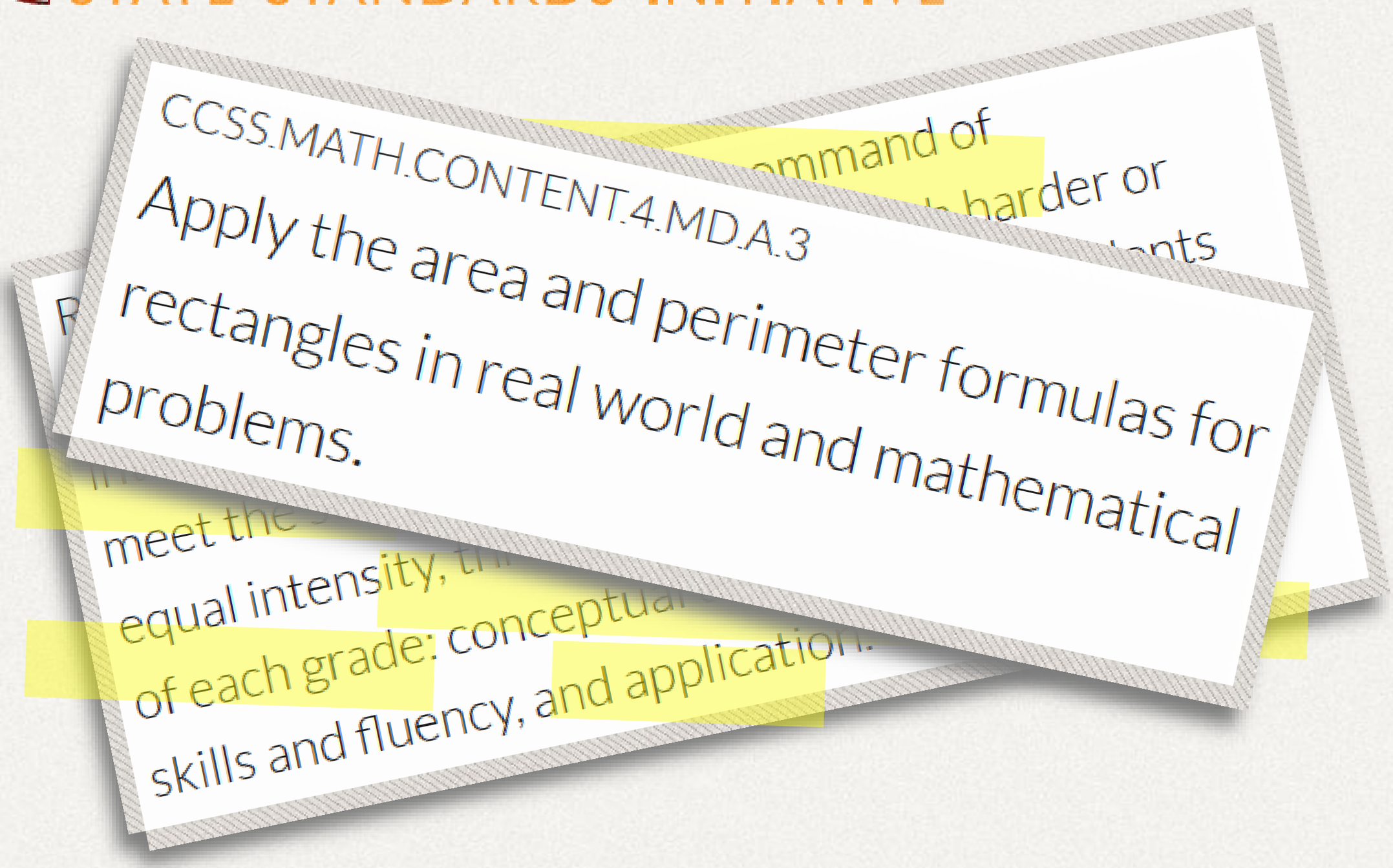
WHAT IS THE PURPOSE OF A K-12 EDUCATION?

- *College readiness*
- *Career readiness*
  - *Association of American Colleges and Universities survey*
  - *Surveyed over 300 employers with at least 25 employees and many new hires*



Source: http://www.aacu.org/leap/documents/2013_EmployerSurvey.pdf

COMMON CORE
STATE STANDARDS INITIATIVE



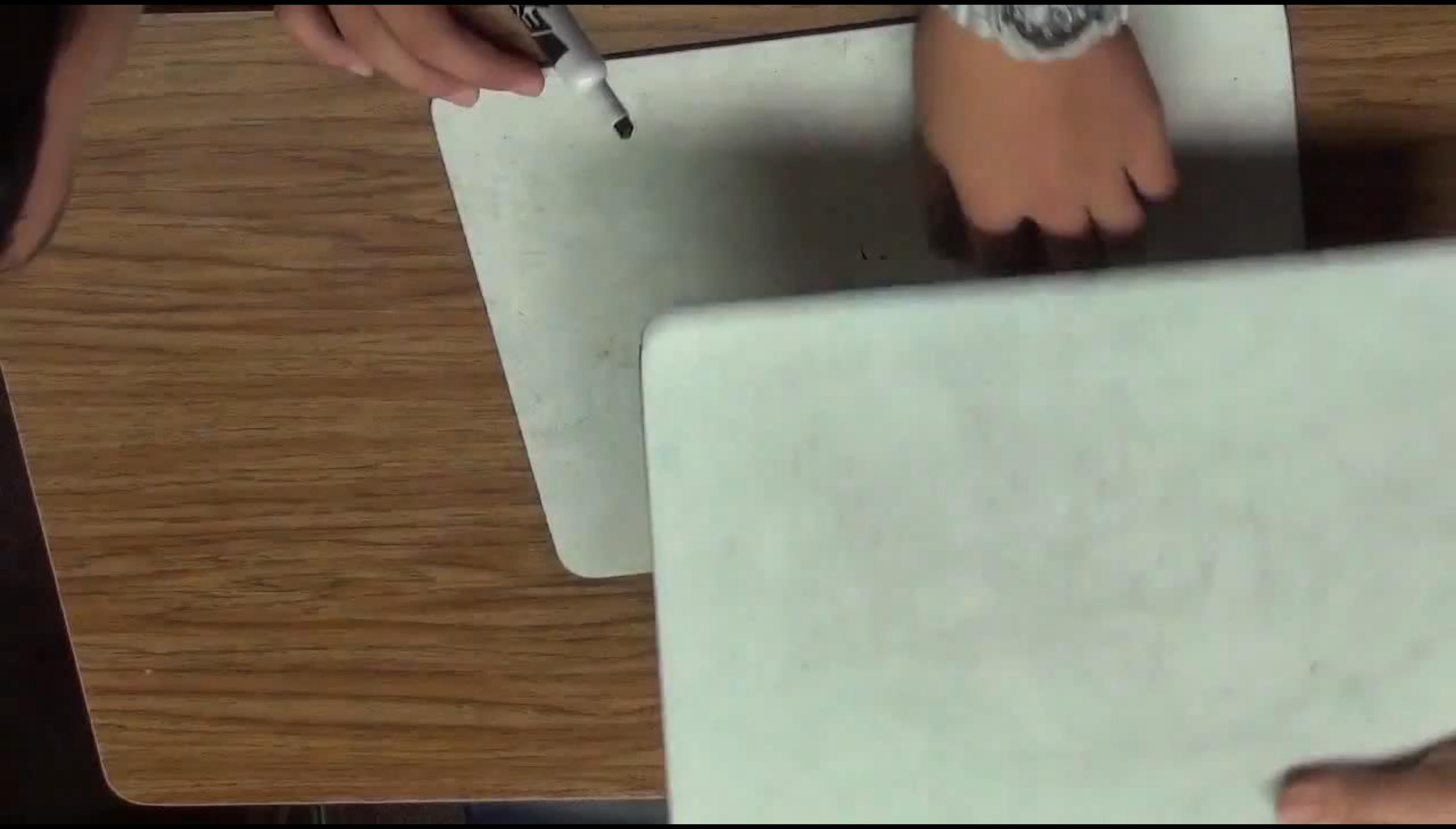
Source: http://www.corestandards.org/other-resources/key-shifts-in-mathematics/

What is the perimeter of a rectangle that measures 8 units by 4 units?

Components of Rigor

- ☑ Procedural Skill and Fluency
- ☑ Conceptual Understanding

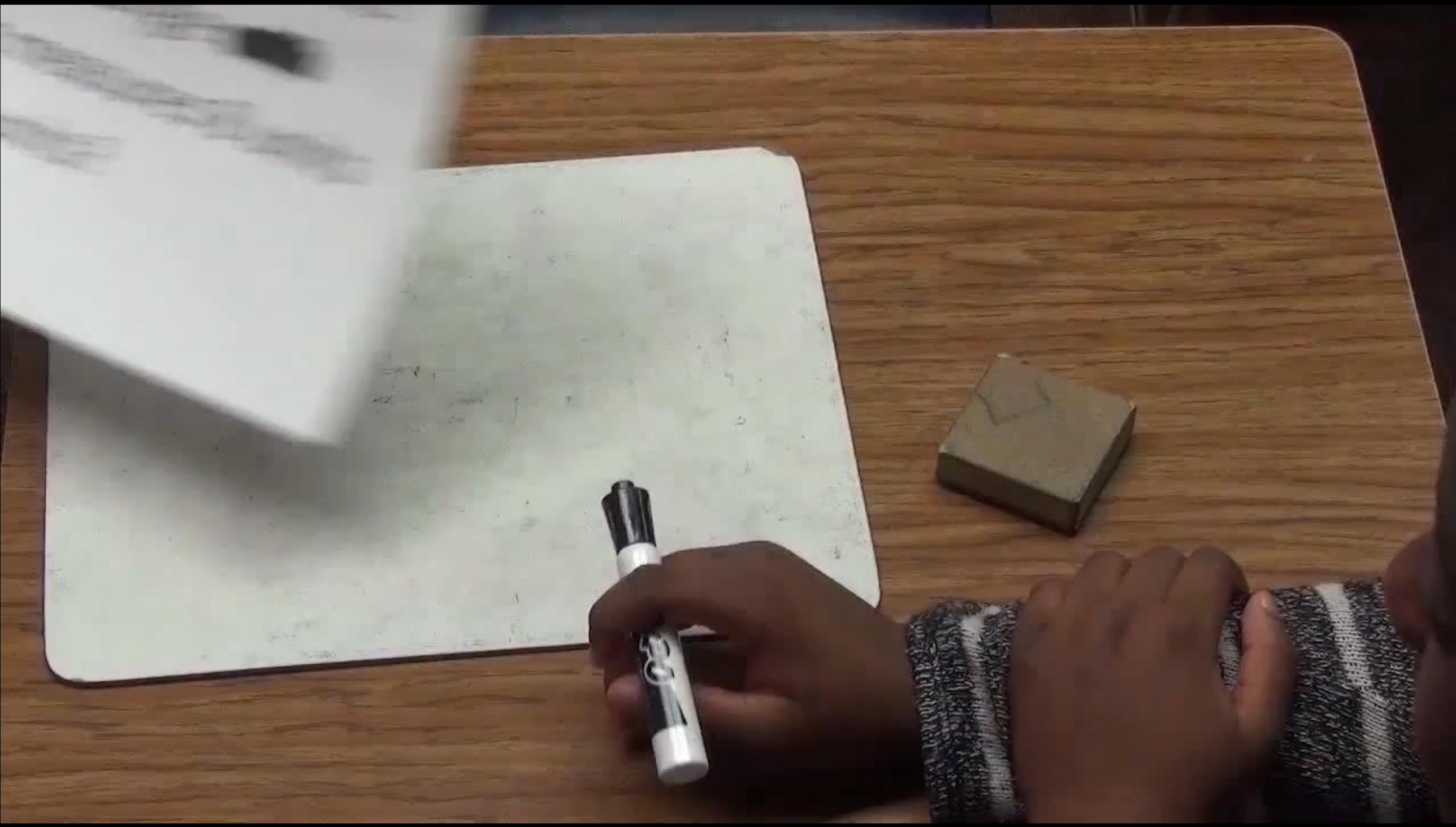
List the dimensions of a rectangle with a perimeter of 24 units.



Components of Rigor

- ☒ Procedural Skill and Fluency
- ☒ Conceptual Understanding

WHY?



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List the

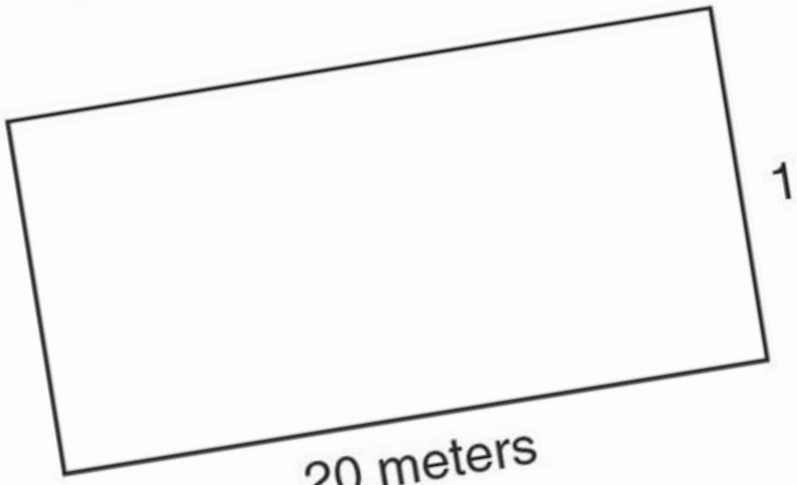
of a rectangle with a perimeter of 24 units.

Components of Rigor

- ☒ Procedural Skill and Fluency
- ☒ Conceptual Understanding

STAR

71 A basketball court is shaped like a rectangle 20 meters long and 10 meters wide.



What is the perimeter in meters of the court?

A 30 meters

B 50 meters

C 60 meters

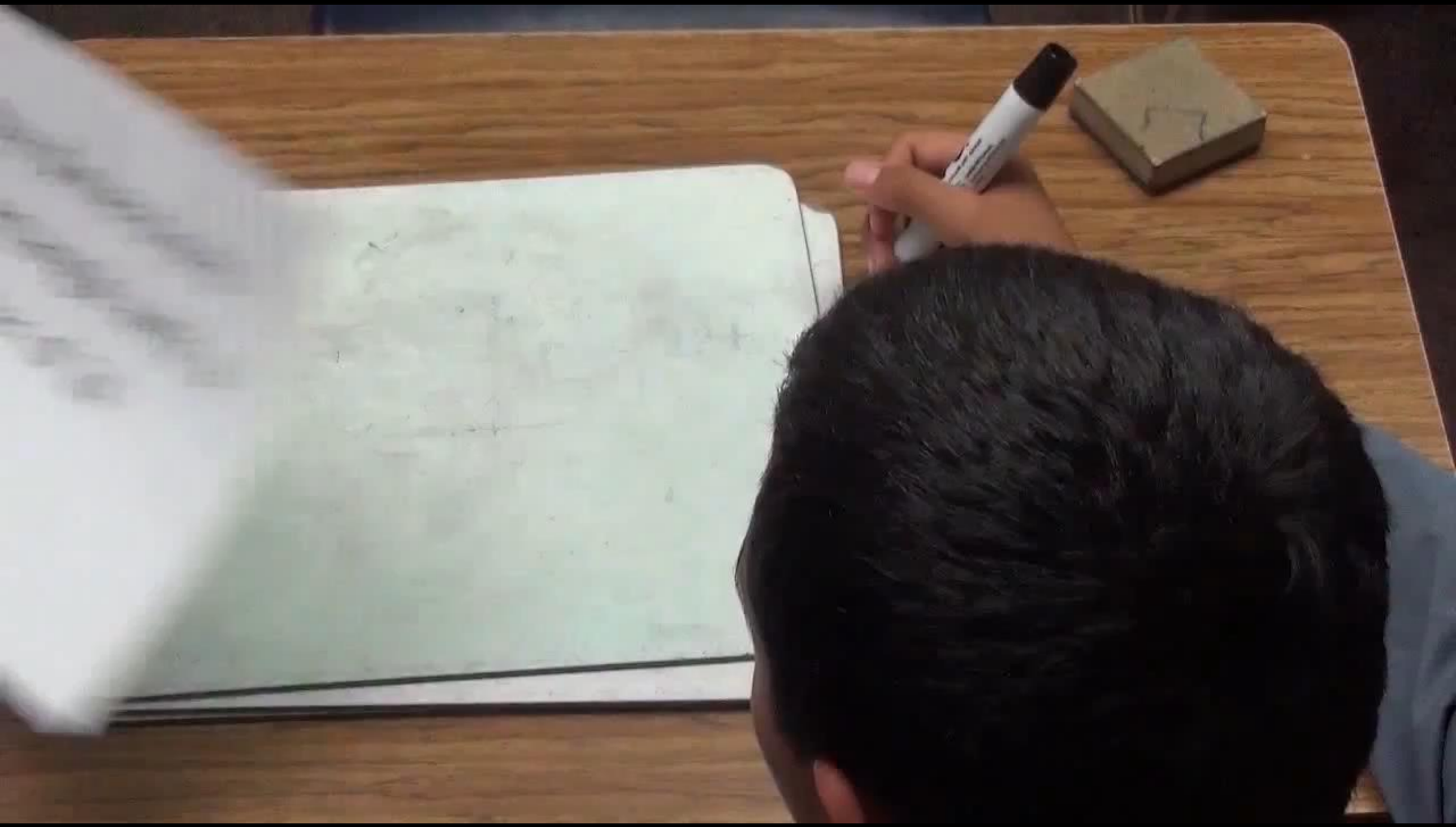
D 200 meters

Source: http://www.cde.ca.gov/ta/tg/sr/documents/cstrtqmath3.pdf

What is the perimeter of a rectangle [redacted] that measures 8 units by 4 units?

Components of Rigor

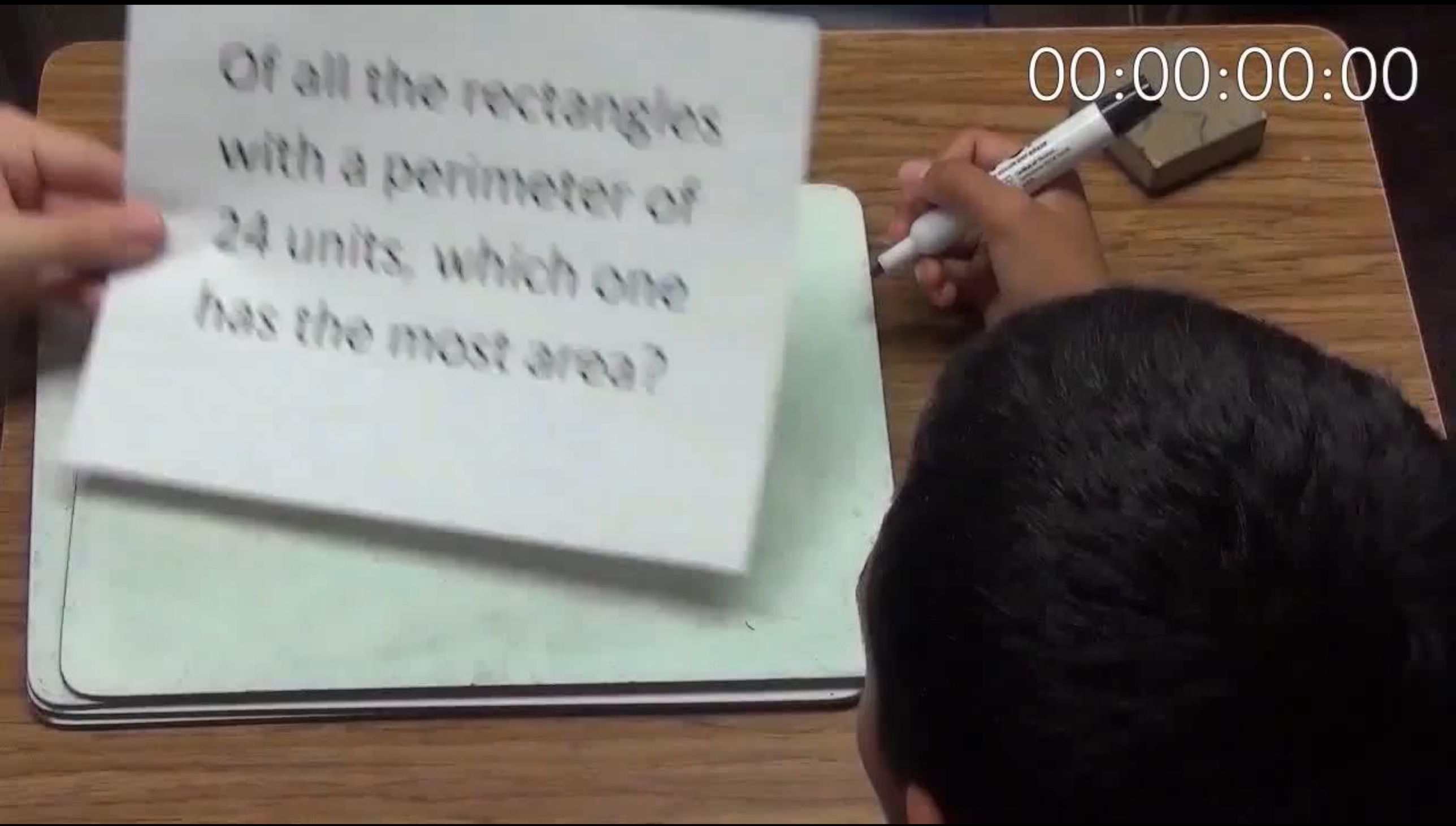
- ☑ Procedural Skill and Fluency
- ☑ Conceptual Understanding



Components of Rigor

- ☑ Procedural Skill and Fluency
- ☑ Conceptual Understanding

Of all the rectangles with a perimeter of 24 units, which one has the most area?


Of all the rectangles with a perimeter of 24 units, which one has the most area?
00:00:00:00

Components of Rigor

- ☒ Procedural Skill and Fluency
- ☒ Conceptual Understanding

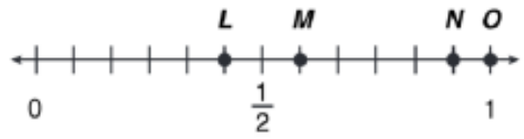
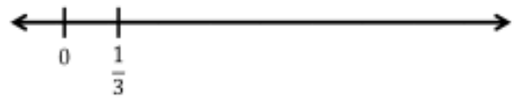
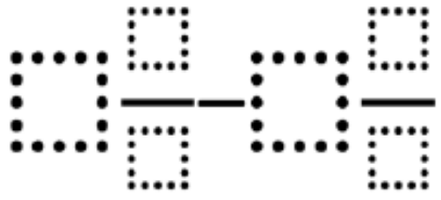
Defining the Problem

- Students appear to demonstrate "deep, authentic command of mathematical concepts" when given commonly used problems.
- However with more challenging problems, the same students seem to no longer demonstrate that command.

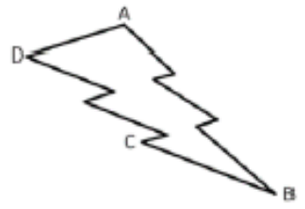
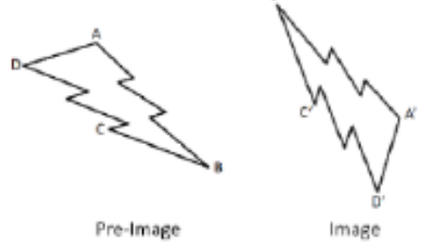
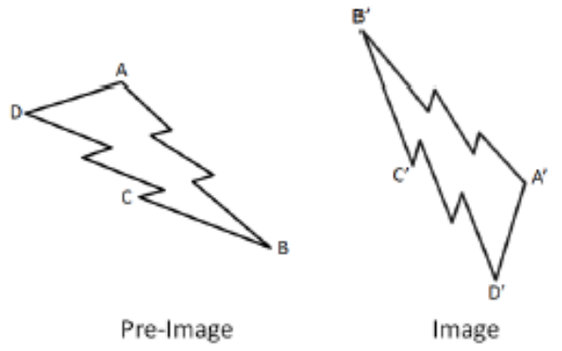
Addressing the Problem

- First, we must have a clear understanding about why these problems are different from one another.
- Next, we need to practice using these problems so that we understand how students may react to them.
- Last, we need a source that can provide us with a variety of free problems.

DOK | Distinguishing Between Depth of Knowledge Levels in Mathematics

Topic	Adding Whole Numbers	Money	Fractions on a Number Line	Area and Perimeter	Subtracting Mixed Numbers
CCSS Standard(s)	• 1.NBT.4 • 2.NBT.5	• 2.MD.8	• 3.NF.2	• 3.MD.8 • 4.MD.3	• 5.NF.1
DOK 1 Example	Find the sum. $44 + 27 =$	If you have 2 dimes and 3 pennies, how many cents do you have	Which point is located at $\frac{7}{12}$ below? 	Find the perimeter of a rectangle that measures 4 units by 8 units.	Find the difference. $5\frac{1}{2} - 4\frac{2}{3} =$
DOK 2 Example	Fill in the boxes below using the whole numbers 1 through 9, no more than one time each, so that you make a true equation. $\square\square + 53 = \square\square$	Make 47¢ in three different ways with either quarters, dimes, nickels, or pennies.	Label the point where $\frac{3}{4}$ belongs on the number line below. Be as precise as possible. 	List the measurements of three different rectangles that each has a perimeter of 20 units.	Create three different mixed numbers that will make the equation true by using the whole numbers 1 through 9, no more than one time each,. You may reuse the same whole numbers for each of the three mixed numbers. $5\frac{4}{5} - \square\frac{\square}{\square} = 3\frac{1}{20}$
DOK 3 Example	Make the largest sum by filling in the boxes below using the whole numbers 1 through 9, no more than one time each. $\square\square + \square\square =$	Make 47¢ using exactly 6 coins with either quarters, dimes, nickels, or pennies.	Create 5 fractions using the whole numbers 0 through 9, no more than one time each, as numerators and denominators and correctly place them all on a number line.	What is the greatest area you can make with a rectangle that has a perimeter of 24 units?	Make the smallest difference by filling in the boxes below using the whole numbers 1 through 9, no more than one time each. 

DOK | Distinguishing Between Depth of Knowledge Levels in Mathematics

Topic	Surface Area and Volume	Probability	Transformations	Factoring Quadratics	Quadratics in Vertex Form
CCSS Standard(s)	• 6.G.4 • 7.G.6	• 7.SP.5 • 7.SP.7	• 8.G.1 • G-CO.5	• A-SSE.3a	• F-IF.7a
DOK 1 Example	Find the surface area of a rectangular prism that measures 3 units by 4 units by 5 units.	What is the probability of rolling a sum of 5 using two 6-sided dice?	Rotate the image below 90° counterclockwise and reflect it across a horizontal line. 	Find the factors: $2x^2 + 7x + 3$	Find the roots and maximum of the quadratic equation below. $y = -3(x-4)^2 - 3$
DOK 2 Example	List the measurements of three different rectangular prisms that each has a surface area of 20 square units.	What value(s) have a 1/12 probability of being rolled as the sum of two 6-sided dice?	List three sequences of transformations that take pre-image ABCD to image A′B′C′D′.  Pre-Image Image	Fill in the blank with integers so that the quadratic expression is factorable. $x^2 + \_\_x + 4$	Create three equations for quadratics in vertex form that have roots at 3 and 5 but have different maximum and/or minimum values.
DOK 3 Example	What is the greatest volume you can make with a rectangular prism that has a surface area of 20 square units?	Fill in the blanks to complete this sentence using the whole numbers 1 through 9, no more than one time each. Rolling a sum of ___ on two ___-sided dice is the same probability as rolling a sum of ___ on two ___-sided dice.	What is the fewest number of transformations needed to take pre-image ABCD to image A′B′C′D′?  Pre-Image Image	Fill the blank by finding the largest and smallest integers that will make the quadratic expression factorable. $2x^2 + 3x + \_\_$	Create a quadratic equation with the largest maximum value using the whole numbers 1 through 9, no more than one time each. $y = -\square(x-\square)^2 + \square$

Version 1.10

Complicated or Complex?


Cookie Monster Cupcakes

method

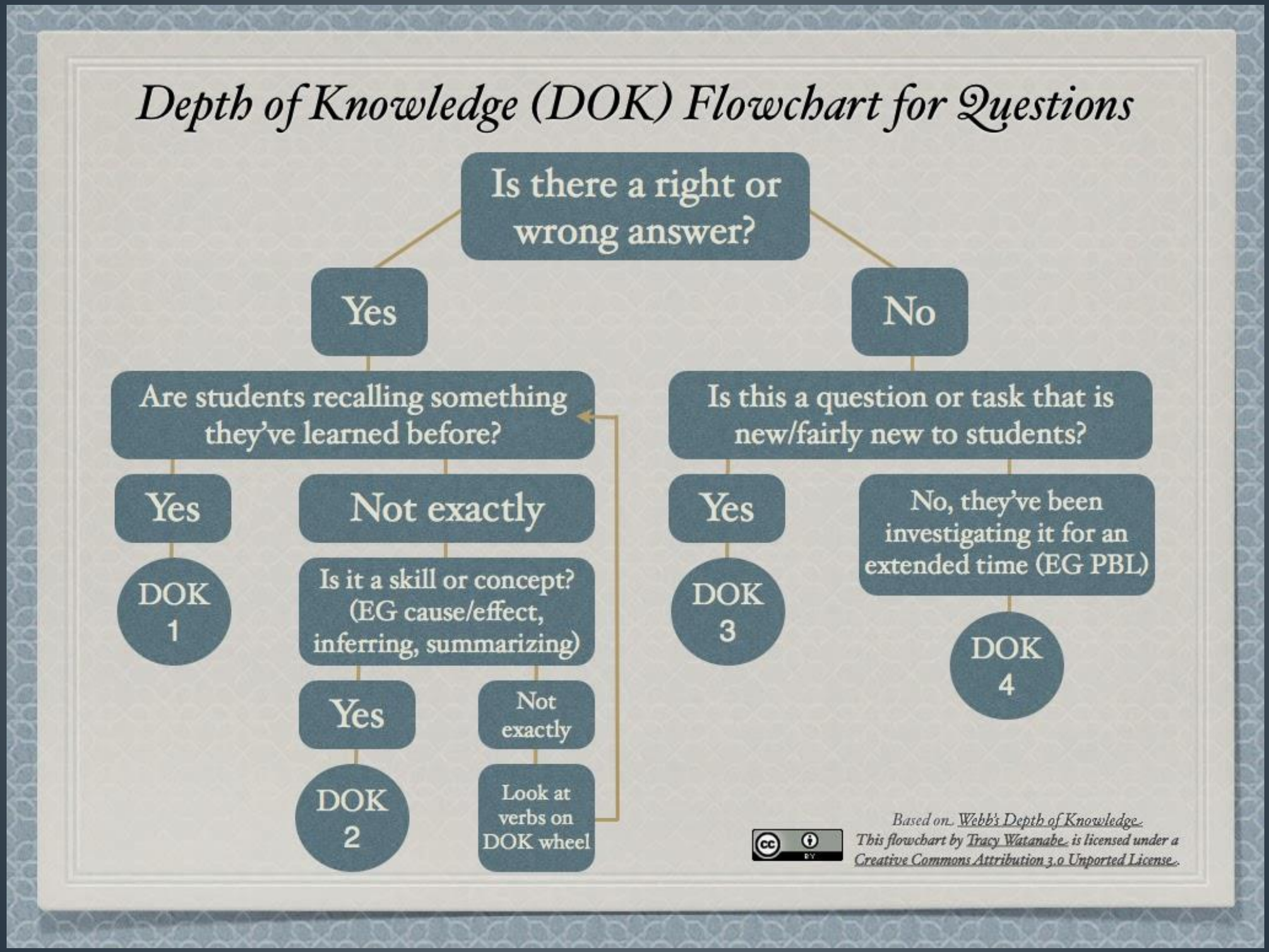
1. Using an electric mixer, whip the butter until it is pale. This will take at least 5 minutes on high.
2. Gradually add in the icing mixture and vanilla until well combined.
3. With the mixer running, add in food colouring until you get to the Cookie Monster colour. This may be a lot if you are using liquid food colouring or a little if using gel food colouring.
4. Add in the milk and mix until the frosting puffs up.
5. Fill a piping bag with a fluted nozzle and pipe on icing.
6. With the writing icing, place black spots on the marshmallows for pupils.
7. Place on each cupcake.
8. Cut cookies in half and place in 'mouth'.


Nailed it

DOK Verb Wheel

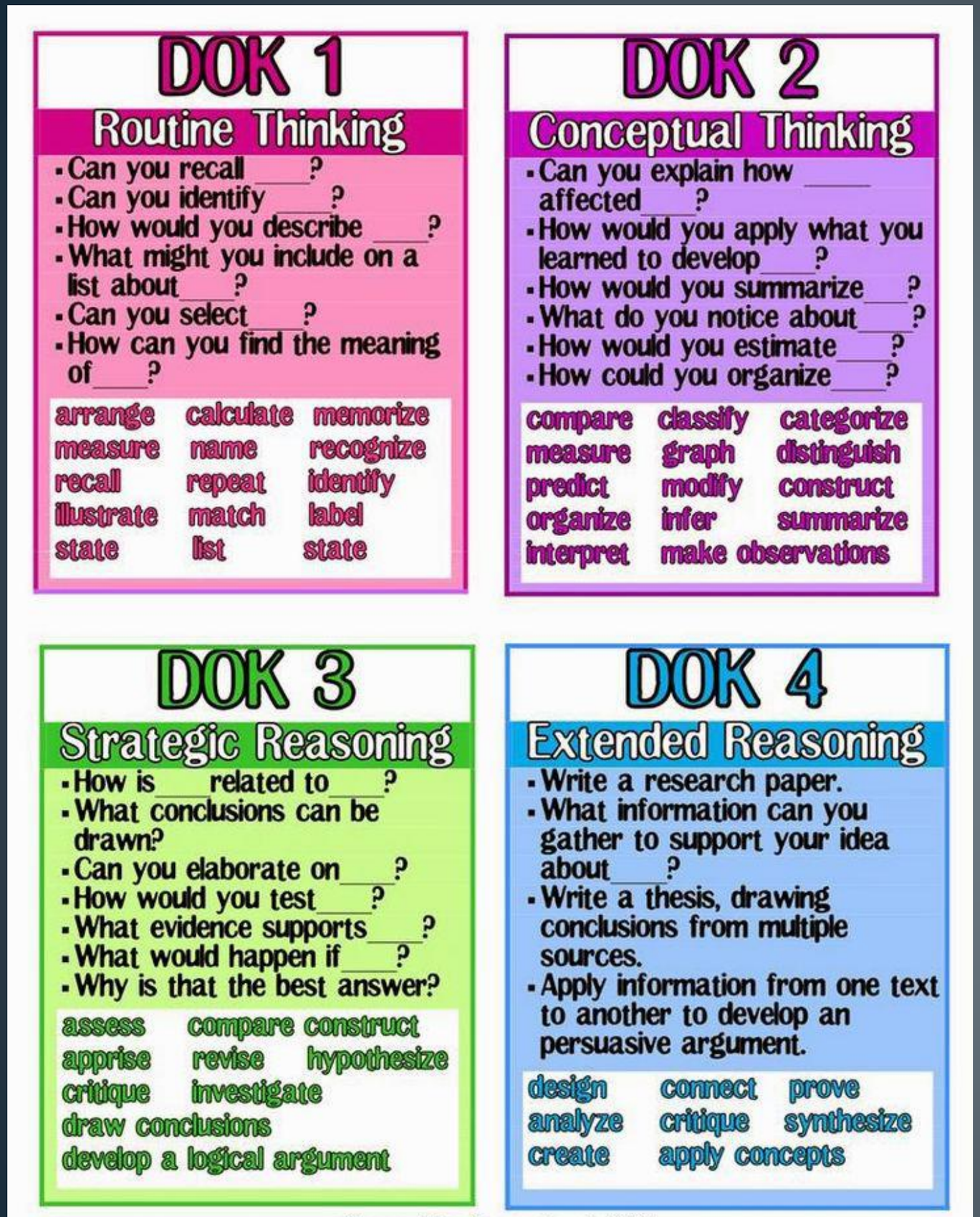
Source: Unknown

DOK Flowchart for Questions



Source: Tracy Watanabe - @tracywatanabe

DOK Posters



Source: Penny Lund
http://isntitelementary.blogspot.com/

DOK Level Differences

- **Level 1: Recall & Reproduction**
  - Often a trivial application of facts.
  - Generally requires little to no cognitive effort beyond remembering the right formula.
  - Usually only one answer.
- **Level 2: Skills & Concepts**
  - Usually requires more than one step to solve.
  - Often multiple answers.
- **Level 3: Strategic Thinking**
  - Usually requires critical thinking about the best way to approach a problem.
  - May be multiple answers or a single optimal answer.
  - Often challenging enough to make your head hurt.
- **Level 4: Extended Thinking**
  - In mathematics these are generally represented by performance tasks or problem-based lessons.

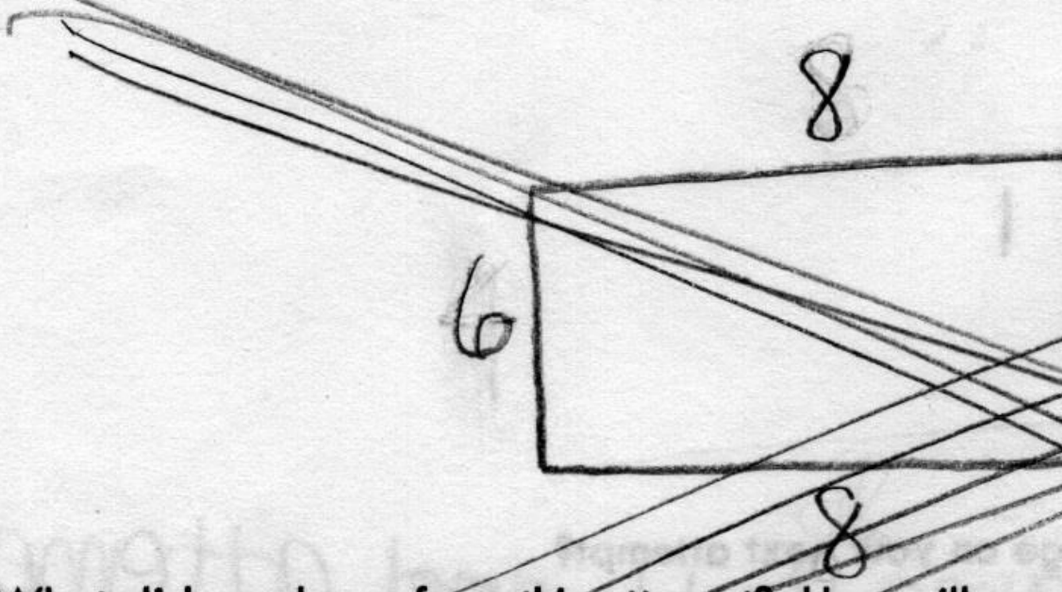
Adding Decimals

Use the numbers 1 through 9, exactly one time each, to fill in the boxes and make three decimals whose sum is as close to 1 as possible.

$$\begin{array}{r} 0.\square\square\square \\ +\,0.\square\square\square \\ \hline \end{array}$$

First attempt:

Points: ____/2 attempt ____/2 explanation



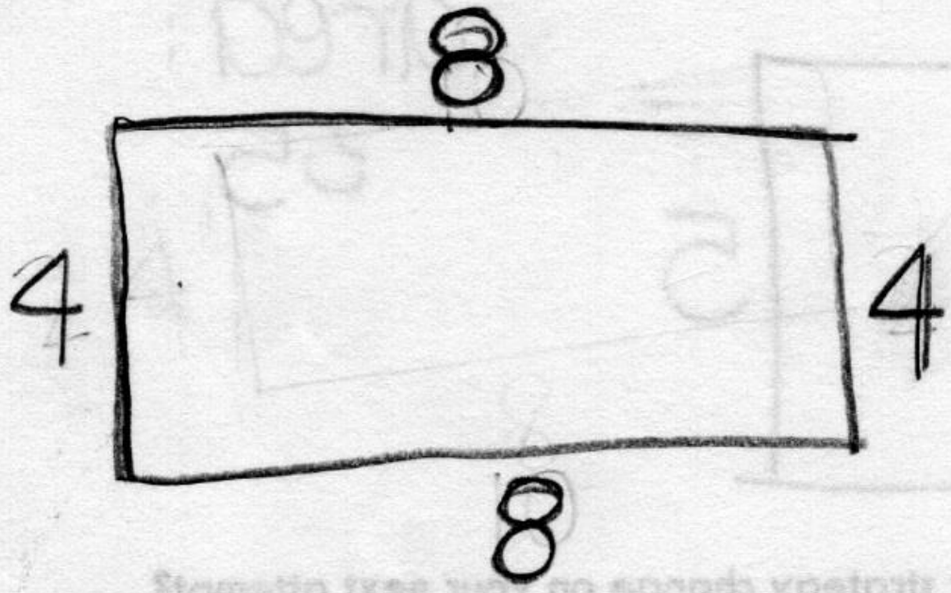
area:
48

What did you learn from this attempt? How will your strategy change on your next attempt?

This attempt doesn't equal 24.

Second attempt:

Points: ____/2 attempt ____/2 explanation



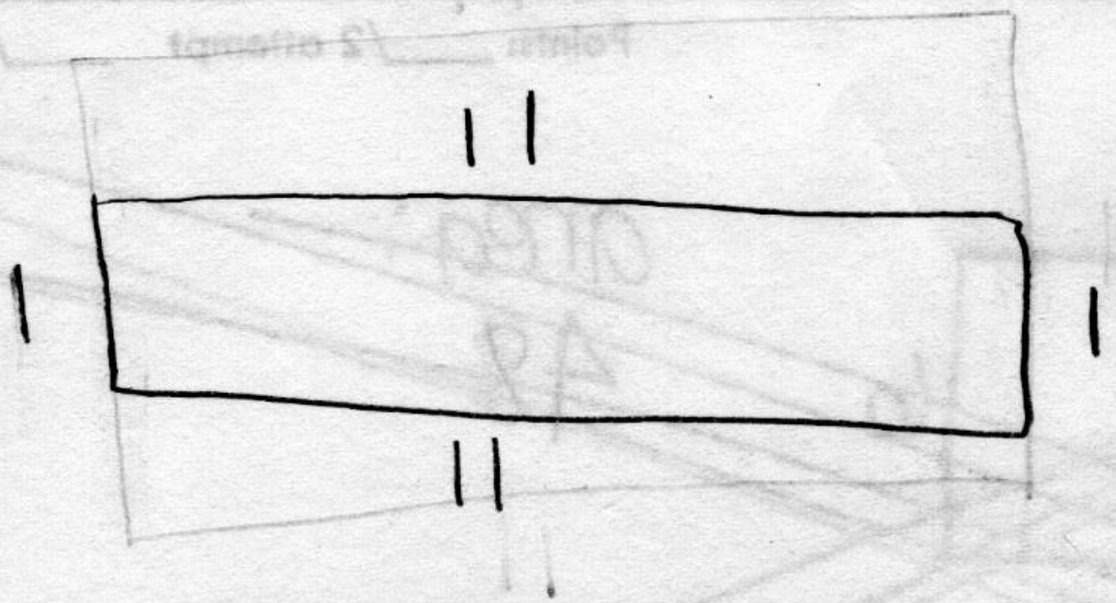
area:
32

What did you learn from this attempt? How will your strategy change on your next attempt?

The perimeter was 24, and the area was 32 but I think there's a bigger #

Fourth attempt:

Points: ____/2 attempt ____/2 explanation

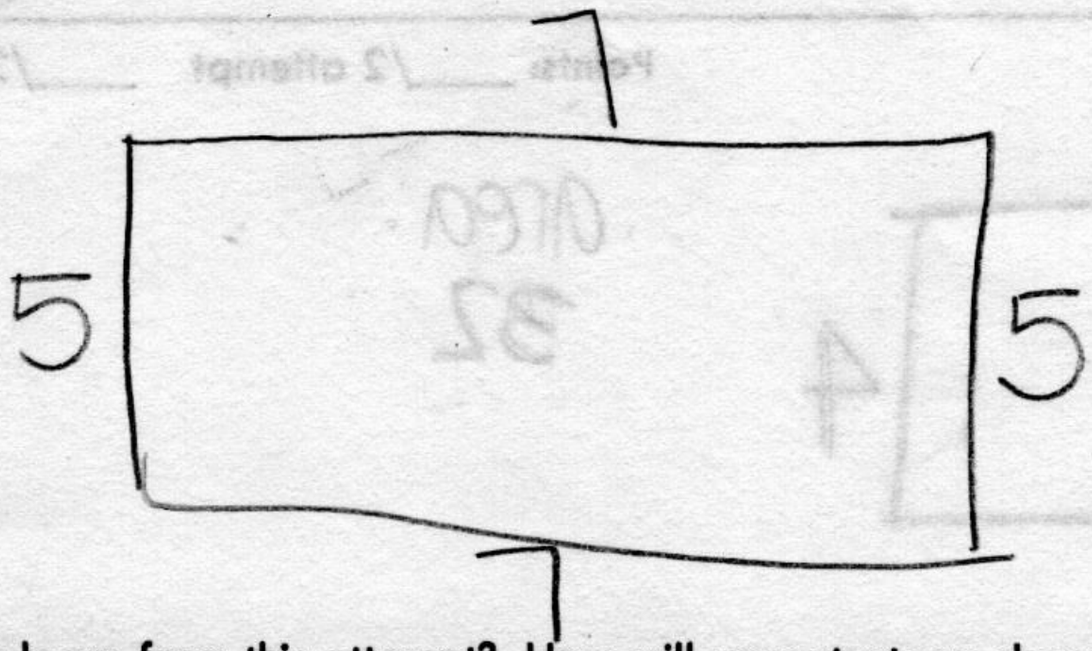


What did you learn from this attempt? How will your strategy change on your next attempt?

The perimeter is 24, but the area is 11 and attempt #2 the area is 32
Strategy: Use #'s with more than one raw.

Fifth attempt:

Points: ____/2 attempt ____/2 explanation



area:
35

What did you learn from this attempt? How will your strategy change on your next attempt?

Goals

- ☑ Change and Transition
- ☑ #ObserveMe
- ☑ Fire Maps vs. Fire Drills
- ☑ Lesson Study
- ☑ Intellectual Autonomy
- ☑ Depth of Knowledge

WHAT DOES IT LOOK LIKE…

- when students **can** work with numbers but **cannot**:
  - critically think
  - analyze and solve complex problems
  - applying knowledge and skills to real-world settings

How far apart are the exits on this freeway: Jct 90 and Jefferson Blvd?

$$1\frac{1}{2} - 1\frac{1}{4}$$

$$1\frac{1}{2} - 1\frac{1}{4}$$

Contact

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@robertkaplinsky.com/mesd

Multnomah Education Service District

ROBERT KAPLINSKY

@robertkaplinsky

DOUBLE-DOUBLE® *Double Meat & Double Cheese* 2.65

CHEESEBURGER 1.75

HAMBURGER 1.50

FRENCH FRIES 1.05

SHAKES *Chocolate Strawberry Vanilla* 1.55

SM	MED	LG	X-LG
99	1.10	1.29	1.49

COKE *Classic or Diet*
SEVEN-UP
ROOT BEER
DR PEPPER
LEMONADE
ICED TEA

MILK 70
COFFEE 70

IN-N-OUT BURGER

OPEN 10:30 a.m. to 1:00 a.m.
.....Fri. and Sat. until 1:30 a.m.

2004-10-31

8:21 PM

YOUR GUEST NUMBER IS
98

IN-N-OUT BURGER LAS VEGAS EASTERN
2004-10-31 8:21 PM

165 1 5 98

Cashier: SAM
GUEST #: 98

Counter-Eat In

Dbl Dbl	
98 Meat Pty XChz	2.65
	88.20
Counter-Eat In	90.85
TAX 7.50%	6.81
Amount Due	97.66
CASH TENDER	$97.66
Change	$.00

2004-10-31

Cashier: SAM
GUEST #: 98

Counter-Eat In

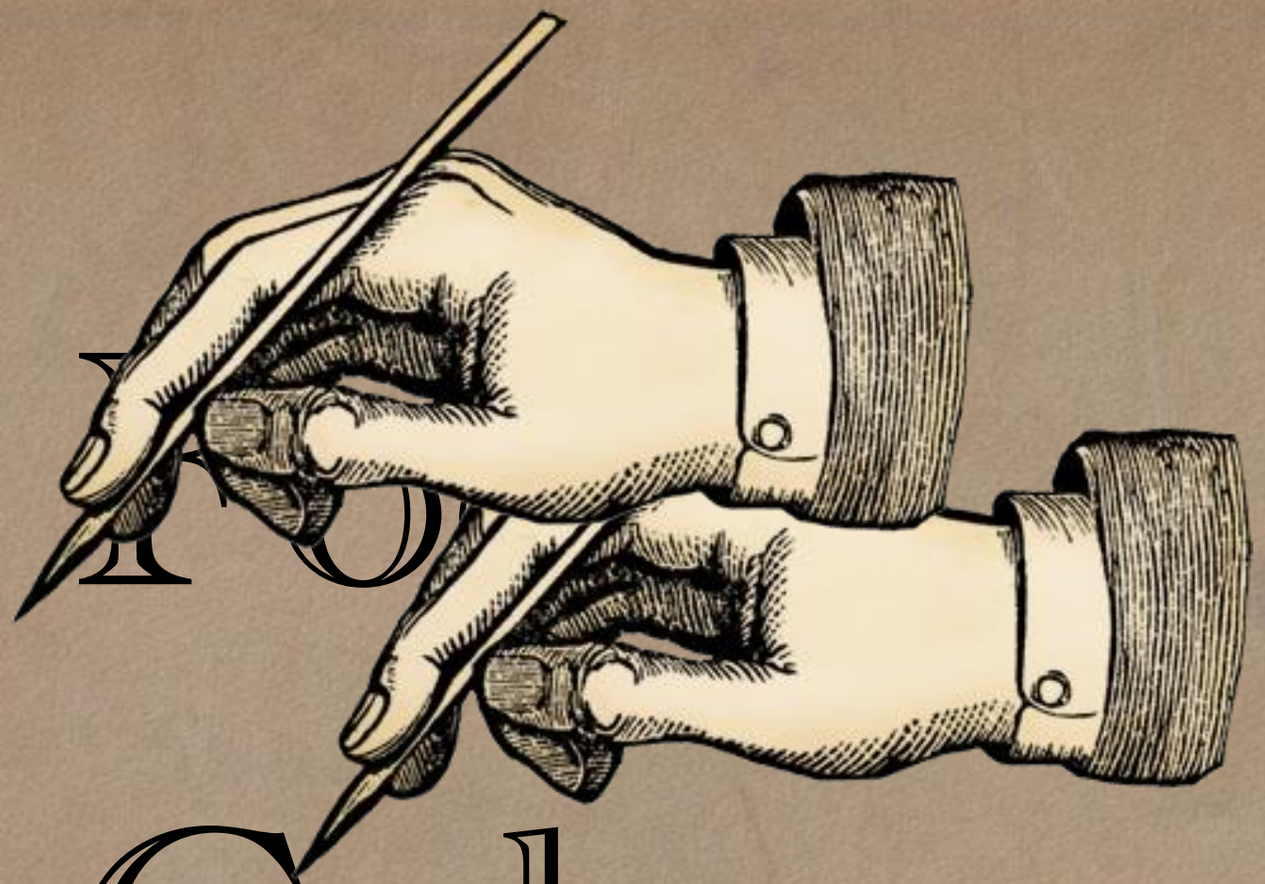
Db1Db1	
98 Meat Pty XChz	2.65
	88.20
Counter-Eat In	
TAX 7.50%	90.85
Amount Due	6.81
	97.66
CASH TENDER	
Change	$97.66
	$.00

2004-10-31

8:21 PM

	Serving Size (g)	Calories
Hamburger w/Onion	243	390
Cheeseburger w/Onion	268	480
Double-Double w/Onion	330	670

- Focus
- Coherence
- Rigor

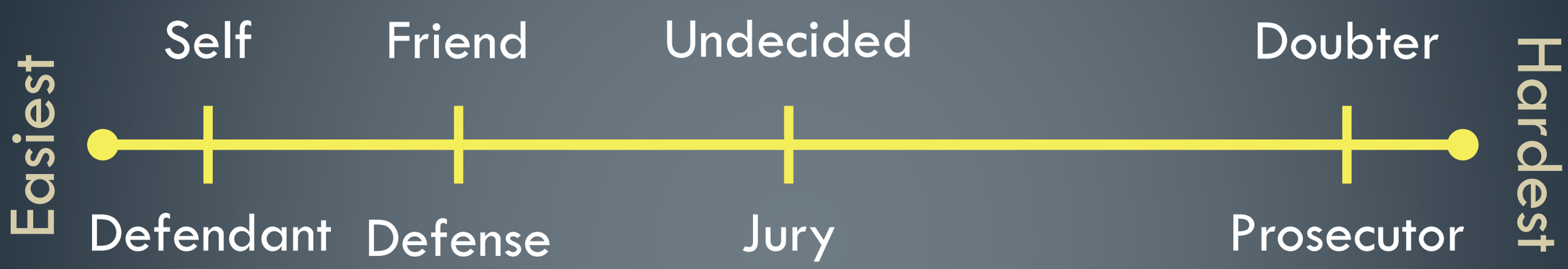


Layers	Cost
1	$1.75
2	$2.65
3	$3.55
4	$4.45
.	.
.	.
20	$18.85
.	.
.	.
100	$90.85
.	.
.	.
N	$1.75 + (N-1)*$0.90

Standards for Mathematical Practice

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.

Levels of Convincing



Construct a viable argument

Critique the reasoning of others

Inspired by *Connecting Mathematical Ideas* by Jo Boaler and Cathy Humphreys

bun + produce + meat + cheese + meat + cheese = $2.65

bun + produce + meat + cheese = $1.75

meat + cheese = $0.90

The Reality

- Students needed guidance to figure out a layer's cost
- Not every class is ready to go straight to 100x100
- Common wrong answers included:
  - $175.00 ($1.75 x 100 cheeseburgers)
  - $132.50 ($2.65 x 50 Double-Doubles)
- Students had equations that had more than X patties
- Students were surprised to see three different equations:
  - Starting with a Double-Double
  - Starting with a cheeseburger
  - Starting with produce and bun only

STUDENT WORK

What problem are you trying to figure out?

How much does a 100×100 burger cost?

What do you already know from the problem?	What do you need to know to solve the problem?
• theres 100 beef patties	• How much does a regular cheeseburger cost.

What is your conclusion?

To get the answer, I first figured out what the price of a regular & double-double cheeseburgers are. From there I subtracted the price of the produce & buns, then multiplyed by 100. That gave me the answer, which I once again had to add the price of the buns & produce.

What is your conclusion?

The only difference between a double double and a cheeseburger is one patty and one slice of cheese. So you subtract the prices of the two to find the price of only one patty & cheese. You then use that number (.90) & subtract it from the cost of one whole cheeseburger to find the price of all the extra stuff. Multiply by 100

What is your conclusion?

A 100×100 at In-n-Out cost $90.85. To solve that, you start by subtracting the price of a cheeseburger from a double double. The answer (.90) is the price of a patty and cheese slice. You multiply (.90) by one less patty than what you want. (x-1), and you add the price of a cheeseburger (1.75). You end up with the eq. [$y = .90(x-1)+1.75$.]. For the 100×100, you plug in 100 to the (x) and you end up with $90.85.

$$\begin{aligned} y &= .90(100-1)+1.75 \\ y &= 89.10+1.75 \\ y &= 90.85 \end{aligned}$$

What is your conclusion?

Figure the price difference from the Double-Double with a cheeseburger. Then find out the prize for the produce and cheese-beef. get total into $90.85


ALTO

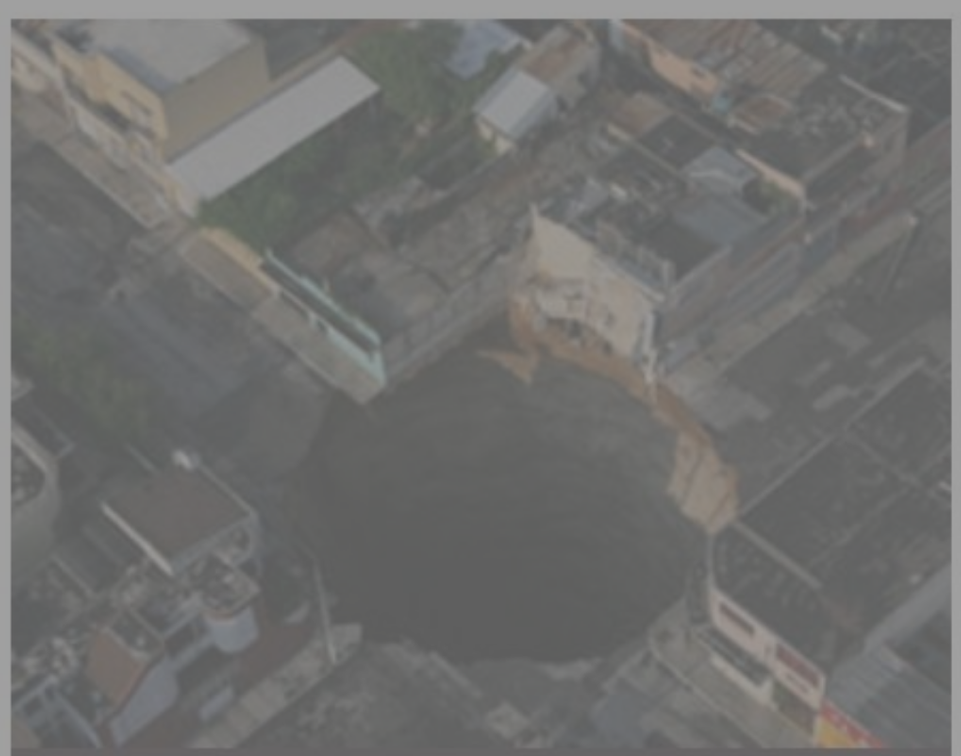
Sinkhole Dimensions

- Slate: “A sinkhole, 65 feet across and 100 feet deep”

How To Fix a Giant Sinkhole

The cement method vs. the graded-filter technique.

By Brian Palmer



A sinkhole in Guatamala

It's not clear whether cement is the best option, however. A 6,500-cubic-foot wad of concrete may serve to concentrate water runoff in other areas, leading to more sinkholes. Many engineers prefer the **graded-filter technique**, in which the hole is filled with a layer of boulders, then a layer of smaller rocks, and, finally, a layer of gravel. This fills the hole, more or less, while permitting water to drain through the area.

2010 Guatemalan Sinkhole - Google Chrome

Reply Reply All Forward

2010 Guatemalan Sinkhole

Kaplinsky, Robert

To: [redacted]

Wednesday, February 06, 2013 1:39 PM

Hi Brian,

I am using your "How to Fix a Giant Sinkhole" article for a math lesson on volume of a cylinder. I have one question for you. You mentioned.

> "It's not clear whether cement is the best option, however. A 6,500-cubic-foot wad of concrete may serve to concentrate water runoff in other areas, leading to more sinkholes."

Can you please tell me where you got 6500 cubic feet from? Did you do 65 x 100? We get something closer to 342,000 cubic feet.

Thanks,
Robert

Re: 2010 Guatemalan Sinkhole - Google Chrome

Reply Reply All Forward

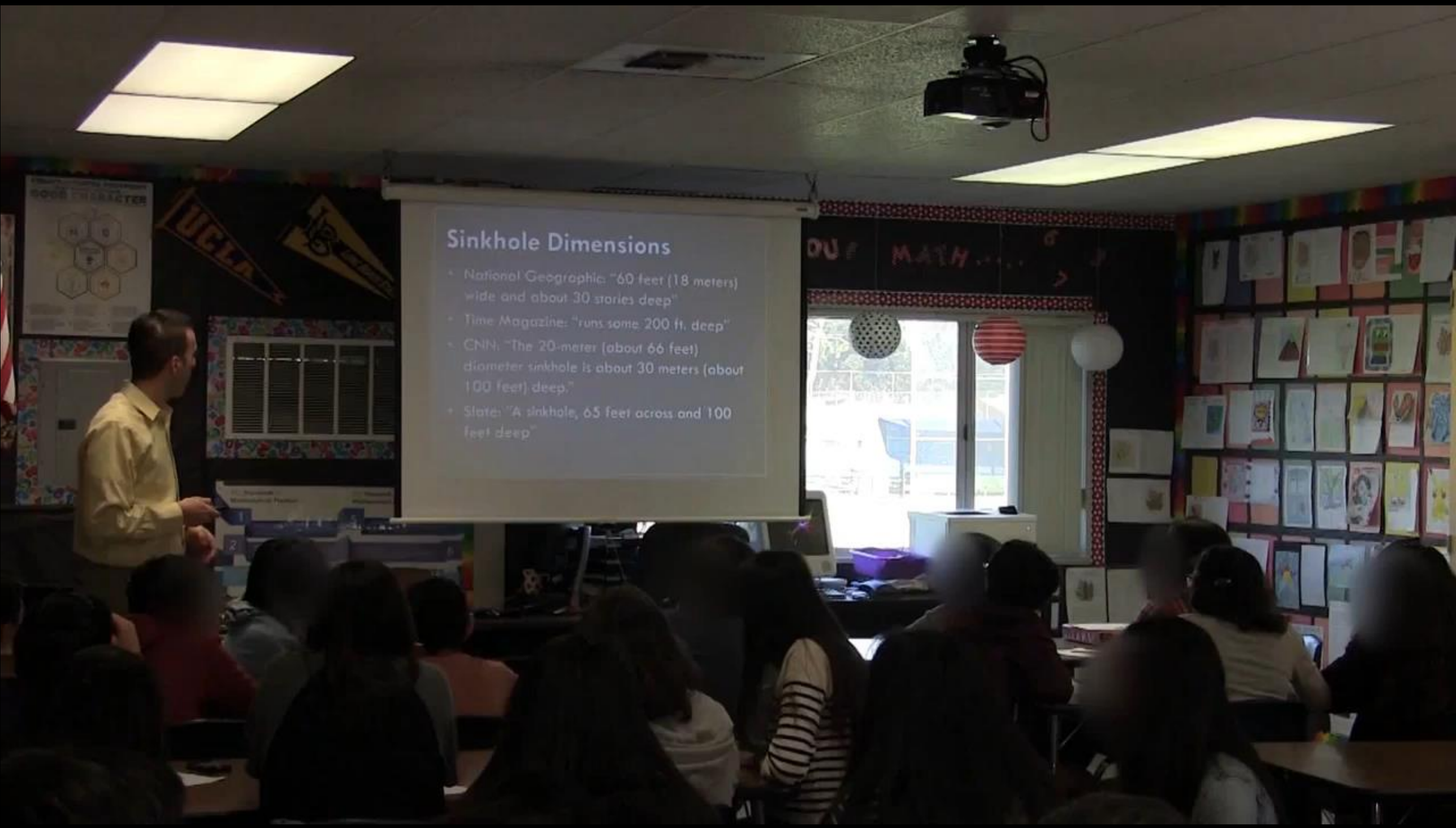
Re: 2010 Guatemalan Sinkhole

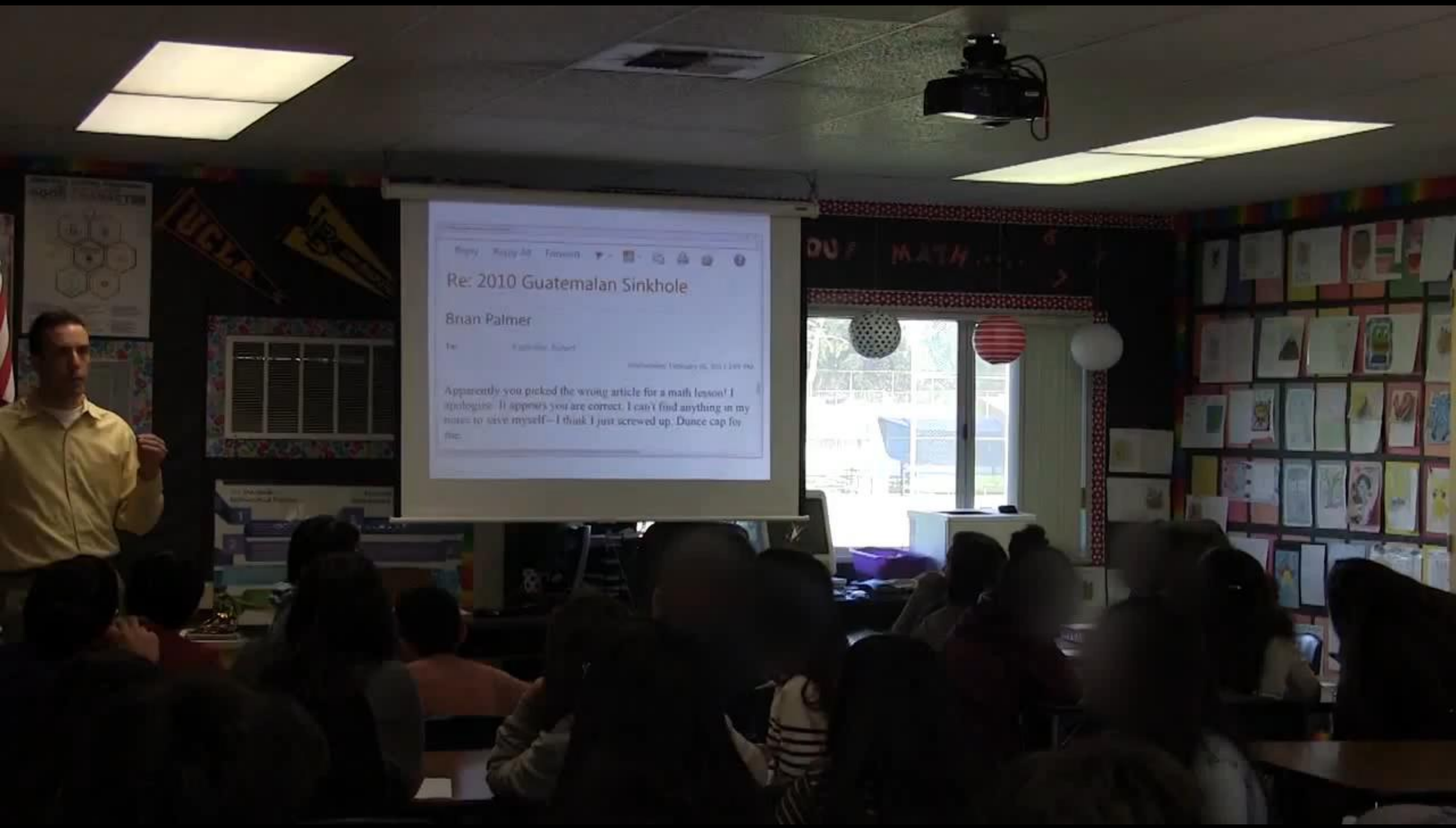
Brian Palmer

To: Kaplinsky, Robert

Wednesday, February 06, 2013 2:01 PM

Apparently you picked the wrong article for a math lesson! I apologize. It appears you are correct. I can't find anything in my notes to save myself-- I think I just screwed up. Dunce cap for me.


Sinkhole Dimensions
• National Geographic: "60 feet (18 meters) wide and about 30 stories deep"
• Time Magazine: "runs some 200 ft. deep"
• CNN: "The 20-meter (about 66 feet) diameter sinkhole is about 30 meters (about 100 feet) deep."
• Slate: "A sinkhole, 65 feet across and 100 feet deep"


Re: 2010 Guatemalan Sinkhole
Brian Palmer
Apparently you picked the wrong article for a math lesson! I apologize. It appears you are correct. I can't find anything in my notes to save myself—I think I just screwed up. Dunce cap for me.

Student Reflections

- "I didn't say his answer was wrong since he is supposed to know more than an average 8th grader."
- "Even though the author was wrong, no one corrected him, because of fear of being wrong and lack of confidence in ourselves."

Student Reflections

- "I didn't say anything when we were shown the 'right' answer because I thought that it must be right because he's the author, but I knew in my mind he was actually wrong."
- "I think that I should be the one who argues for my opinion, not just listening to others and accepting that my answer is wrong all the time."

Why Are You Using That Problem?

- Part of a coherent unit
  - Use the problem to introduce a new concept
- Stand-alone problems
  - Productive struggle
  - Problem completion

Why Are You Using That Problem?

- Use the problem to introduce a new concept
  - Best Case:
    - Great context for beginning a unit
  - Worst Case:
    - What was the purpose of this problem?
    - Why didn't you finish it?
    - Why didn't you let students struggle through it?
    - Did the teacher end the problem because he or she was confused and gave up?

Why Are You Using That Problem?

- Productive struggle
  - Best Case:
    - Students worked hard and made connections.
  - Worst Case:
    - Why did the teacher let the students sit there confused instead of telling them what to do?
    - Did the students even learn anything because they never figured out the answer?
    - Why didn't the teacher finish the problem? Did she lose track of time?

Why Are You Using That Problem?

- Problem completion
  - Best Case:
    - Everyone experienced a complete problem.
  - Worst Case:
    - Who really did the work today: the students or the teacher?
    - Why did the teacher not see all those great opportunities for students to make their own connections and take advantage of them?
    - Why did the teacher give such obvious hints and tell them what to do?

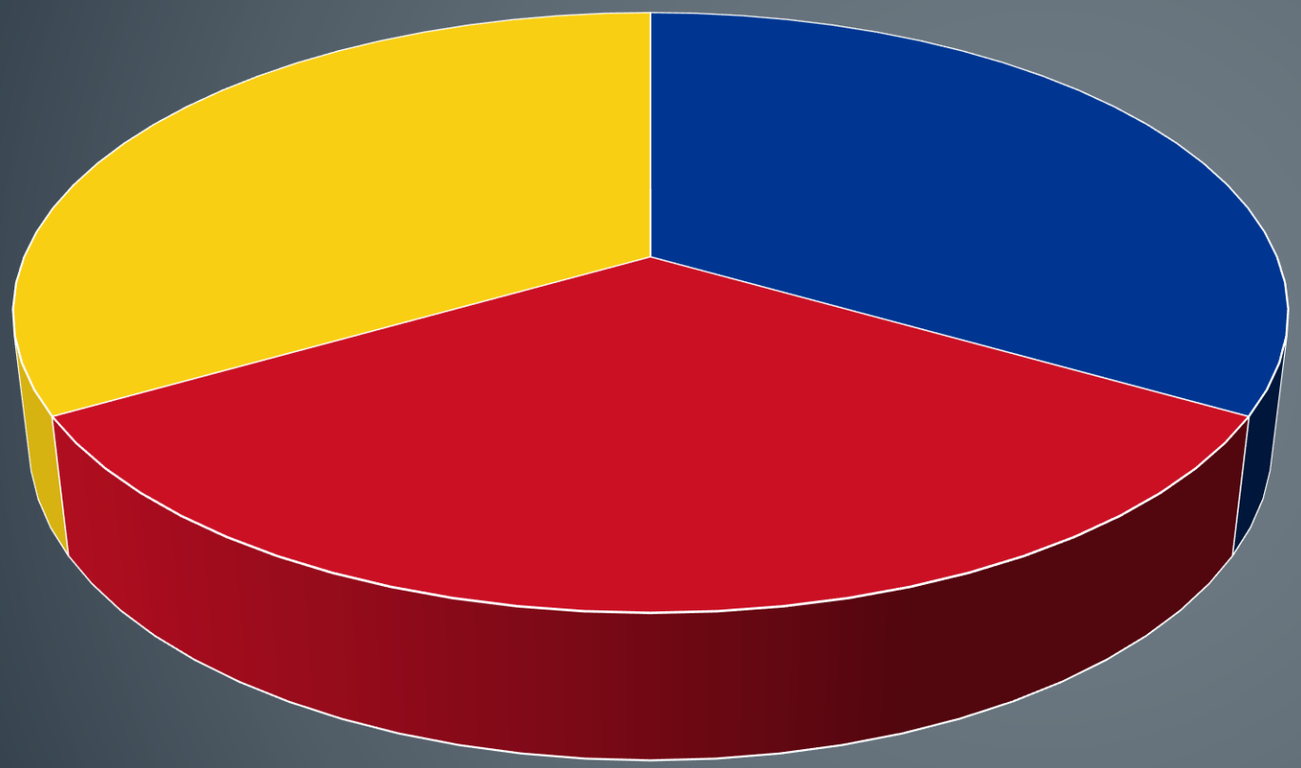
h

πr^2

8.G.9

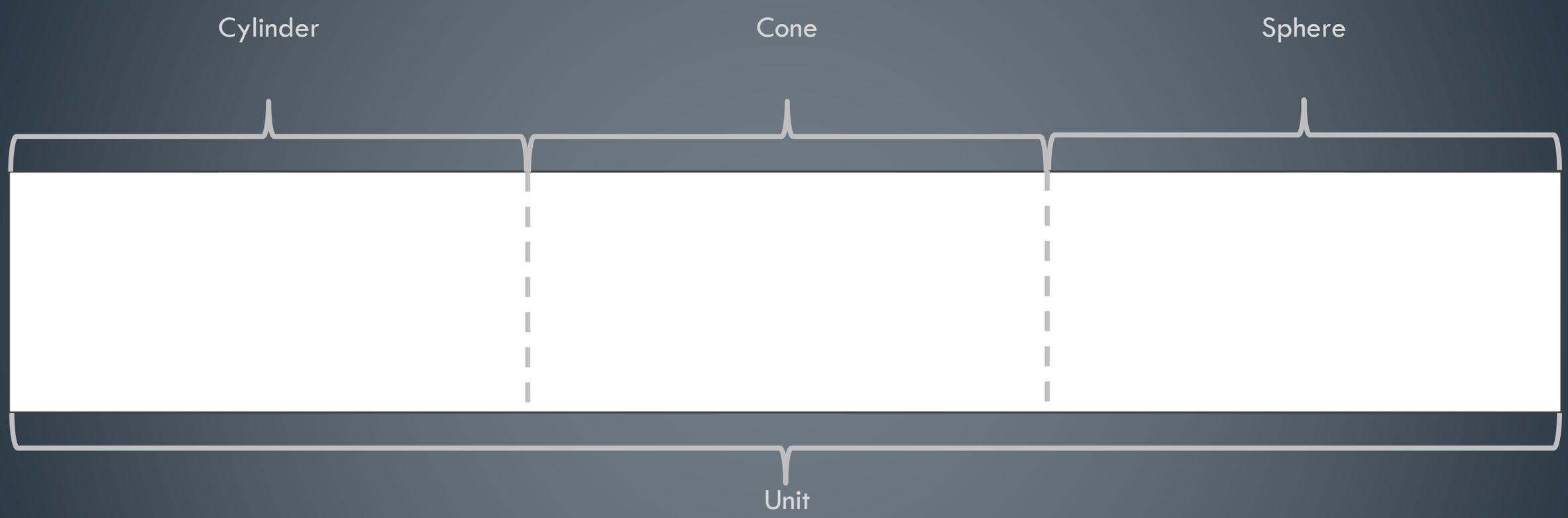
- Know the formulas for the volumes of cones, cylinders, and spheres and use them to solve real-world and mathematical problems.

Intensity Breakdown



- Procedural Skills & Fluency
- Conceptual Understanding
- Application

Setting Up The Unit

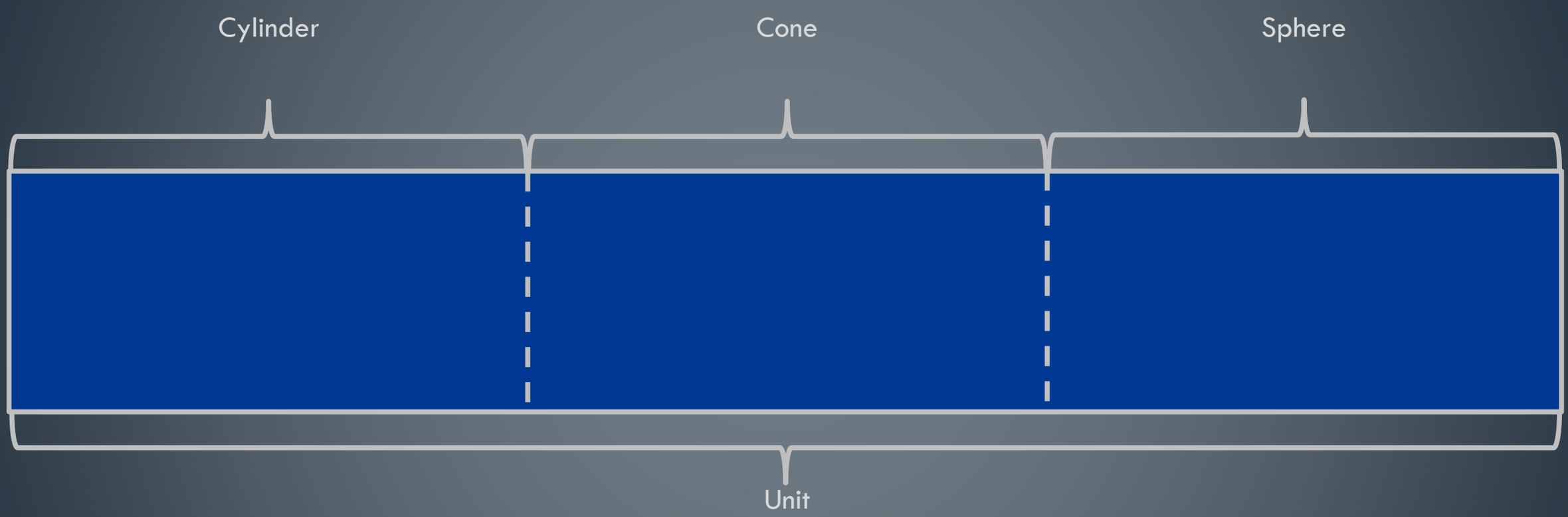


Procedural

Conceptual

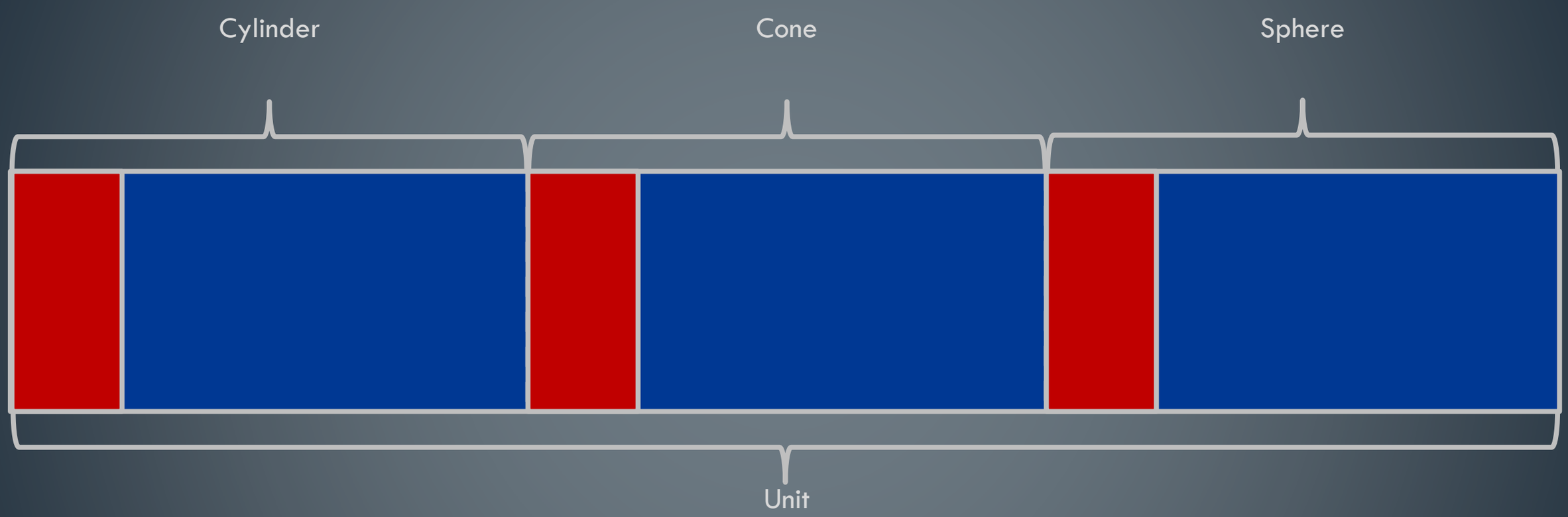
Application

How I Used To Teach



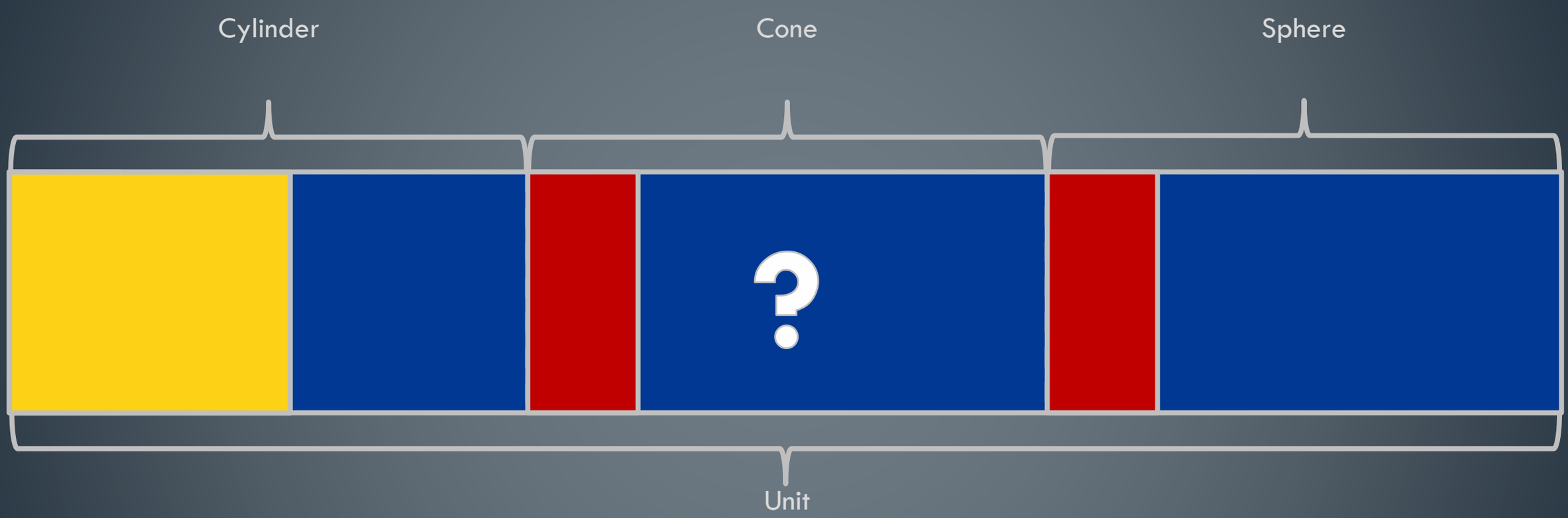
Procedural Conceptual Application

Then I Included Conceptual



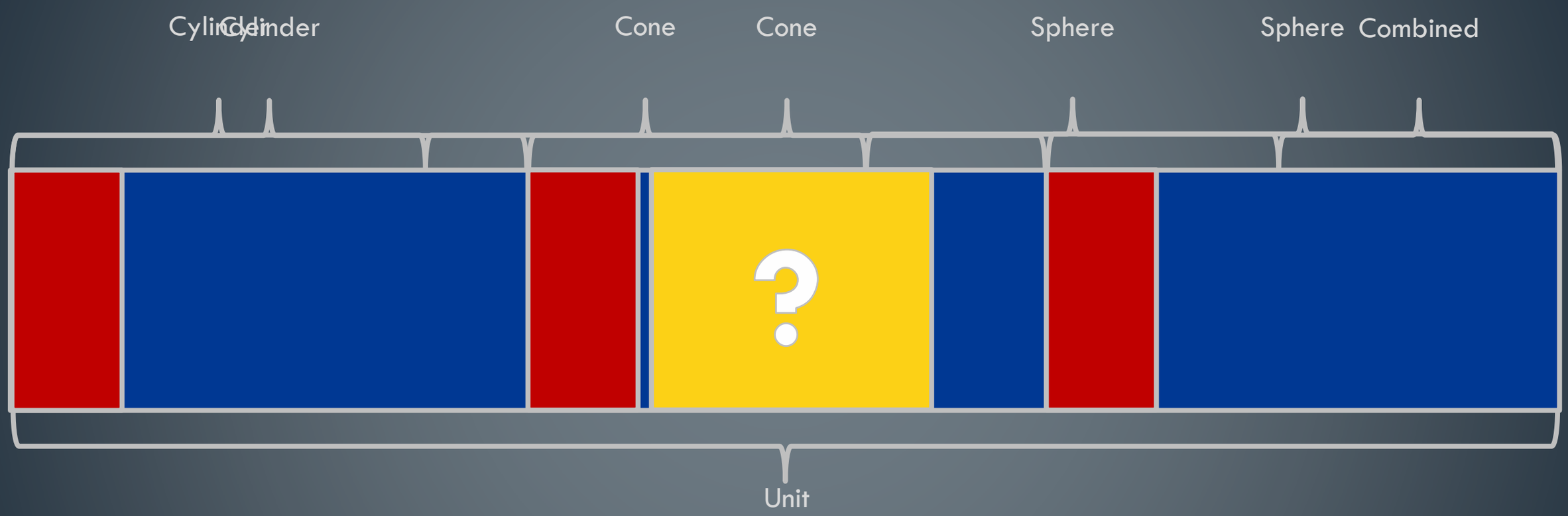
Procedural Conceptual Application

Where Does Application Go?



Procedural Conceptual Application

Option 1: Do It At The End

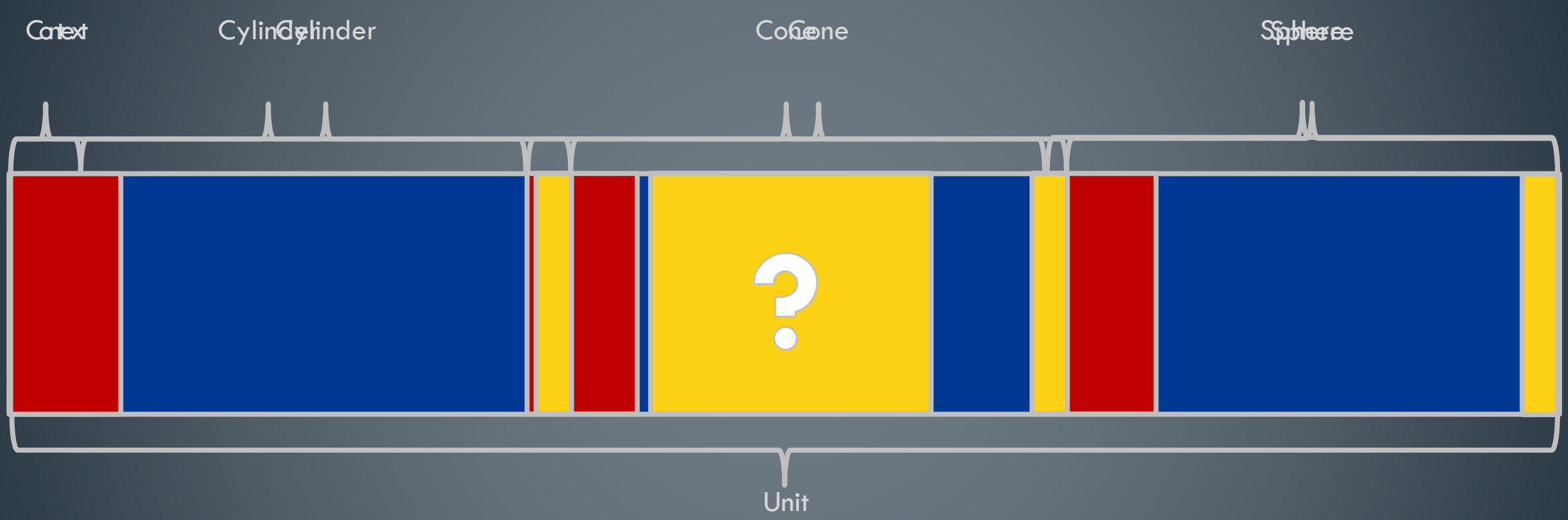


Procedural

Conceptual

Application

Option 2: Do It Everywhere



Procedural Conceptual Application

Content and Language Objectives using

Content Objective Example:

SWBAT apply the mathematics they know to solve problems arising in everyday life, society, and the workplace. (MP4)

Language Objective Example:

SWBAT understand and use stated assumptions, definitions, and previously established results in constructing arguments. (MP3)

- SWBAT attend to the meaning of quantities, not just how to compute them (MP2)
- SWBAT know and flexibly use different properties of operations and objects. (MP2)
- SWBAT analyze situations by breaking them into cases, and can recognize and use counterexamples. (MP3)
- SWBAT apply the mathematics they know to solve problems arising in everyday life, society, and the workplace. For example:
  - In early grades, this might be as simple as writing an addition equation to describe a situation. (MP4)
  - In middle grades, a student might apply proportional reasoning to plan a school event or analyze a problem in the community. (MP4)
  - By high school, a student might use geometry to solve a design problem or use a function to describe how one

PROBLEM-BASED LEARNING FAQ

- *How long do problem based lessons take?*
- *How do I write an objective for a problem-based lesson?*
- *How do I get students to explain their reasoning?*
- *How is problem-based learning assessed?*

How Do We Assess Student Work?

- Option #1 – Don't assess the problem
- Option #2 – Use general purpose rubric
- Option #3 – Use a problem-specific rubric
- Option #4 – Use a practice-specific rubric

Option #2 - General Purpose Rubric

- One point for reaching the correct conclusion
- One point for providing sufficient reasoning to support the conclusion.

What is your conclusion?

In order to solve this problem, you need the width and the height of the hole. Once you have it you plug them into the equation $r^2\pi.h$ which is to find the volume. Once you find the volume you will know how much cement you will need to order so that you could fill that hole, which in this case would be 342, 119 feet of cement.

What is your conclusion?

This particular sinkhole in Guatemala City, was about 20 meters (66 feet) in diameter and about 30 meters (100 feet) deep. We are trying to find the volume of the hole to figure out how much material is needed to fill it. I used the cylinder volume formula ($V = \pi r^2 h$). When you plug in the radius and the height, you get $V = \pi (33)^2 (100)$. I did not use 66 as my radius, because that is my diameter. Radius is half of the diameter. After you solve, you are left with 342,119.44 ft^3. You don't use ft^2 or ft because the hole is 3 dimensional. From here on, you just use the material cost and amount to find the price of the job.

What is your conclusion?

In order to fill the sinkhole with cement. They will need 342,119 ft^3 of cement. How is this possible?

Diameter - 66 feet, but we are looking for radius.

66/2 = 33 Now we got our radius which is 33.

r=33

Depth = 100 feet.

So we have a radius and height. we can use the volume of a cylinder formula. which is $V = \pi r^2 h$

$V = \pi(33)^2 \cdot 100$

$V = \pi(1089) \cdot 100$

$V = 3421.20$

$V = 342119.44$

Option #3 - Problem-Specific Rubric

Requirement	Possible Points	Points Earned
Student finds the correct numerical value based on the dimensions used.	3	
Student uses the correct units (i.e., cubic feet/meters for volume and feet/meters for length)	1	
Student correctly uses half the diameter for the radius and explains why.	2	
Student creates a narrative using sentences to explain his or her reasoning.	2	

Correct # value	___ / 3	Explains $\frac{d}{2} = r$	___ / 2
Correct units	___ / 1	Narrative w/ sentences	___ / 2

What is your conclusion?

In order to solve this problem, you need the width and the height of the hole. Once you have it you plug them into the equation $r^2\pi.h$ which is to find the volume. Once you find the volume you will know how much ~~[redacted]~~ cement you will need to order so that you could fill that ~~[redacted]~~ hole, which in this case would be 342, 119 feet of ~~[redacted]~~ cement.

Correct # value	___ / 3	Explains $\frac{d}{2} = r$	___ / 2
Correct units	___ / 1	Narrative w/ sentences	___ / 2

What is your conclusion?

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Correct # value	___ / 3	Explains $\frac{d}{2} = r$	___ / 2
Correct units	___ / 1	Narrative w/ sentences	___ / 2

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$V = \pi(33)^2 \cdot 100$

$V = \pi(1089) \cdot 100$

$V = 3421.20$

$V = 342119.44$

Option #4 - Practice-Specific Rubric

Requirement	Possible Points	Points Earned
Student explains how equations, words, pictures, and/or symbols are connected.	2	
Student does not just state steps taken, but convinces reader that the steps they took are a correct way to approach problem.	2	
Student carefully specifies units of measure and uses it consistently in conclusion.	1	
Student accurately calculates a numerical value for the answer.	3	

Explained connections	___ / 2	Convinced others	___ / 2
Calculated accurately	___ / 3	Specified units	___ / 1

What is your conclusion?

In order to solve this problem, you need the width and the height of the hole. Once you have it you plug them into the equation $r^2\pi.h$ which is to find the volume. Once you find the volume you will know how much [redacted]e you will need to order so that you could fill that [redacted] cement hole, which in this case would be 342, 119 feet of [redacted] cement.

Explained connections	___ / 2	Convinced others	___ / 2
Calculated accurately	___ / 3	Specified units	___ / 1

What is your conclusion?

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Explained connections	___ / 2	Convinced others	___ / 2
Calculated accurately	___ / 3	Specified units	___ / 1

What is your conclusion?

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Problem-Based Lesson Resources

- Problem-based lesson search engine: http://robertkaplinsky.com/prbl-search-engine/
- My lessons: http://www.robertkaplinsky.com/lessons
- Dan Meyer: http://threeacts.mrmeyer.com
- Andrew Stadel: http://www.estimation180.com/lessons.html
- Graham Fletcher: http://gfletchy.com/3-act-lessons/
- Geoff Krall: http://tinyurl.com/PrBLmaps
- Dan Meyer's TED talk: http://tinyurl.com/meyer-TED

Home

How I Can Help You

Real World Problems

My workshops help teachers implement problem-based lessons by helping them experience them from both student and teacher perspective, leading to

Depth of Knowledge

Problems at higher depth of knowledge levels have the potential to challenge the most gifted students yet remain accessible to struggling students. I can help teachers

What People Are Saying

Robert was a dynamic trainer who presented information in an unassuming, learner-centered way, allowing teacher participants to think about their own teaching and apply the new strategies accordingly. Throughout the two days, Robert modeled sound instructional strategies as he explained the why, the what, and the how of implementing this approach to math instruction. He

Lessons

View all | Kinder | 1st | 2nd | 3rd | 4th | 5th | 6th | 7th | 8th | Alg 1 | Geo | Alg 2

How Many Chip Bags Will There Be?

How Can We Make Stronger Passwords?

How Many Hot Dogs And Buns Should He Buy?

What Does 2000 Calories Look Like?

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Robert Kaplinsky's Problem-Based Lessons

File Edit View Insert Format Data Tools Add-ons Help

View only

	A	B	C	D	
1	Lesson	Concept / Skill	Standard 1	Standard 2	Star
2	How Many Chip Bags Will There Be?	Ratio and Proportions, Population Sampling	6.RP.3	6.RP.3c	7.RP
3	How Can We Make Stronger Passwords?	Permutations, Combinations, Probability, Exponents, Exponential Growth	7.SP.8	8.EE.1	S-MD
4	How Many Hot Dogs And Buns Should He Buy?	Least Common Multiple (LCM)	6.NS.4		
5	What Does 2000 Calories Look Like?	Unit Rates, Ratios, Solving Equations, and Solving Inequalities	6.EE.3	6.EE.4	6.EE
6	How Much Money Are The Coins Worth?	Decimal Operations and Coin Counting	2.MD.8	5.NBT.7	6.NS
7	How Many Times Will A Case of Paper Jam?	Interpreting Percentages	6.RP.3c	7.RP.3	
8	How Many Soda Combinations Are There On A Coke Freestyle?	Counting, Composing, and Decomposing Numbers	K.CC.5	K.CC.6	K.OA
9	What Should The Freeway Sign Show?	Fractions on Number Lines, Converting Units, Decimal and Fraction Operations	3.NF.1	3.NF.2	3.NF
10	How Fast Was The Fastest Motorcycle Speeding Ticket Ever?	Converting Units and Unit Rates	5.MD.1	6.RP.3d	7.RP
11	How Much Did Patrick Peterson Lose By Not Cashing His Check?	Compound and/or Simple Interest	7.RP.3	N-RN.2	A-SS
12	How Many Biscuits Can You Make?	Dividing Fractions and Mixed Numbers	5.NF.7	5.NF.7a	5.NF
13	How Much Bigger Should They Make Zoolander's School?	Scale and Proportions	5.NF.5A	7.RP.2	7.G.1
14	Where Is The Freeway Sign Located?	Identifying Fractions on a Number Line	3.NF.1	3.NF.2	3.NF
15	How Far Apart Are Exits On A Ring Road?	Arc length measures	G-C.5		
16	How Much Is One Third Of A Cup Of Butter?	Identifying Fractions on a Number Line	3.NF.1	3.NF.2	3.NF
17	How Do Skytypers Write Messages?	Transformations (Rotations, Reflections, Dilations, and Translations)	8.G.1	8.G.2	8.G.3
18	How Big Is The Bermuda Triangle?	Coordinate Geometry: Area of Triangle	G-GPE.7		
19	What Fraction Of Children Are In The Right Car Seat?	Representing and Comparing Fractions	3.NF.1	3.NF.2	3.NF
20	How Much Did The Temperature Drop?	Absolute Value	6.NS.7c	7.NS.1c	
21	How Much Shorter Are Staggered Pipe Stacks?	Circles, Pythagorean Theorem, trigonometric ratios, and linear functions	8.G.7	A-CED.1	A-CE
22	How Do You Write A Check To Pay For Something?	Expanded Form	2.NBT.3	4.NBT.2	5.NB
23	How Can We Correct The Scarecrow?	Pythagorean Theorem	8.G.6	G-SRT.4	
24	How Much Does A 100×100 In-N-Out Cheeseburger Cost?	Building and Interpretting Linear Functions	8.F.1	8.F.3	8.F.4
25	How Can We Water All Of The Grass?	Circles, Pythagorean Theorem, trigonometric ratios	7.G.4	8.G.7	G-SR
26	How Much Money IS That?!	Volume of rectangular prism	5.MD.3	5.MD.4	5.MD
27	How Much Money Should Dr. Evil Demand?	Exponential Growth	N-RN.2	A-SSE.1	A-SS
28	How Tall Is Mini-Me?	Scale and Dividing Decimals	5.NF.5	5.NF.5a	5.NF
29	How Did They Make Ms. Pac-Man?	Transformations (Rotations, Reflections, and Translations)	8.G.1	8.G.2	8.G.3
30	Which Ticket Option Is The Best Deal?	Unit Rates and Ratios	6.RP.2	6.RP.3	6.RP
31	How Far Apart Are The Freeway Exits?	Fractions on a Number Line and Subtracting Fractions	3.NF.2	3.NF.2b	4.NF
32	Do We Have Enough Paint?	Area	3.MD.5	3.MD.6	3.MD
33	How Many Stars Are There In The Universe?	Scientific Notation	8.EE.3	8.EE.4	
34	What Rides Can You Go On?	Inequalities and Measurement	2.MD.1	6.NS.7a	6.NS
35	Do You Have Enough Money?	Money	2.MD.8		
36	Which Bed Bath & Beyond Coupon Should You Use?	Percent Discount	7.RP.3		
37	Is Gas Cheaper With Cash Or Credit Card?	Percent Discount	7.RP.3		
38	Where's The Nearest Toys R Us?	Pythagorean Theorem (Distance in coordinate system)	8.G.8	G-SRT.8	G-GP

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