

RICH REAL WORLD

PROBLEMS

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GOALS

WHAT IS A REAL WORLD PROBLEM?

HOW DO STUDENTS RESPOND?

WHY DO PEOPLE USE THEM?

HOW DO I INCORPORATE THEM?

FREQUENTLY ASKED QUESTIONS

WHERE CAN I FIND MORE?









SINKHOLE DIMENSIONS

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



How To Fix a Giant Sinkhole

The cement method vs. the graded-filter technique.



18

0

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.

Reply

Reply All

Forward



2010 Guatemalan Sinkhole

Kaplinsky, Robert

To:



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 65×100 ? We get something closer to 342,000 cubic feet.

Thanks,
Robert

[Reply](#)

[Reply All](#)

[Forward](#)



Re: 2010 Guatemalan Sinkhole

Brian Palmer

To: [Kaplinsky, Robert](#)

Wednesday, February 06, 2013 2:01 PM

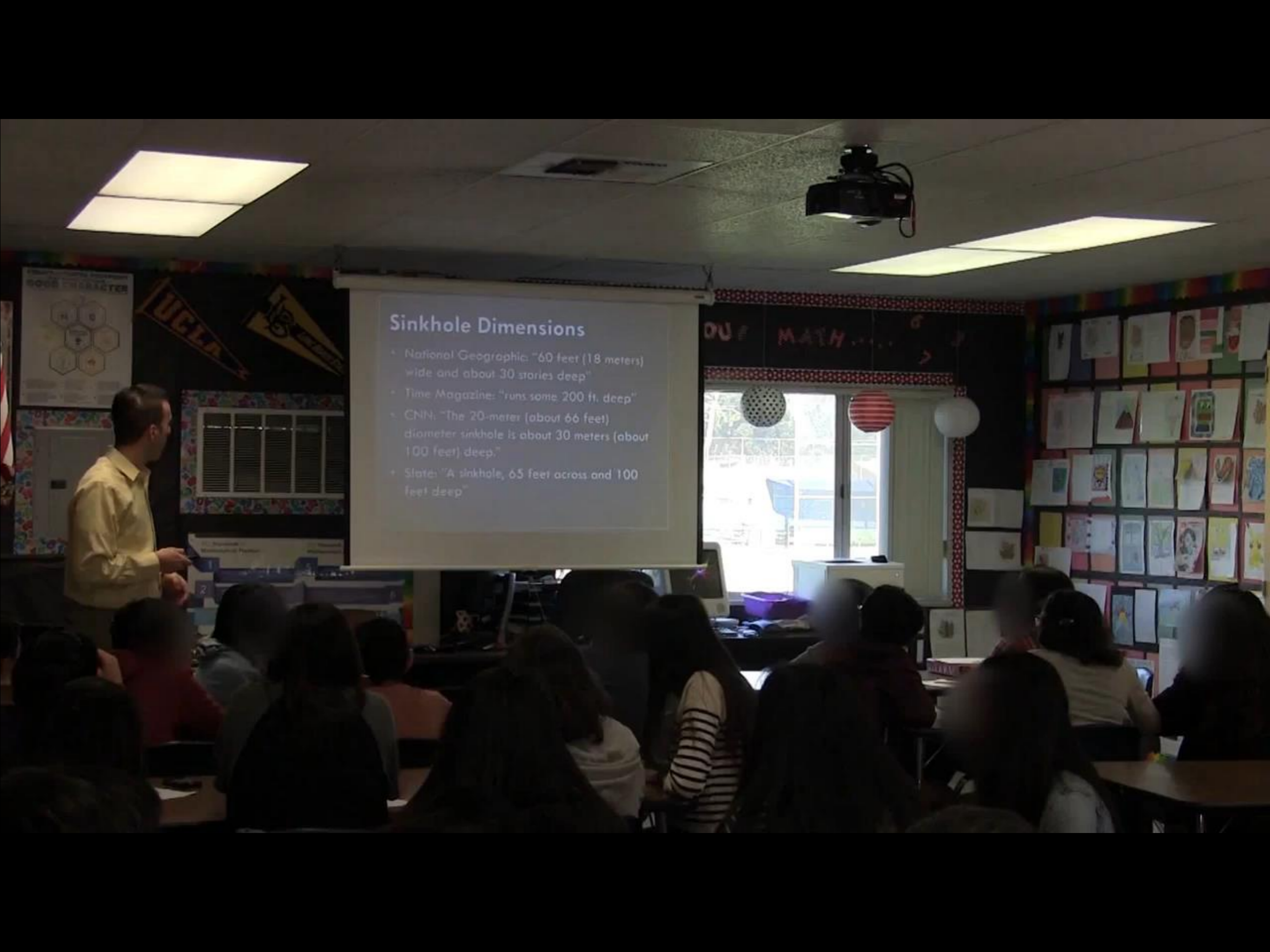
Apparently you picked the wrong article for a math lesson! I apologize. It appears you are correct. I can't find anything in my notes to save myself-- I think I just screwed up. Dunce cap for me.

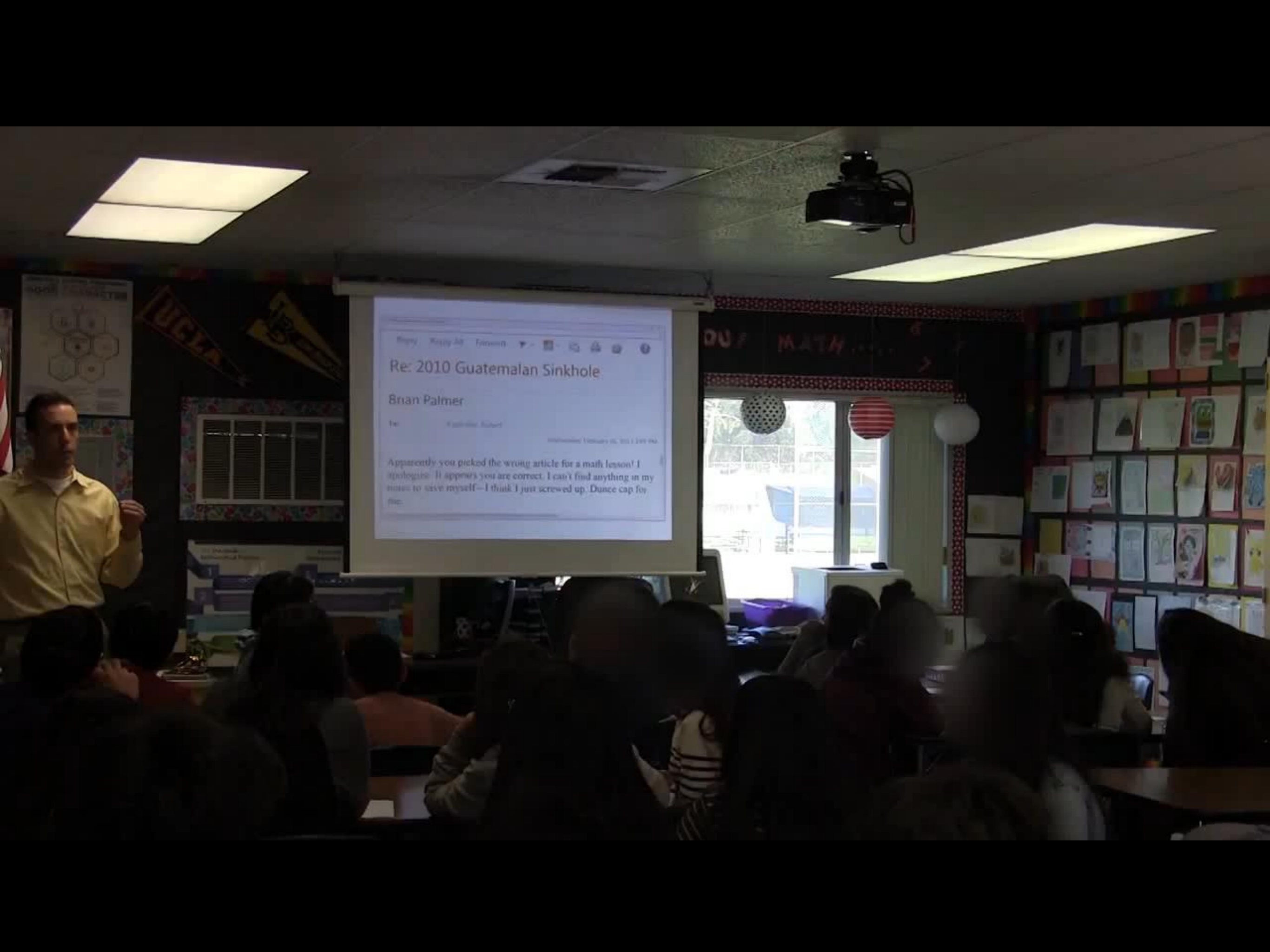
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- WHERE CAN I FIND MORE?**

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"





Reply Reply All Forward

Re: 2010 Guatemalan Sinkhole

Brian Palmer

To: [Kaprielian, Robert](#)

Wednesday, February 10, 2011 1:09 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. Dunc 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 Brian was wrong, no one corrected him, because of fear of being wrong and lack of confidence in ourselves.”

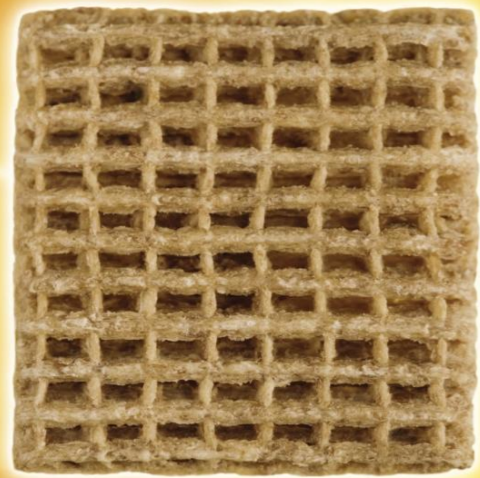
STUDENT REFLECTIONS

- “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.”



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





OLD
(Boring)

NEW
Diamond
Shreddies

Cereal



NEW
(Exciting!)





SQUARE OR DIAMOND?

Vote for your Favourite at DiamondShreddies.com



Diamond

Shreddies
Combo Pack



Square

Diamond

ENLARGED TO SHOW TEXTURE

Made with 100% Whole Grain Wheat

620 g Cereal
SERVING SUGGESTION



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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WHY ARE YOU USING?

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?

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?

Problem completion

- **Best Case:**
 - Everyone experienced a complete problem.
- **Worst Case:**
 - Who did the work today: the students or 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?

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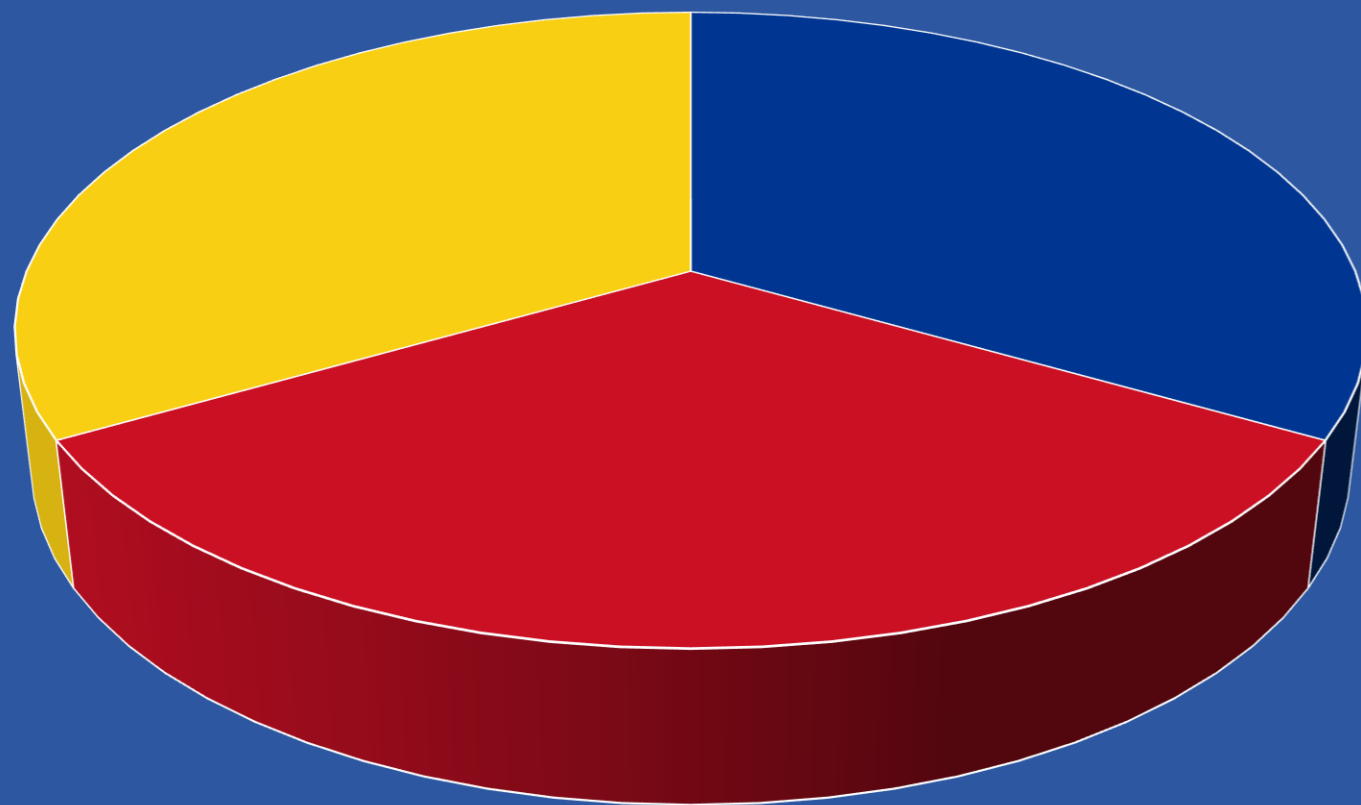
h

πr^2

CCSS 8.G.9

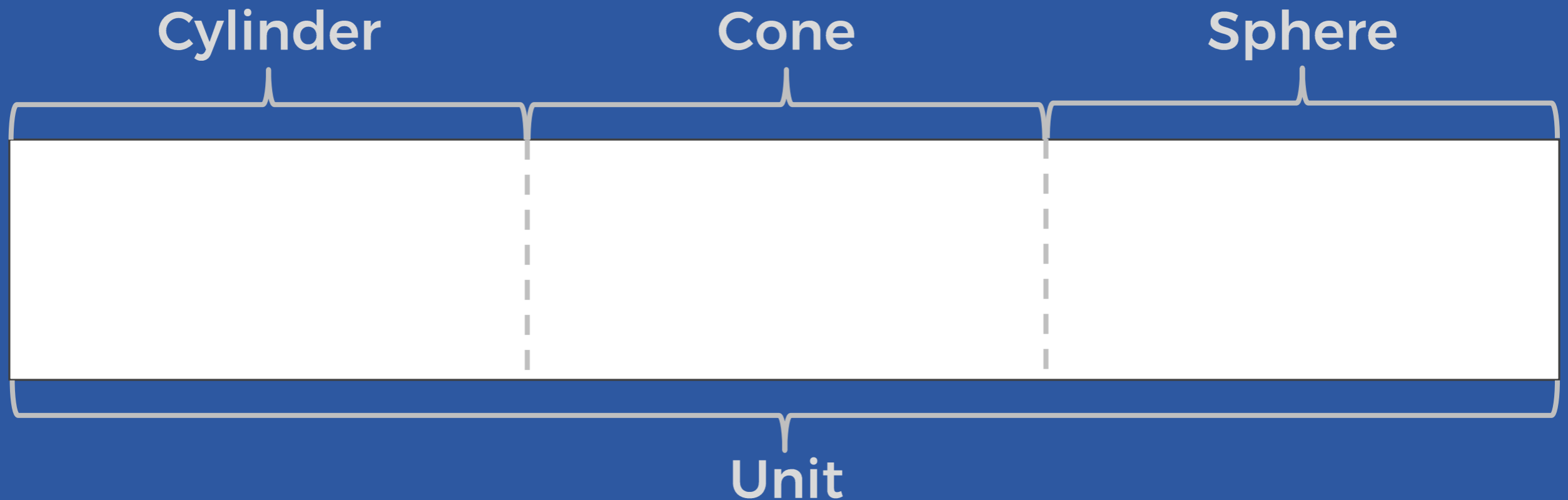
- Know the formulas for the volumes of **cones**, **cylinders**, and **spheres** and use them to solve real-world and mathematical problems.

INTENSITY BREAKDOWN



- Procedural Skills & Fluency
- Conceptual Understanding
- Application

SETTING UP THE UNIT

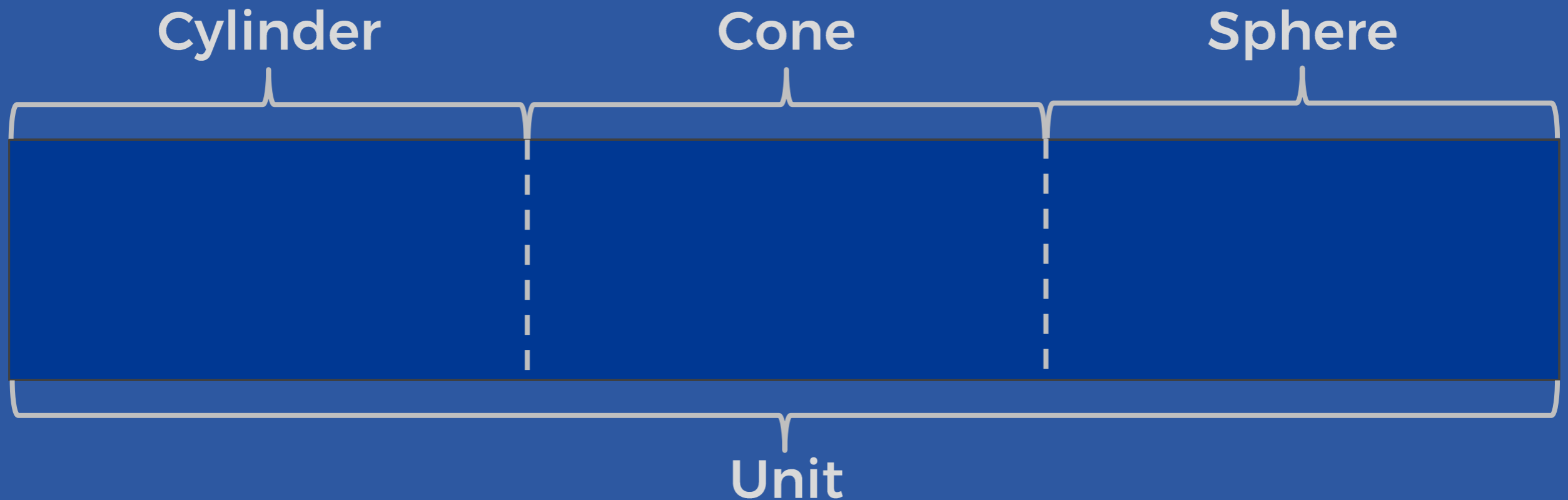


■ Procedural

■ Conceptual

■ Application

HOW I USED TO TEACH

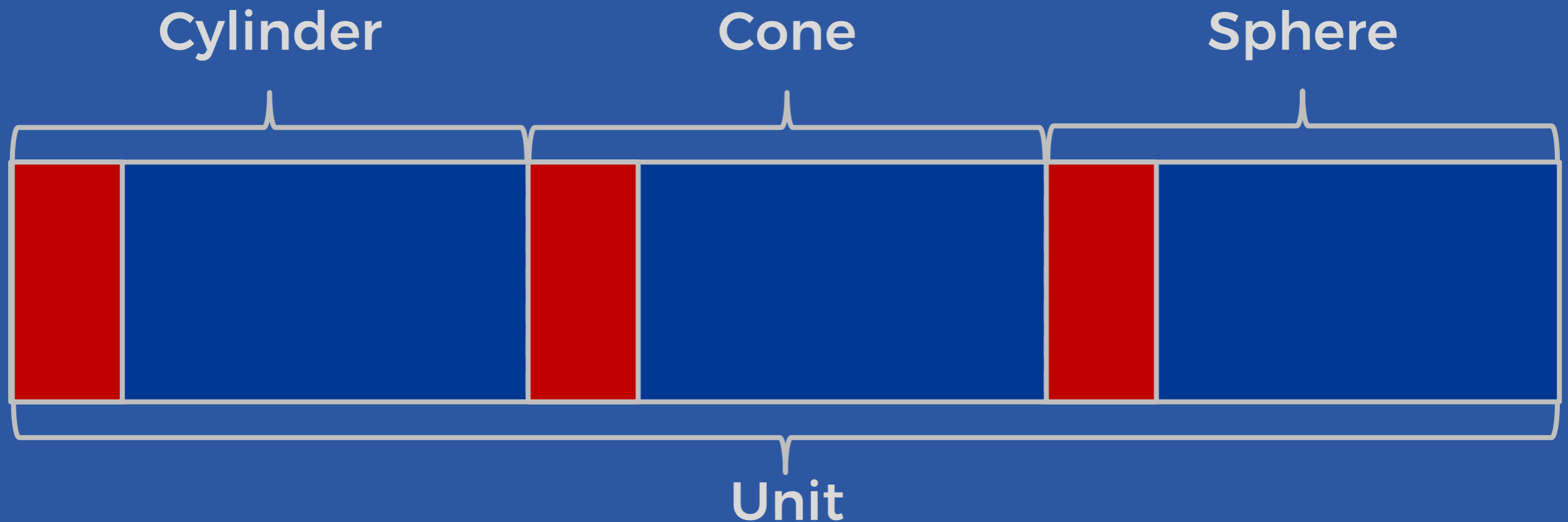


■ Procedural

■ Conceptual

■ Application

NEXT CAME CONCEPTUAL

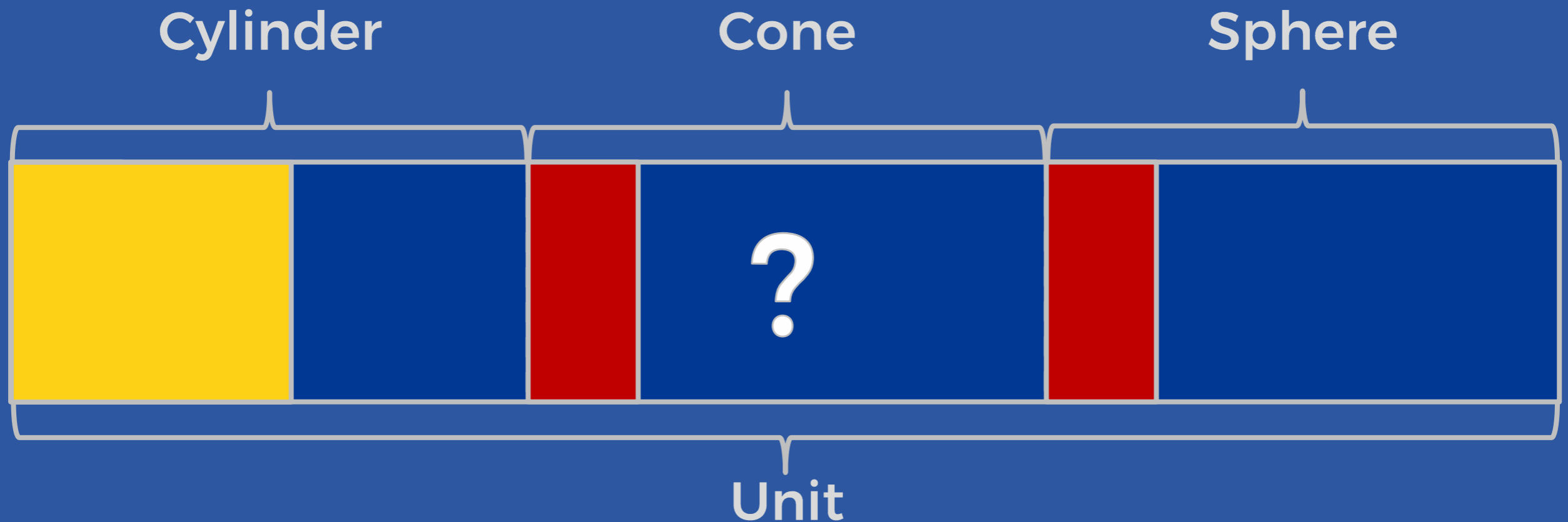


■ Procedural

■ Conceptual

■ Application

WHERE'S APPLICATION?

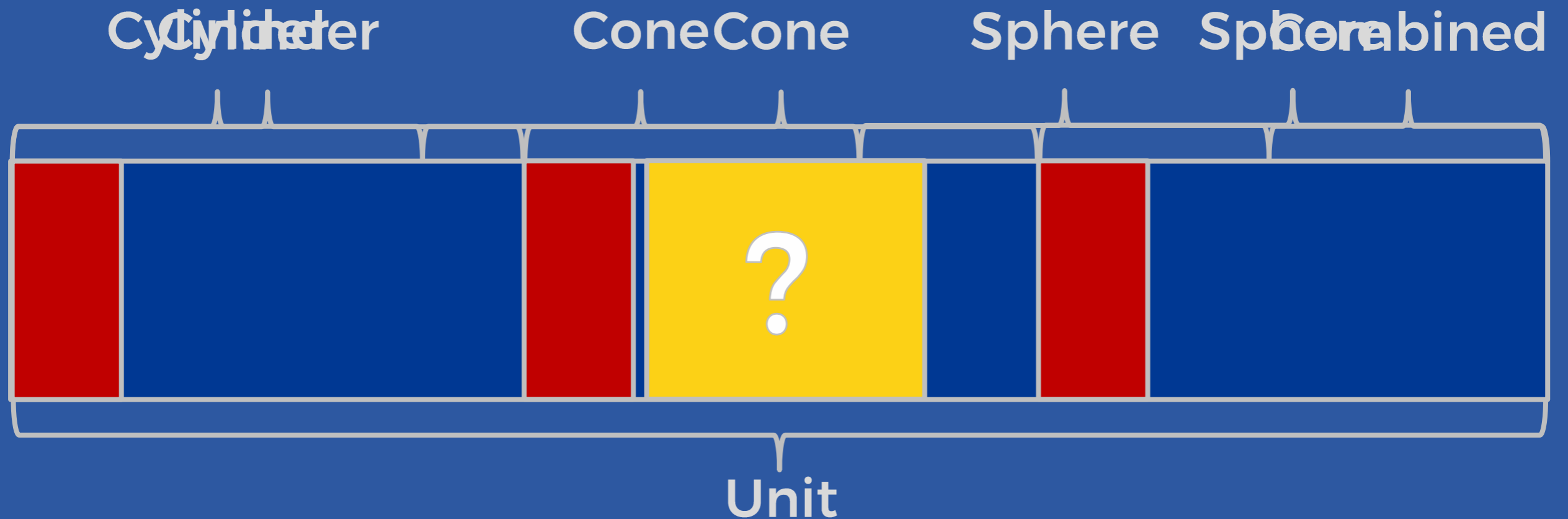


■ Procedural

■ Conceptual

■ Application

OPTION 1: DO AT THE END



■ Procedural

■ Conceptual

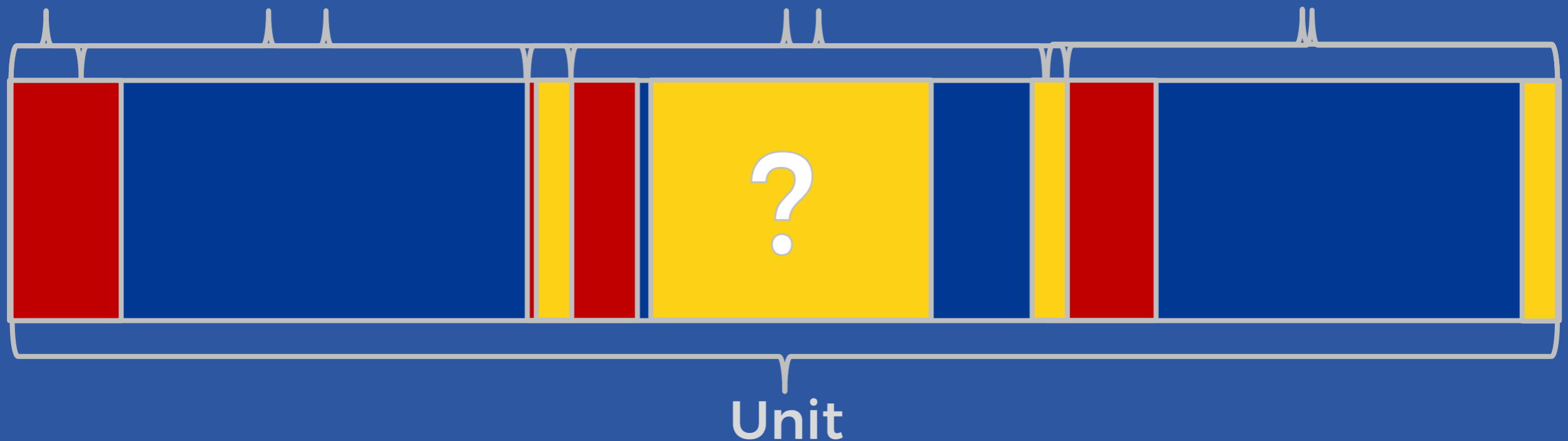
■ Application

OPTION 2: EVERYWHERE

Context Cylinder

Cone

Sphere



■ Procedural

■ Conceptual

■ Application

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PROBLEM-BASED FAQ

- How long do problem based lessons take?
- How do I write an objective for a problem-based lesson?

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** explain correspondences between equations, verbal descriptions, tables, and graphs. (MP1)

- 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 FAQ

- How long do problem based lessons take?
- How do I write an objective for a problem-based lesson?
- How is problem-based learning assessed?

ASSESSING 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

GENERAL PURPOSE

- 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 $r^2 \pi \cdot h$ which is to find the volume. Once you find the volume you will know how much ~~volume~~ cement you will need to order so that you could fill that ~~to~~ hole, which in this case would be 342,119 feet of ~~volume~~ 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 ft³. You don't use ft² 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 ft³ 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 $V = \pi r^2 h$

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

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

$$V = 3421.20$$

$$V = 342119.44$$

PROBLEM-SPECIFIC

Requirement	Points Possible	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 & 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

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PRACTICE-SPECIFIC

Requirement	Points Possible	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?

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Explained connections

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___ / 2

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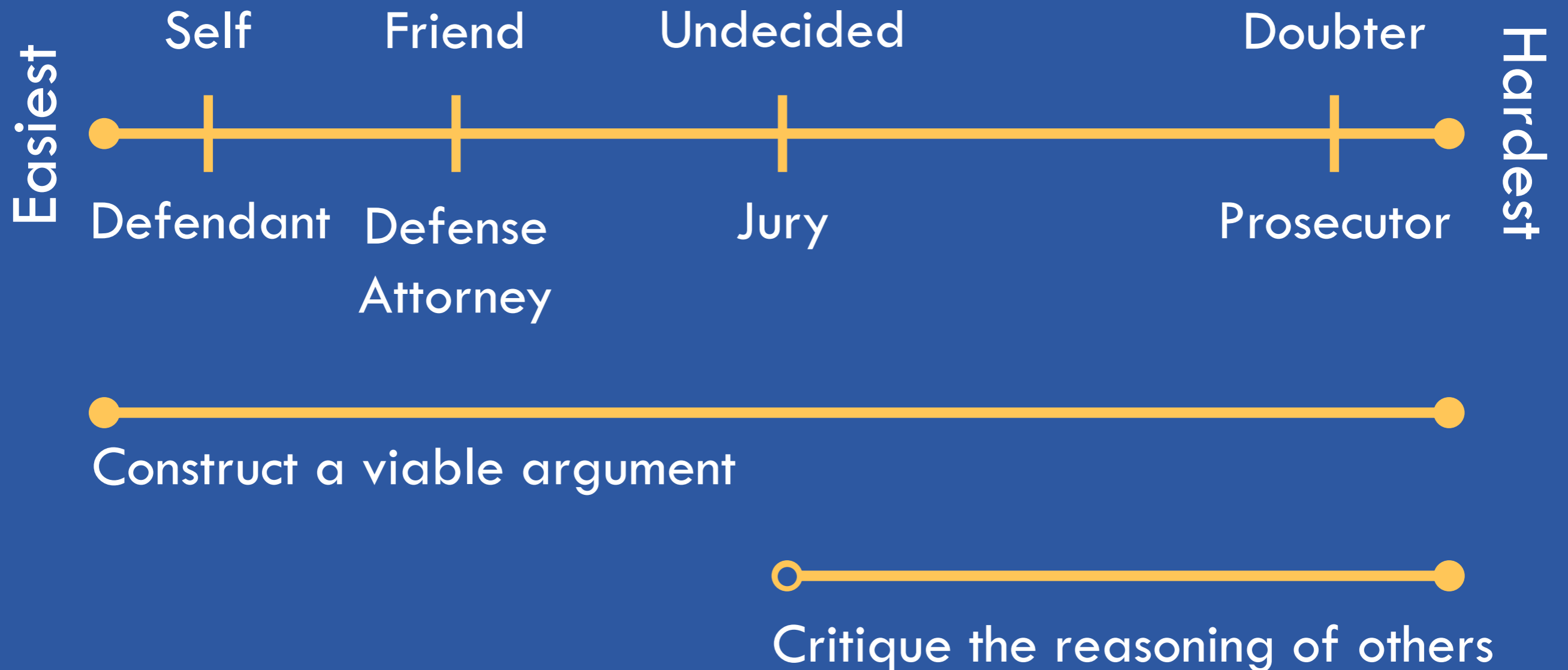
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- How long do problem based lessons take?
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- How is problem-based learning assessed?
- How do I get students to explain their reasoning?

LEVELS OF CONVINCING



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

PROBLEM-BASED FAQ

- How long do problem based lessons take?
- How do I write an objective for a problem-based lesson?
- How is problem-based learning assessed?
- How do I get students to explain their reasoning?
- Why shouldn't I use other problem solving methods?



Complicated or Complex?



Cookie Monster Cupcakes



Nailed it

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'.

CUBES

A problem solving strategy

C - Circle the #s

U - underline the ques.

B box the words

What problem are you trying to figure out?

What guesses do you have?

What do you already know from the problem?

What do you need to know to solve the problem?

What is your conclusion? How did you reach that conclusion?

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PBL RESOURCES

- Problem-based lesson search engine:
robertkaplinsky.com/prbl-search-engine
- My lessons (Elementary, Middle, and High School)
robertkaplinsky.com/lessons
- Dan Meyer (Middle and High School)
threeacts.mrmeyer.com
- Andrew Stadel (Elementary and Middle School)
www.estimated180.com/lessons.html
- Graham Fletcher (Elementary and Middle School)
gfletchy.com/3-act-lessons



Home



How Big Is The World's Largest Deliverable Pizza?
(Area of Rectangles)

Search

Type and hit enter ...



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First Name

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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 increase students' success with performance tasks and the Common Core State Standards.



Depth of Knowledge

Problems at higher depth of knowledge levels have the potential to challenge your most talented student yet remain accessible to everyone. I can help teachers develop best practices for implementing them so that students persevere longer towards finding the solution.

Lessons

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- [5th](#)
- [6th](#)
- [7th](#)
- [8th](#)
- [Alg 1](#)
- [Geo](#)
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How Much Money Were Those Pennies?



How Can We #SaveNelly?



How Many Chip Bags Will There Be?



How Can We Make Stronger Passwords?

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