The Need for Reasoning and Sense Making

ROBERT KAPLINSKY
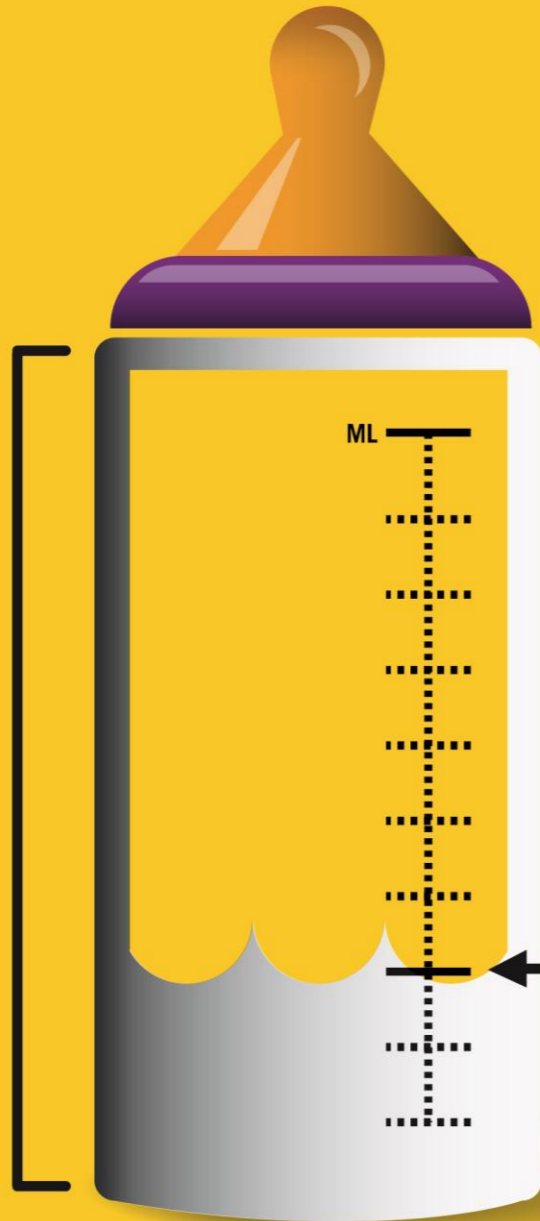
Math Question

- Solve the problem on your own. Do not work or share your answer with anyone else.

- You will have 30 seconds to complete it.

- Write your answer down on a paper.

- Pay attention to the emotions you feel while solving the problem and write those emotions down as well.

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

What keeps Blackboy
when students make
tons of problem?

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.

CHOOSE CAR SEAT:
BY AGE & SIZE

THE ONES
WHO
ACTUALLY
DO.

THE NUMBER
OF PEOPLE
WHO
THINK
THEY HAVE
THEIR CHILD
IN THE RIGHT
SEAT.
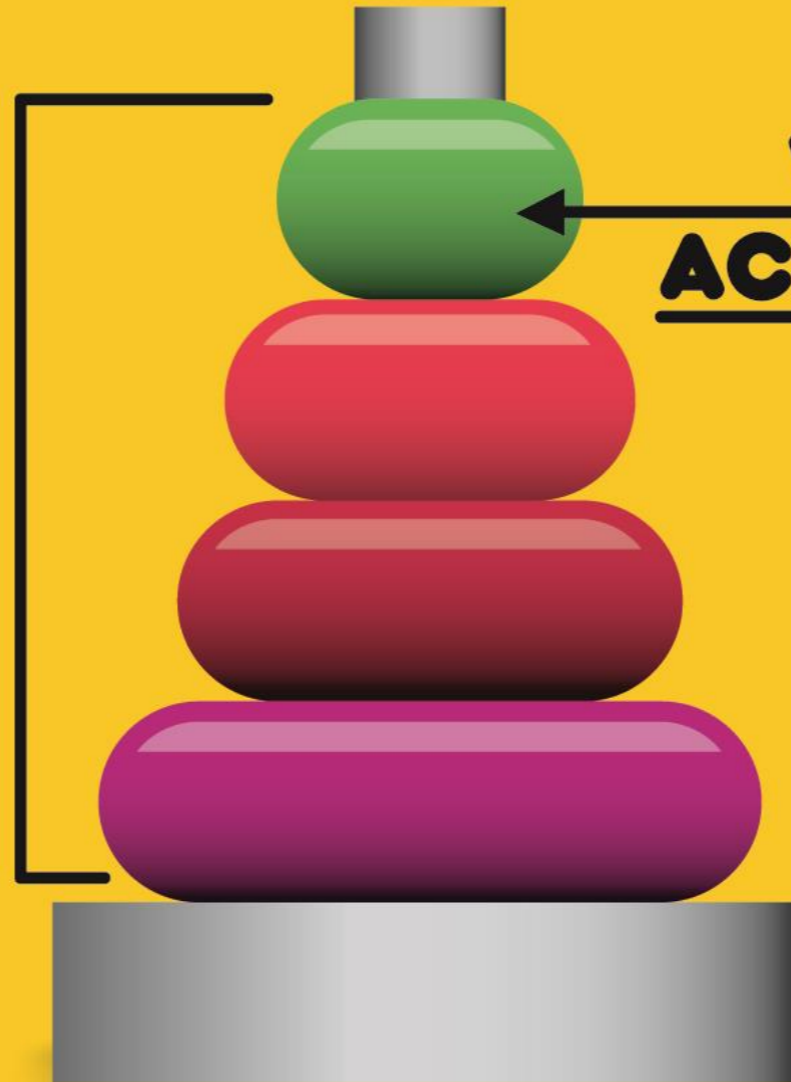
- "because they have their child in the right seat"
- "because their car seats are not being used correctly"

IF YOUR CHILD IS IN THE RIGHT CAR SEAT.

Ad Council

VISIT SAFERCAR.GOV/THERIGHTSEAT

NHTSA
www.nhtsa.gov

Child Car Safety

How do we fix this?

- These advertisements need some adjustments to more accurately depict the information.

- In groups:
  - Explain why you believe the advertisement does not show one fourth.
  - Include a revised sketch of the same item that better illustrates one fourth.
  - Explain how this new sketch better illustrates one fourth.
  - Include anything else you would change about the advertisement.

WHAT IS THE PURPOSE OF A K-12 EDUCATION?

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

WHAT IS THE PURPOSE OF A K-12 EDUCATION?
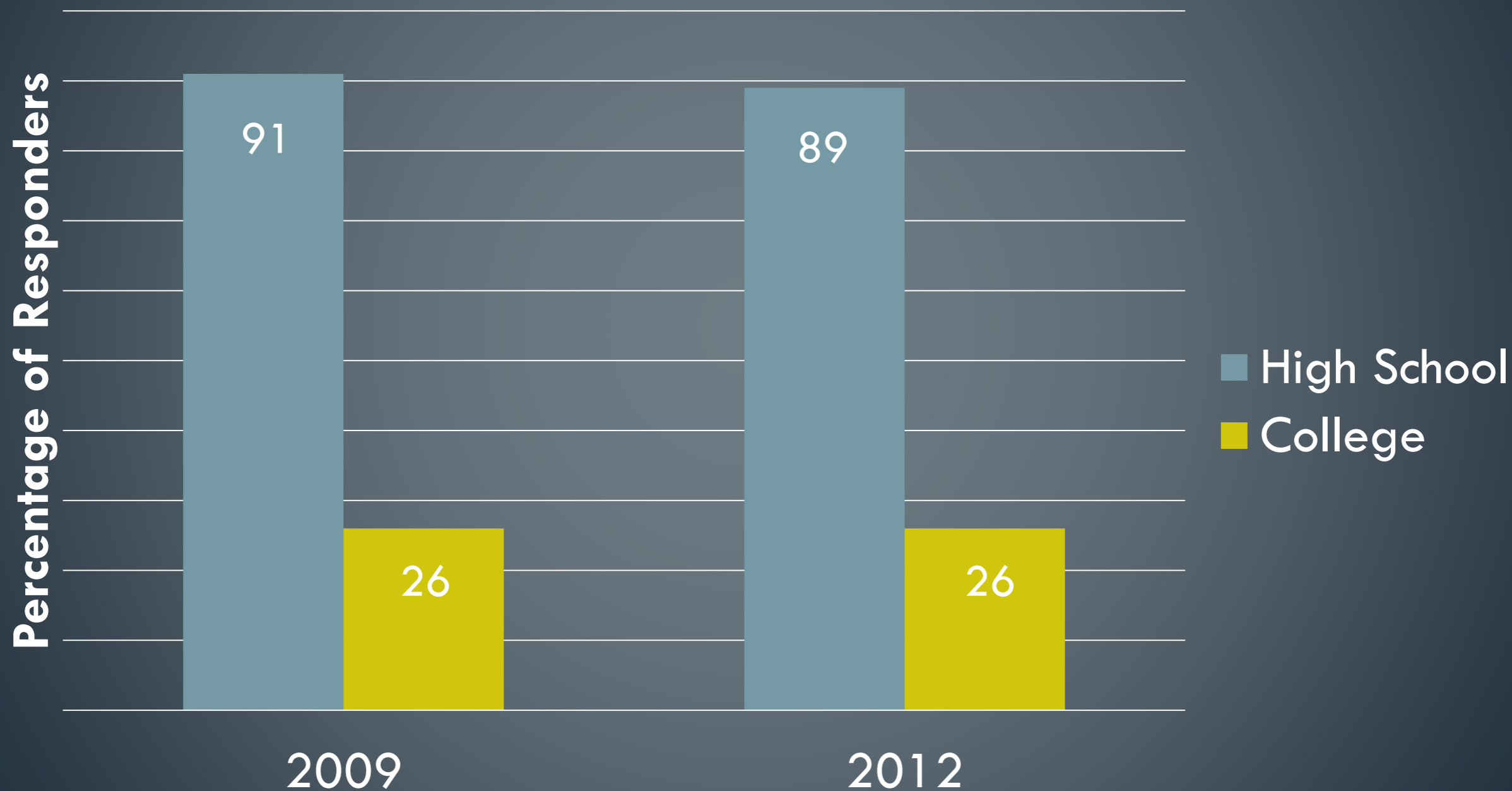
- College readiness
- Career readiness
  - Association of American Colleges and Universities survey
  - Surveyed over 300 employers with at least 25 employees and many new hires

More Less Same

Critical thinking and
analytical reasoning skills

Analyzing and solving
complex problems

Communicating
effectively orally
and in writing

Applying knowledge and
skills to real-world setting

Working w/ numbers and
understanding statistics

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

New Student Expectations

ELA, Social Studies, and Tech Subjects

1. Demonstrate independence.
2. Build strong content knowledge.
3. Respond to the varying demands of audience, task, purpose, and discipline.
4. Comprehend as well as critique.
5. Value evidence.
6. Use technology and digital media strategically and capably.
7. Understand other perspectives and cultures.

Science

1. Ask questions (for science) and defining problems (for engineering).
2. Develop and use models.
3. Plan and carry out investigations.
4. Analyze and interpret data.
5. Use mathematics and computational thinking.
6. Construct explanations (for science) and design solutions (for engineering).
7. Engage in argument from evidence.
8. Obtain, evaluate, and communicate information.

Mathematics

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.

Sources: CCSS ELA student portraits, NGSS practices, CCSS mathematics practice

MATH

SCIENCE

S2. Develop and use models.
S5. Use mathematics & computational thinking.
M4. Model with mathematics.
M6. Attend to precision.

M1. Make sense of problems & persevere in solving them.
M2. Reason abstractly & quantitatively.
M7. Look for & make use of structure.
M8. Look for & express regularity in repeated reasoning.

S1. Ask questions & define Problems.
S3. Plan & carry out Investigations.
S4. Analyze & interpret data.
S6. Construct explanations & design solutions.

E2. Build a strong base of knowledge through content rich texts.
E5. Read, write, and speak grounded in evidence.
M3 and E4. Construct viable arguments & critique reasoning of others.
S7. Engage in argument from evidence.

S8. Obtain, evaluate & communicate Information.

E6. Use technology & digital media strategically & capably
M5. Use appropriate tools strategically

E3. Obtain, synthesize, and report findings clearly and effectively in response to task and purpose.

E1. Demonstrate independence in reading complex texts, and writing and speaking about them.
E7. Come to understand other perspectives & cultures through reading, listening, and collaborations.

ELA

Sources: CCSS ELA student portraits, NGSS practices, CCSS mathematics practice

Adapted from work of Tina Cheuk, Stanford University

WHAT DOES IT LOOK LIKE...

- when students **<u>can</u>** work with numbers but **<u>cannot</u>**:
  - 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?

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

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

Selected Response

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

a. 7 ½

b. ¼

c. -2

d. "dang this is hard"

Constructed Response

Solve $1\frac{1}{2} - 1\frac{1}{4}$. Explain how you know. "You have to make them equal. Then you have to find the least common denominator. Then you have to multiply 2 times 2 to get 4 and 2 times 1 to get 2. Then you subtract 2 minus 1 to get 1."

Constructed Response

Solve $1\frac{1}{2} - 1\frac{1}{4}$. Explain how you know.

"I already have 1 so I can take that away. Now I have to take away one fourth from one half. I know that there are two fourths in a half so if I take one fourth away I will be left with one fourth."

Performance Task

Assessing Deeper Understanding

Make the smallest difference using the numbers 1 through 9 no more than one time each.
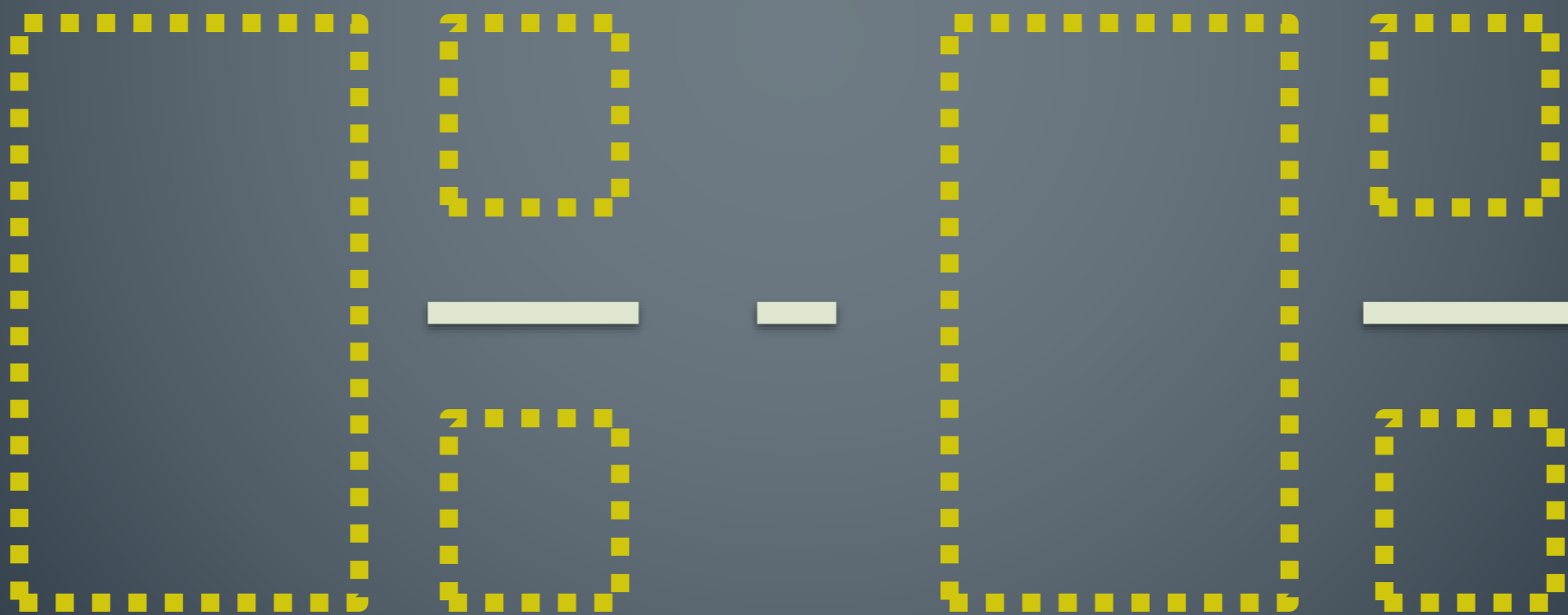
Depth of Knowledge

- What?

Depth of Knowledge Examples

Science

- DOK 1 - What is a solid? / What is a liquid?

- DOK 2 - Describe the difference between a solid and liquid.

- DOK 3 - Is toothpaste a solid or a liquid? Explain and justify your answer.

- DOK 4 - Design and implement an experiment to further investigate the properties of solids and liquids, then share your results with classmates.

Social Studies

- DOK 1 - Name the U.S. presidents in order.

- DOK 2 - Using the left and right political continuum, categorize the presidents of the 20th and 21st centuries according to their political standing.

- DOK 3 - Hypothesize how Dwight D. Eisenhower would react to today's world political situation.

- DOK 4 - Analyze the strategies and effectiveness of George H. W. Bush's war strategies in the Persian Gulf with the war.

Source: Southern Nevada Regional Professional Development Program

Depth of Knowledge

- What?

- How?

- Why?

Depth of Knowledge – Level One

What is the circle's circumference? $\pi \approx 3.14$

10 units

$C = \pi \cdot 20$
$C \approx 3.14 \cdot 20$
$C \approx 62.8$ units
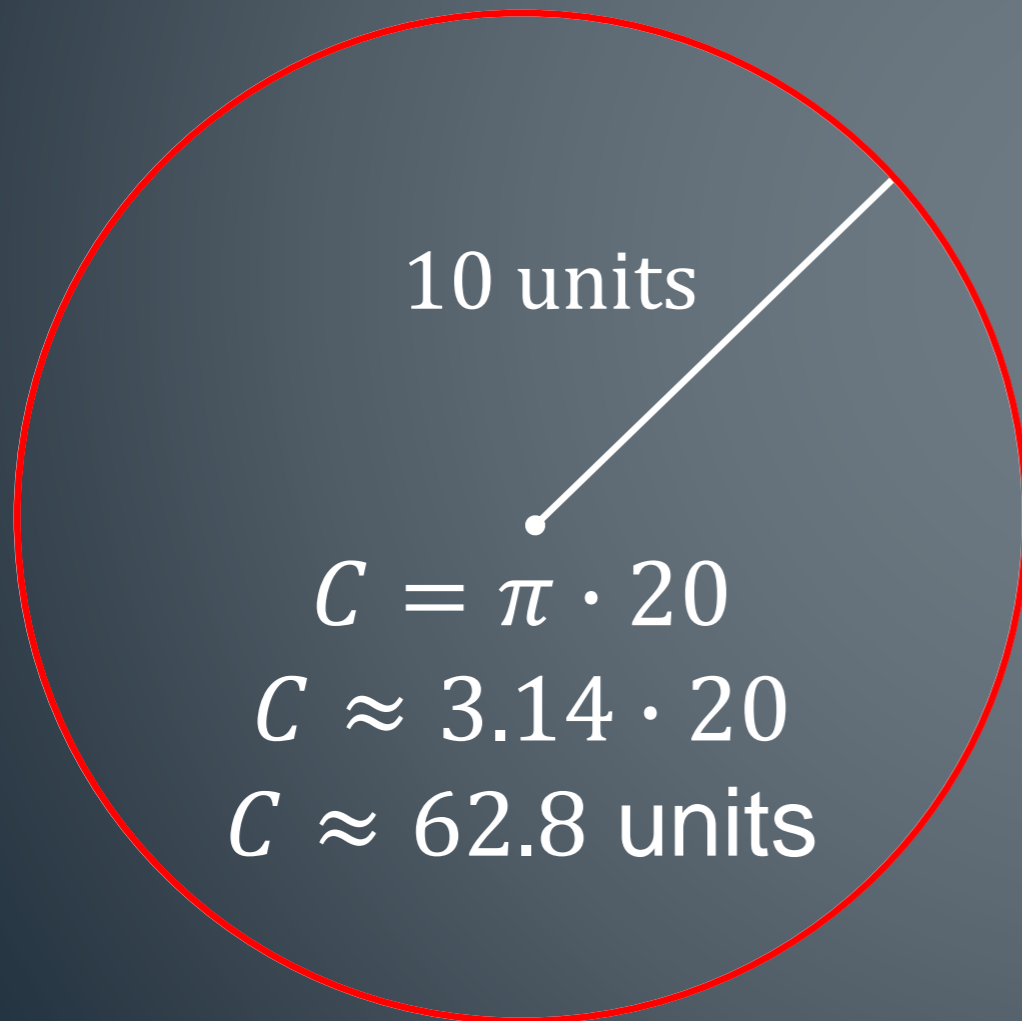
$C = \pi d$ or $C = 2\pi r$

What is the circle's area? $\pi \approx 3.14$

10 units

$A = \pi \cdot 10^2$
$A \approx 3.14 \cdot 100$
$A \approx 314$ units^2
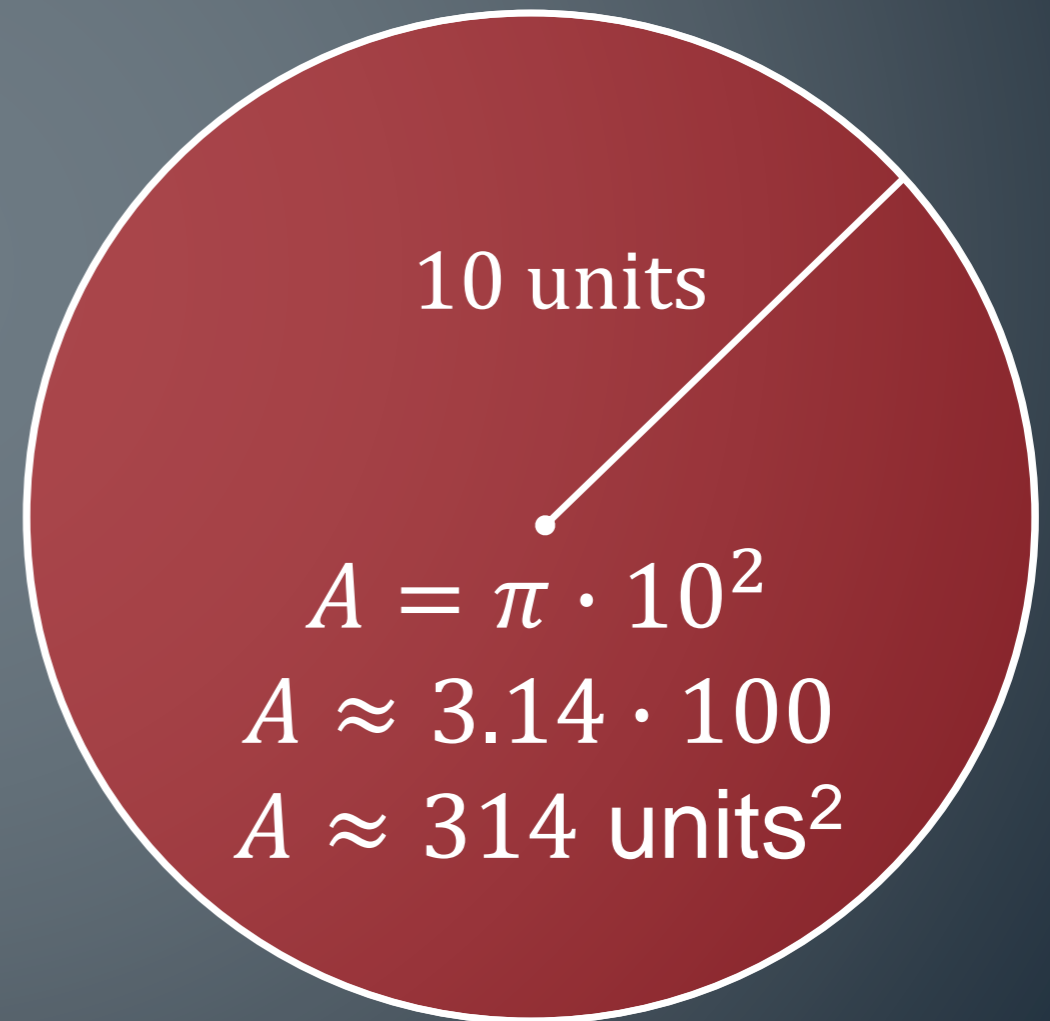
$A = \pi r^2$

70 This circular stage has a radius of 25 meters.
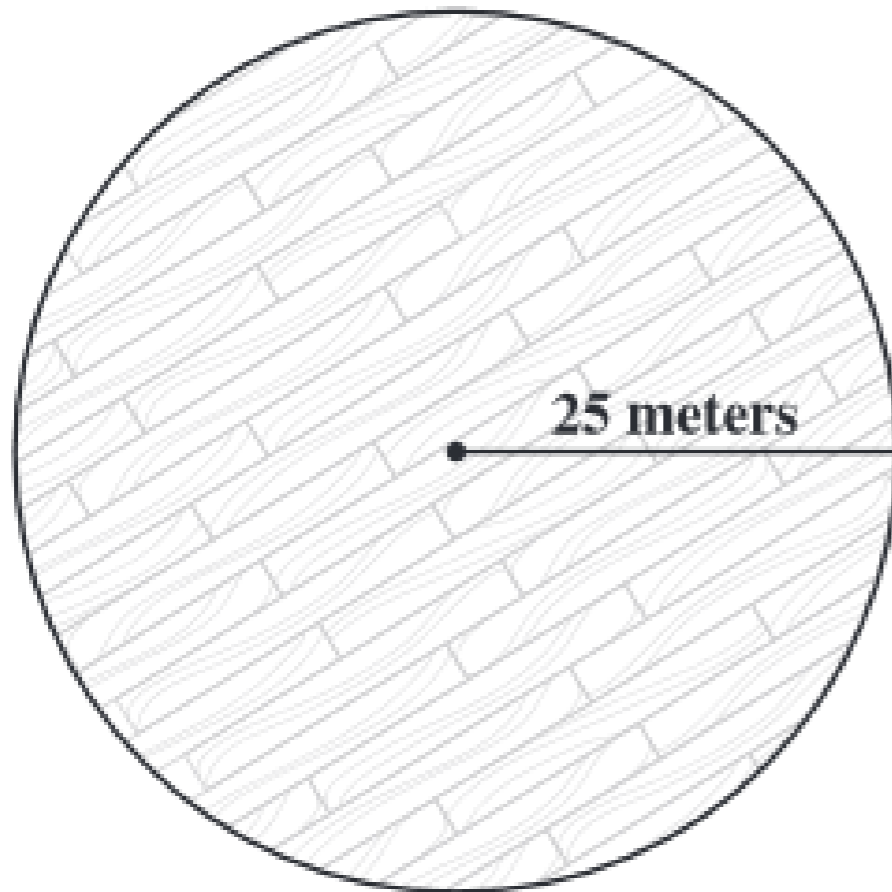
25 meters

Which equation could be used to find the area of the stage in square meters?

A $A = 25\pi$

B $A = 50\pi$

C $A = \pi \cdot 25^2$

D $A = \pi \cdot 50^2$

CSM02059

72 The top part of this hat is shaped like a cylinder with a diameter of 7 inches.
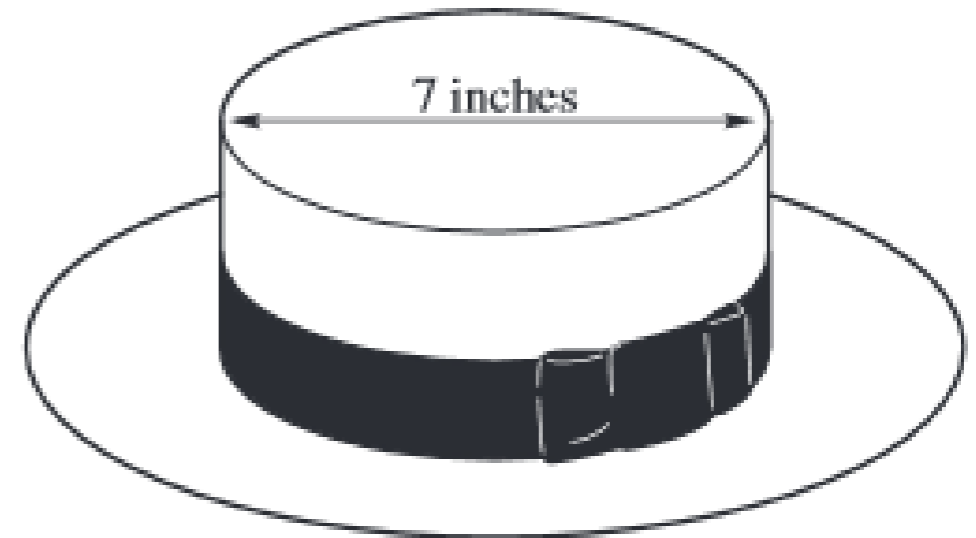
7 inches

Which measure is *closest* to the length of the band that goes around the outside of the hat?

A 10.1 inches

B 11.0 inches

C 22.0 inches

D 38.5 inches

CSM00268

What is the circle's circumference? $\pi \approx 3.14$

What is the circle's area? $\pi \approx 3.14$

10 units

10 units
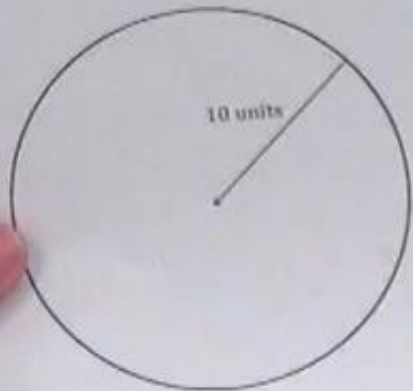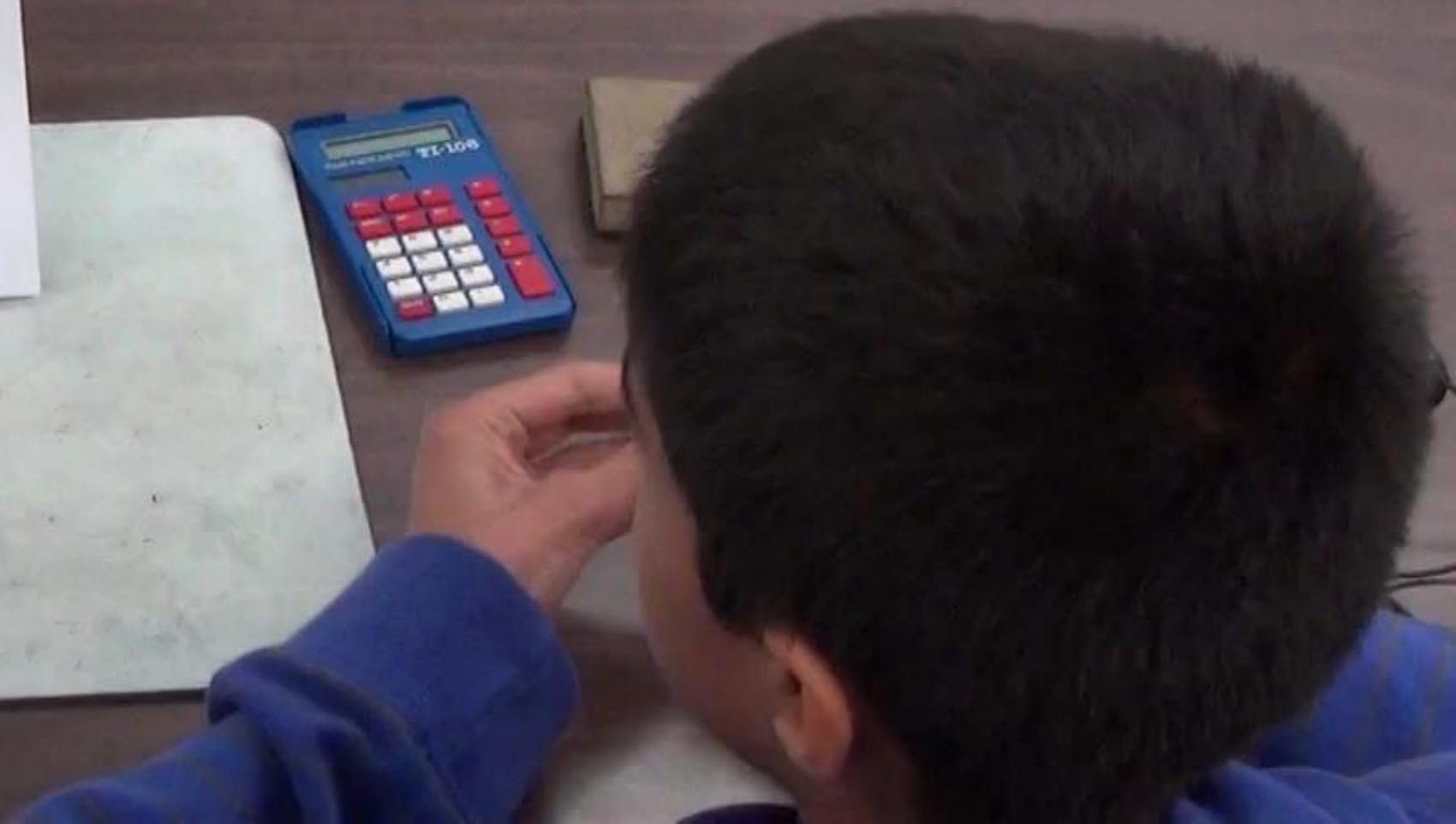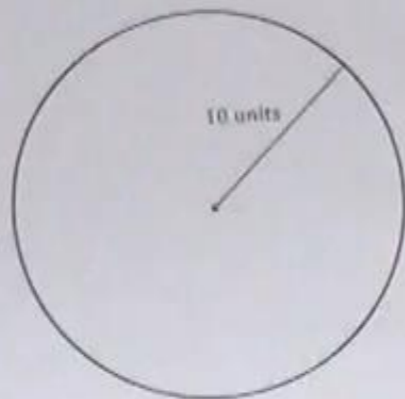
Student Data Facts

- 396 seventh grade students were assessed
- 68.26% correctly answered the circumference question
- 78.59% correctly answered the area question

Claim	Content Category	Assessment Targets	DOK	Minimum # Scored Tasks		Minimum # Items per Item Type		Min/Max Number of Items
				CAT	PT/ECR	SR	CR	
		A. Analyze proportional relationships and use them to solve real-world and mathematical problems.	1,2					
		D. Solve real-life and mathematical		p(9)=1.0				
		E. Draw, construct, and describe geometrical figures and describe the relationship between them.	2,3					
		F. Solve real-life and mathematical problems involving angle measure, area, surface area, and volume.	1,2					
Supporting	Supporting Cluster	problems involving angle measure, area, surface area, and volume.	1,2					
		G. Use random sampling to draw inferences about a population.	1,2	0		2	1	5/8
		H. Draw informal comparative inferences about two populations.	1,2	p(2)=1.0				
		I. Investigate chance processes and develop, use, and evaluate probability models.	1,2					

70 This circular stage has a ra___ ___ meters.

25 meter___

Which equat___ ___ould be used to find the area of the stage in ___re meters?

A $A = 25\pi$

B $A = 50\pi$

C $A = \pi \cdot 25^2$

D $A = \pi \cdot 50^2$

**72** The ___ ___f this hat is shaped like a cylinder with a dia___ ___7 inches.

7 in___

Which measure is *closest* to ___ ___ength of the band that goes around the ___ ___e of the hat?

___0.1 inches

B   ___ inches

C   22___ ___s

D   38.5 in___

CSM00268

Depth of Knowledge – Level Two

Which circle is bigger? How do you know?

Circle A

Area = 36 units^2

Circle B

Circumference = 36 units

$$C = \pi \cdot 2 \cdot r$$

$$36 \approx 6.28 \cdot r$$

$$\frac{36}{6.28} \approx r$$

$$5.73\ units \approx r$$

$$A = \pi \cdot r^2$$

$$A \approx 3.14 \cdot 5.73^2$$

$$A \approx 3.14 \cdot 32.83$$

$$A \approx 103.15\ units^2$$

SBAC Constructed Response Rubric

- For full credit (2 points):
    - Student reaches the correct conclusion.

        AND

    - Student provides sufficient reasoning to support this conclusion.

- For partial credit (1 point):
    - Student reaches the correct conclusion but does not provide sufficient reasoning to support this conclusion.

        OR

    - Student does not reach the correct conclusion but provides reasoning to support this conclusion that contains a minor conceptual or computation error.

Which circle is bigger? How do you know?

Circle B
Circumference = 36 units

Circle A
Area = 36 units²

Video Facts

- Of the ten students interviewed:
  - Ten correctly answered both of the DOK 1 questions.
  - One earned two points on the DOK 2 question.
  - Six earned one point on the DOK 2 question.
  - Three earned zero points on the DOK 2 question.

Student Data Facts

- Of the 396 seventh grade students who were assessed, 12.12% correctly answered the DOK 2 question.

- 97.92% of the students who correctly answered the DOK 2 question also correctly answered both of the two DOK 1 questions.

- 10.61% of the students who correctly answered both of the two DOK 1 questions also correctly answered the DOK 2 question.

More Student Data Facts

- 28.28% of the students earned only one point.

- All of them earned one point by choosing Circle B and providing insufficient reasoning.

- 59.59% of the students earned no points.

What Can We Learn From This?

- Simply emphasizing rote knowledge and skills is not enough.
- Instruction needs to be balanced with opportunities for reasoning and sense making.
- Challenging students to articulate their understandings is the key to discovering the misconceptions.

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DOUBLE-DOUBLE® *Double Meat & Double Cheese* 2⁶⁵

CHEESEBURGER 1⁷⁵

HAMBURGER 1⁵⁰

FRENCH FRIES 1⁰⁵

SHAKES *Chocolate Strawberry Vanilla* 1⁵⁵

SM	MED	LG	X-LG
99	1¹⁰	1²⁹	1⁴⁹

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

MILK	70
COFFEE	70

OPEN 10:30 a.m. to 1:00 a.m.
IN-N-OUT BURGER
....................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

DblDbl
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

Counter-Eat In

DblDbl
98 Meat Pty XChz   2.65
                                            88.20

Counter-Eat In   90.85
TAX 7.50%   6.81
Amount Due   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
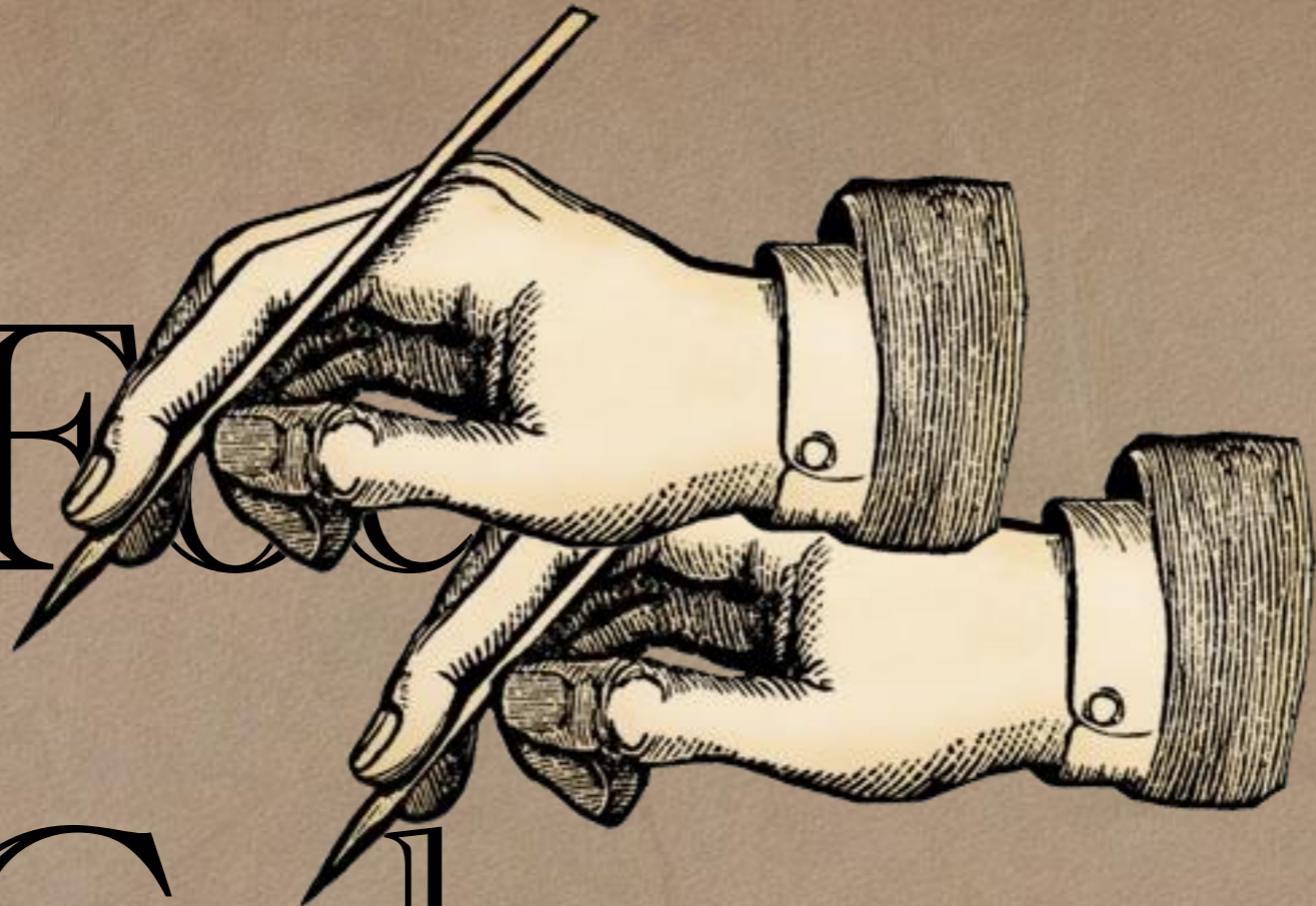
- Focus
- Coherence
- Rigor

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

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?

· theres 100 beef patties

What do you need to know to solve the problem?

· 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.

Questioning Scenarios

- The activity begins with teachers in groups of three taking the roles of teacher, student, or observer.

- The individuals playing the role of teacher and student each receive a slip of paper describing their scenario.

- The individual playing the role of observer waits to record all of the teacher's questions to the student.

- Once the activity begins, the teacher will talk to the student in the context of the scenario they read about on the slips of paper.

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IVE

FOX
NEWS

Junction
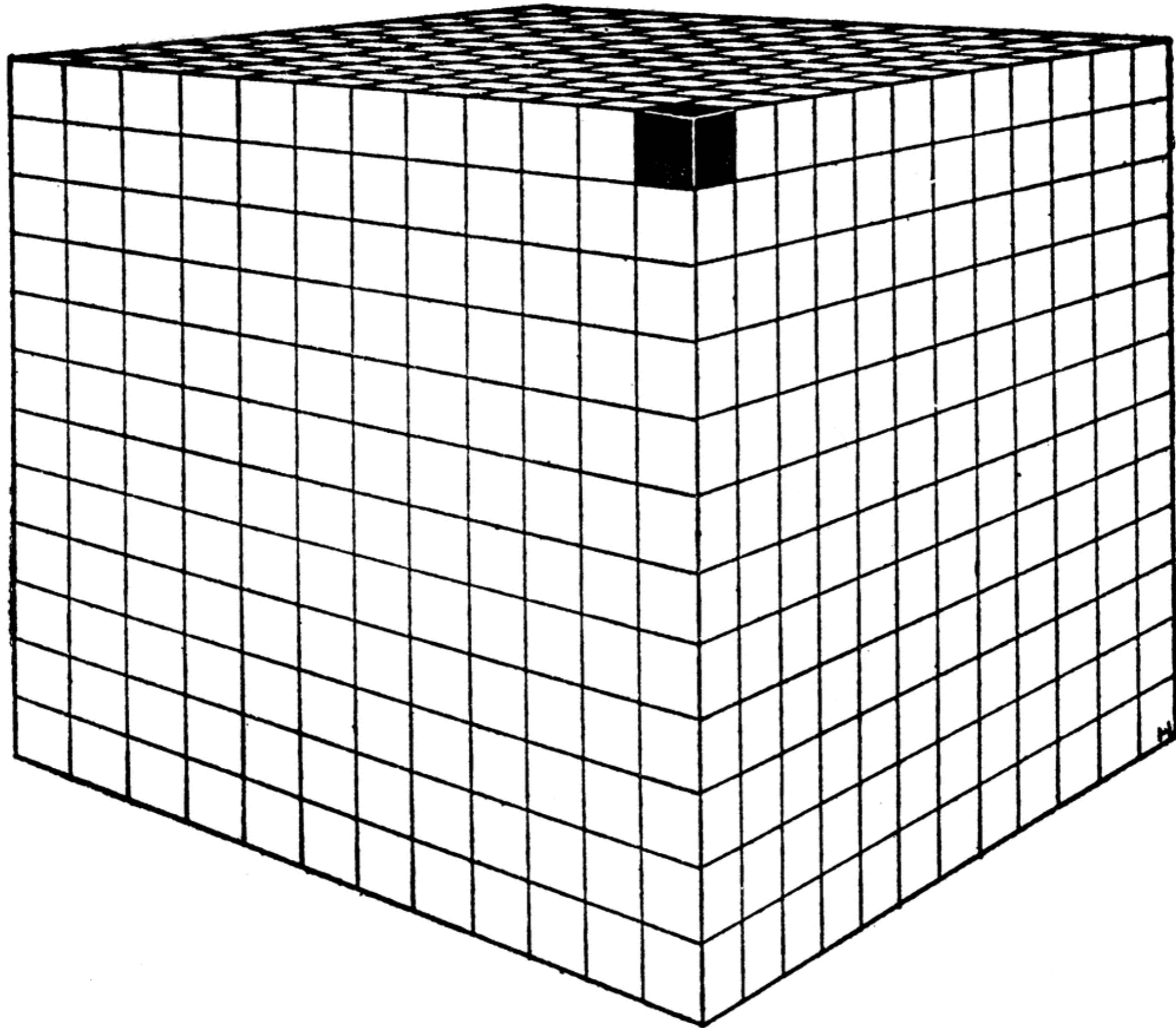
Solving Real-World Geometry Problems

High School

- G-MG.1 – Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).
- G-GMD.3 – Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems.

Middle School

- 8.G.9 Know the formulas for the volumes of cones, cylinders, and spheres and use them to solve real-world and mathematical problems.
- 7.G.6 – Solve real-world and mathematical problems involving area, volume and surface area of two- and three-dimensional objects.
- 6.G.2 –Apply the formulas V = l w h and V = b h to find volumes of right rectangular prisms with fractional edge lengths in the context of solving real-world and mathematical problems.

Elementary School

- 5.MD.5 – Relate volume to the operations of multiplication and addition and solve real world and mathematical problems involving volume.
- 4.MD.3 – Apply the area and perimeter formulas for rectangles in real world and mathematical problems
- 3.MD.7d – Find areas of rectilinear figures by decomposing them into non-overlapping rectangles and adding the areas of the non-overlapping parts, applying this technique to solve real world problems.
- 2.MD.1 – Measure the length of an object by selecting and using appropriate tools such as rulers, yardsticks, meter sticks, and measuring tapes.
- 1.MD.2 – Express the length of an object as a whole number of length units.
- K.MD.1 – Describe measurable attributes of objects, such as length or weight. Describe several measurable attributes of a single object.

WHAT ISN'T MATHEMATICAL MODELING?

- *It is not modeling in the sense of, "I do; now you do."*

- *It is not modeling in the sense of using manipulatives to represent mathematical concepts.*

- *It is not modeling in the sense of a "model" being just a graph, equation, or function.*

- *It is not just starting with a real world situation and solving a math problem.*

- *It is not beginning with the mathematics and then moving to the real world.*

TICKET BOOTH

1 TICKET = $.50

12 TICKETS = $5.00

25 TICKETS = $10.00

50 TICKETS = $25.00

120 TICKETS = $50.00

HAVE FUN!

The Reality

- What does "best" mean?
  - 120 tickets for $50 is "best" because you get the most tickets
  - 1 ticket for $0.50 is "best" because you spend the least amount of money
- "What do you need to know to solve the problem?"
  - How many tickets will we use?
  - How long will we be staying there?
  - How many people are we going with?
  - How many tickets do the rides cost?
- Once they started working, they had no idea what to do.
  - They didn't realize that they could buy multiple sets of tickets.

The Four C's

- O Communication
- O Curiosity

- 6.G.4 - Represent three-dimensional figures using nets made up of rectangles and triangles, and use the nets to find the surface area of these figures.
- 7.G.6 - Solve real-world and mathematical problems involving area, volume and surface area.
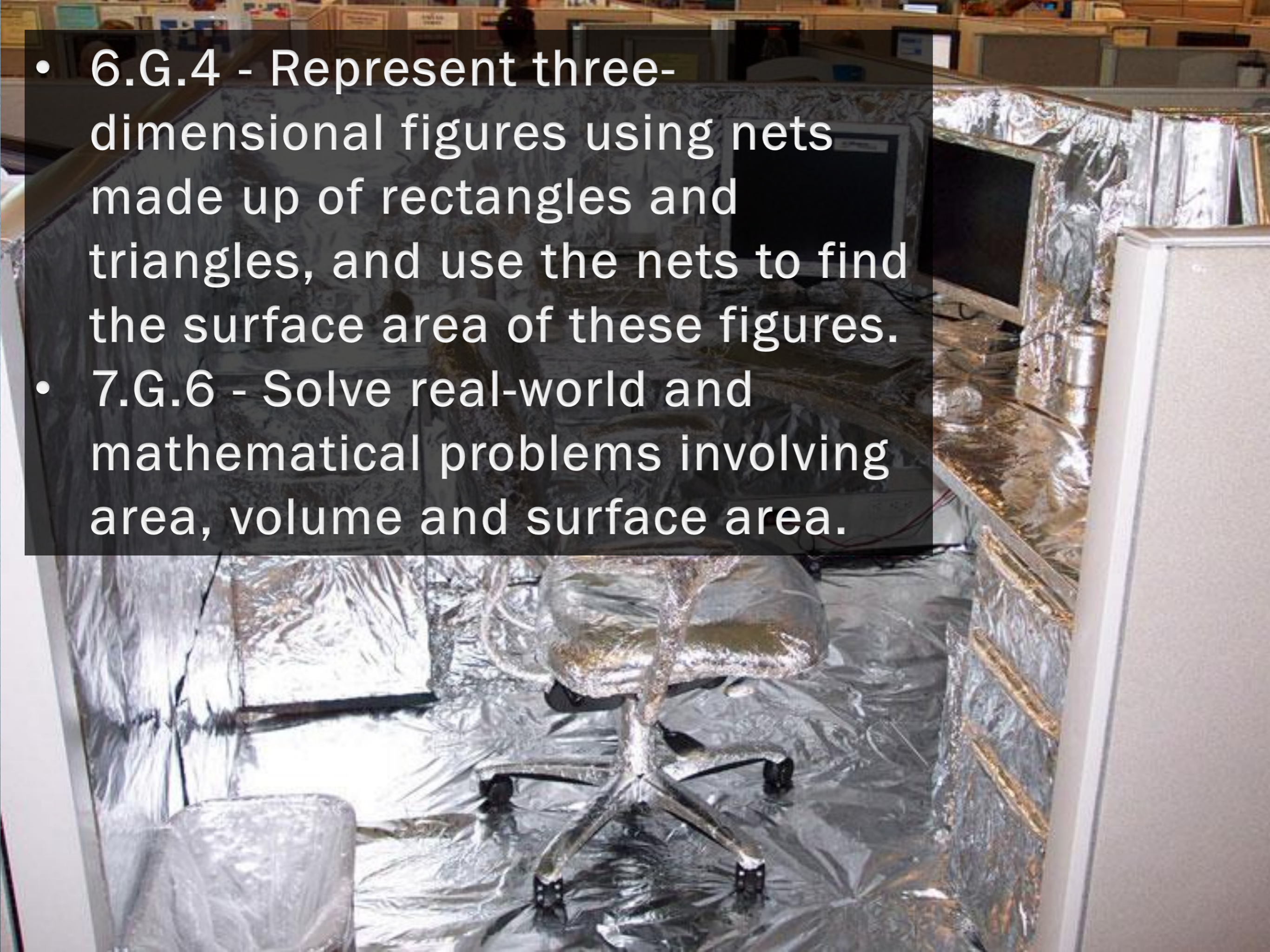
- 8.EE.3 - Use numbers expressed in the form of a single digit times an integer power of 10 to estimate very large or very small quantities, and to express how many times as much one is than the other.
- 8.EE.4 - Perform operations with numbers expressed in scientific notation, including problems where both decimal and scientific notation are used.

- 7.RP.2 - Recognize and represent proportional relationships between quantities.

- 6.NS.3 - Fluently add, subtract, multiply, and divide multi-digit decimals using the standard algorithm for each operation.
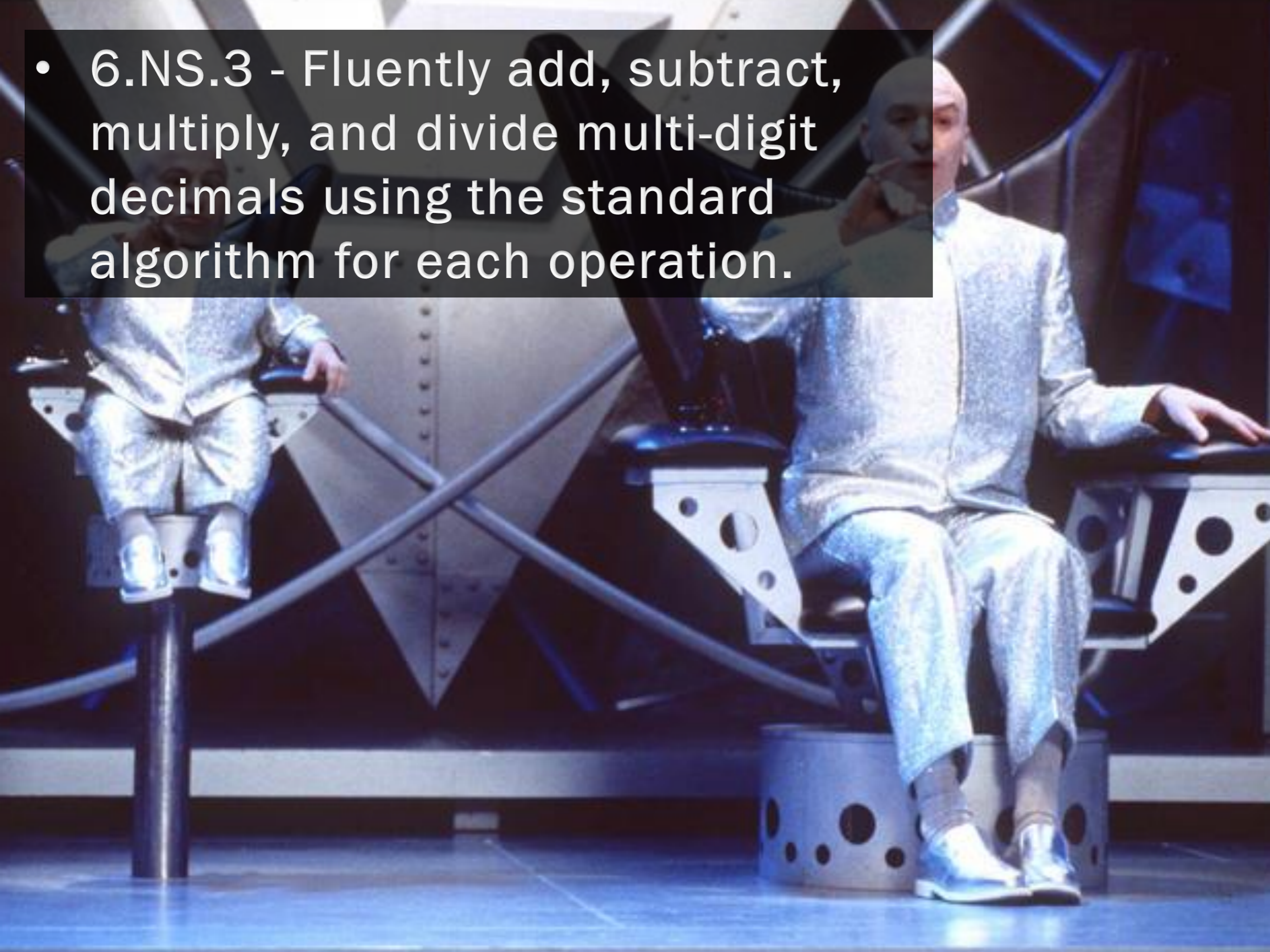
- 8.G.9 - Know the formulas for the volumes of cones, cylinders, and spheres and use them to solve real-world and mathematical problems.
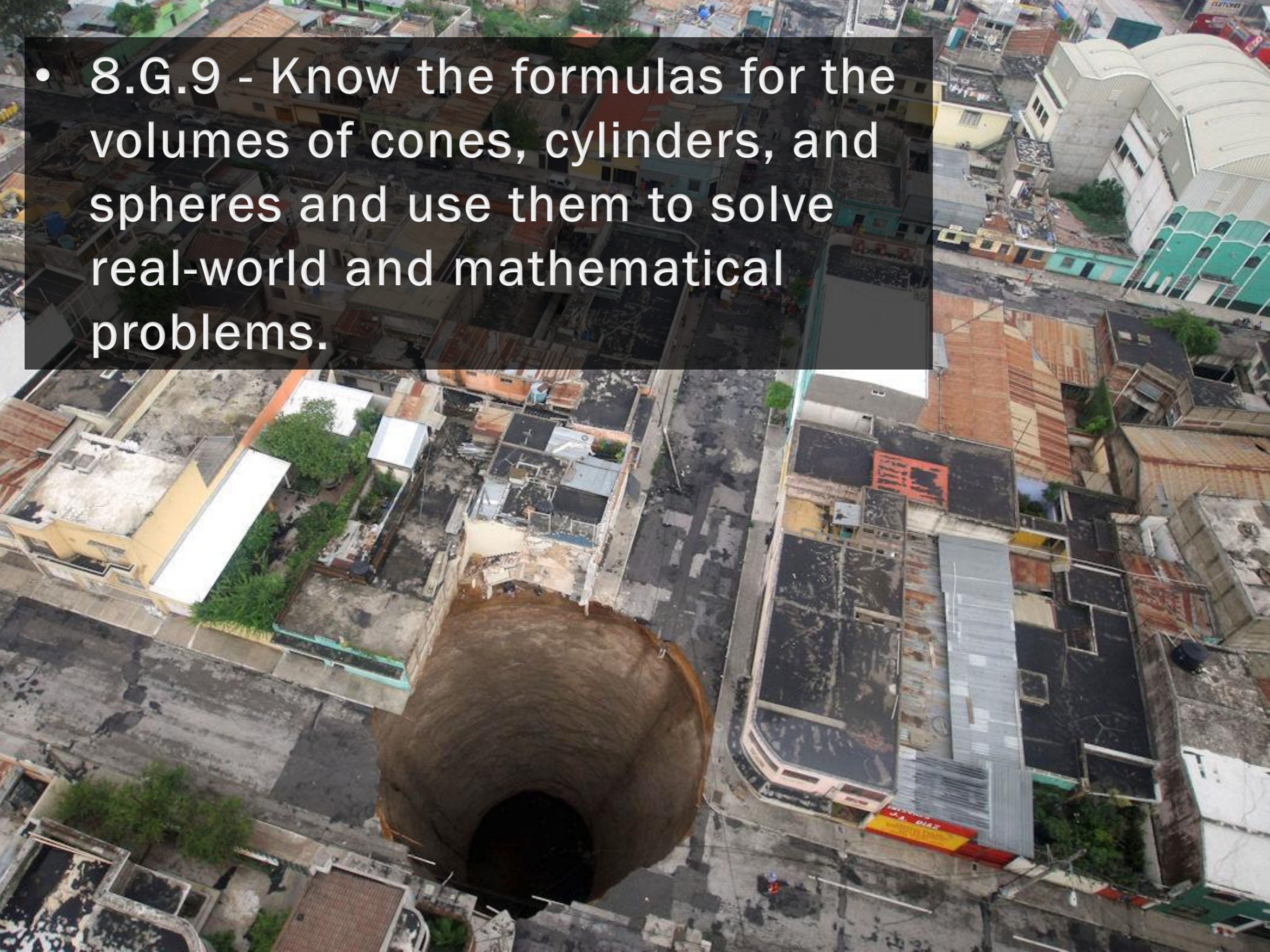
- 8.G.1 - Verify experimentally the properties of rotations, reflections, and translations.
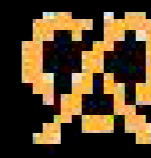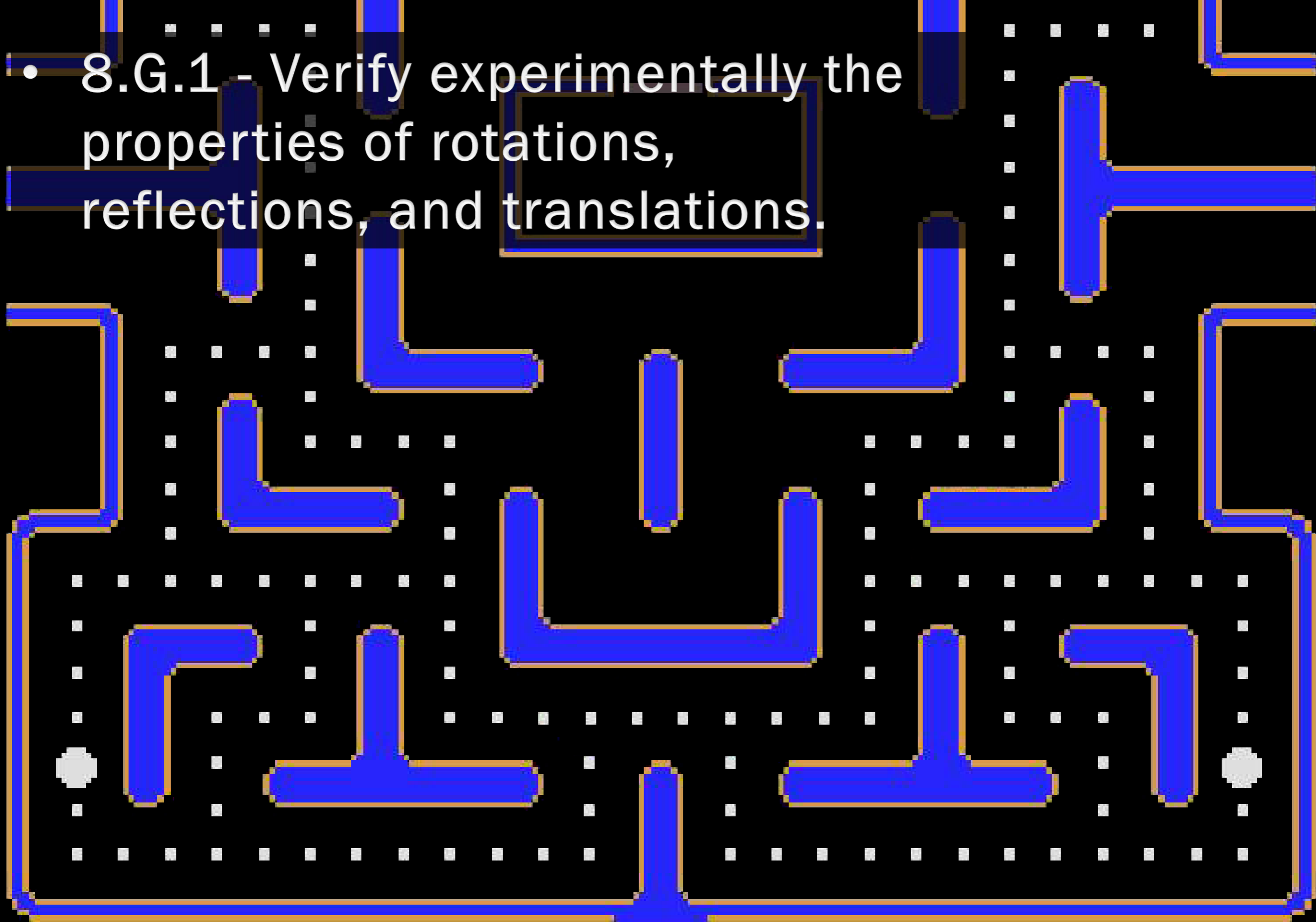
Fresh Roasted PEANUTS
$2.59 lb

Salted PEANUTS
$2.59 lb

SALTED PEANUTS
IN MESH BAG
20 OZ
$3.59

The Four C's

O Communication

O Curiosity

O Critical Thinking

Problem Solving Framework

▶ Inspired by Geoff Krall's resources at emergentmath.com

Name: _____ Period: _____ Date: _____

What problem are you trying to figure out?

What do you already know from the problem?	What do you need to know to solve the problem?

What is your conclusion?

The Four C's

O Communication

O Curiosity

O Critical Thinking

O Content Knowledge

PROBLEM-BASED LEARNING FAQ

- *How often do teachers do problem-based learning?*
- *How long do problem based lessons take?*
- *Do teachers use problem-based lessons to introduce a topic or after you've already taught it?*
- *How is problem-based learning assessed?*
- *How much time does it take to create a problem-based lesson?*

Higher DOK for Middle School

- Use the Order of Operations with the numbers shown on the card below (in any order) so that when you simplify the expression, the answer is 24

Assessing Deeper Understanding

Make the smallest difference using the numbers 1 through 9 no more than one time each.
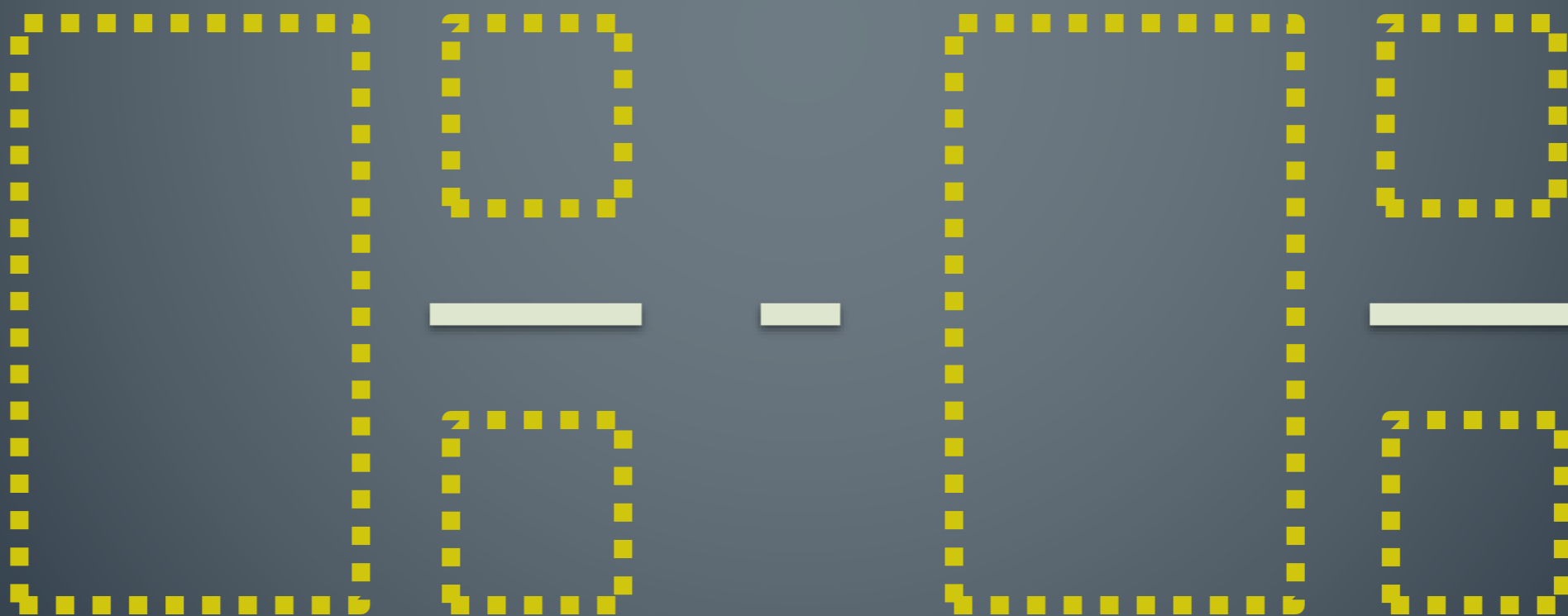
Higher DOK for Middle School

- What are three equations whose solution is $x = -1$?

Higher DOK for Middle School

- Make the largest (or smallest) product by filling in the boxes using the numbers 1-9 no more than one time each.

$$\square \cdot 10^{\square} \cdot \square \cdot 10^{\square}$$

Higher DOK for Middle School

- Fill in the empty boxes with integers 1 through 9, using each number at most once, so that there are infinitely many solutions to the system of equations.

$$\square x + \square y = \square$$

$$\square x + \square y = \square$$

Higher DOK for Middle School

- Directions: Fill in the empty boxes with integers 1 through 9, using each number at most once, so that there is no solution to the system of equations.

$$\Box \, x + \Box \, y = \Box$$

$$\Box \, x + \Box \, y = \Box$$

Open Middle Problems

- Open middle problems require a higher depth of knowledge than most problems that assess procedural and conceptual understanding.

- They often have a "closed beginning" meaning that they all start with the same initial problem

- They often have a "closed end" meaning that they all end with the same answer

- They have an "open middle" meaning that there are multiple ways to approach and ultimately solve the problem

www.openmiddle.com

Problem-Based Lesson Resources

- My lessons: http://www.robertkaplinsky.com/lessons

- Dan Meyer: http://threeacts.mrmeyer.com

- Andrew Stadel: http://tinyurl.com/mrstadel

- Geoff Krall: http://tinyurl.com/PrBLmaps

- Mathalicious: http://www.mathalicious.com

- Yummy Math: http://www.yummymath.com

- 101 Questions: http://www.101qs.com

- Dan Meyer's TED talk: http://tinyurl.com/meyer-TED

Robert KAPLINSKY
Glenrock Consulting

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How Many Sheets Do You Need To Break Out Of Prison?
Operations with rational numbers

Why Choose Us?

1 Math content expert

Robert graduated from University of California, Los Angeles (UCLA) with a Bachelors of Science in Mathematics. He has taught mathematics to students at the elementary, middle, and high school levels. As an instructor for UCLA, he also taught math

Lessons

All   2nd   3rd   4th   5th   6th   7th   8th   Algebra   Functions   Geometry   Modeling   Numb & Quant   Stats & Prob

How Much Is One Third Of A Cup Of Butter?

How Do Skytypers Write Messages?

	Task Name	Concept / Skill	Standard 1	Standard 2	Standard 3	Standard 4	Sta
2	How Can We Water All Of The Grass?	Circles, Pythagorean Theorem, trigonometric ratios	7.G.4	8.G.7	G-SRT.8	G-MG.1	G-N
3	How Much Money IS That?!	Volume of rectangular prism	5.MD.3	5.MD.4	5.MD.5	5.MD.5b	5.M
4	How Much Money Should Dr. Evil Demand?	Exponential Growth	N-RN.2	A-SSE.1	A-SSE.3c	A-SSE.4	A-R
5	How Tall Is Mini-Me?	Scale and Dividing Decimals	5.NF.5	5.NF.5a	5.NF.5b	6.NS.3	
6	How Did They Make Ms. Pac-Man?	Transformations (Rotations, Reflections, and Translations)	8.G.1	8.G.2	8.G.3	8.G.4	G-S
7	Which Ticket Option Is The Best Deal?	Unit Rates and Ratios	6.RP.2	6.RP.3	6.RP.3a	6.RP.3b	
8	How Far Apart Are The Freeway Exits?	Fractions on a Number Line and Subtracting Fractions	3.NF.2	3.NF.2b	4.NF.2	4.NF.3a	4.N
9	Do We Have Enough Paint?	Area	3.MD.5	3.MD.6	3.MD.7		
10	How Many Stars Are There In The Universe?	Scientific Notation	8.EE.3	8.EE.4			
11	What Rides Can You Go On?	Inequalities and Measurement	2.MD.1	6.NS.7a	6.NS.7b		
12	Do You Have Enough Money?	Money	2.MD.8				
13	Which Bed Bath & Beyond Coupon Should You Use?	Percent Discount	7.RP.3				
14	Is Gas Cheaper With Cash Or Credit Card?	Percent Discount	7.RP.3				
15	Where's The Nearest Toys R Us?	Pythagorean Theorem (Distance in coordinate system)	8.G.8	G-SRT.8	G-GPE.7		
16	How Sharp Is The iPhone 5's Retina Display?	Pythagorean Theorem (Length of a side)	8.G.7	G-SRT.8	G-GPE.7		
17	When Should She Take Her Medicine?	Operations with Time Intervals	4.MD.2				
18	How Big Are Sunspots?	Converting Units, Proportions, and Scientific Notation	5.MD.1	7.RP.2	7.G.4	8.EE.4	G-M
19	What Michael's Coupon Should I Use?	Percent Discount	7.RP.3	A-CED.3			
20	Is It Cheaper To Pay Monthly or Annually?	Decimal Operations and/or Systems of Equations	5.NBT.7	8.EE.8c	A-CED.3	A-REI.11	F-E
21	How Big Is The 2010 Guatemalan Sinkhole?	Volume of Cylinder	5.MD.3	5.MD.4	5.MD.5	8.G.9	G-C
22	How Can You Win Every Prize At Chuck E. Cheese's?	Decomposing Numbers and/or Systems of Equations	2.NBT.7	3.NBT.2	3.NBT.3	8.EE.8c	A-C
23	How Many Royal Flushes Will You Get?	Probability	7.SP.5	7.SP.6	7.SP.7	S-MD.5	S-M
24	How Much Does The Paint On A Space Shuttle Weigh?	Surface Area	6.G.4	7.G.6	8.G.7	G-MG.1	G-M
25	How Did Motel 6 Go From $6 to $66?	Percent Increase and Compound Interest	7.RP.3	A-SSE.1b	F-BF.1	F-IF.8b	F-L
26	How Much Does The Aluminum Foil Prank Cost?	Surface Area and Unit Rates	6.G.4	6.RP.2	6.RP.3	7.G.6	
27	How Many Laps Is A 5k Race?	Perimeter	4.MD.3				
28	Which Toilet Uses Less Water?	Systems of Equations/Inequalities	8.EE.8c	A-CED.3	A-REI.11	F-BF.1	
29	How Did Someone Get A $103,000 Speeding Ticket In Finland?	Linear Equations	A-CED.2	F-BF.1	F-IF.4	F-IF.6	
30	Which Pizza Is A Better Deal?	Area or Circle, Square, and Unit Rates	3.MD.5	3.MD.6	3.MD.7	4.MD.3	6.R
31	How Big Is The World's Largest Deliverable Pizza?	Area of Square	3.MD.5	3.MD.6	3.MD.7	4.NBT.3	4.M
32	How Many Sheets Do You Need To Break Out Of Prison?	Integer Operations	5.NBT.6				
33	Do Hybrid Cars Pay For Themselves?	Systems of Equations or Rates	6.RP.2	6.RP.3	8.EE.8c	A-CED.3	F-E
34	How Many Hot Dogs Did They Eat?!	Linear and Quadratic Functions	8.F.3	8.F.4	F-BF.1	F-BF.2	F-IF
35	How Much Purple Ribbon Will You Need?	Perimeter & Circumference	3.MD.8	4.MD.3	7.G.4		
36	Are We There Yet?	Adding Times	3.MD.1	4.MD.2			
37	Which Chinese Food Coupon Should I Use?	Percent Discount	7.RP.3				
38	How Big Is The Vehicle That Uses Those Tires?	Ratio and Proportions	7.RP.2				
39	Where Would The Angry Birds Have Landed?	Create Equation From Quadratic Graph	A-CED.1	F-BF.1	F-IF.4	F-IF.7a	F-L
40	How Many Movies Can You See In One Day?	Adding Times	3.MD.1	4.MD.2			
41	Which Carrots Should You Buy?	Unit Rates	6.RP.1	6.RP.2	6.RP.3		
42	How Fast Can You Throw A Baseball?	Converting Units and Unit Rates	5.MD.1	6.RP.2			

Problem-Based Lesson Search Engine

This search engine searches all of the sites below to quickly help you find a problem-based lesson (also called 3-Act Task, mathematical modeling, or application problem):

[   ] **Submit**

The links below are the pages that are being searched by the search engine:

- 101 Questions

- Andrew Stadel

- Dan Meyer

- Dane Ehlert

- Emergent Math's Problem Based Curriculum Maps

- Estimation180

- Geoff Krall