

Motivating Our Students with Real World Problem- Based Lessons

ROBERT KAPLINSKY

 @robertkaplinsky









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

CHEESEBURGER **1⁷⁵**

HAMBURGER **1⁵⁰**

FRENCH FRIES **1⁰⁵**

SHAKES *Chocolate
Strawberry
Vanilla* **1⁵⁵**

<u>SM</u>	<u>MED</u>	<u>LG</u>	<u>X-LG</u>
99	1¹⁰	1²⁹	1⁴⁹
COKE <i>Classic or Diet</i>			
SEVEN-UP			
ROOT BEER			
DR PEPPER			
LEMONADE			
ICED TEA			

MILK	70
COFFEE	70



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

165 1 5 98

8:21 PM

Cashier: SAM
GUEST #: 98

Counter-Eat In

Db Db	2.65
98 Meat Pty XChz	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

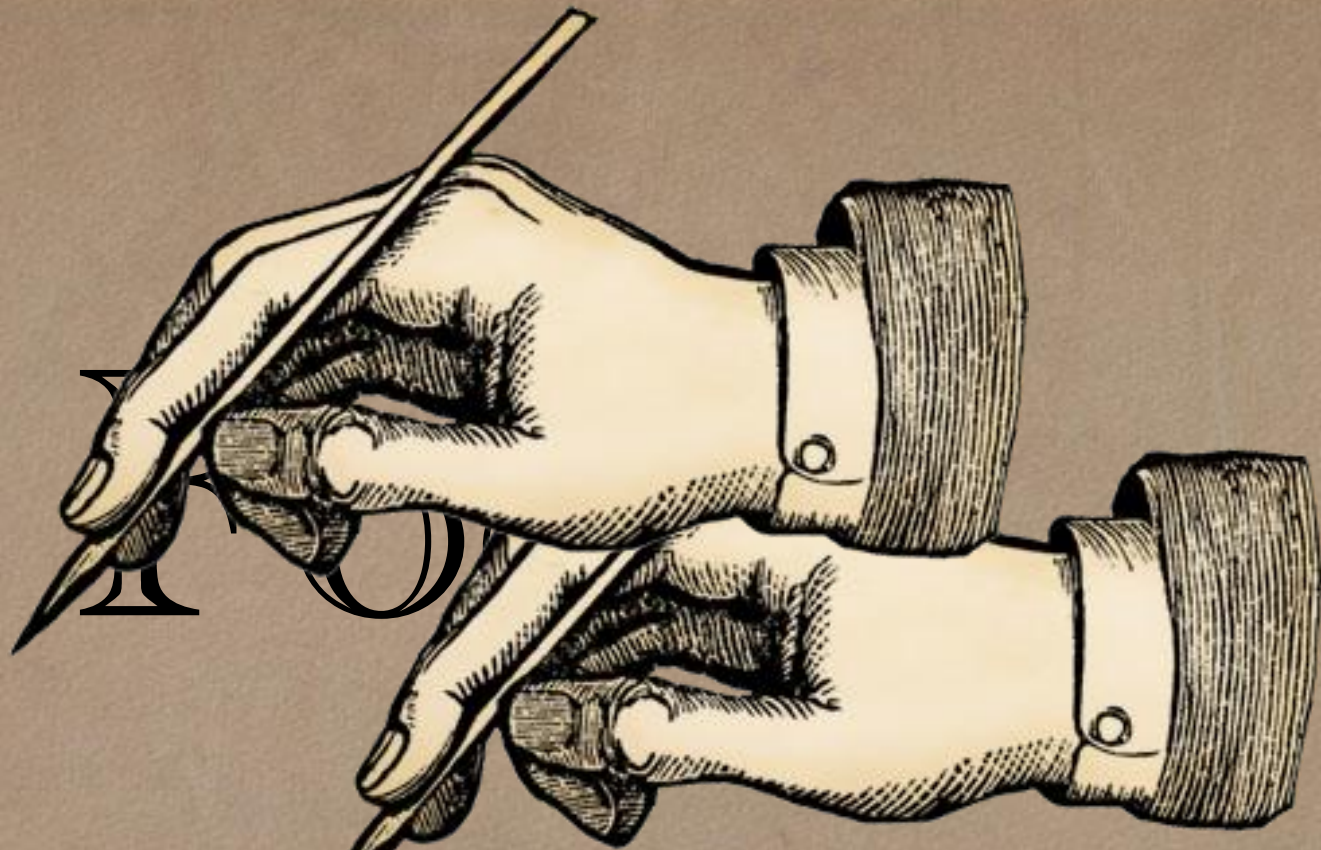
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2004-10-31

8:21 PM

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



•

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 100×100
- Common wrong answers included:
 - \$175.00 ($\1.75×100 cheeseburgers)
 - \$132.50 ($\2.65×50 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?	
<p>How much does a 100x100 burger cost?</p> <p style="text-align: right;">Regular (one patty) \$1.25</p> <p style="text-align: center;">\$132.50</p>	
What do you already know from the problem?	What do you need to know to solve the problem?
<ul style="list-style-type: none"> • there's 100 beef patties • costs 2.50 	<ul style="list-style-type: none"> • How much does a regular cheeseburger cost. 25.1 - <p style="text-align: center;">OP.</p> <p style="text-align: center;">OP. OP.</p>
What is your conclusion?	
<p>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 multiplied by 100. That gave me the answer, which I once again had to add the price of the buns & produce.</p> <p style="text-align: center;"> $22.8 + 00.1 - xOP_0 = 6$ $128_0 + xOP_0 = 6$ </p>	

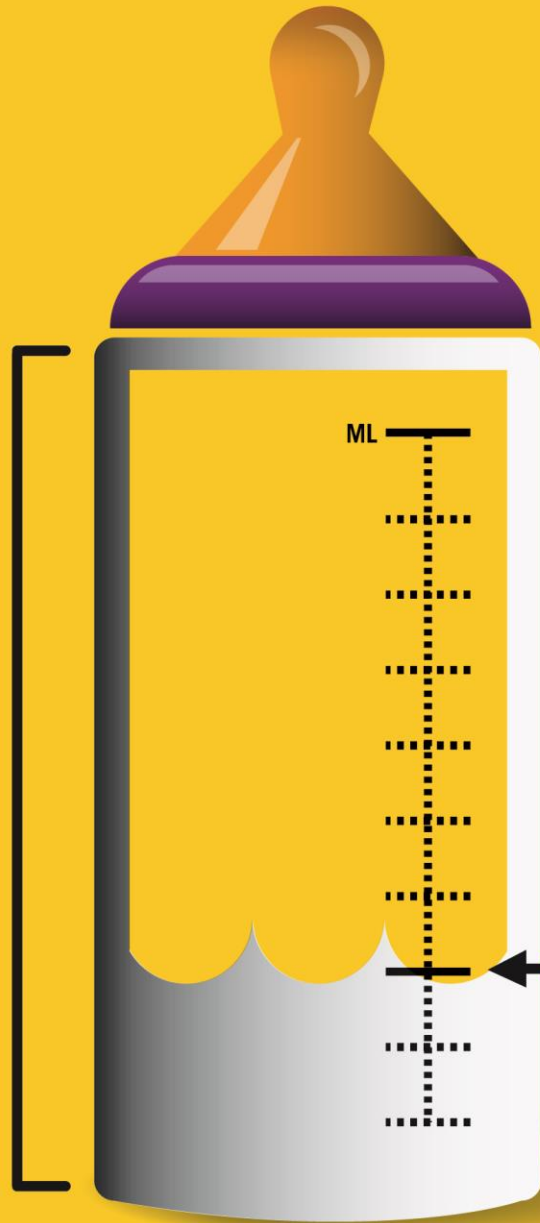
CHOOSE CAR SEAT:
BY AGE & SIZE



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



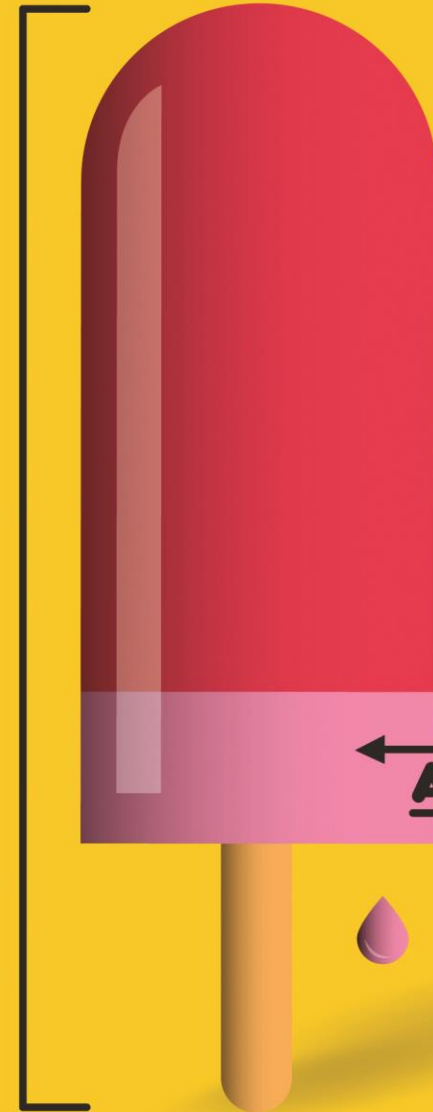
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Math Question

- 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.

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 ($125 \div 5$)
- 0 students calculated the answer to be 625 (125×5)
- 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.

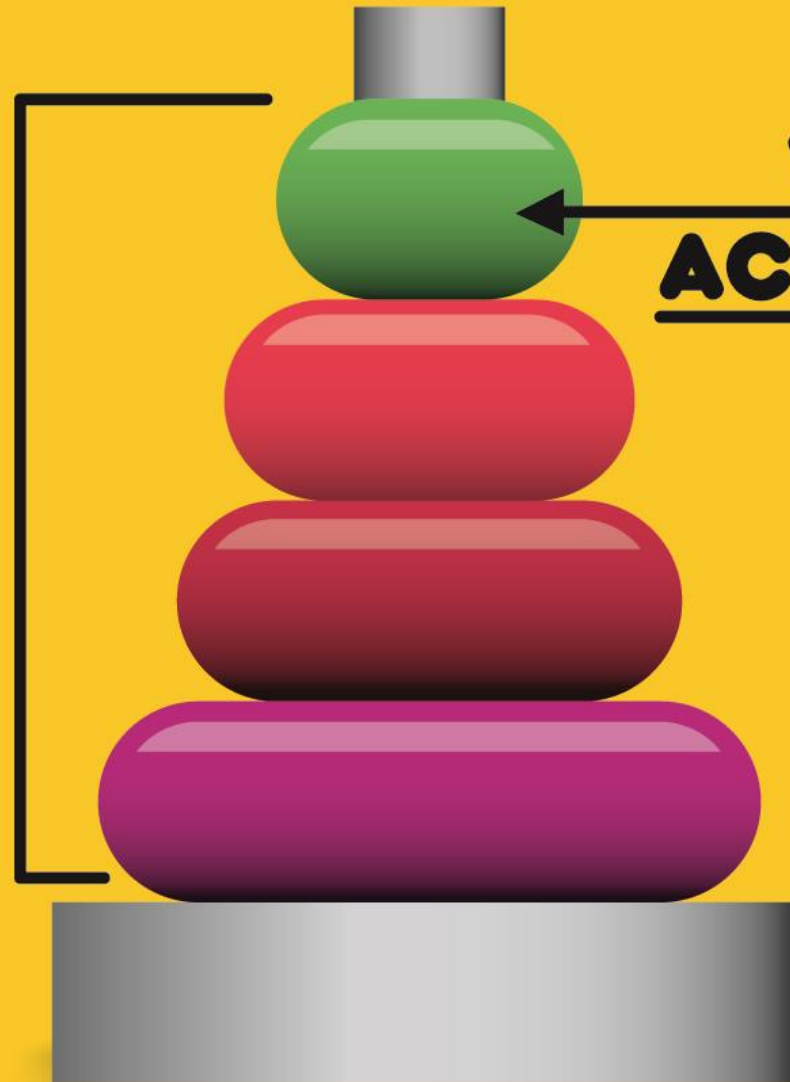
be reduced by about half if the correct child safety seats were always used.

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



THE ONES
**WHO
ACTUALLY
DO.**

- “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.



VISIT SAFERCAR.GOV/THERIGHTSEAT



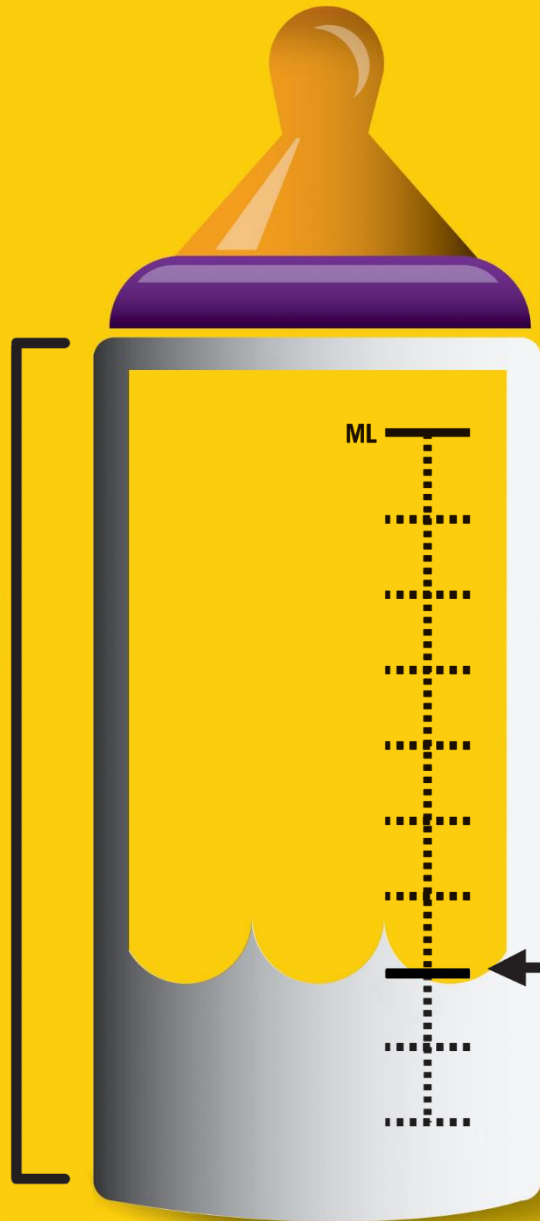
CHOOSE CAR SEAT:
BY AGE & SIZE



THE NUMBER
OF PEOPLE

**WHO
THINK**

THEIR CAR
SEATS ARE
BEING USED
CORRECTLY.



THE ONES
**WHO
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KNOW FOR SURE
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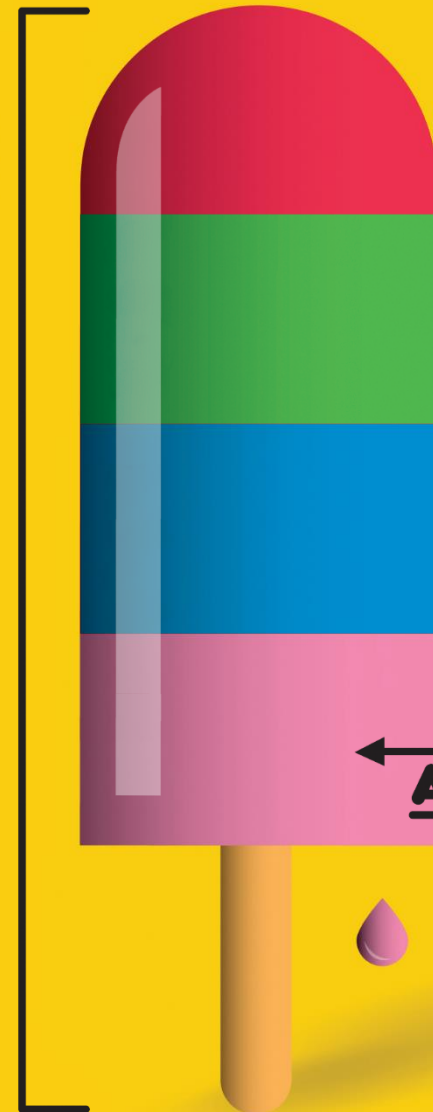
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VISIT SAFERCAR.GOV/THERIGHTSEAT





LIVE

FOX
NEWS

Junction



PGR
PROCURADURÍA
GENERAL DE
LA REPÚBLICA

**SUBPROCURADURIA
DE INVESTIGACIÓN ESPECIALIZADA
EN DELINCUENCIA ORGANIZADA**

PGR
PROCURADURÍA
GENERAL DE
LA REPÚBLICA





FOX



5:00

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.*

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?*

WHAT DOES IT LOOK LIKE...

- when students have procedural skill but not conceptual understanding or the ability to apply mathematics?
- when students can work with numbers but cannot:
 - critically think
 - applying knowledge and skills to real-world settings
 - analyze and solve complex problems

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





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

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

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

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

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

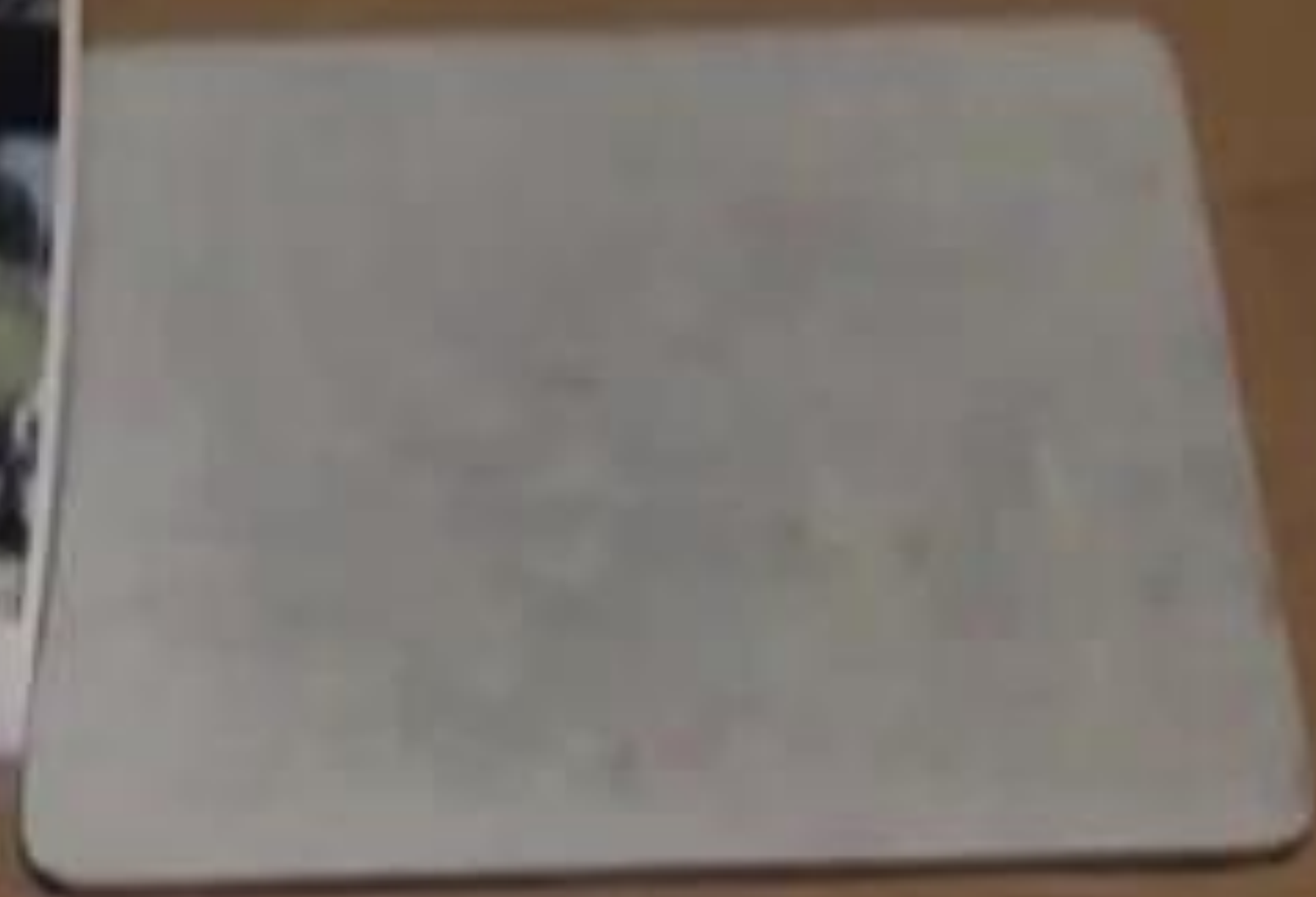
$\frac{1}{4}$

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

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

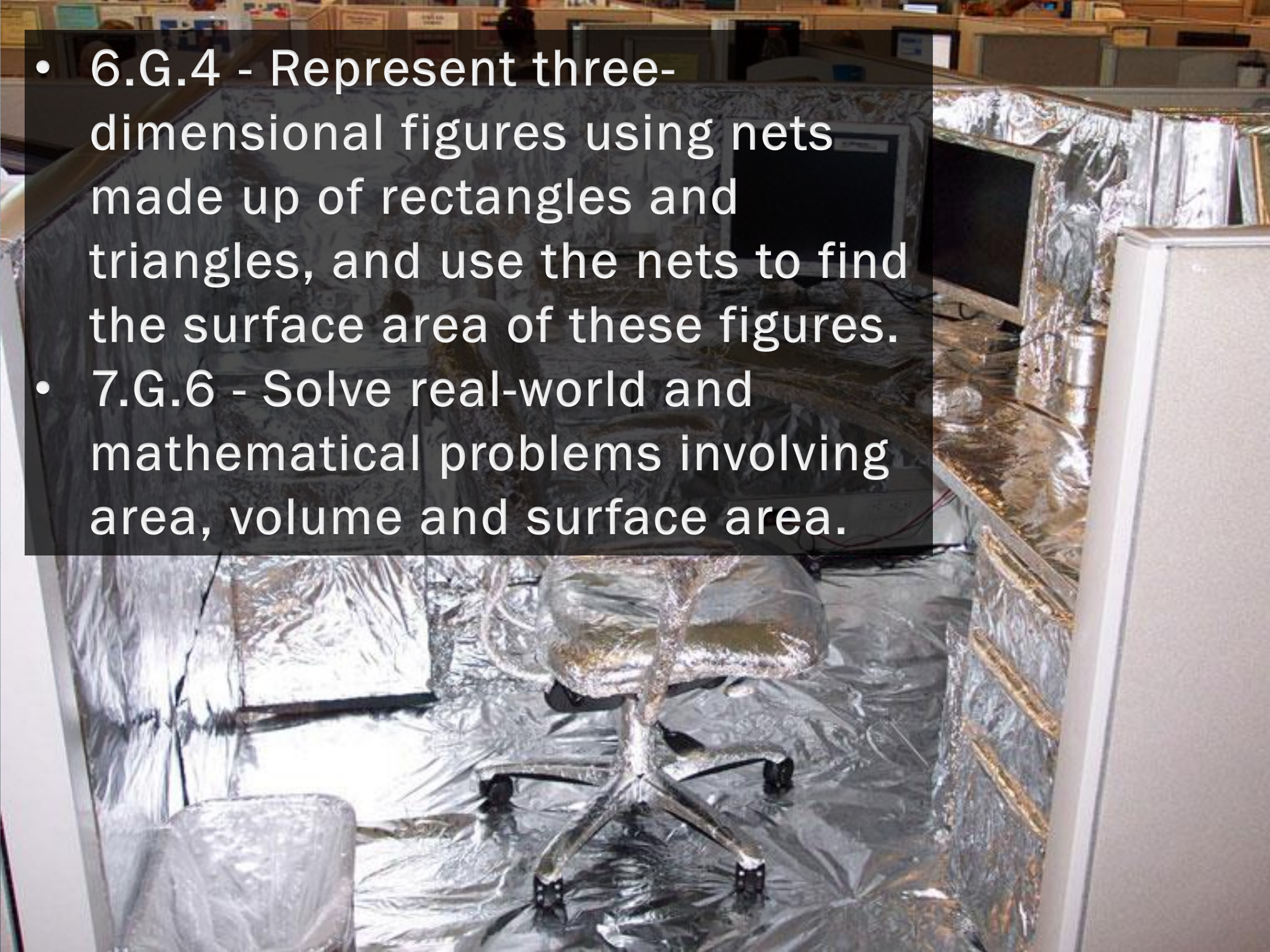
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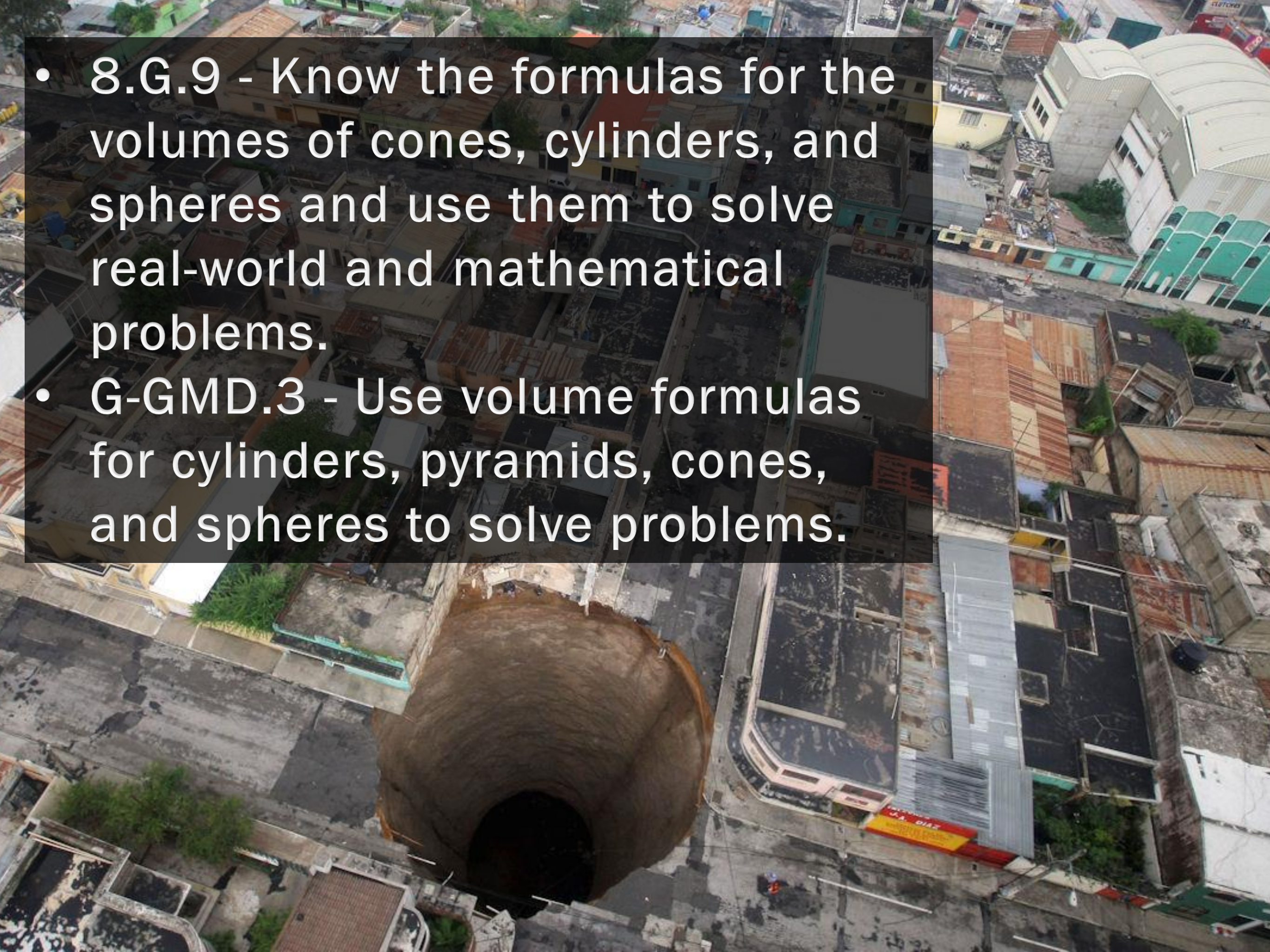
The Four C's

- o Communication
- o Curiosity

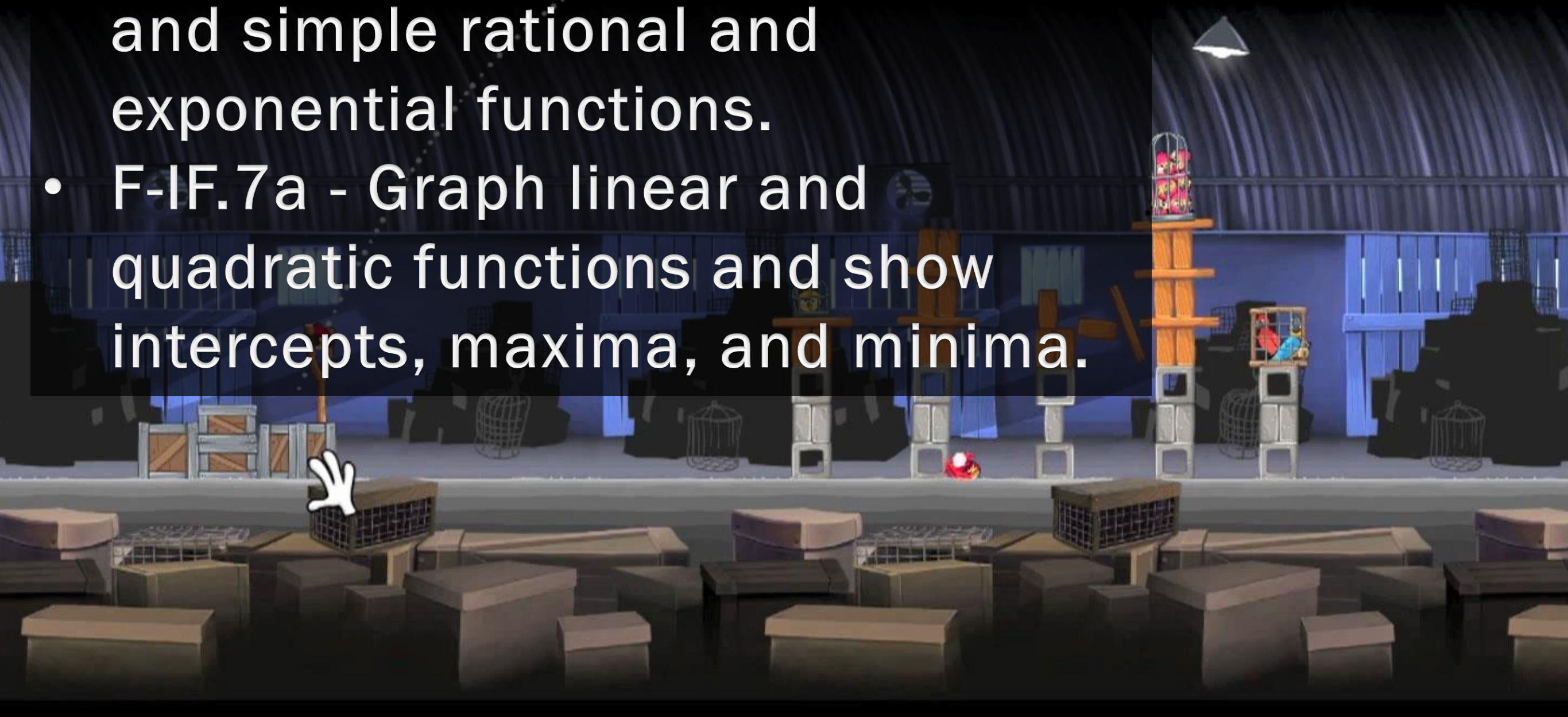
- 6.G.4 - Represent three-dimensional figures using nets made up of rectangles and triangles, and use the nets to find the surface area of these figures.
- 7.G.6 - Solve real-world and mathematical problems involving area, volume and surface area.



- 8.G.9 - Know the formulas for the volumes of cones, cylinders, and spheres and use them to solve real-world and mathematical problems.
- G-GMD.3 - Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems.



- A-CED.1 - Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions.
- F-IF.7a - Graph linear and quadratic functions and show intercepts, maxima, and minima.



- 6.RP.2 - Understand the concept of a unit rate



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: _____

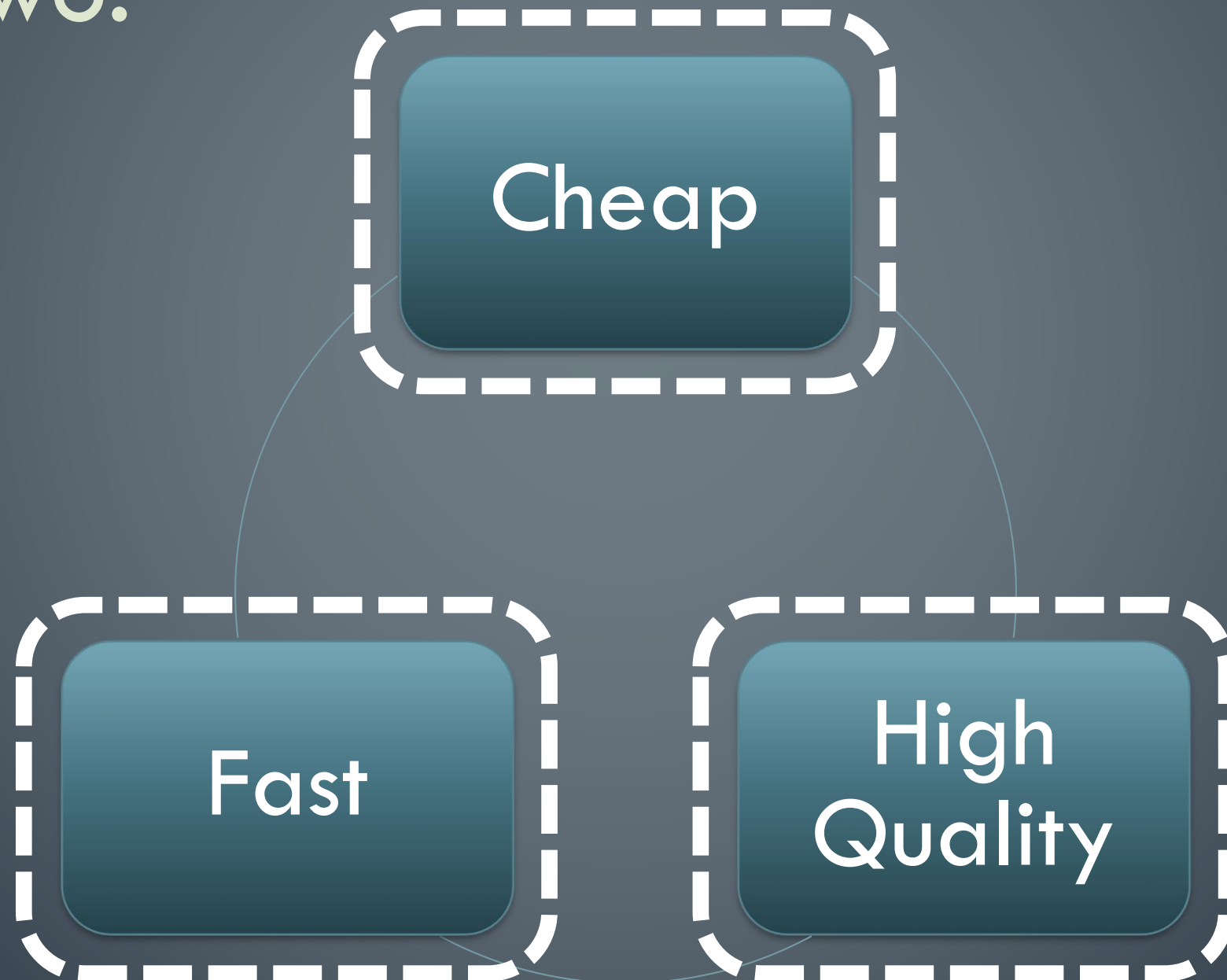
What problem are you trying to figure out?	What guesses do you have?
What do you already know from the problem?	What do you need to know to solve the problem?
What should we title this lesson?	
What is your conclusion? How did you reach that conclusion?	

The Four C's

- o Communication
- o Curiosity
- o Critical Thinking
- o Content Knowledge

Construction

- Pick two:



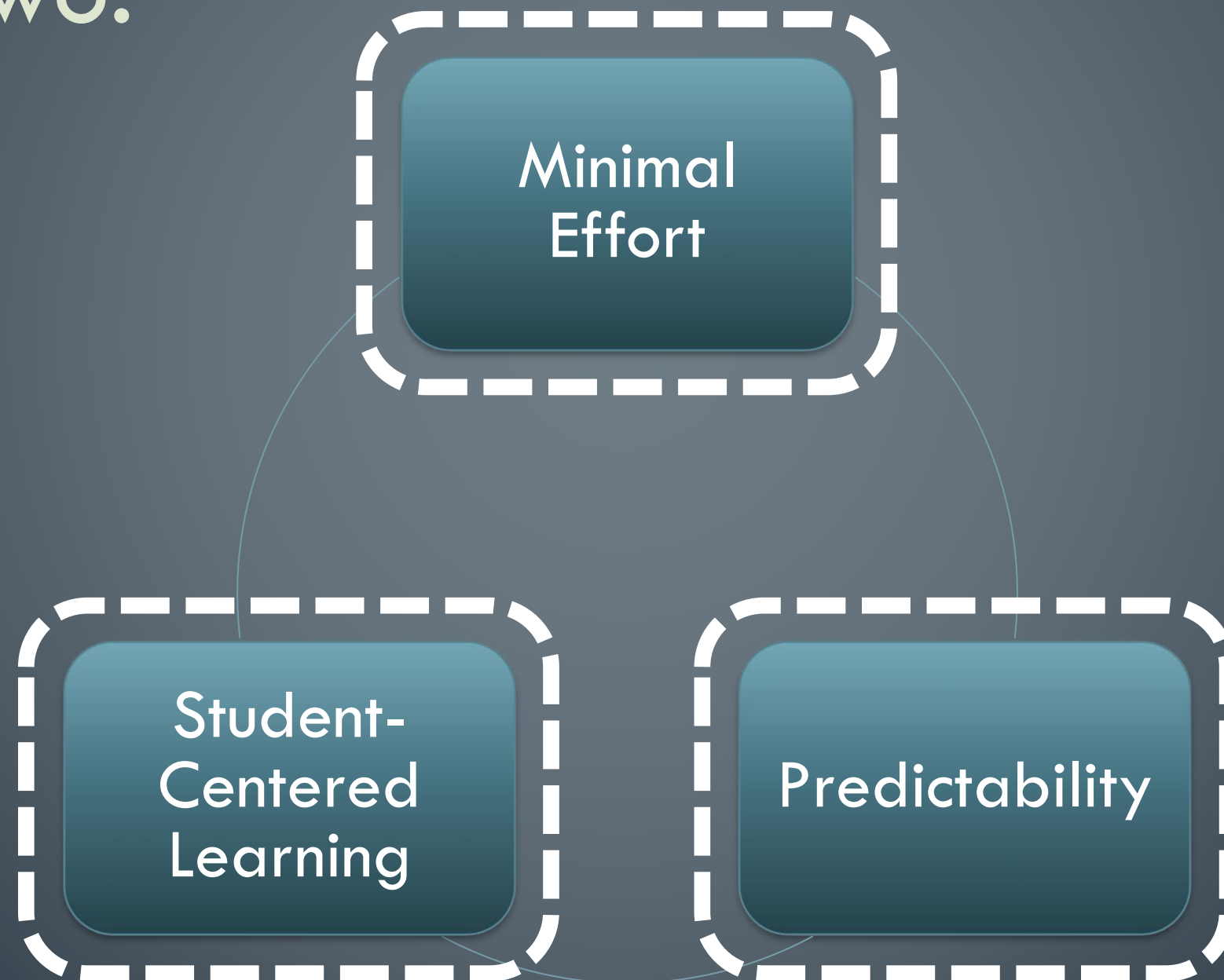
Family

- Pick two:



Problem-Based Learning

- Pick two:



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://tinyurl.com/mrstadel>

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

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



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





How Much Is One Third Of A Cup Of Butter?



How Do Skytypers Write Messages?



Robert Kaplinsky's Problem-Based Lessons

File Edit View Insert Format Data Tools Help All changes saved in Drive



	A	B	C	D	E	F	
1	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-M
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			



Google Search

I'm Feeling Lucky

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):

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](#)

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101qs.com

Andrew Stadel

Dan Meyer

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Problem Based Curriculum Maps

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