Real-World Problem-Based Learning Using Perplexing Tasks

ROBERT KAPLINSKY

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
TAX 7.50%   90.85
Amount Due   6.81
                                         97.66

CASH TENDER
Change $97.66
                                        $.00

2004-10-31

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GUEST #: 98

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Db1Dbl
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	Serving Size (g)	Calories
Hamburger w/Onion	243	390
Cheeseburger w/Onion	268	480
Double-Double w/Onion	330	670
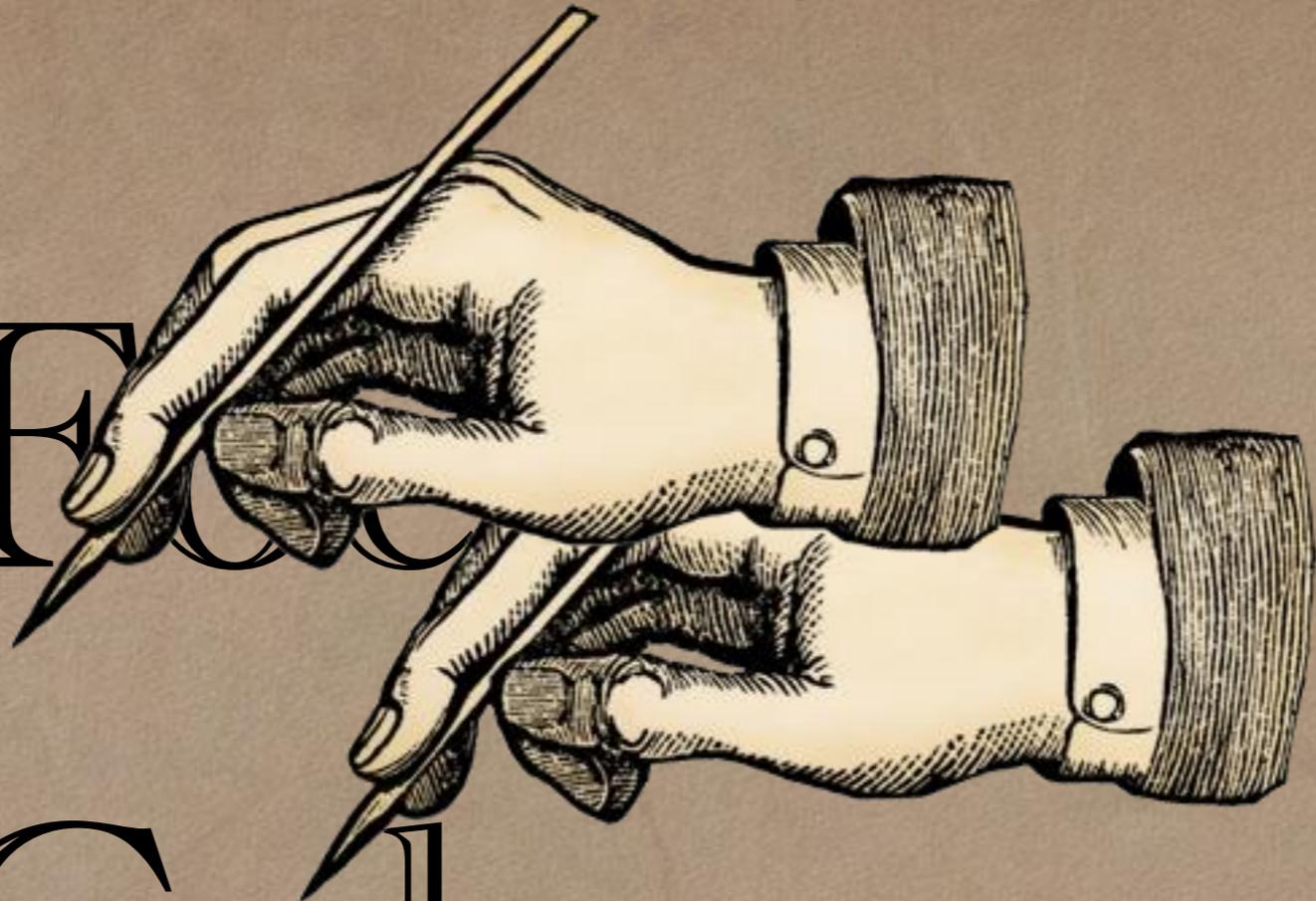
- Foc
- Coherence
- Rigor

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

Problem Based Learning and 3 Student Questions

- When will I ever use this?
- Why does it work?
- How do I do it?

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 100x100 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, them multiplyed by 100. That gave me the answer, which I once again had to add the price of the buns & produce.

The Four C's

O Communication

O Curiosity

- 3.MD.1 - Tell and write time to the nearest minute and measure time intervals in minutes. Solve word problems involving addition and subtraction of time intervals in minutes.
- 4.MD.2 - Use the four operations to solve word problems involving distances, intervals of time, liquid volumes, masses of objects, and money.
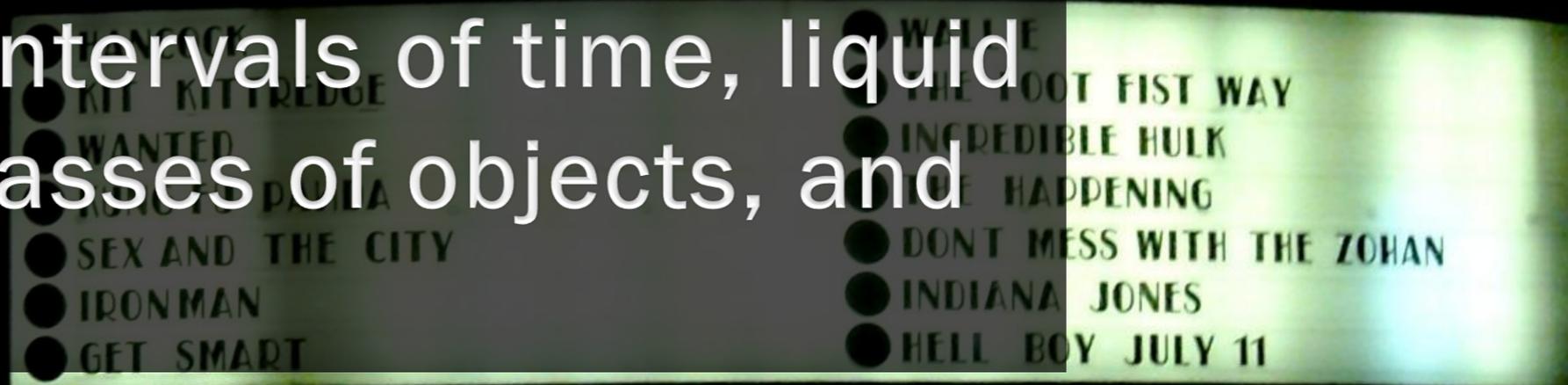
- 5.NBT.7 Add, subtract, multiply, and divide decimals to hundredths, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method and explain the reasoning used.
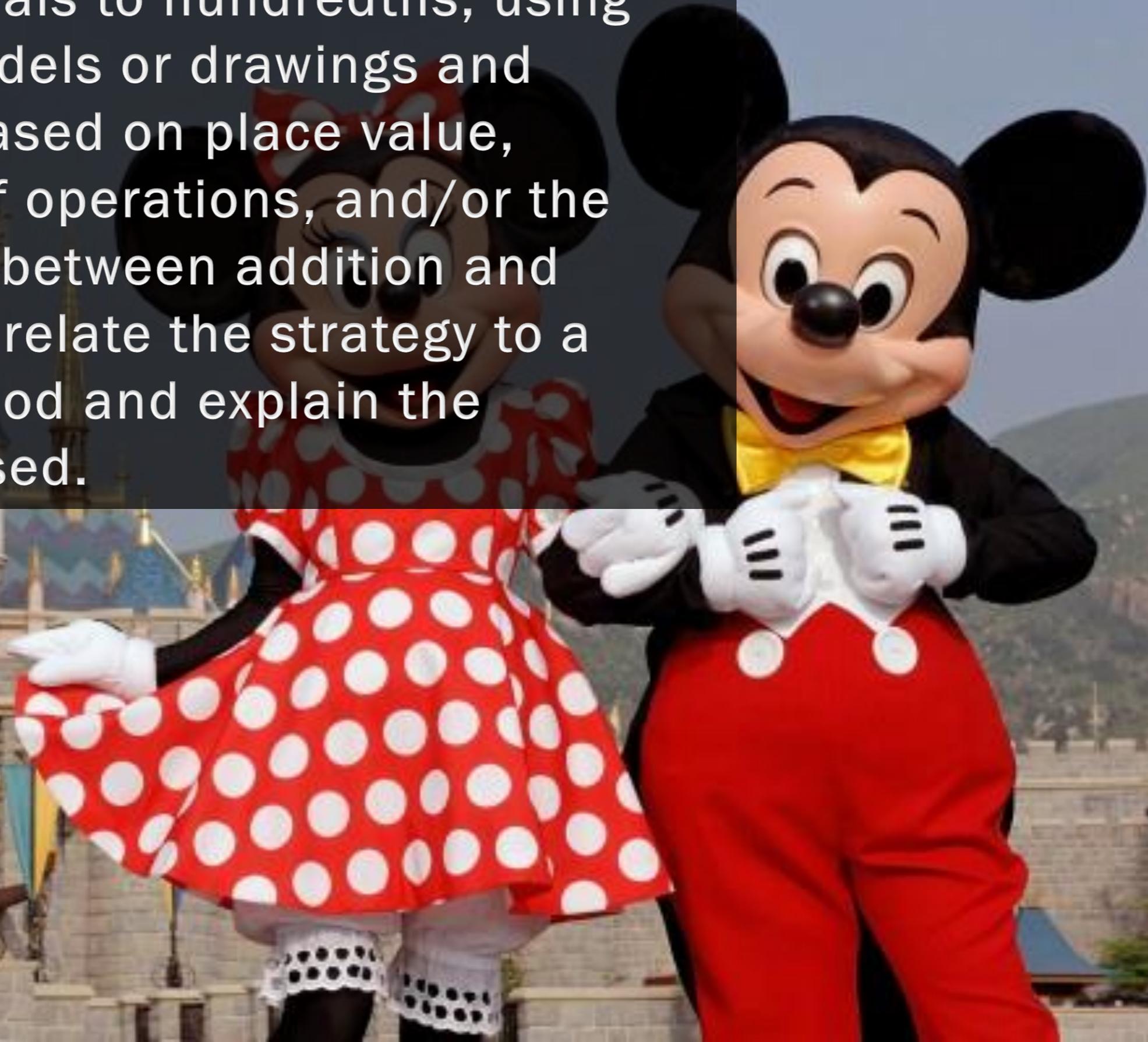
- 6.G.4 - Represent three-dimensional figures using nets made up of rectangles and triangles, and use the nets to find the surface area of these figures.
- 7.G.6 - Solve real-world and mathematical problems involving area, volume and surface area.
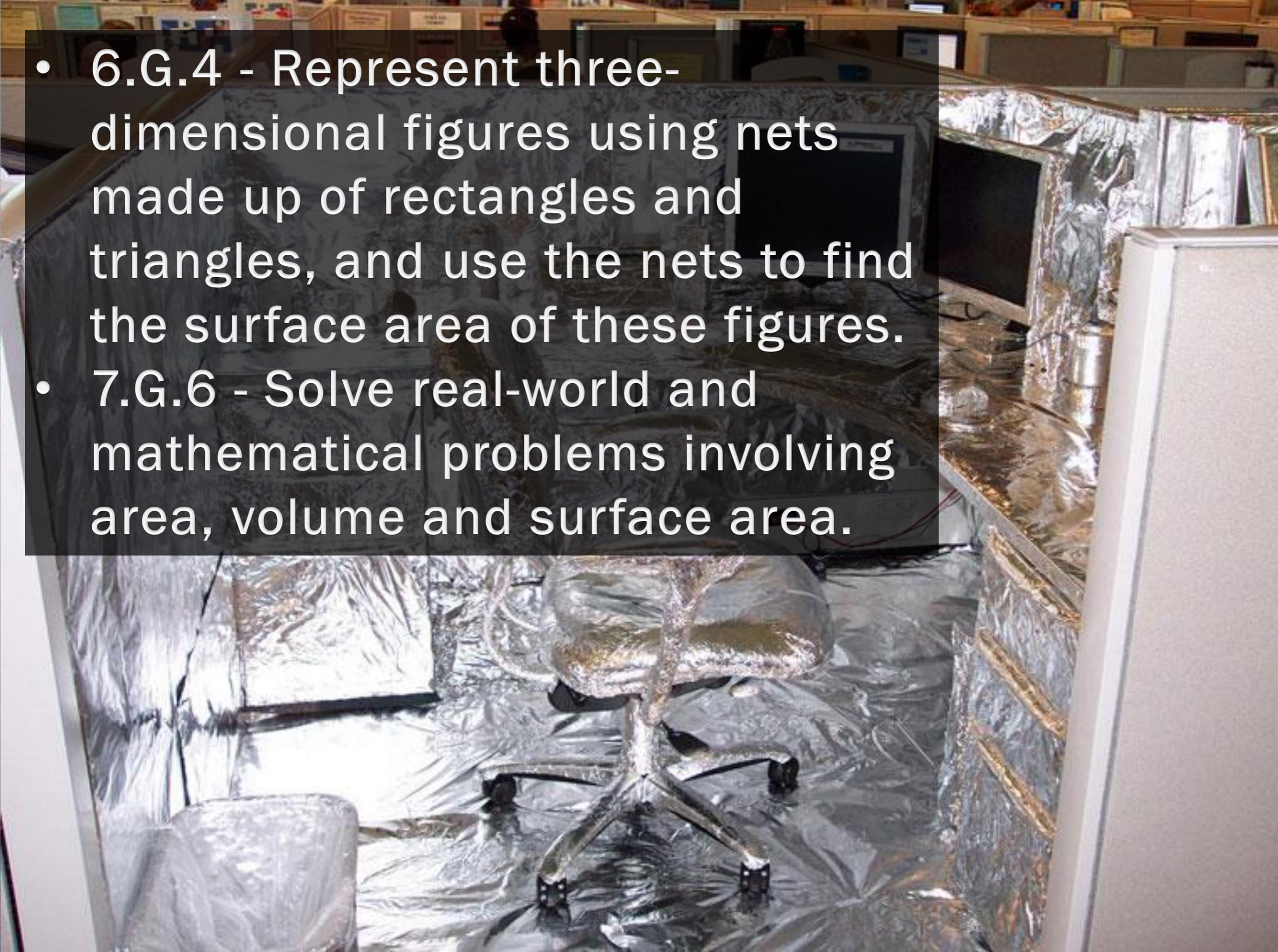
- 8.G.9 - Know the formulas for the volumes of cones, cylinders, and spheres and use them to solve real-world and mathematical problems.
- G-MG.1 - Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).
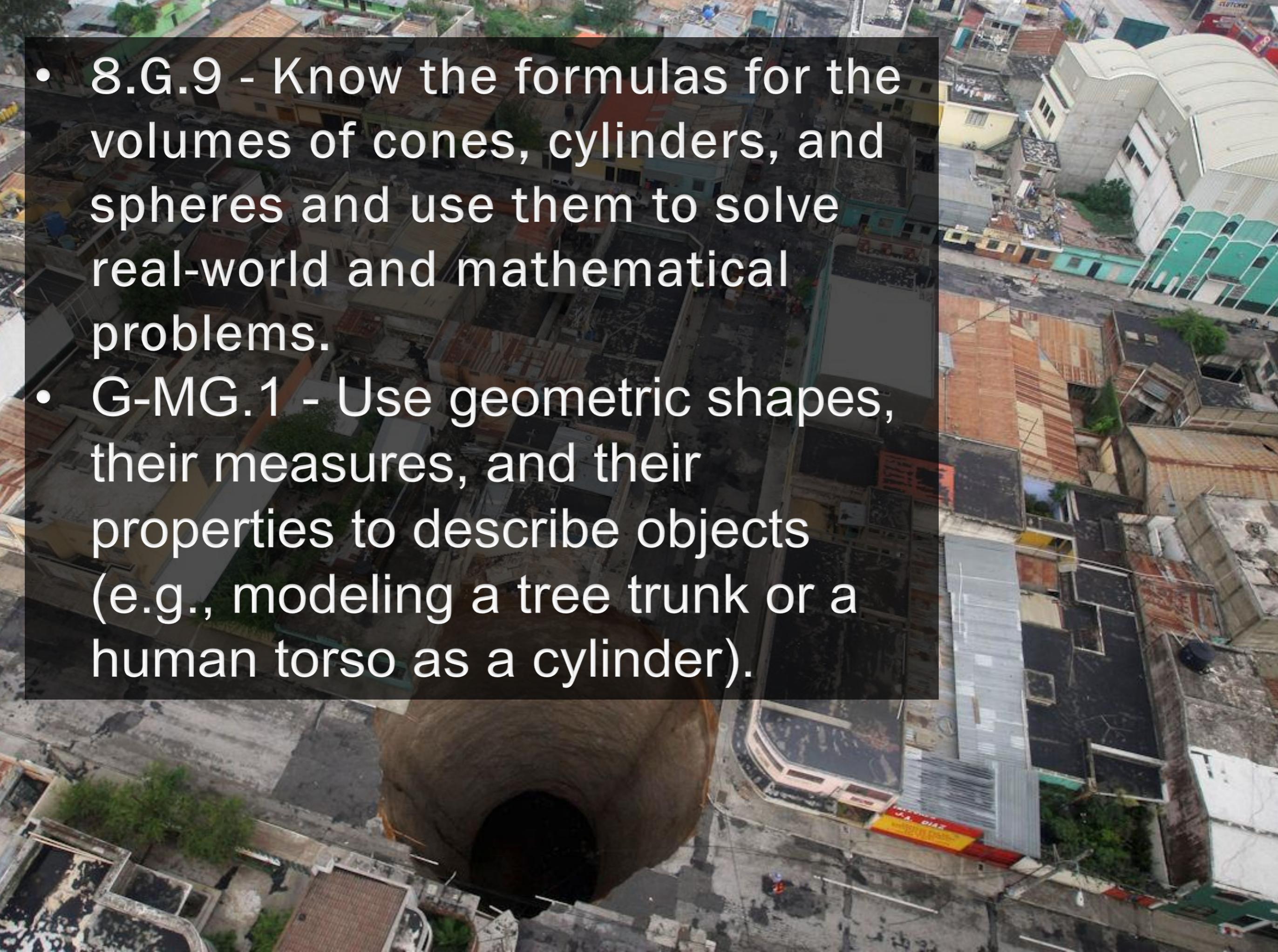
- G-SRT.8 - Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.
- G-GPE.7 - Use coordinates to compute perimeters of polygons and areas of triangles and rectangles, e.g., using the distance formula.
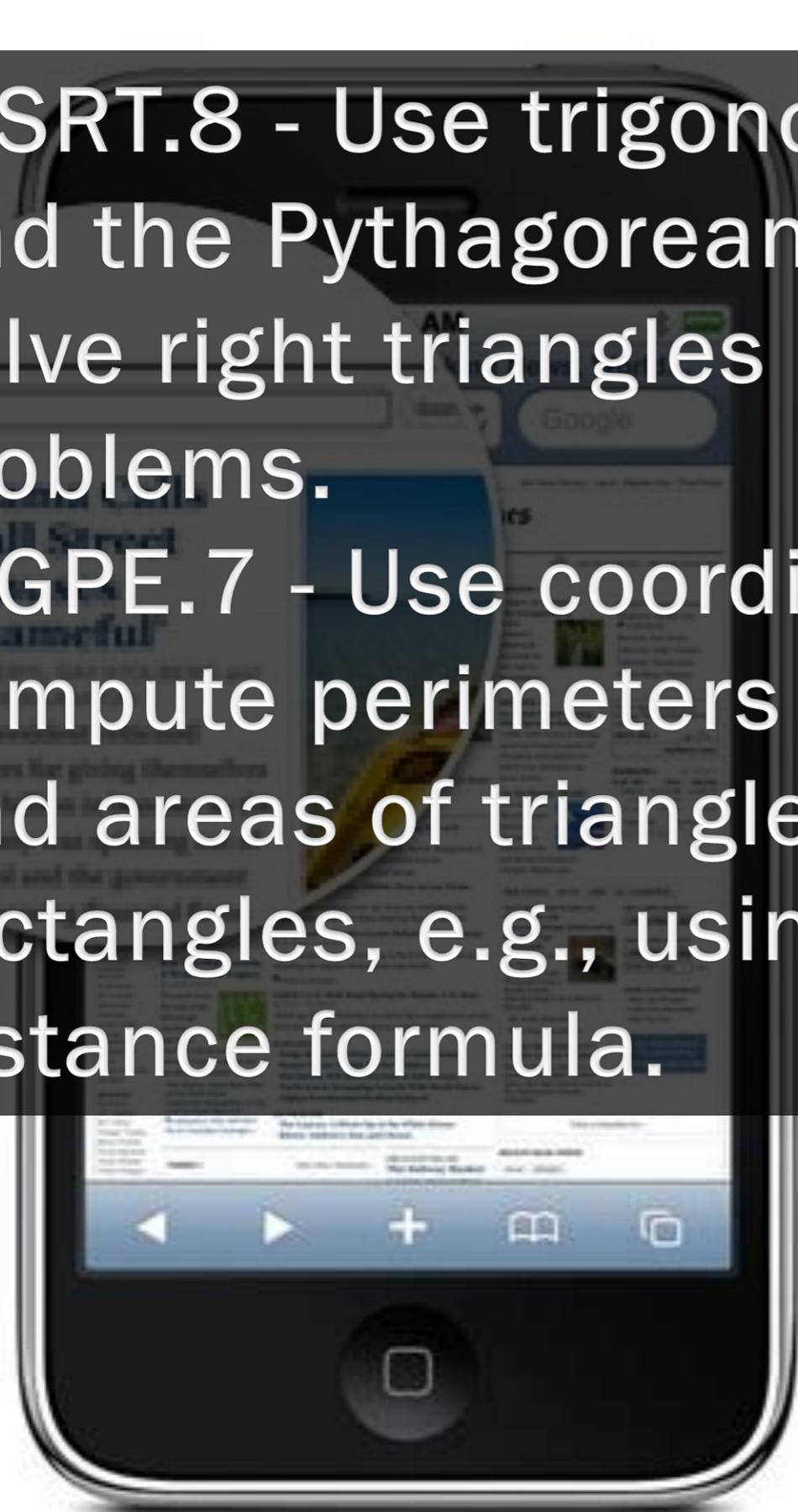
No Retina Display

Retina Display

- 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.

- G-CO.6 Use geometric descriptions of rigid motions to transform figures and to predict the effect of a given rigid motion on a given figure.

Fresh Roasted
PEANUTS
$2.59 lb
Product of
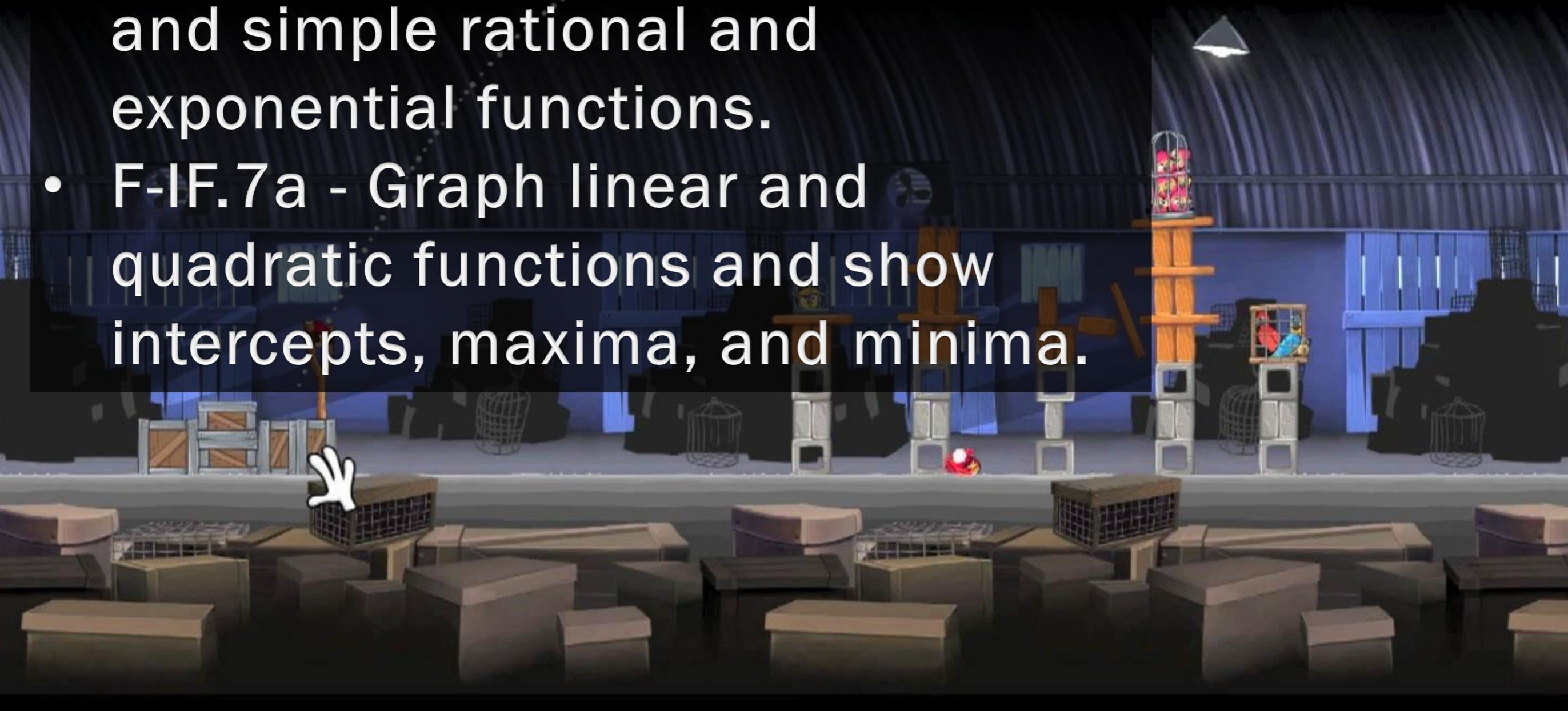
Salted
PEANUTS
$2.59 lb
Product of USA
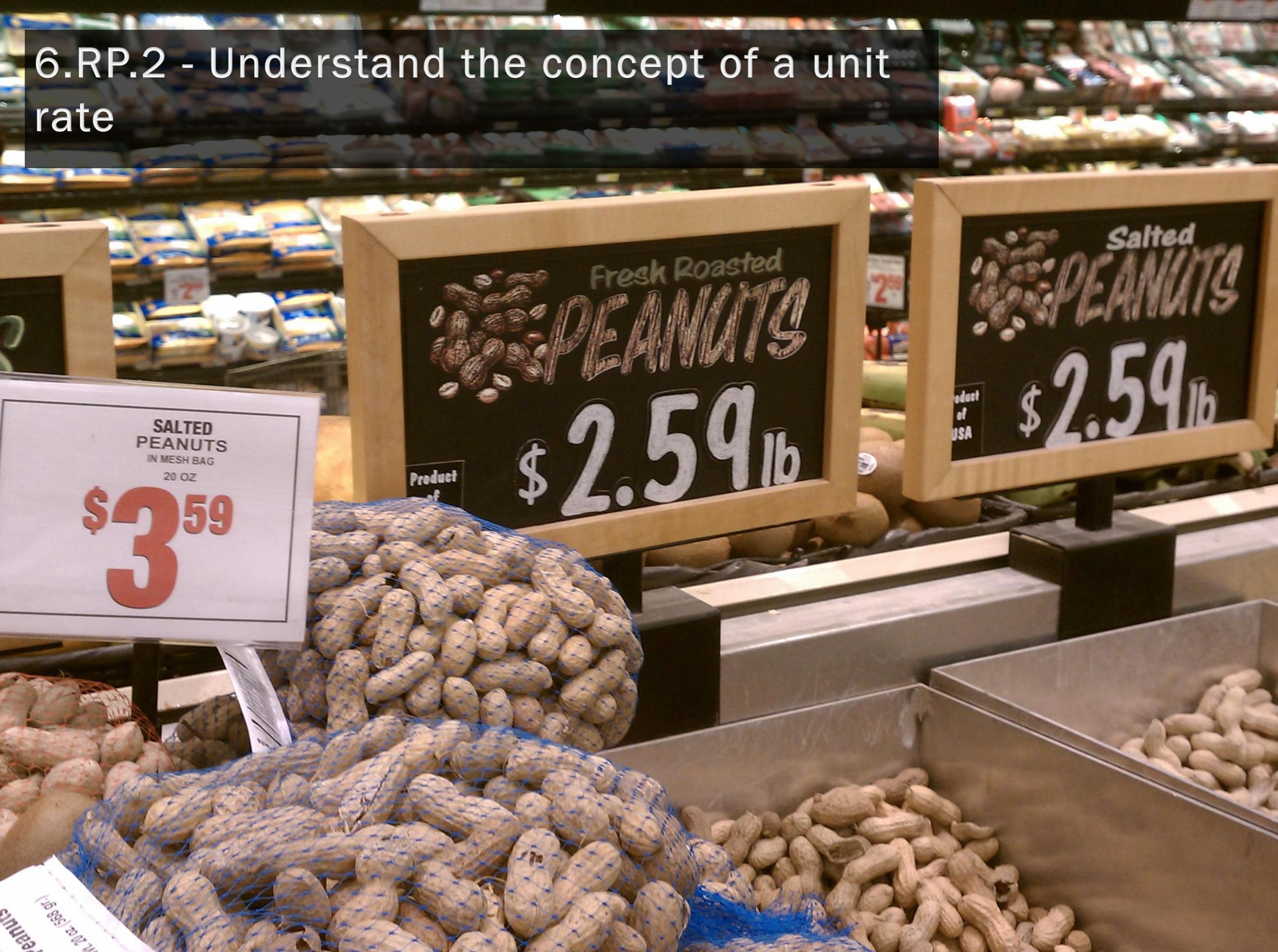
SALTED
PEANUTS
IN MESH BAG
20 OZ
$3.59

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?*

WHAT DOES IT LOOK LIKE...

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

How far apart are the exits on this
freeway: Jct 90 and Jefferson Blvd?
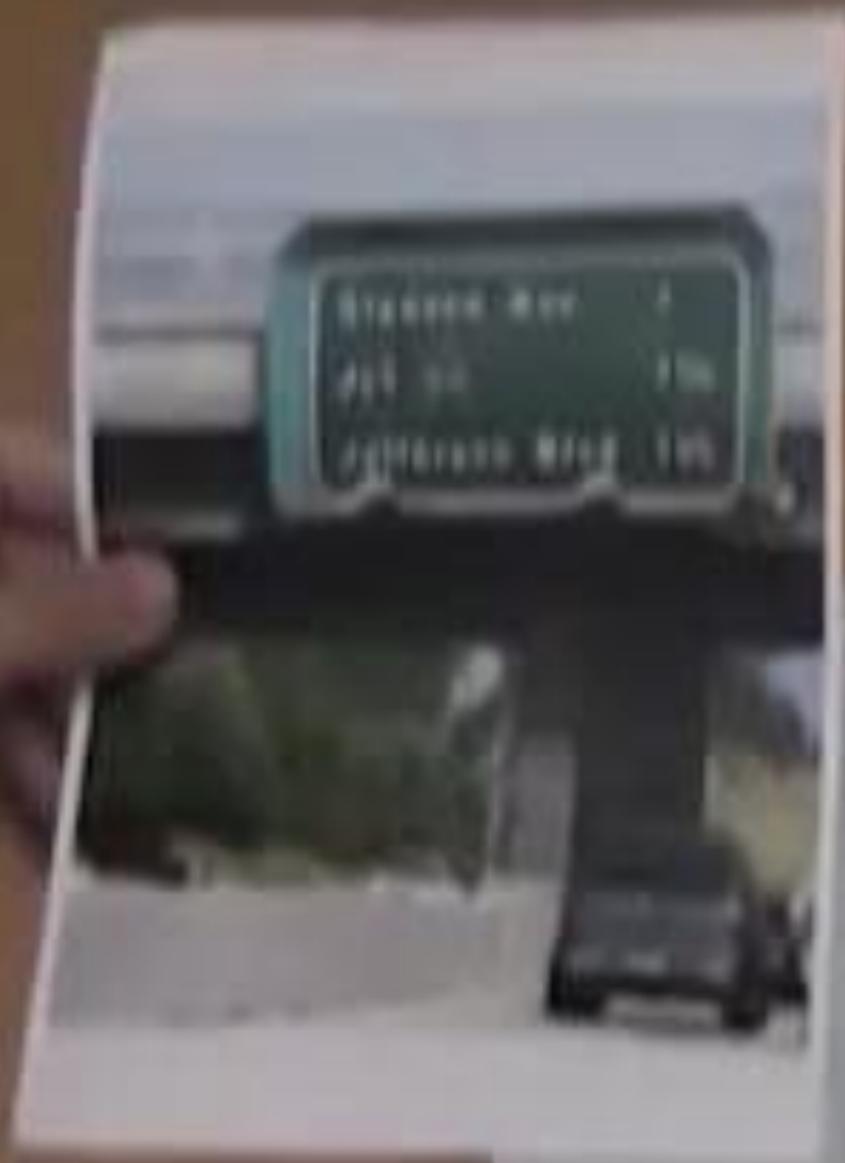
$$1\frac{1}{2} - 1\frac{1}{4}$$

$$1\frac{1}{2} - 1\frac{1}{4}$$
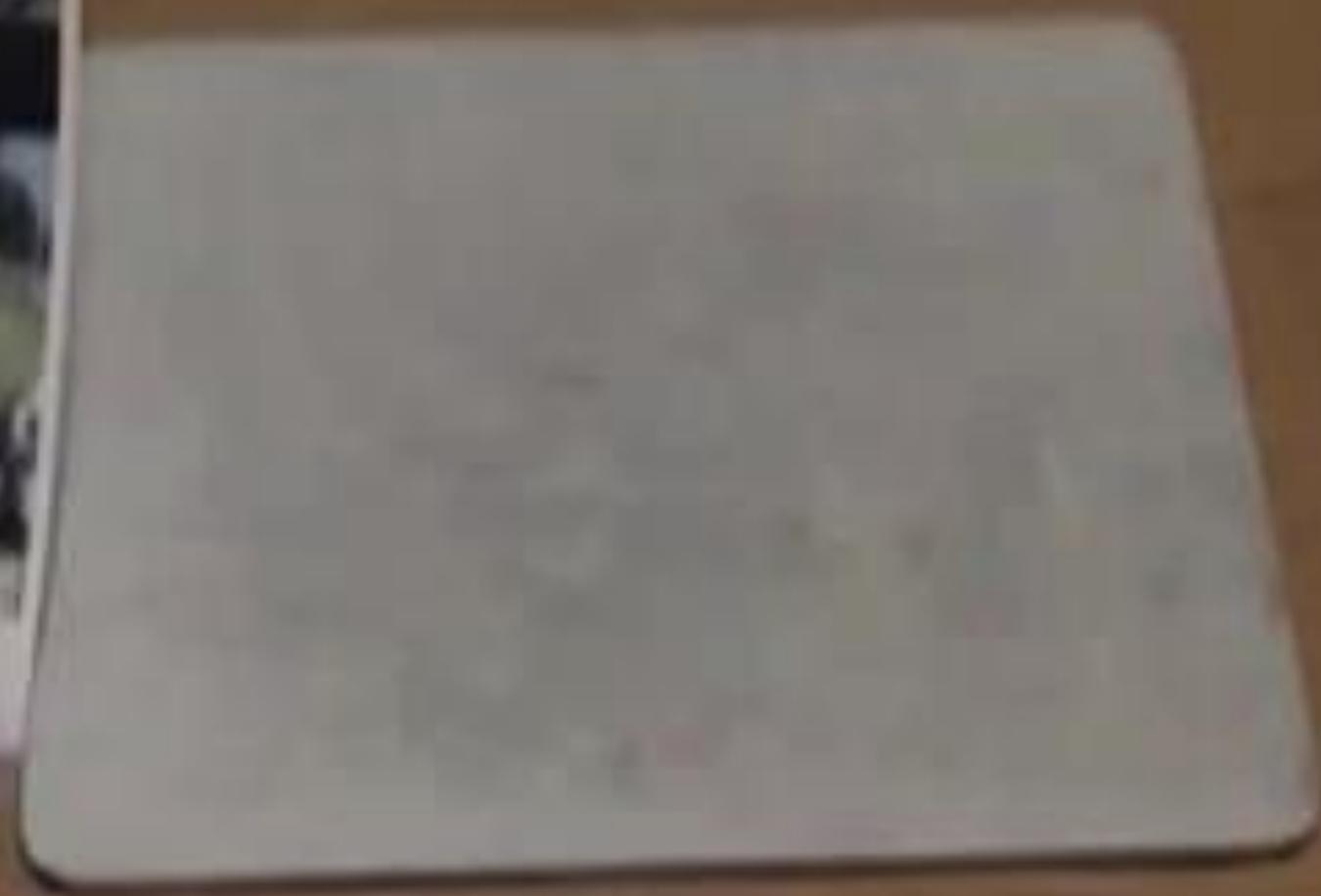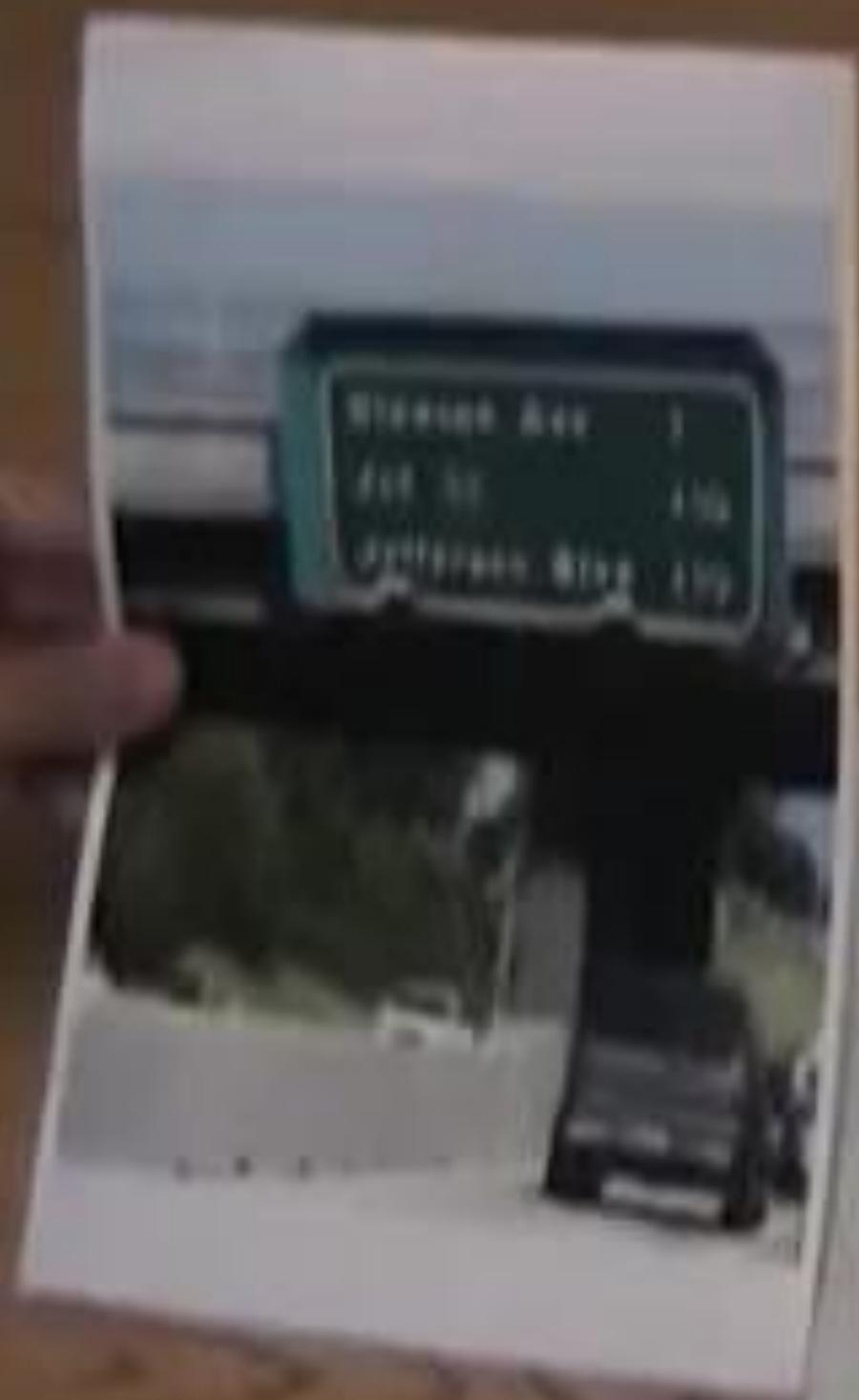
Problem-Based Lesson Resources

- 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

- Nathan Kraft: http://tinyurl.com/mrkraft

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

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

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

Robert KAPLINSKY
Glenrock Consulting
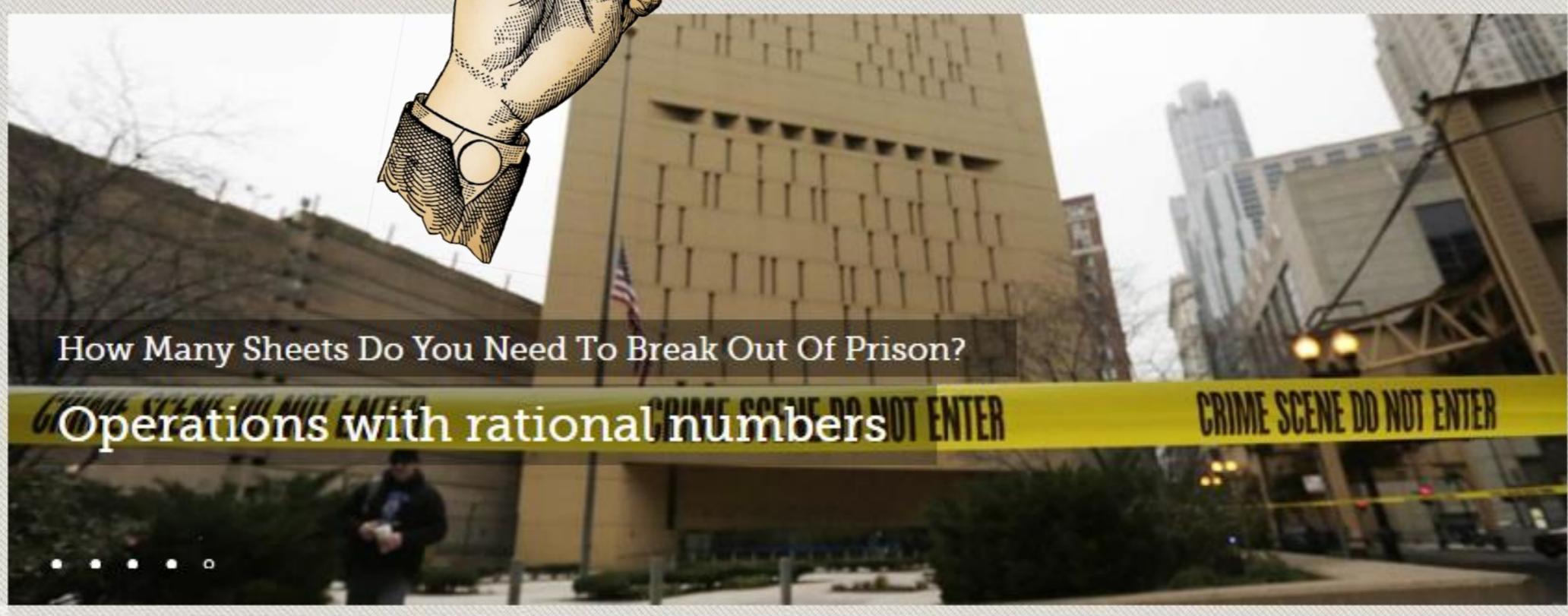
How Many Sheets Do You Need To Break Out Of Prison?

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 teaches math content courses to teachers.

Teachers have different comfort levels when it

Lessons

How Can We Water All Of The Grass?

How Much Money IS That?!

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

How Can We Water All Of The Grass?

How Much Money IS That?!

Each Lesson Includes:

- The Situation

- The Challenge

- Questions to Ask

- Consider This

- What You'll Need

- Student Work

- Teacher Work

- Common Core Content Standards

- Sources

- Download files and Download PDF links

	A	B	C	D	E	F	
	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-B
21	How Big Is The 2010 Guatemalan Sinkhole?	Volume of Cylinder	5.MD.3	5.MD.4	5.MD.5	8.G.9	G-G
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-B
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			