Implementing Problem-Based Learning

ROBERT KAPLINSKY

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

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	$97.66
Change	$.00

2004-10-31 8:21 PM

THANK YOU!

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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

- Focus
- Coherence
- Rigor

Application

Procedural Skill and Fluency

Conceptual Understanding

Application

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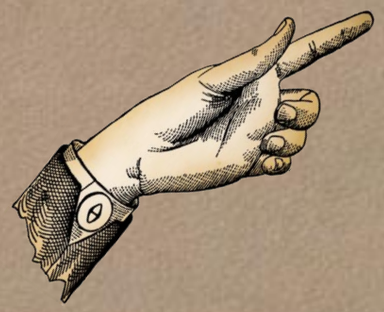
Procedural Skill and Fluency

Conceptual Understanding

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

Application



Procedural Skill and Fluency

Conceptual Understanding

Standards for Mathematical Practice

1. Make sense of problems and persevere in solving them.

Standards f Practice

1. Make sens ving them.

Is this the same as 100 cheeseburgers?

Standards f Practice

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Is this the same as 100 cheeseburgers?

How do I figure out how much a layer cost?

Standards for Mathematical Practice

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2. Reason abstractly and quantitatively.

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$$\$1.75 + 0.9n$$

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2. Reason abstractly and quantitatively.

$$\$1.75 + 0.9\cancel{n}$$

$$\$1.75 + 0.9(n - 1)$$

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.

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.].

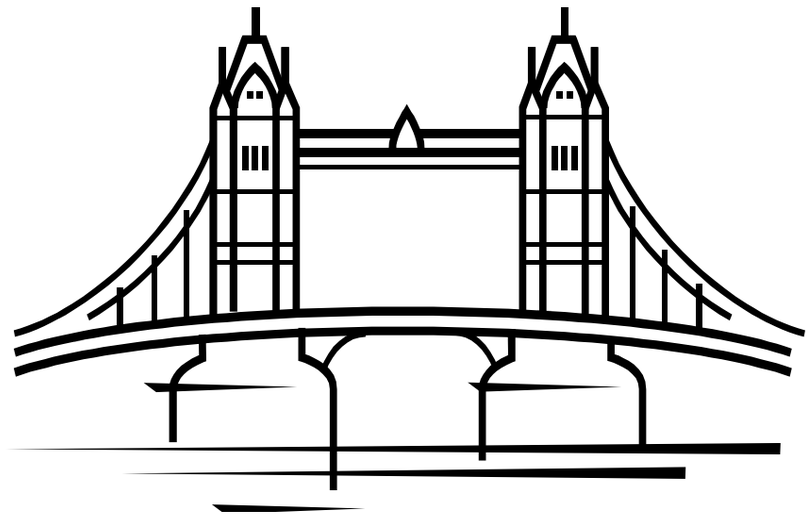
For the 100×100, you plug in 100 to the (x) and you end up with $90.85.

[
y = .90(100-1) +1.75
y = 89.10 +1.75
y = 90.85
]

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.
4. Model with mathematics.

$$\$1.75 + 0.9(n-1)$$



$$\$1.75 + 0.9(n-1)$$

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.
4. Model with mathematics.
5. Use appropriate tools strategically.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Standards for Mathematical Practice

1. Make sense of problems and persevere in solving them.
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6. Attend to precision.

Standards for Mathematical Practice

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6. Attend to precision.
7. Look for and make use of structure.

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

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bun + produce + meat + cheese = $1.75

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meat + cheese = $0.90

Standards for Mathematical Practice

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4. Model with mathematics.
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7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

Problem Based Learning and 3 Student Questions

- When will I ever use this?

Problem Based Learning and 3 Student Questions

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

Problem Based Learning and 3 Student Questions

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


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

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- "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?

The Reality

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- “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?
- The problem solving process didn’t go like I expected
  - Once they started working, they had no idea what to do.
  - They didn’t realize that they could buy multiple sets of tickets.
  - They did not use unit rates.

What is your conclusion?

25 tickets is better because its cheap.

What is your conclusion?

I think 25 is way better because you save more money and get more tickets

What is your conclusion?

the best deal would be 25 tickets because you can get 5 more then the 120 deal, also would better. so tickets by less money.

What is your conclusion?

The Best deal is to buy 25 tickets 5 times and you would get a total of $50.00. This is the best deal because it is cheaper than 120 tickets for 50 dollars. I would get 125 tickets for $50.00 which is a better deal than 120 tickets for 50 dollars because I save $5 and get 5 more tickets for the same price.

The Four C's

- Communication

The Four C's

- Communication
- Curiosity

REGAL

- HANCOCK
- KIT KITTREDGE
- WANTED
- KUNG FU PANDA
- SEX AND THE CITY
- IRONMAN
- GET SMART
- WALL E
- THE FOOT FIST WAY
- INCREDIBLE HULK
- THE HAPPENING
- DONT MESS WITH THE ZOHAN
- INDIANA JONES
- HELL BOY JULY 11

Drinks

Box Office

Box Office

- 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.

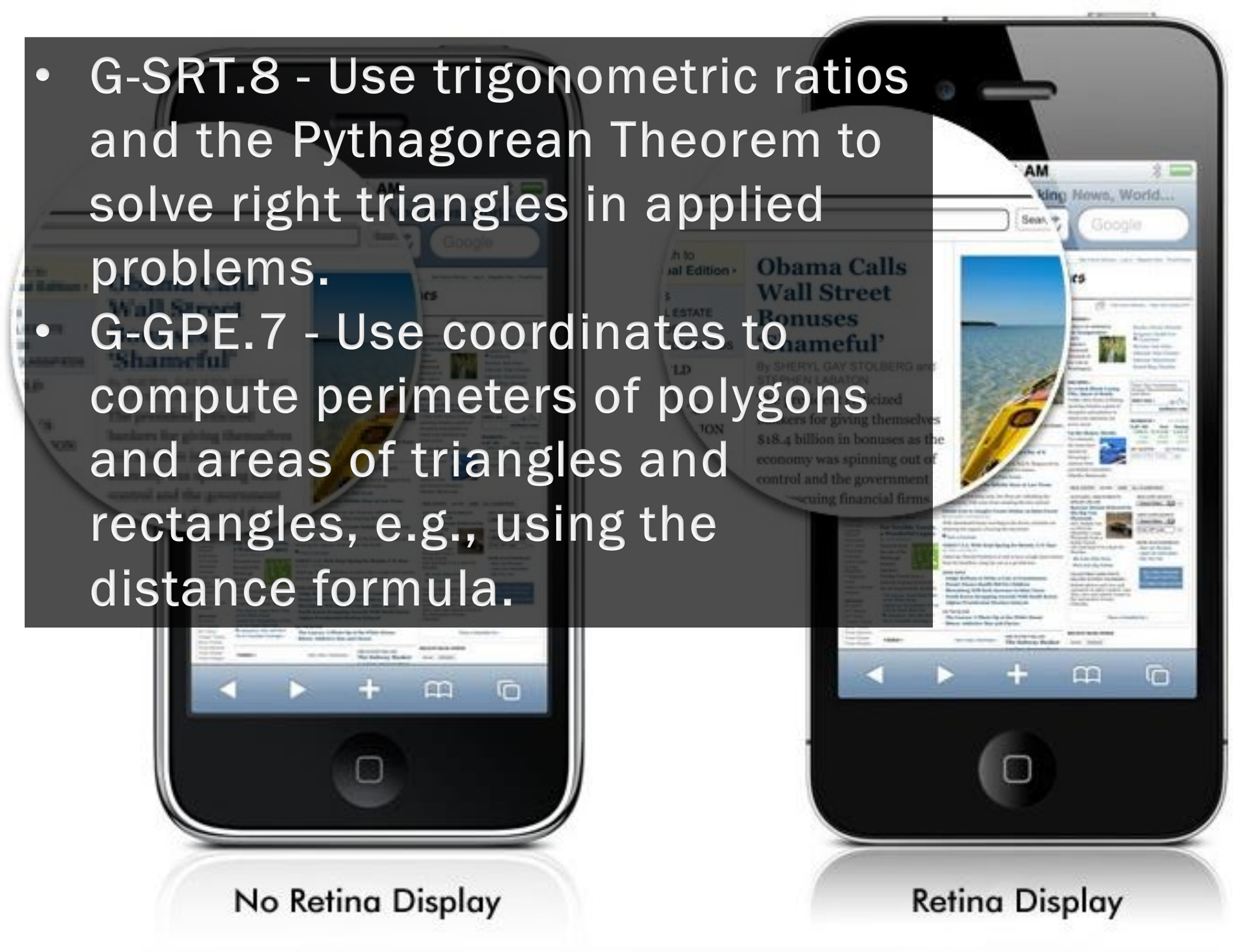
- 6.G.4 - Represent three-dimensional figures using nets made up of rectangles and triangles, and use the nets to find the surface area of these figures.
- 7.G.6 - Solve real-world and mathematical problems involving area, volume and surface area.

- 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).

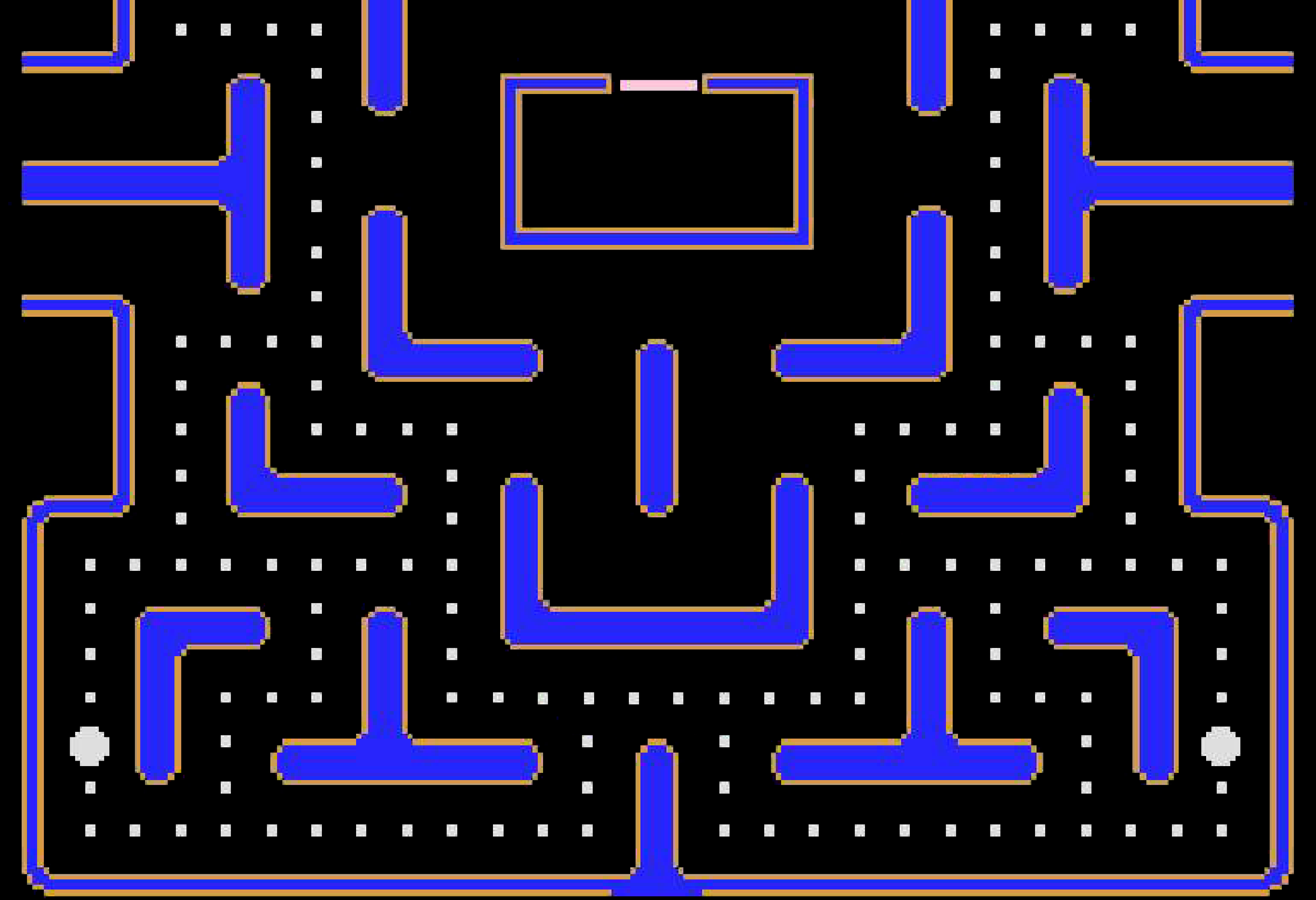
No Retina Display

Retina Display

- 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.



- 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.

SALTED
PEANUTS
IN MESH BAG
20 OZ
$3.59

Fresh Roasted
PEANUTS
$2.59 lb

Salted
PEANUTS
$2.59 lb

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

The Four C's

- Communication
- Curiosity
- 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?	

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.

The Four C's

- Communication
- Curiosity
- Critical Thinking
- Content Knowledge

PROBLEM-BASED LEARNING FAQ

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- *How is problem-based learning assessed?*
- *How much time does it take to create a problem-based lesson?*

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

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.

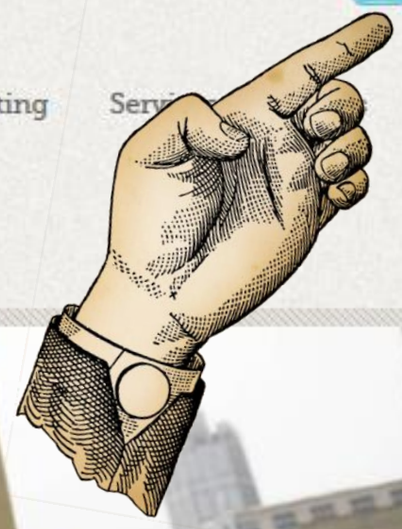
Teachers have different comfort levels when it

Lessons

How Can We Water All Of The Grass?

How Much Money IS That?!

Robert KAPLINSKY
Glenrock Consulting



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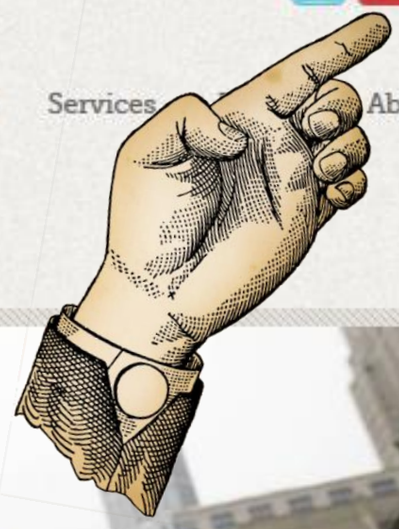

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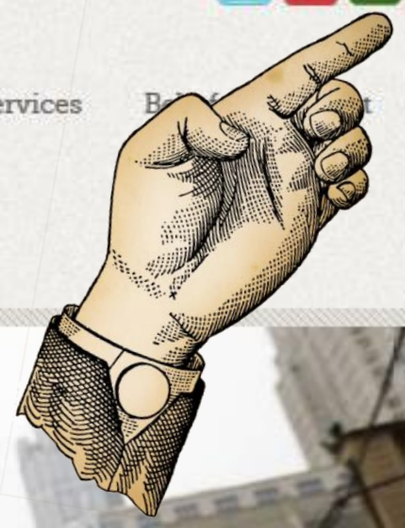

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How Much Money IS That?!

Robert Kaplinsky's Problem-Based Lessons

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	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-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-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-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-I
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			

Contact

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gmdept