WHAT DO WE KNOW ABOUT EDUCATION?

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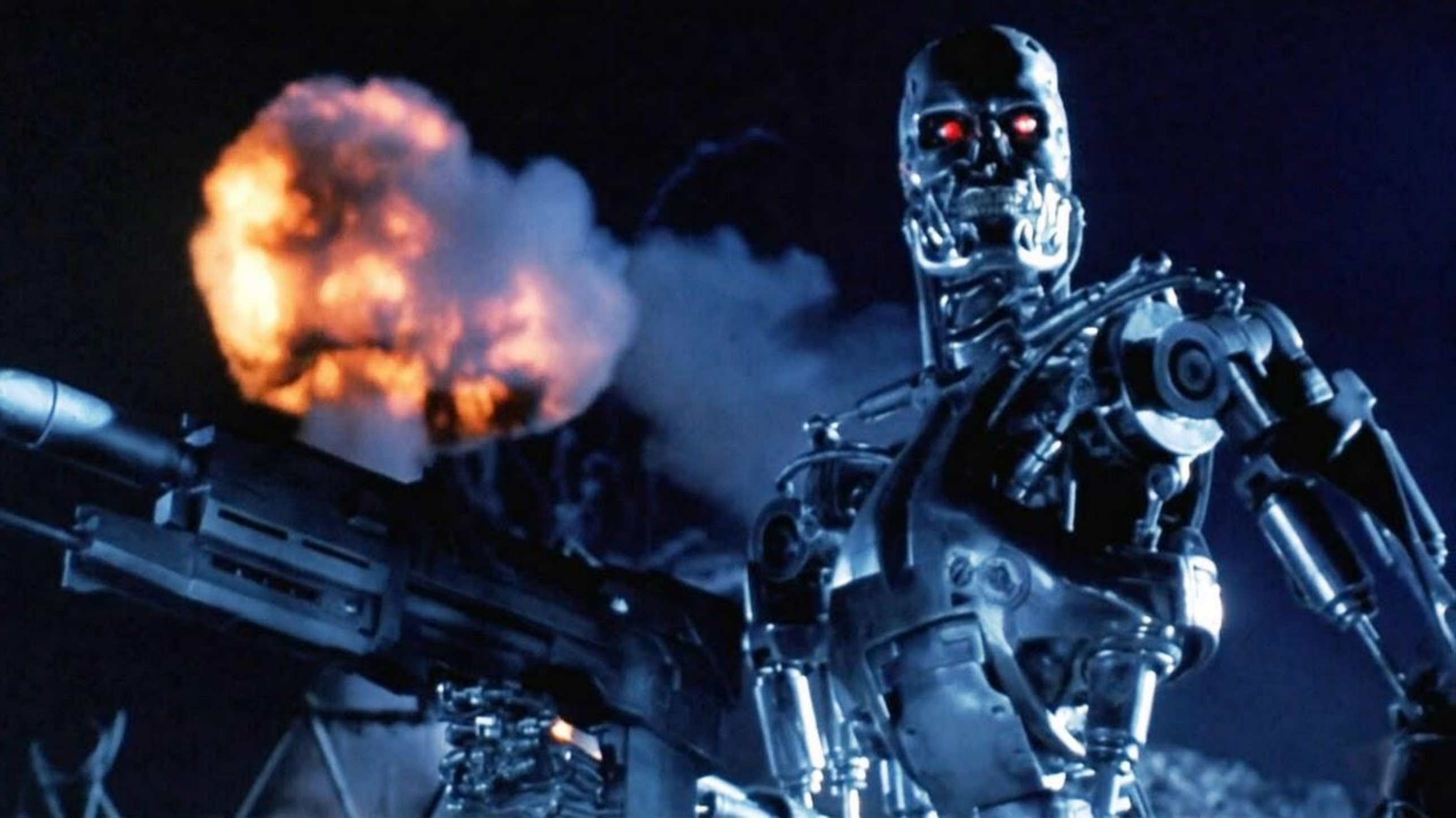
paradigm shift

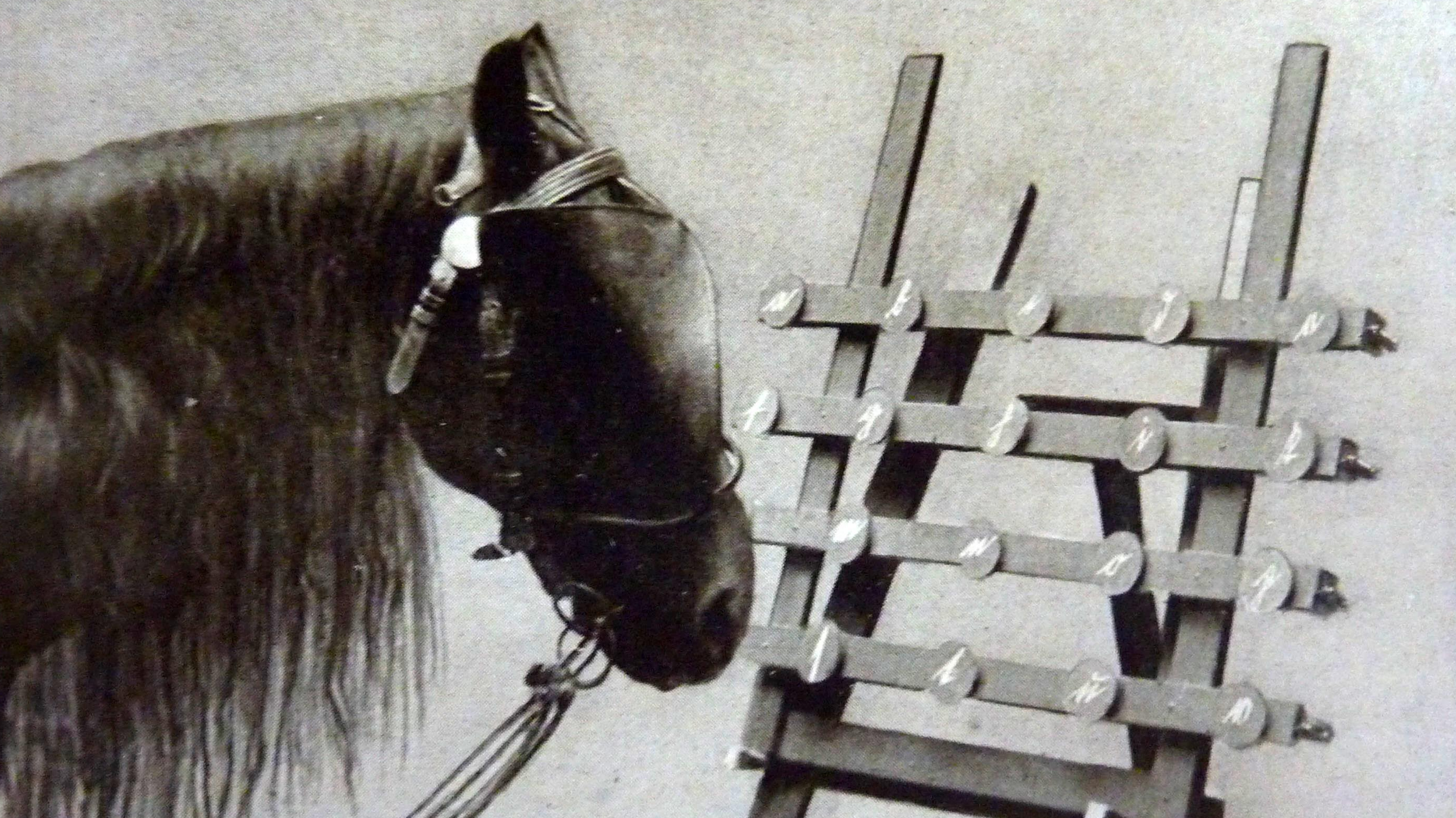

142
FAIRBANKS CITY

GOALS

- ❑ WHAT IS INTELLIGENCE?
- ❑ WHY DON'T STUDENTS REMEMBER?
- ❑ WHAT MATHEMATICS IS IMPORTANT?
- ❑ WHAT ABOUT WHAT WE USED TO DO?



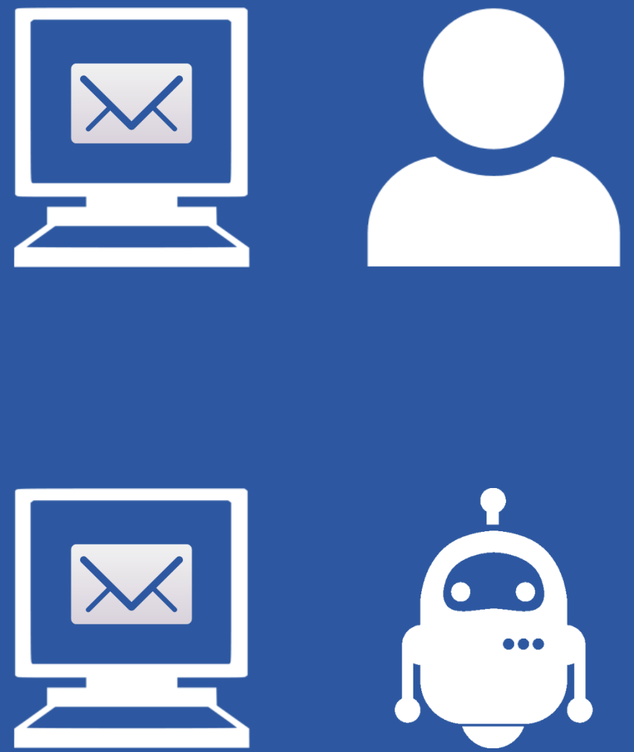

$\frac{2}{3} + \frac{3}{4} =$
26743 : 8 =
12986 × 3 =



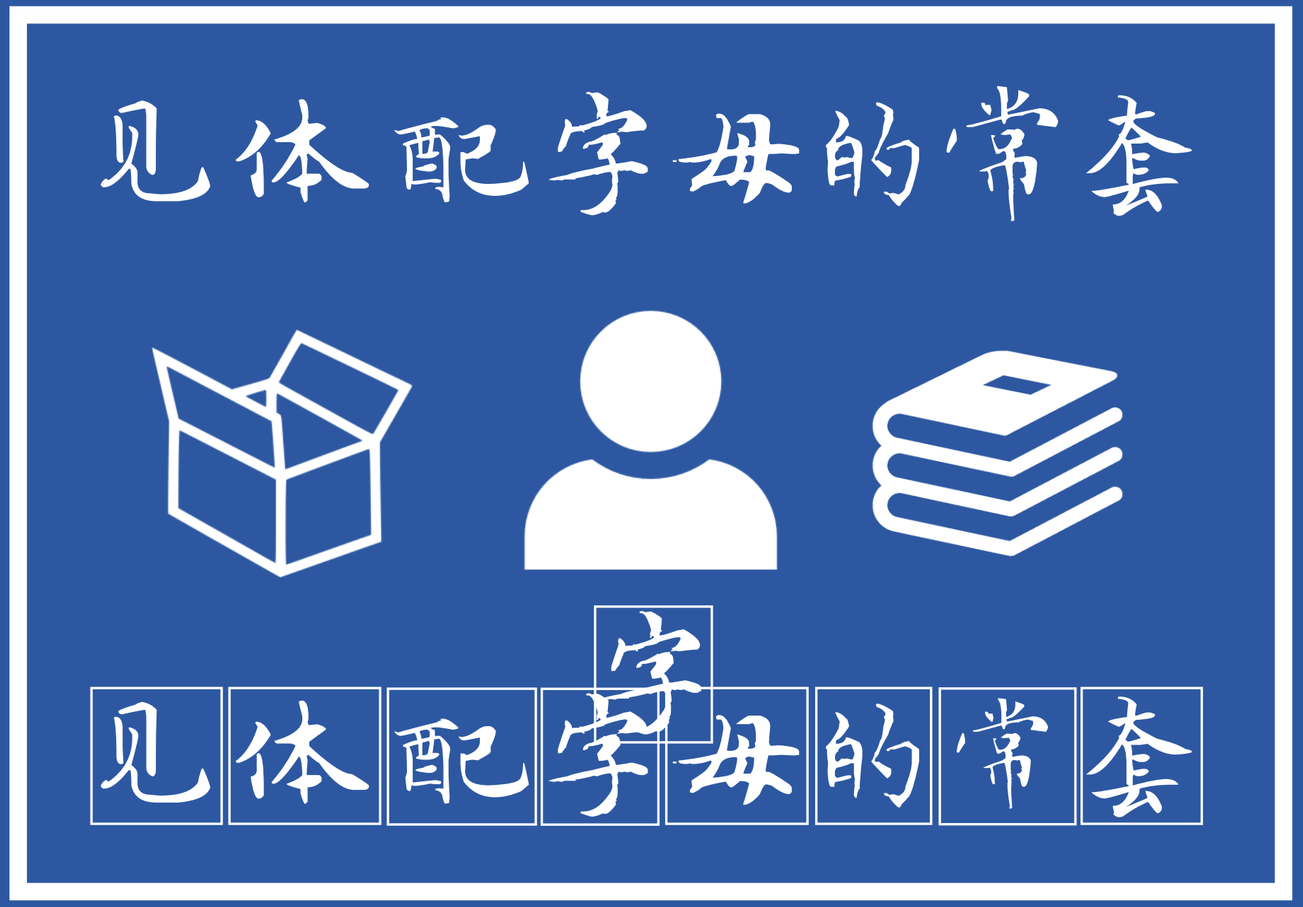
Yes… no… uh… yes… maybe?

MANY STUDENTS

TURING TEST



CHINESE ROOM



DISCUSSION TIME

- What does intelligence even mean?
- How do we ask questions that measure intelligence?
- Will the tasks that work now always be Chinese room and horse proof?

GOALS

- [x] WHAT IS INTELLIGENCE?
- [ ] WHY DON'T STUDENTS REMEMBER?
- [ ] WHAT MATHEMATICS IS IMPORTANT?
- [ ] WHAT ABOUT WHAT WE USED TO DO?

[redacted]
February 28 ·

If a theif forces you to take money out of an ATM, do not argue or resist. What you do is punch in your pin # backwards. EX: if its 1234, you'll type 4321. When you do that, the money will come out but will be stuck in the slot. The machine will immediately alert the local police without the robbers knowledge & begin taking photos of the suspect.
Every ATM has the feature. Stay safe.

Like Share

19

1,782 shares

3 Comments

Friend Requests See All

[redacted]
Confirm Friend

People You May Know See All

[redacted]
Add Friend

Will Entering Your PIN in Reverse at an ATM Summon the Police?

Entering your PIN in reverse at any ATM will not automatically send an alarm to local police -- the idea is nothing more than an old and unimplemented suggestion.

CLAIM

Entering your PIN in reverse at any ATM will automatically summon the police.
See Example(s)

RATING

FALSE

ORIGIN

Messages offering a seemingly helpful heads-up about how to deal with a situation in which one is forced to hand over money withdrawn from an ATM under duress began circulating on the Internet in September 2006:

Tell them what you're going to tell them. Tell it to them.

Then tell them what you told them.

UNKNOWN

NAME: _____ DATE: _____

Lesson 12 Skills Practice

Objective: Write PIN Backwards

Write backwards.

1. 0461
   1640

2. 3625
   5263

3. 9572
   2759

4. 8713
   3178

7. 6842
   2486

8. 7532
   2357

9. 1549
   94

13.

14

Presentation

- Tell them what you're going to tell them.
- Tell it to them.
- Then tell them what you told them.

Lesson

- State the lesson objectives.
- Teach the lesson.
- Review the lesson objectives.

The definition of insanity is doing the same thing over and over again but expecting different results.

UNKNOWN

Why Some Ideas Survive and Others Die...

MADE to STICK

Chip Heath & Dan Heath

- Understood
- Remembered
- Lasting impact

STICKY ATTRIBUTES

- ❑ SIMPLE
- ❑ UNEXPECTED
- ❑ CONCRETE
- ❑ CREDIBLE
- ❑ EMOTIONAL
- ❑ STORIES

Simplify.

$$(x^2 + 3)(2x^3 - 7x + 4)$$

Fig. 1.

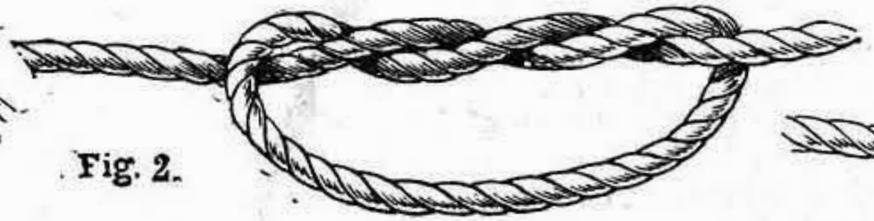


Fig. 2.

Fig. 2a.

Fig. 3.

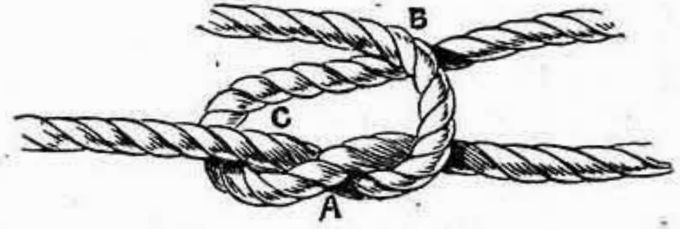


Fig. 5.

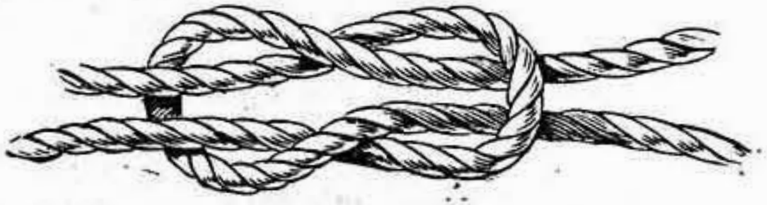


Fig. 4.

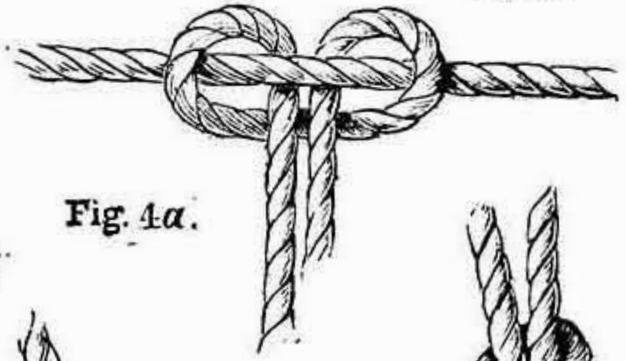


Fig. 4a.

Fig. 14.

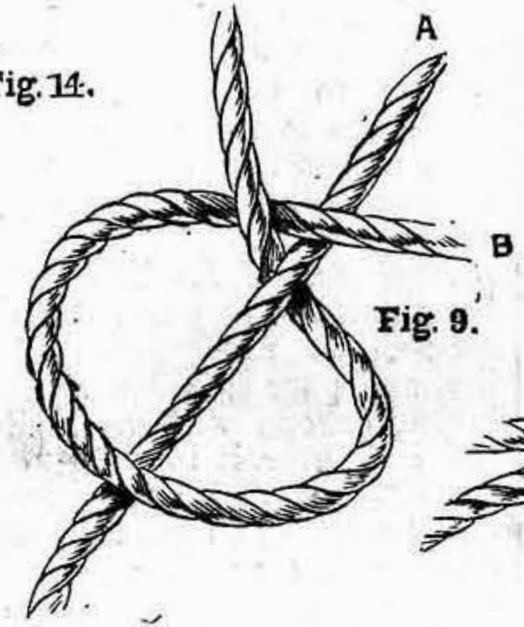


Fig. 9.

Fig. 6.

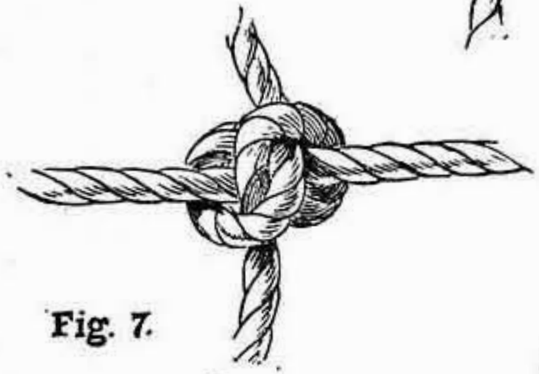


Fig. 7.

Fig. 8.

Fig. 10.

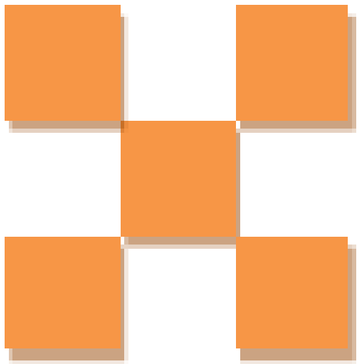
Fig. 11.

Fig. 13.

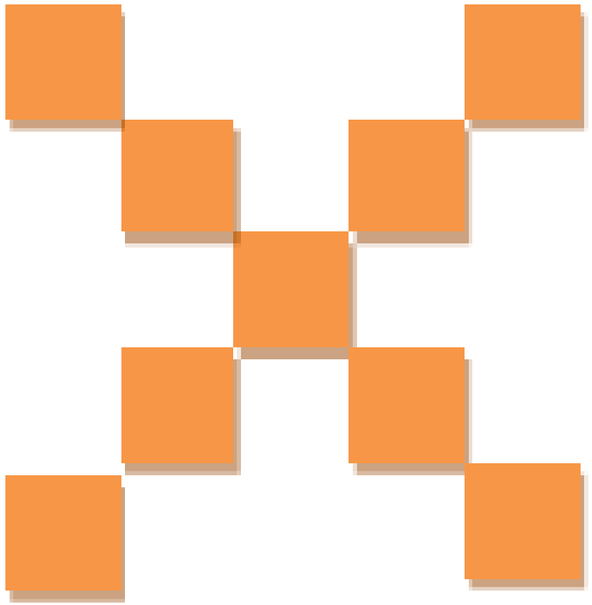
Fig. 12.

If math is the aspirin, then how do you create the headache?

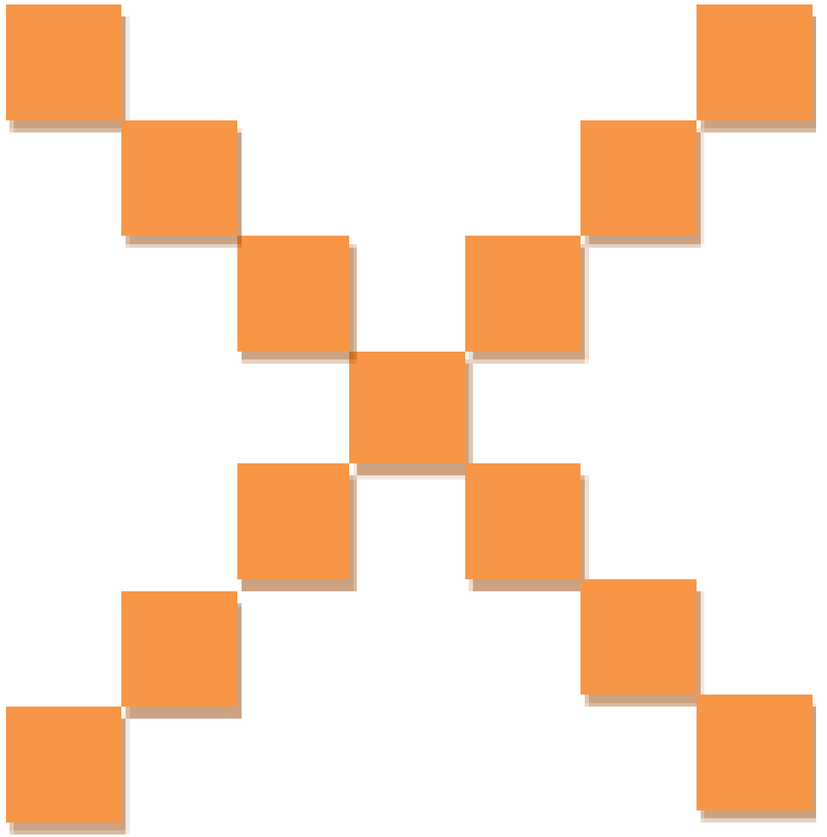
DAN MEYER



Step 1

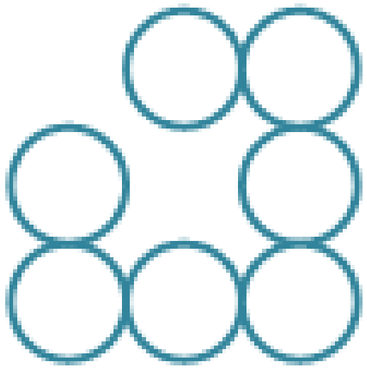


Step 2



Step 3

Source: visualpatterns.org



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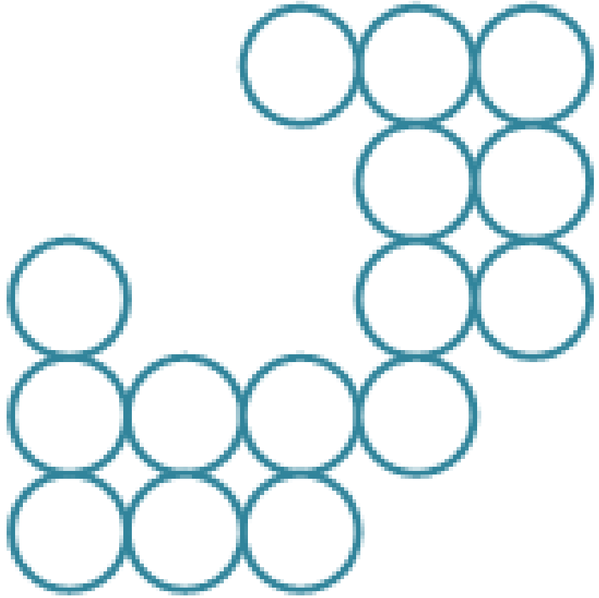

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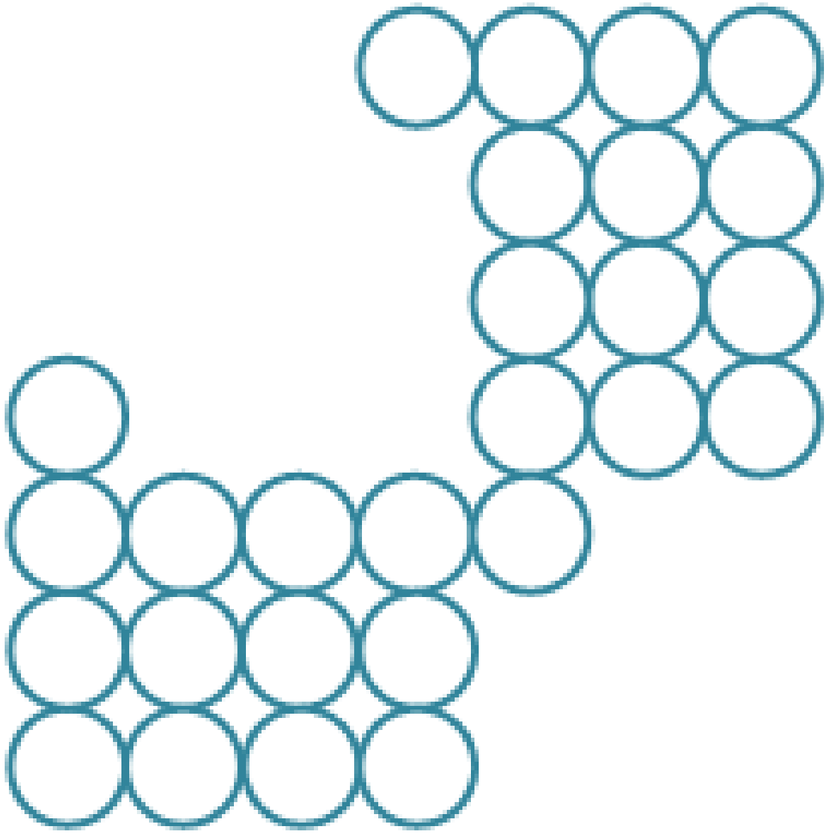


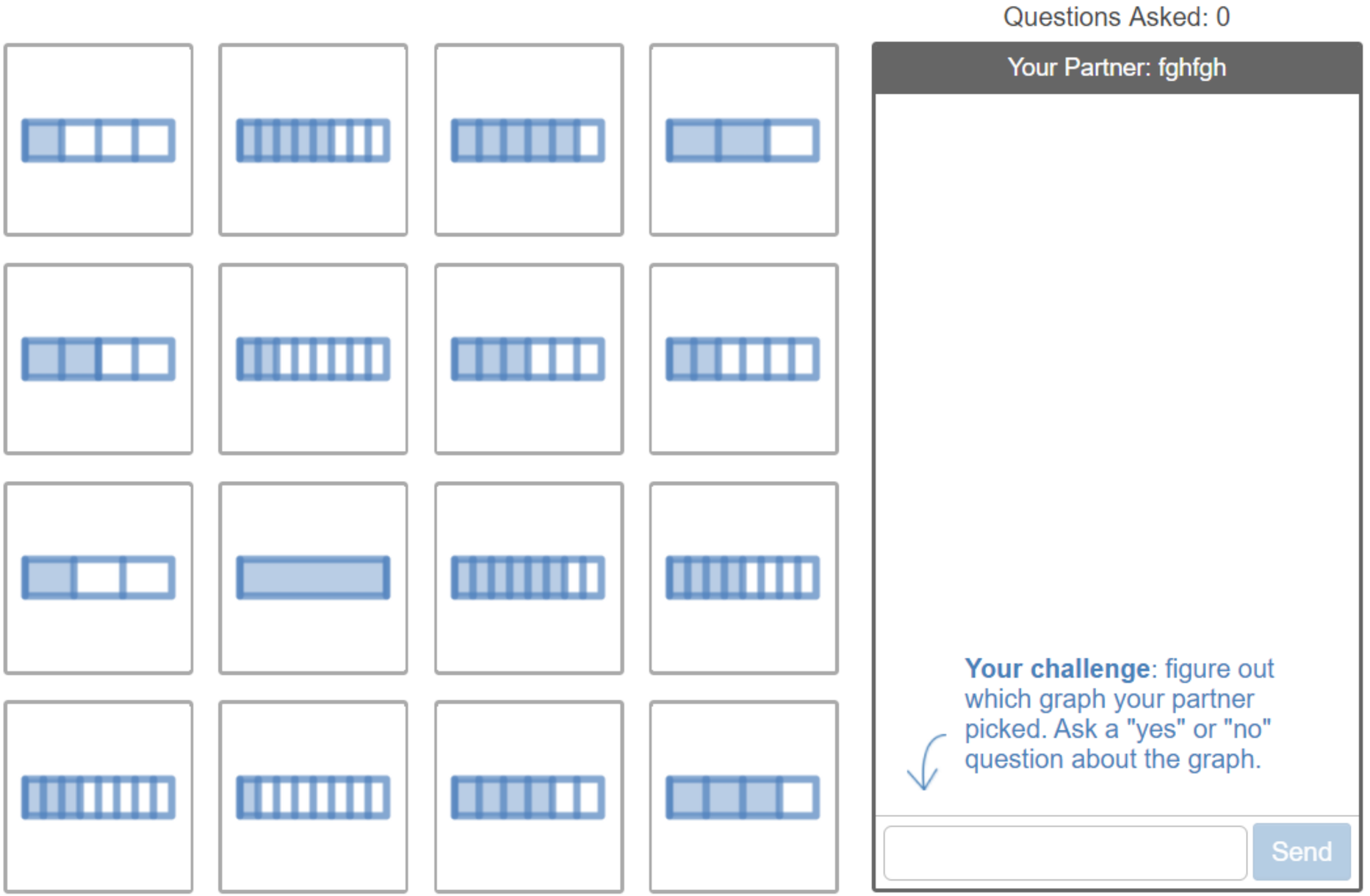
Step 3

Source: visualpatterns.org

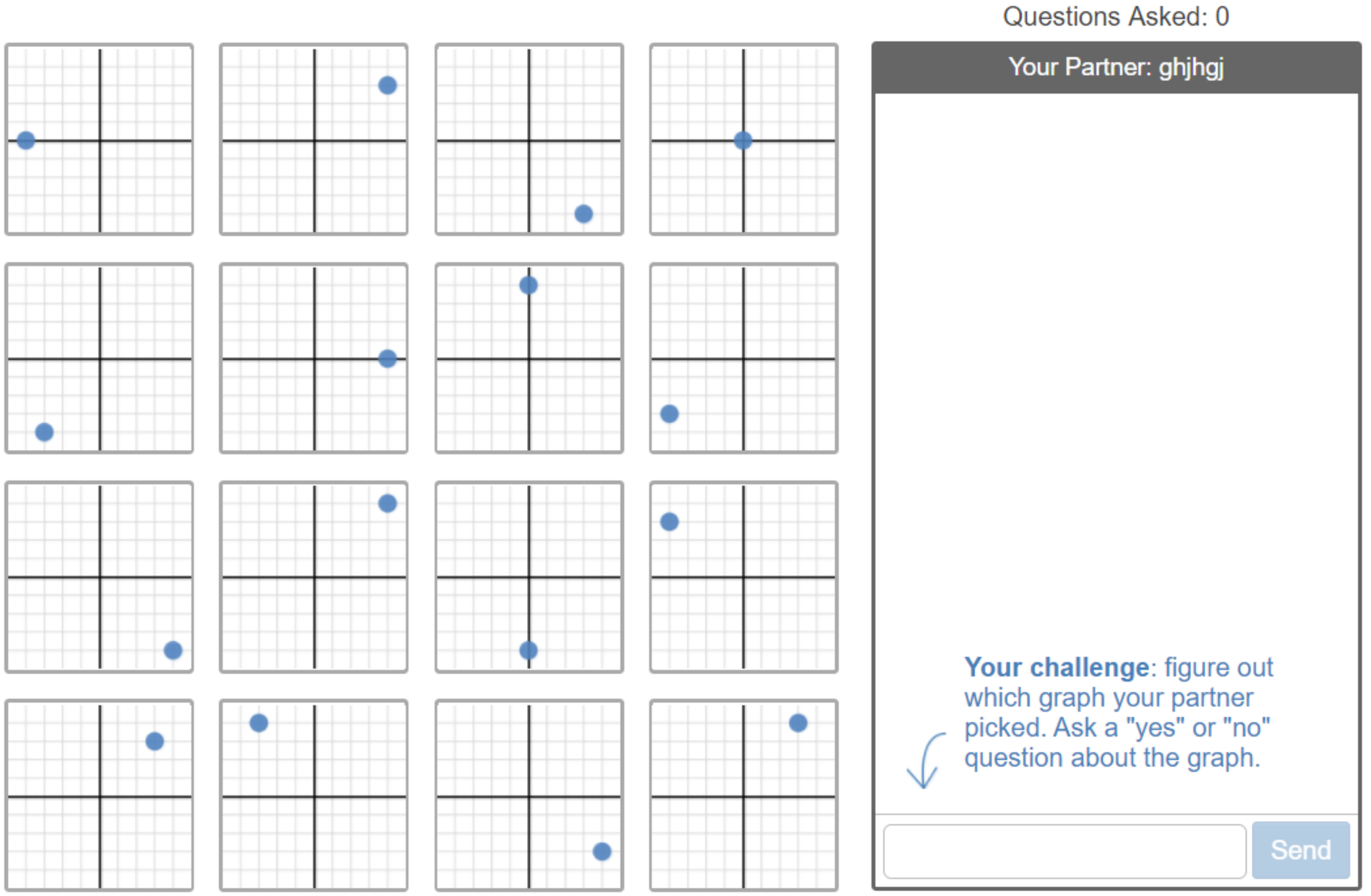
Select a person that's special to you for any reason. Next

Skip the practice round.

Source: teacher.desmos.com/polygraph



Source: teacher.desmos.com/polygraph



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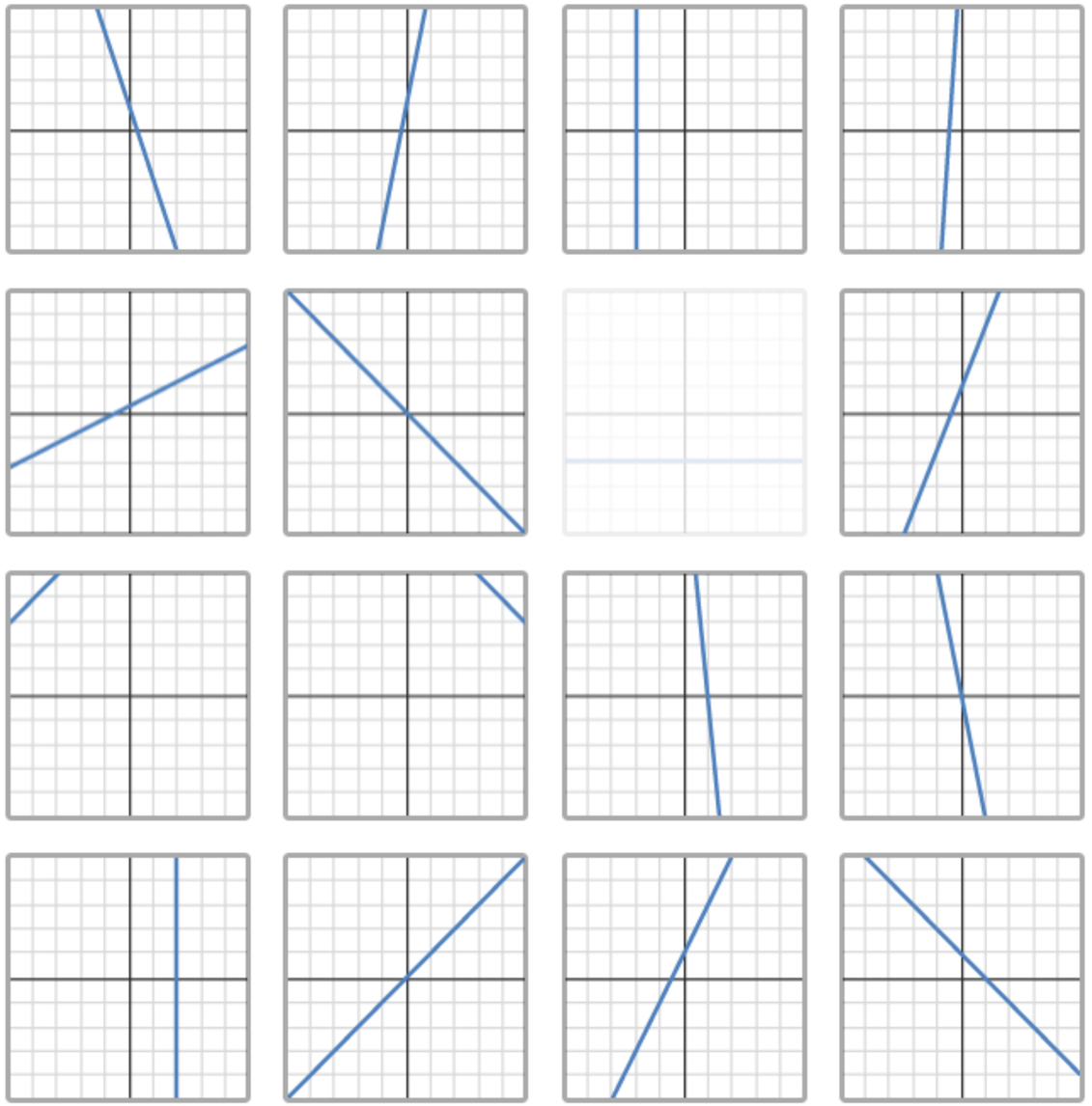


Questions Asked: 2

Your Partner: Lupita

YOU ASKED
Does your line go up and down?

YOUR PARTNER CHOSE
Yes

YOUR PARTNER ELIMINATED
×

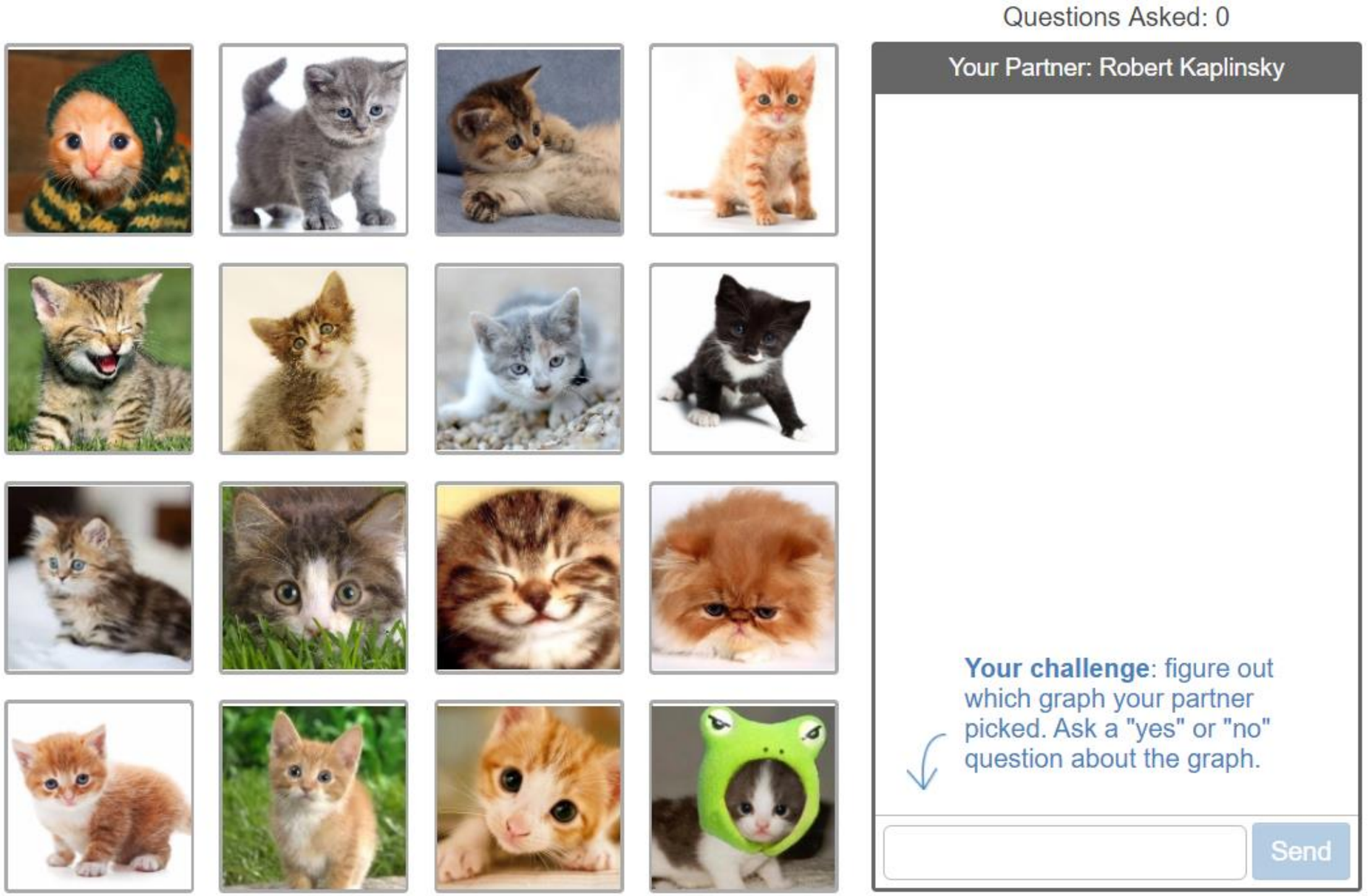
YOU ASKED
Is your line slanted?

YOUR PARTNER CHOSE
I Don't Know

Select lines to eliminate based on your partner's answer. Then press the button below.

Go on without Eliminating

Source: teacher.desmos.com/polygraph



Source: teacher.desmos.com/polygraph

Source: robertkaplinsky.com/lessons

Source: Kent Haines

Source: robertkaplinsky.com/lessons

STICKY ATTRIBUTES

- [x] SIMPLE
- [ ] UNEXPECTED
- [ ] CONCRETE
- [ ] CREDIBLE
- [ ] EMOTIONAL
- [ ] STORIES

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Source: reasonandwonder.com

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THINKING TIME

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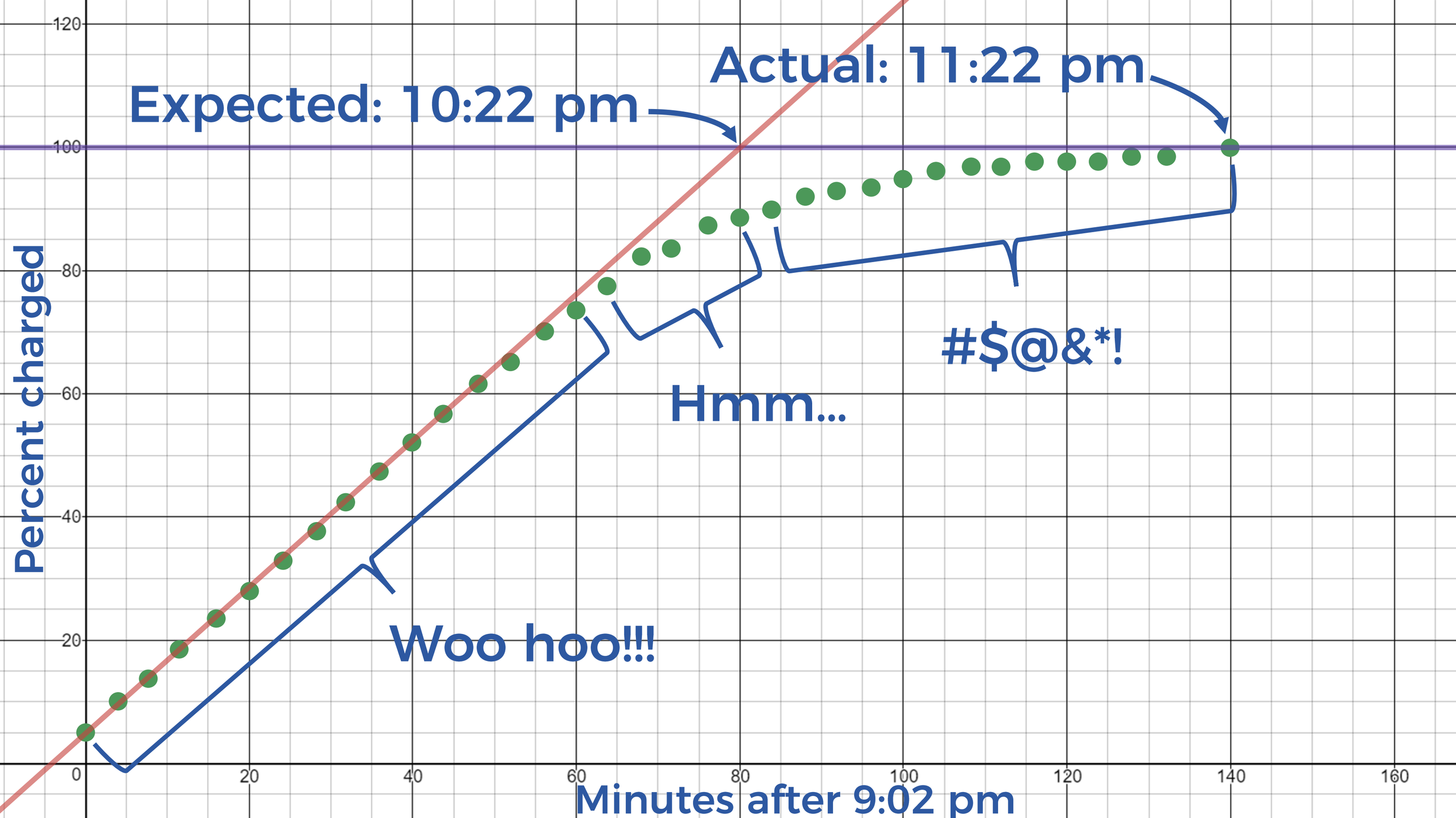
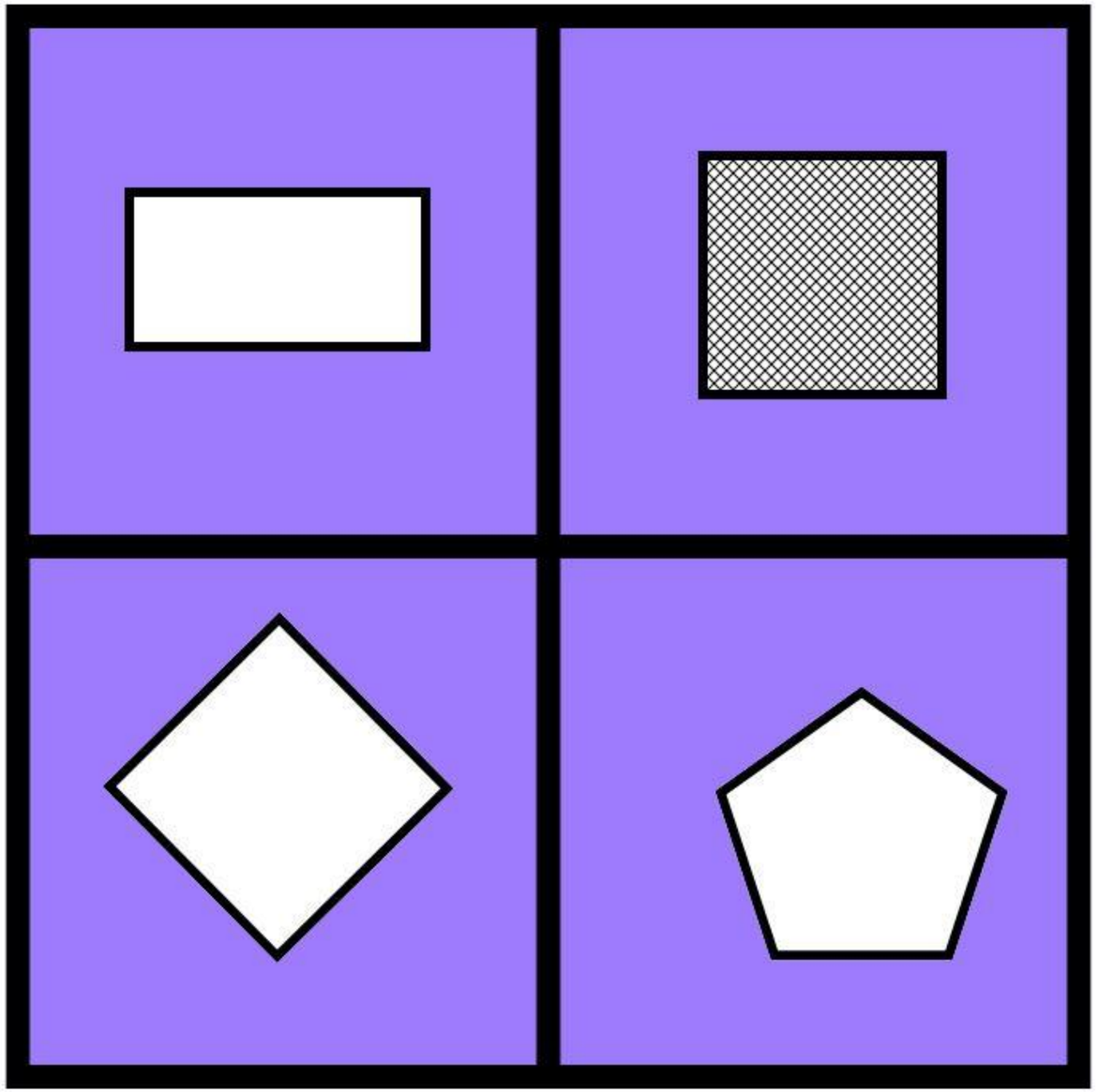

Actual: 11:22 pm
Expected: 10:22 pm
#$@&*!
Hmm...
Woo hoo!!!
Percent charged
Minutes after 9:02 pm
120
100
80
60
40
20
0
20
40
60
80
100
120
140
160

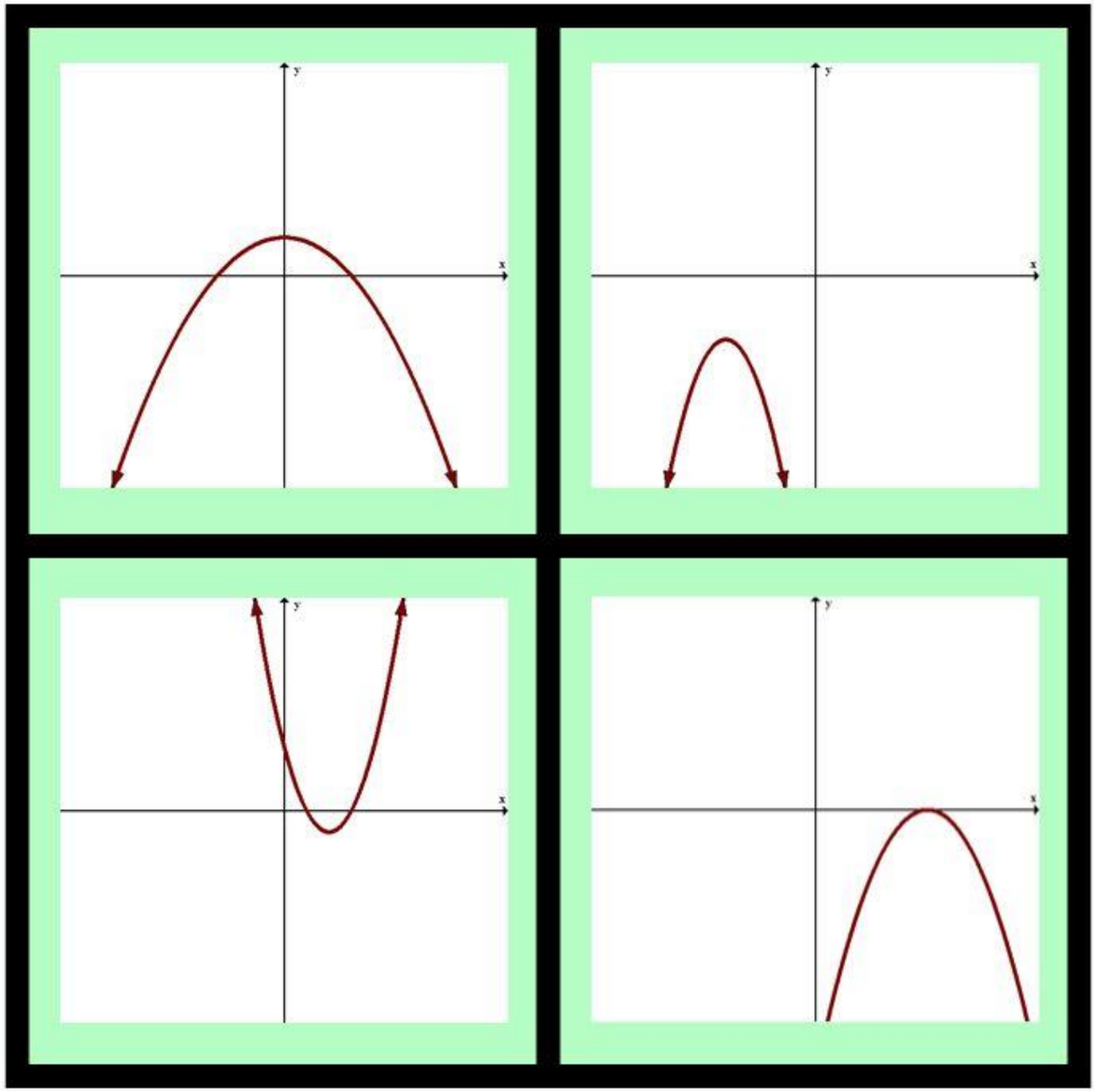
UNEXPECTED

- ❑ PATTERN BREAKING
- ❑ COUNTERINTUITIVE
- ❑ KNOWLEDGE GAPS
- ❑ OPEN MIDDLE



Source: wodb.ca

Source: wodb.ca



Source: wodb.ca

UNEXPECTED

- [x] PATTERN BREAKING
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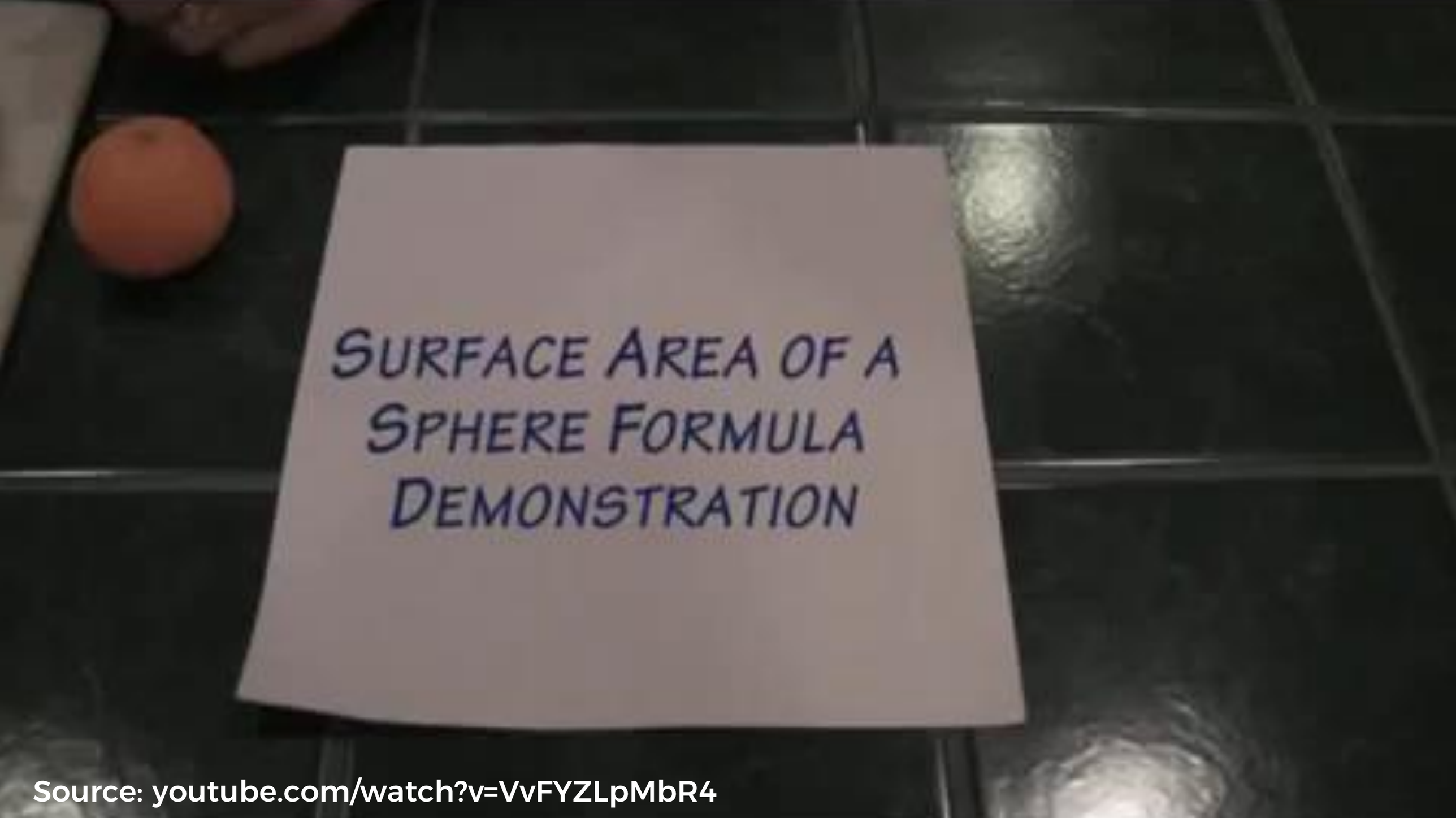
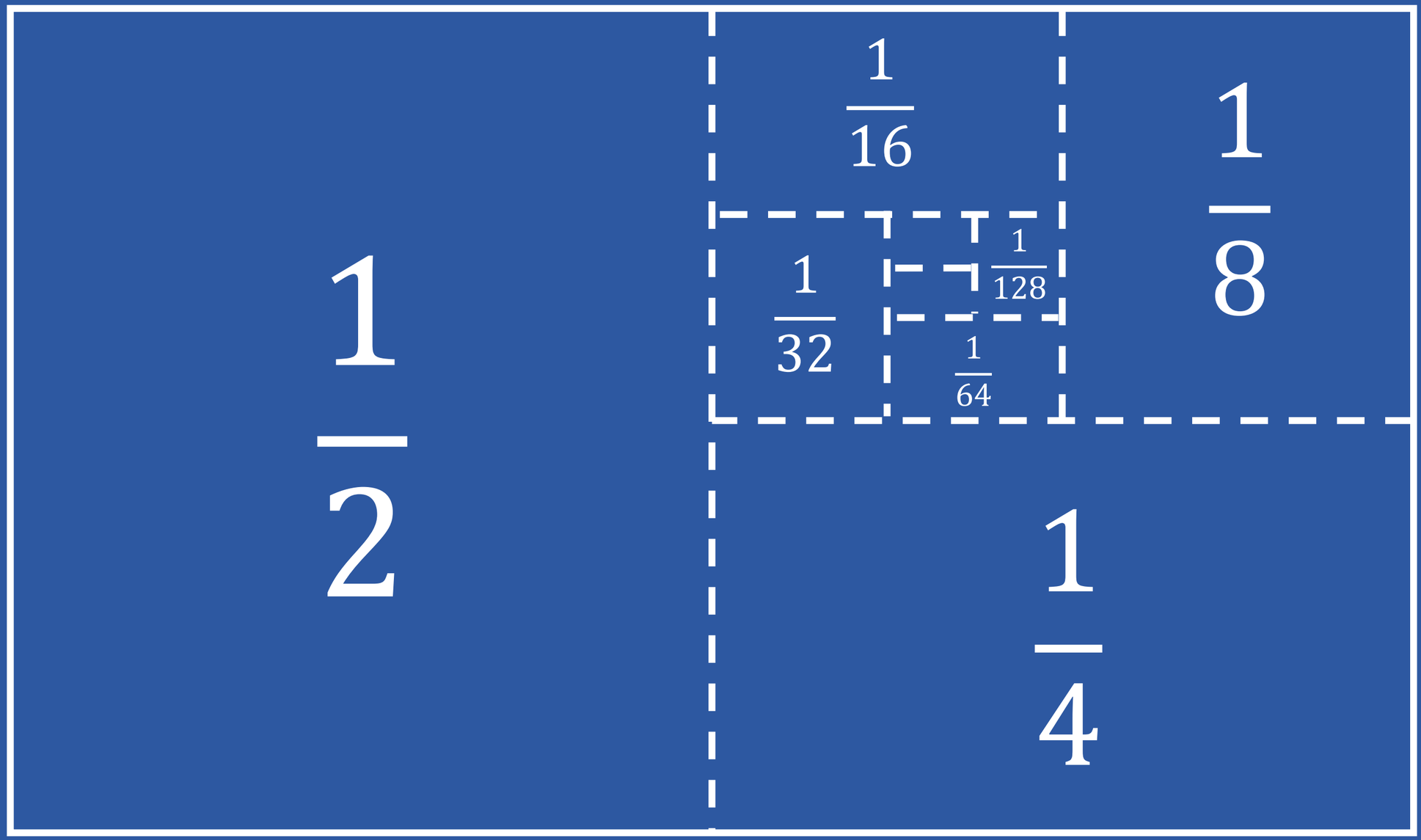


Source: youtube.com/watch?v=VvFYZLpMbR4

$$\frac{1}{2}+\frac{1}{4}+\frac{1}{8}+\frac{1}{16}+\frac{1}{32}+\cdots$$

$$=1$$


1/2
1/16
1/8
1/32
1/128
1/64
1/4

Source: Kyle Pearce - youtube.com/watch?v=Yr53Ji4SZDg

UNEXPECTED

- [x] PATTERN BREAKING
- [x] COUNTERINTUITIVE
- [ ] KNOWLEDGE GAPS
- [ ] OPEN MIDDLE

Curiosity... arises from the perception of a gap in knowledge or understanding.

GEORGE LOEWENSTEIN

Source: robertkaplinsky.com/lessons

Source: robertkaplinsky.com/lessons

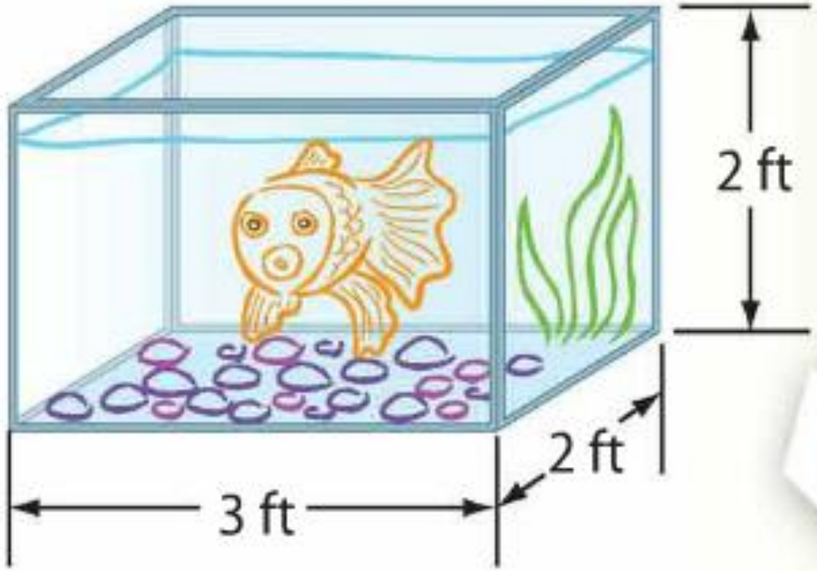
Source: robertkaplinsky.com/lessons

Source: robertkaplinsky.com/lessons

Real-World Link

Watch

Aquarium The dimensions of an aquarium are shown.



1. What is the area of the base of the aquarium? _____

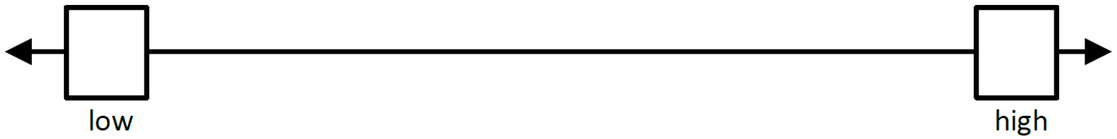
2. What is the height of the aquarium? _____

3. Fill in the blanks to find the volume.

_____ × _____ × _____ = 12 ft^3

What problem are you trying to figure out?

What estimates do you have?



Place your estimate on the number line.

What info do you already know about the problem?

What info do you need about the problem?

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

UNEXPECTED

- [x] PATTERN BREAKING
- [x] COUNTERINTUITIVE
- [x] KNOWLEDGE GAPS
- [ ] OPEN MIDDLE


N

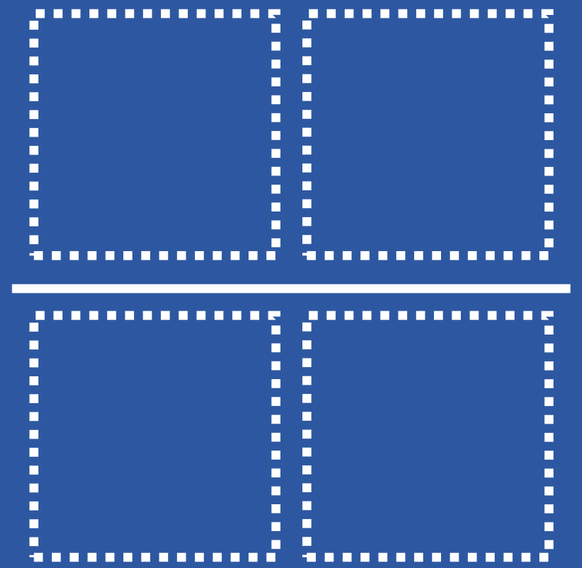
Google Maps My Village to Treasure Chest Travel 3621 miles, 21 days, 4 hours

Map data ©2017 Google 500 mi

My Village

	Treasure Map	Google Maps
Beginning	Closed	Closed
Middle	Open	Closed
End	Closed	Closed

Using the digits 1-9, at most one time each, fill in the boxes to create a fraction that is as close to one as possible.



Extension: How many ways can you prove that you are correct?

Source: Peter Morris on openmiddle.com

	Open Middle	Closed Middle
Beginning	Closed	Closed
Middle	Open	Closed
End	Closed	Closed

Name _____ My Homework _____

Independent Practice

Solve each syst

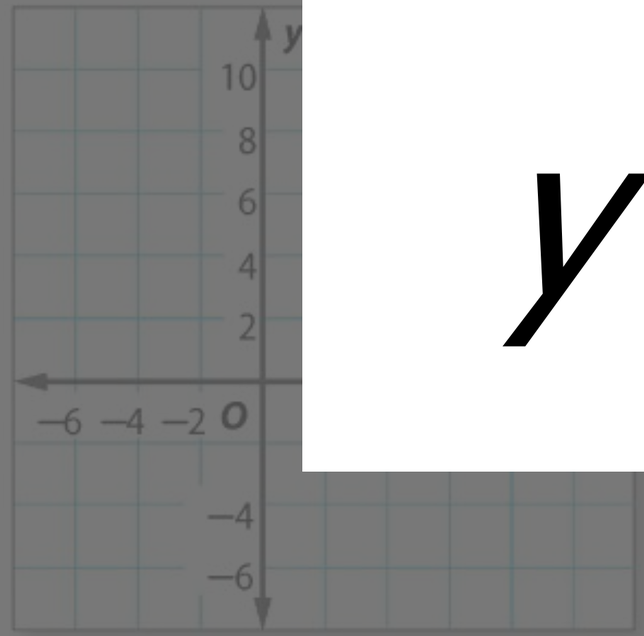
1. $y = x$
   $y = 2x - 4$

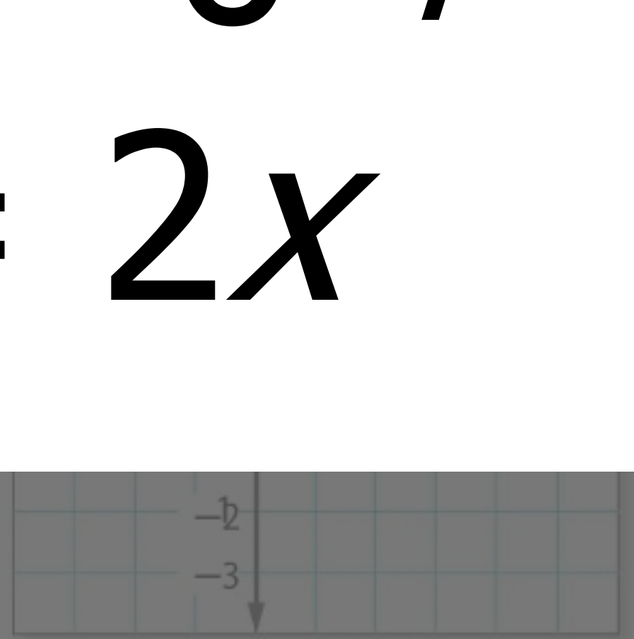
Show your work.

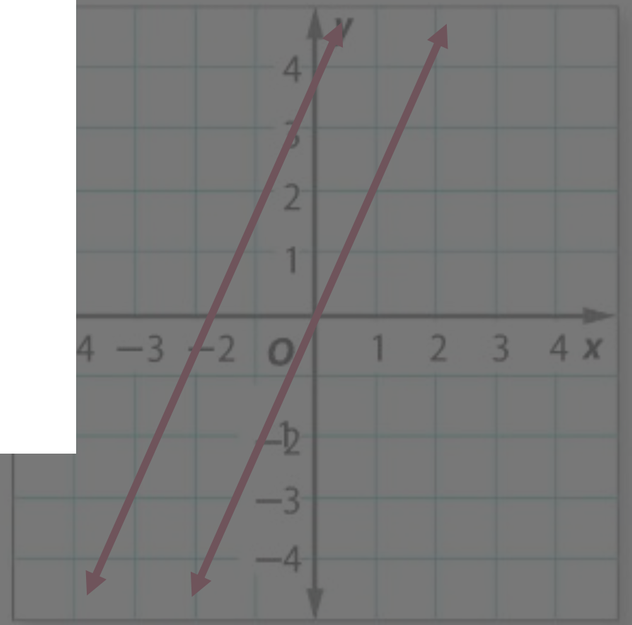
$$0 \neq 4$$

$$y = 2x$$

$y - 2x = 4$
$y = 2x$





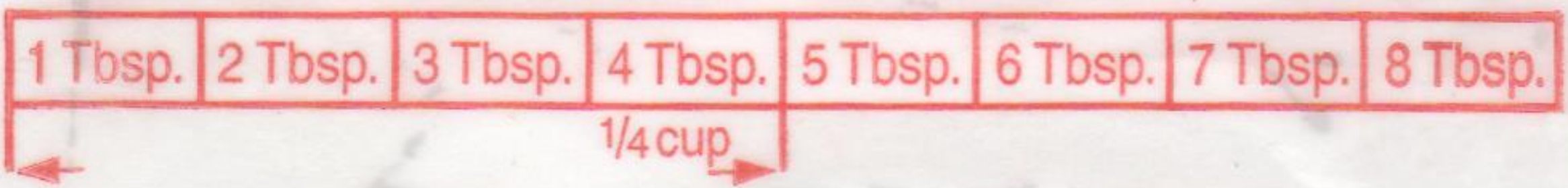


Source: robertkaplinsky.com/lessons

THIS UNIT NOT LABELED FOR INDIVIDUAL RETAIL SALE.

Ingredients: Pasteurized Cream, Salt.

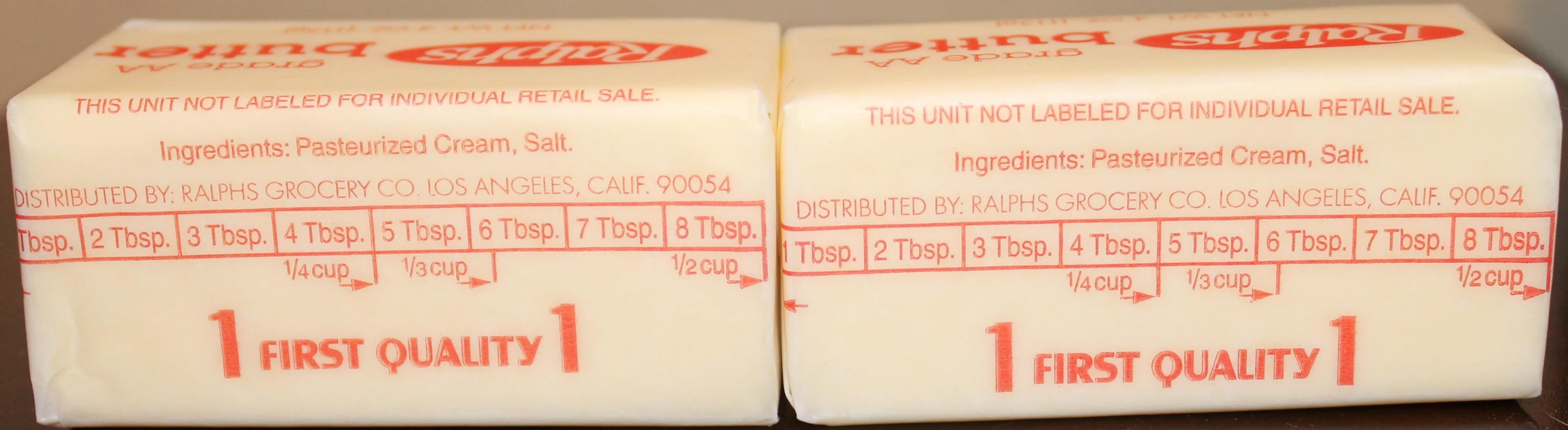
DISTRIBUTED BY: RALPHS GROCERY CO. LOS ANGELES, CALIF. 90054



1 FIRST QUALITY 1

grade AA

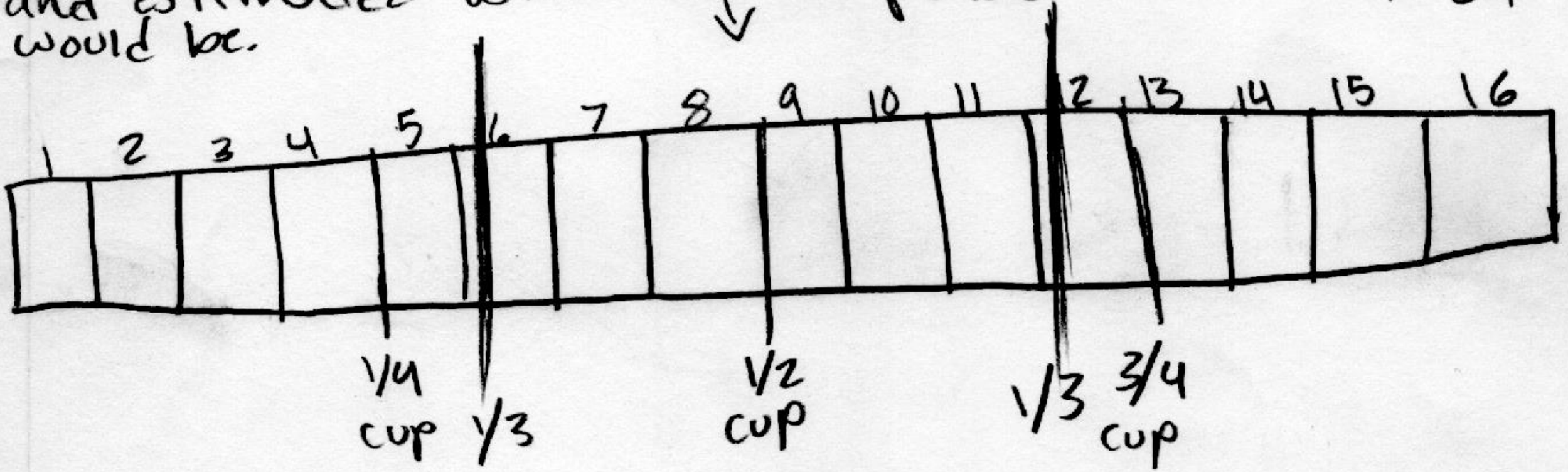
Source: robertkaplinsky.com/lessons



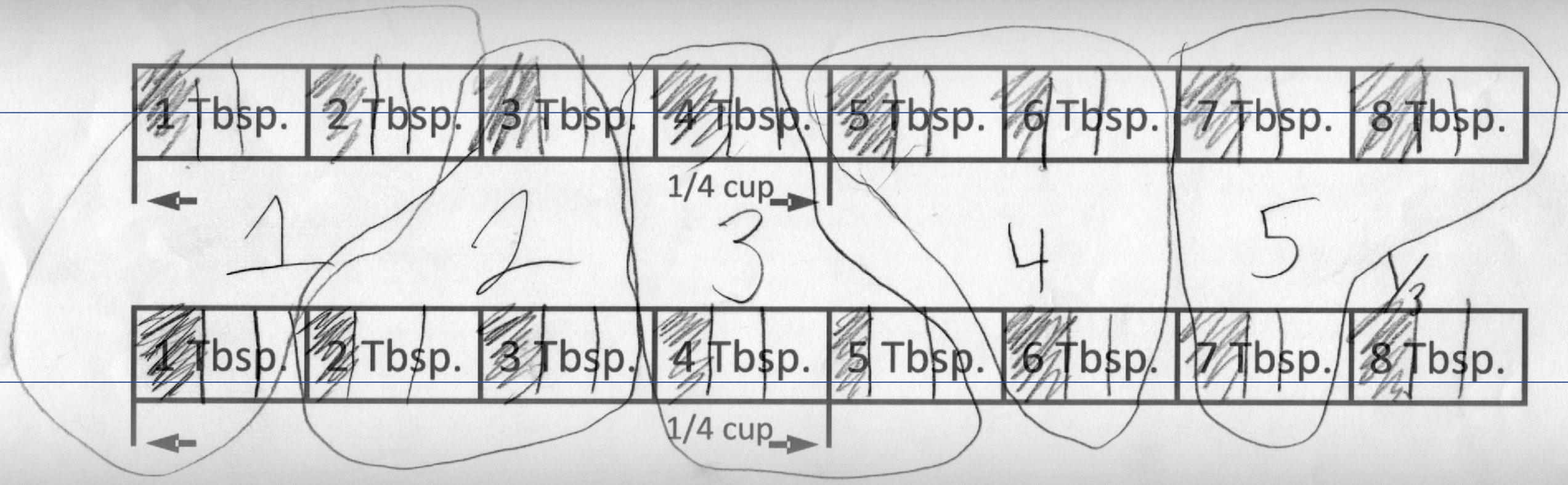
Source: robertkaplinsky.com/lessons

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

I reached my answer by drawing a picture of 16 Tbsp and estimated where on the picture would the 1/3 cup would be.



I also divided 16 by 3. → $3\overline{)16}$ 5 r 1 (15, 1)


1 Tbsp.
2 Tbsp.
3 Tbsp.
4 Tbsp.
5 Tbsp.
6 Tbsp.
7 Tbsp.
8 Tbsp.
1/4 cup
1
2
3
4
5
1/3

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

First, I got the total amount of tablespoons that equal a cup, which is 16 tbsp. After that, I divided 16 by 3 to find 1/3 of a cup. My quotient was 5 with a remainder of 1. So I divided the remainder to all three equal groups. My answer was that 1/3 of a cup of butter is 5.33 or 5 1/3 cups. To check, I multiplied 5.33 by 3 and my answer was 15.99. If you round that, you get 16.00 as the answer.

UNEXPECTED

- ☑ PATTERN BREAKING
- ☑ COUNTERINTUITIVE
- ☑ KNOWLEDGE GAPS
- ☑ OPEN MIDDLE

STICKY ATTRIBUTES

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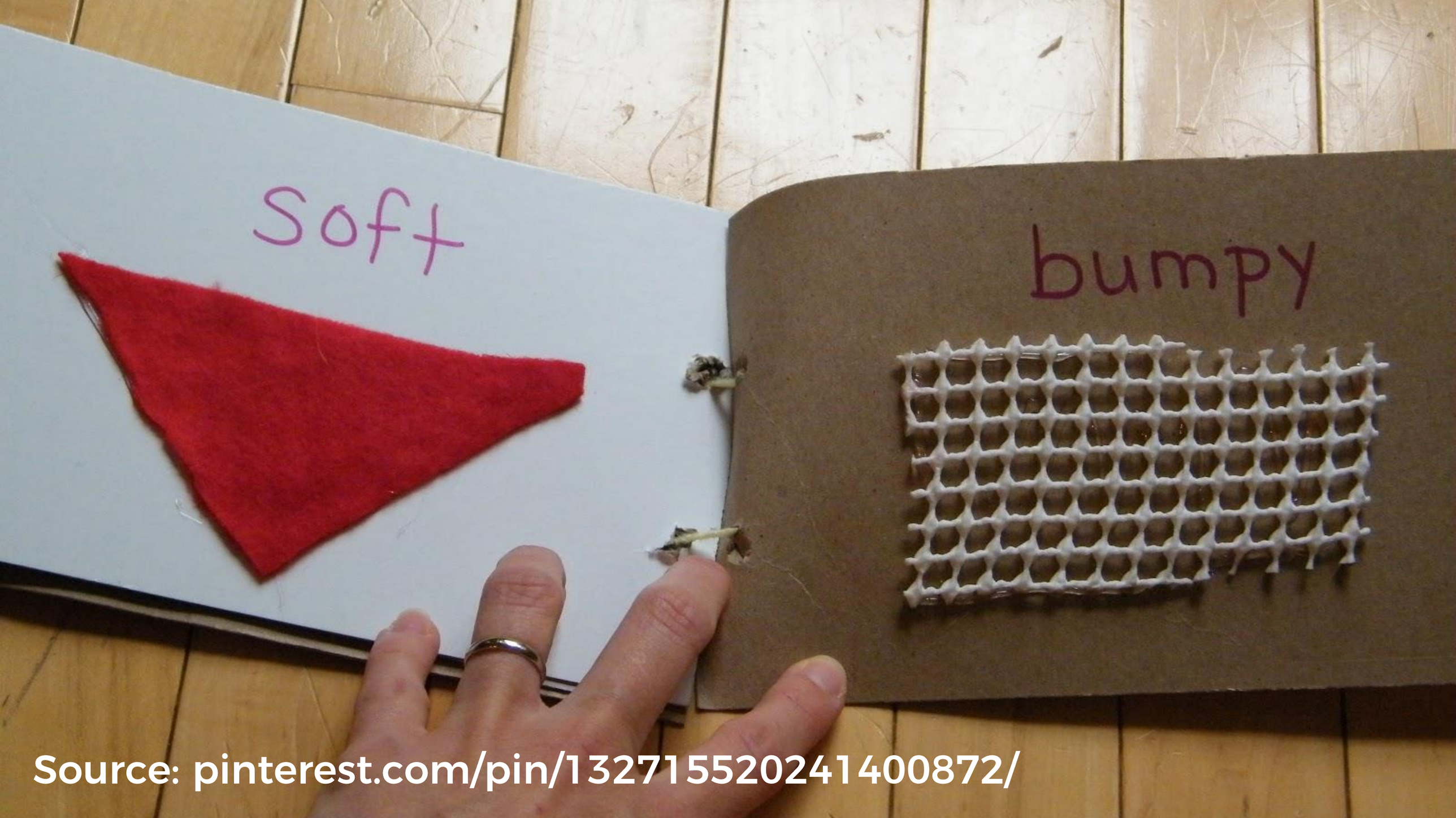
RobertKaplinsky.com



Source: pinterest.com/pin/132715520241400872/

Source: Color Dog


HunterDouglas
HunterDouglas
WINDOW FASHIONS
VICTORIA
15553
PRESIDENT'S
MINI BRIE
19.6 OUNCES
5.99
4988
VALLEY SUN
SUN-DRIED TOMATOES
JULIENNE CUT 32 OUNCE
UNIT PRICE PER OUNCE
.234
SELL PRICE
7.49

NAME: _____ DATE: _____ PERIOD: _____

Lesson 7 Skills Practice

Objective: Divide Decimals by Decimals

Divide.

1. $4.86 \div 0.2$

2. $628.2 \div 34.9$

7. $2.25 \div 0.15$

8. $421.6 \div 0.4$

13. $7.52 \div 0.74$

14. $0.105 \div 0.6$

Fans stream Nelly to help him pay off $2.4 million debt

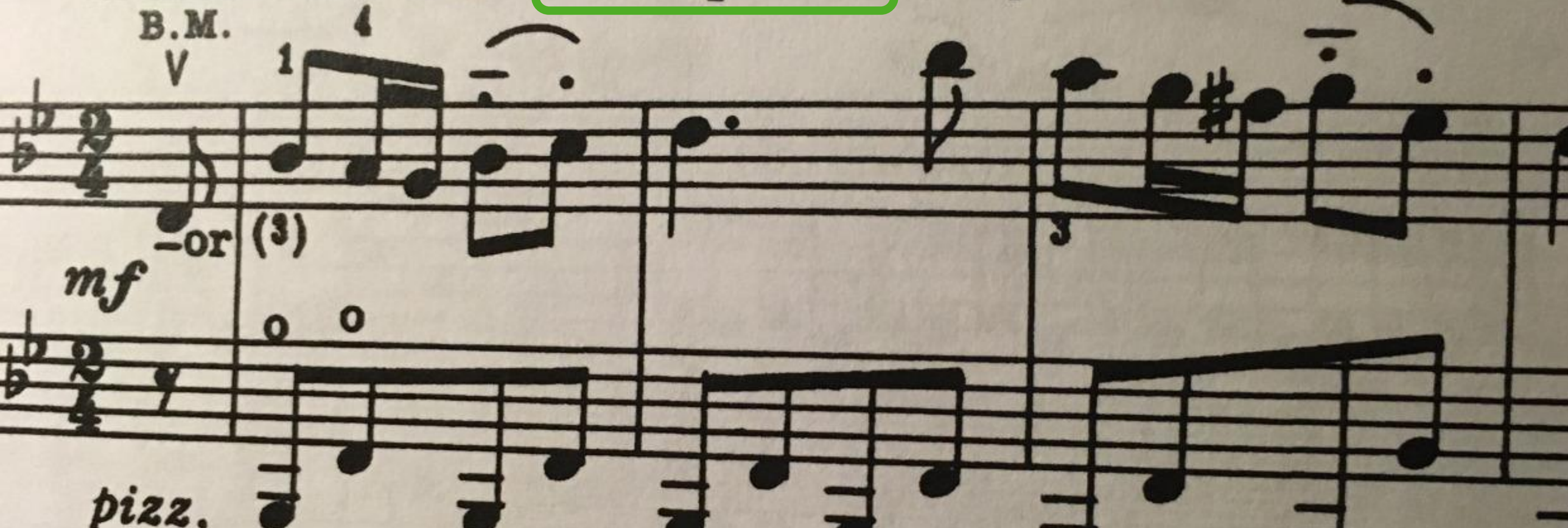
by Lisa Respers France @CNNMoney

September 13, 2016: 2:47 PM ET

- How many $0.006 are there in $2,400,000?
- How many 6 are there in 24?

9. Canzonett

In moderate time-with sparkle (Key of G minor)



LESSON 19-1

Stretching, Compressing, and Reflecting Sine and Cosine Graphs

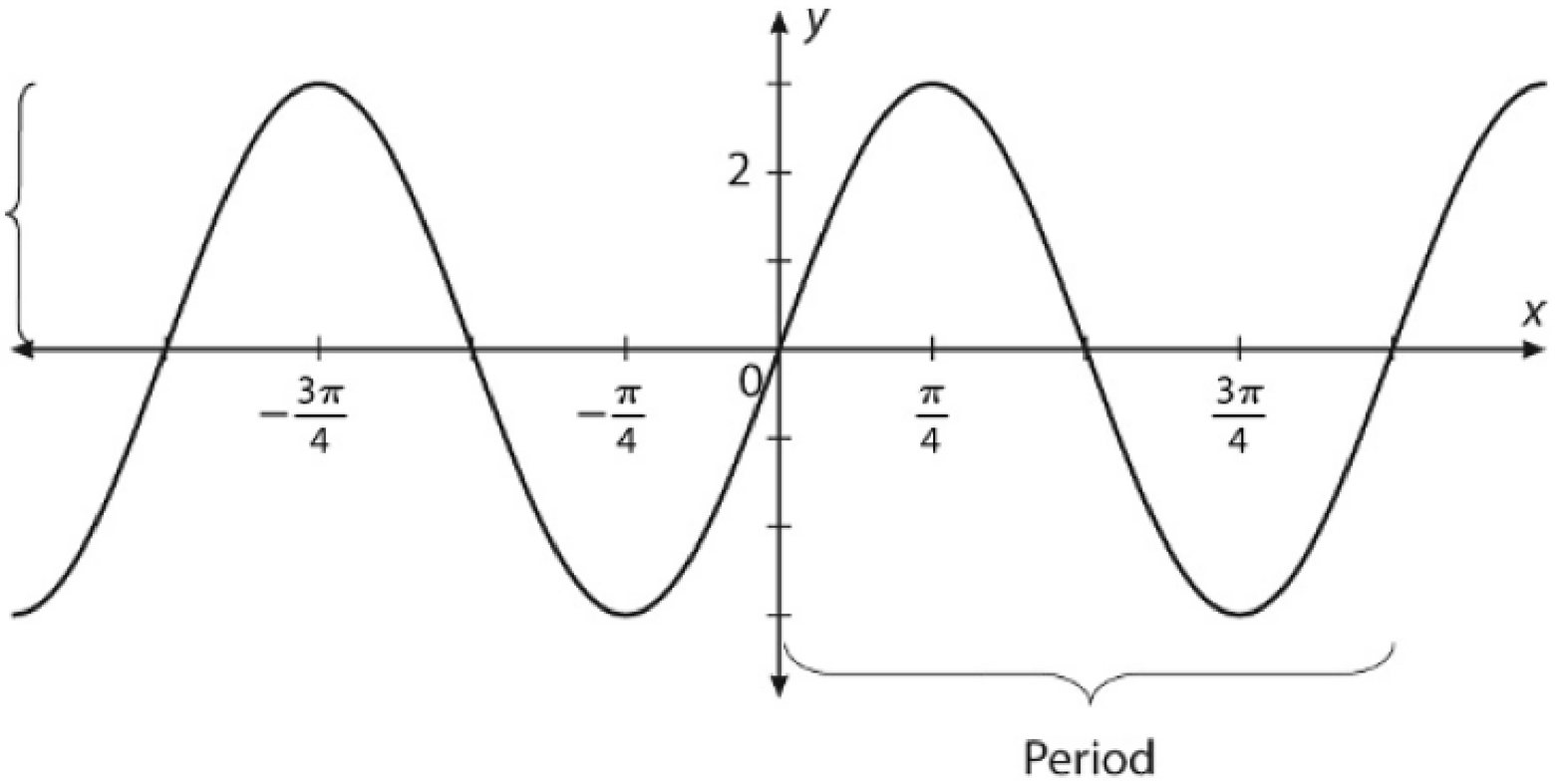
Reteach

For a sine function, $y = a\sin\left(\frac{1}{b}x\right)$.

Amplitude $= |a|$

Period $= 2\pi \cdot b$

If $a < 0$, the graph is reflected across the x-axis.



Example Write the function shown in the graph above.

Source: graphingstories.com

$$P = 2L + 2R$$

$$A = \pi r^2$$

$$A = \frac{1}{2}bh$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

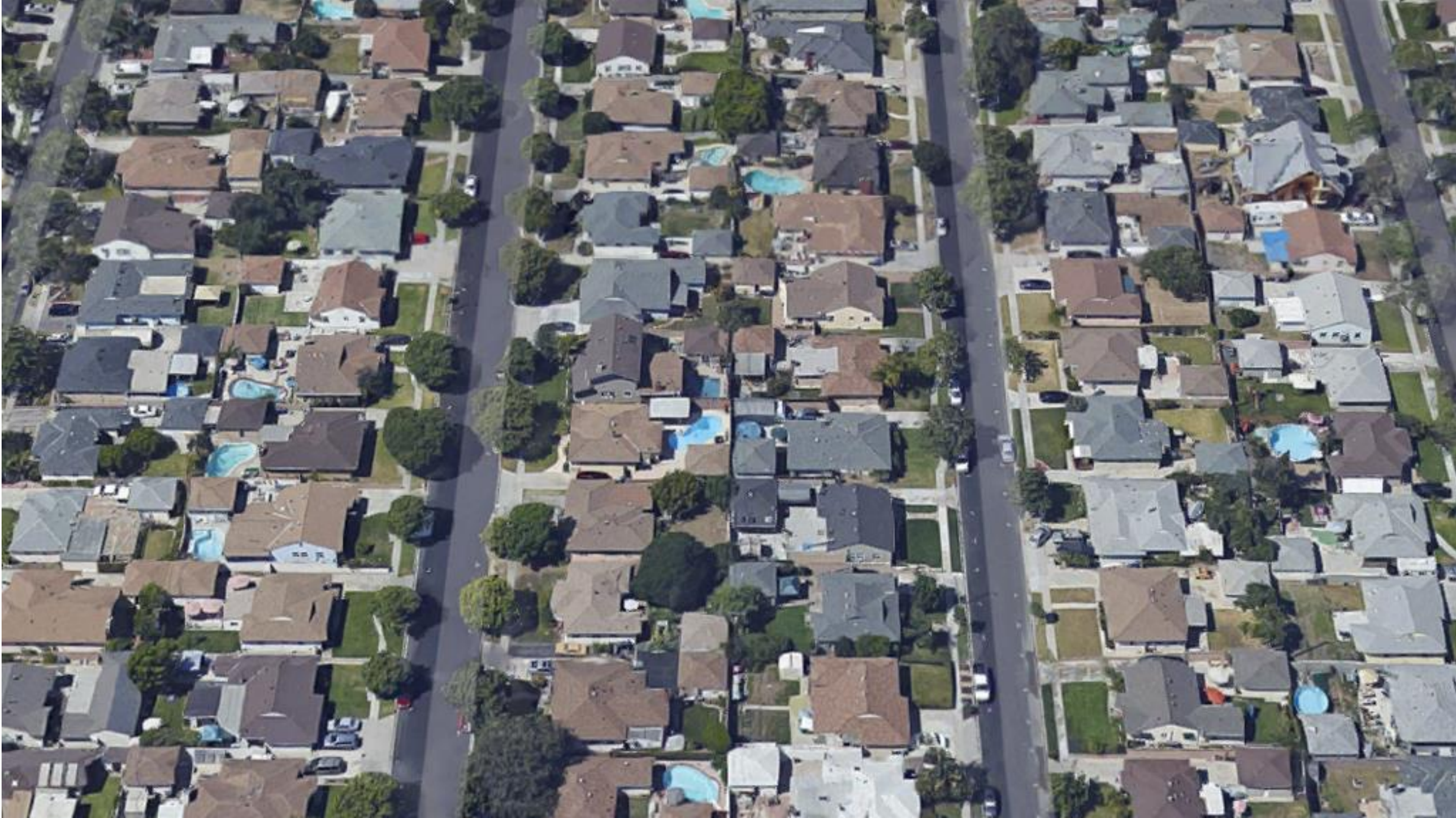
$$\log_b(x^y) = y \cdot \log_b(x)$$

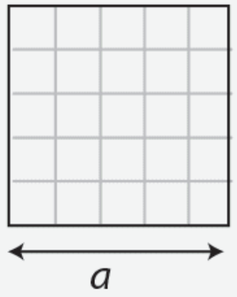
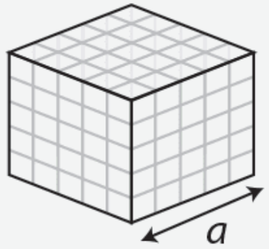
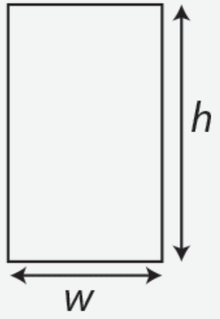
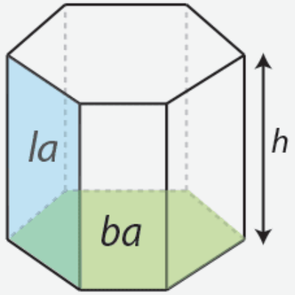
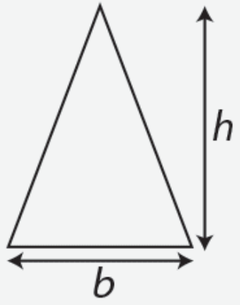
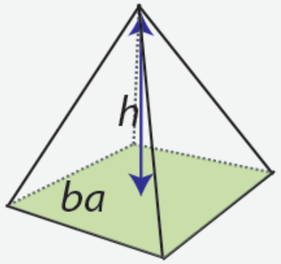
$$e^{i\pi} + 1 = 0$$

$$a^2 + b^2 = c^2$$

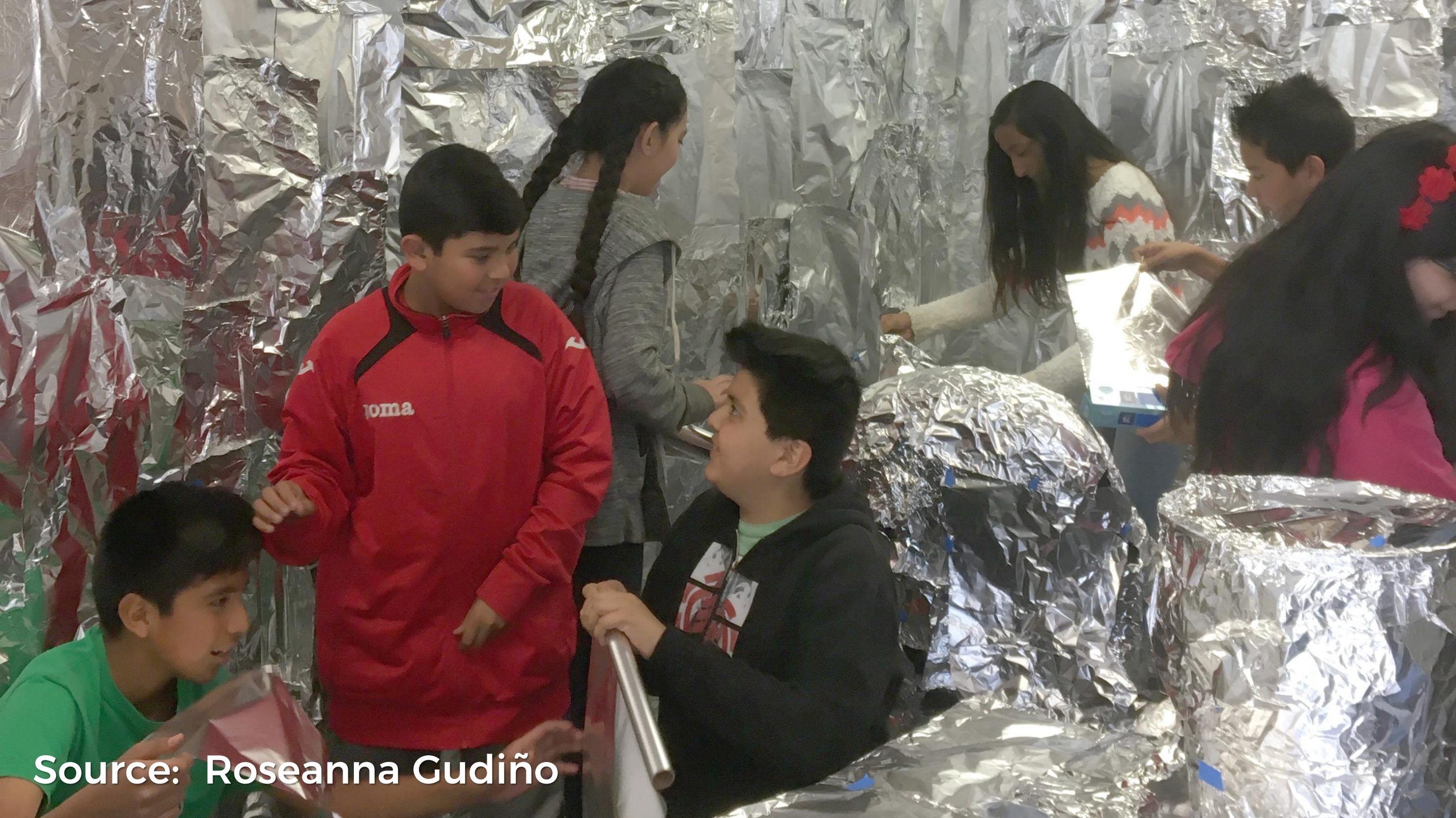
“Wait, was it a negative plus a negative or a negative times a negative that equals a positive.”

TOO MANY STUDENTS



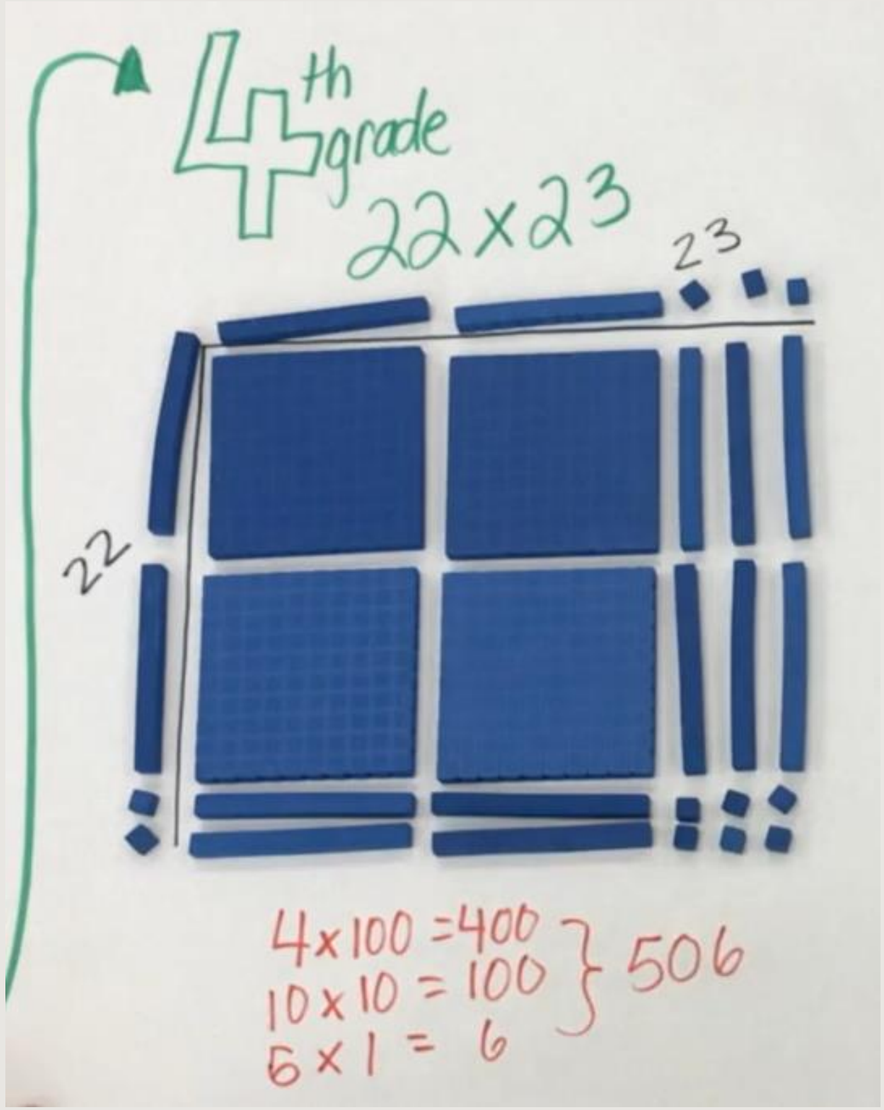
Two-dimensional plane shapes	**Area** *The measure of how many squares will fit into a shape.* ***Units²***	Three-dimensional solid shapes	**Surface Area** *The measure of the area of all outward facing sides.* ***Units²***	**Volume** *The measure of how many cubes will fit into a shape.* ***Units³***
Square 	Area = a^2 or $a \times a$ **Example:** *a = 5cm* *Area = 5^2 = 25cm²*	**Cube** 	Surface Area = 6 × a^2 **Example:** *a = 5cm* *Surface Area = 150cm²*	Volume = a^3 or a × a × a **Example:** *a = 5cm.* *Volume = 125cm³*
Rectangle 	Area = *w* × *h* **Example:** *w = width=10cm* *height=20cm* *Area =10 × 20 = 200cm²*	**Prism** 	Surface Area = 2 × ba + la **Example:** *ba = base area = 20cm²* *la = lateral area (all sides) = 60cm²* *Surface area =* *2 × 20 + 60 = 100cm²*	Volume = ba × h **Example:** *ba = base area = 20cm²* *h = height = 5cm* *Volume = 20 × 5 = 100cm³*
Triangle 	Area = *b* × *h* × 0.5 **Example:** *b = base = 20cm* *h = vertical height = 15cm* *Area = 20 × 15 × 0.5 =150cm²*	**Pyramid** 	Surface Area = ba + la **Example:** *ba = base area = 16cm²* *la = lateral area (all sides) = 60cm²* *Surface area = 16 + 60 = 76cm²*	Volume = ba × h × 1/3 **Example:** *ba = base area = 16cm²* *h = height = 9cm* *Volume = 16 × 9 × 1/3 = 48cm³*
n 	Area = *n* × *s* × *a* × 0.5	**on**	Surface Area = fa × s	

Source: robertkaplinsky.com/lessons

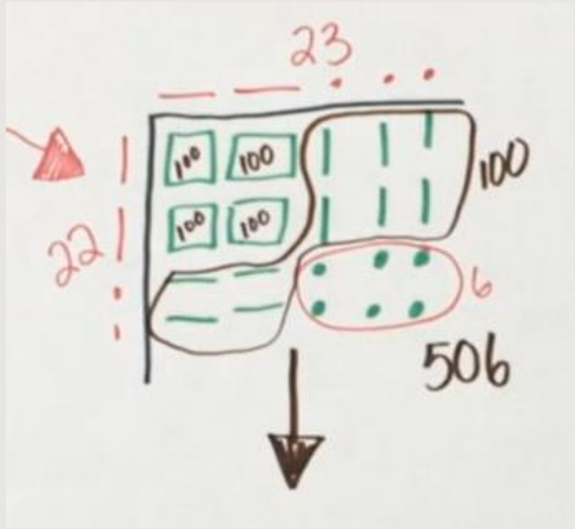


Source: Roseanna Gudiño

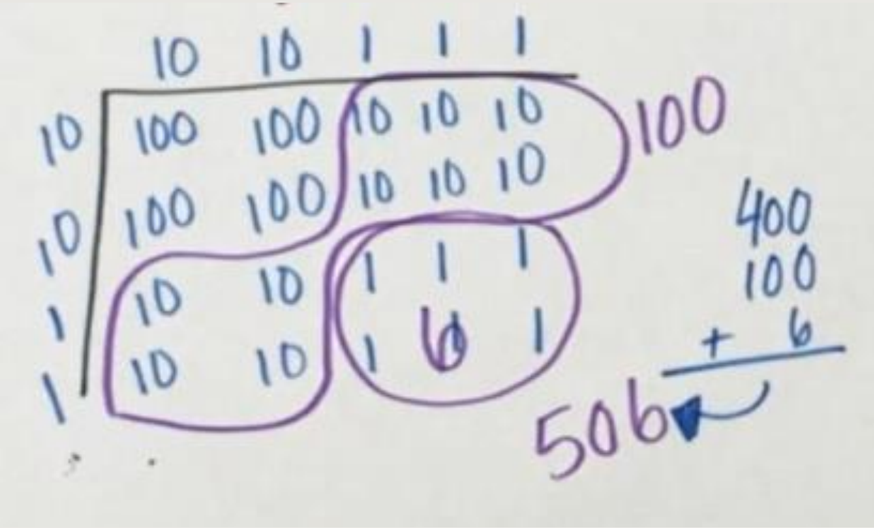
Source: gfletchy.com/progression-videos



Concrete



Representational



Abstract

Source: gfletchy.com

MY OLD METHODS

$$4(x+3)$$

$$4(x)+4(3)$$

$$(x+3)(x-1)$$

F $x(x)$

O $x(-1)$

I $3(x)$

L $3(-1)$

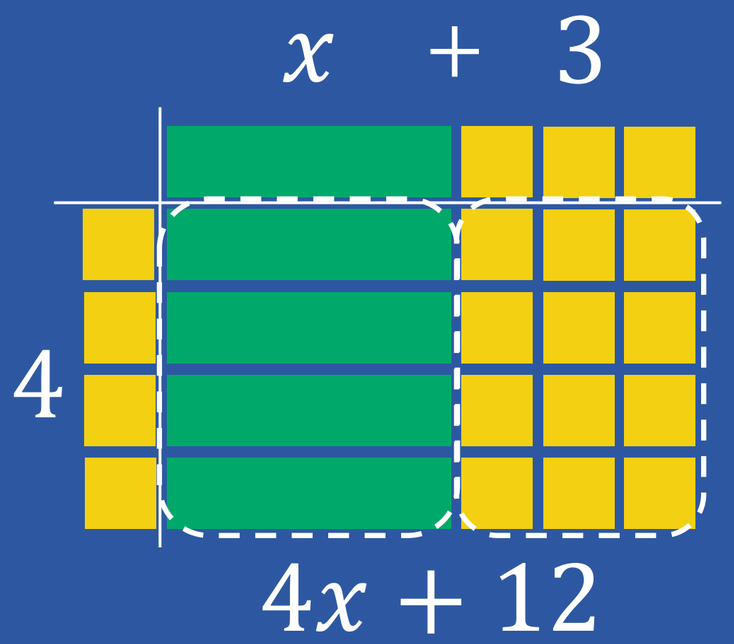
$$= x^2 - x + 3x - 3$$

$$= x^2 + 2x - 3$$

DISTRIBUTIVE PROPERTY

$$4(x+3)$$

Concrete



Representational

	x	$+\ 3$
4	$4x$	12

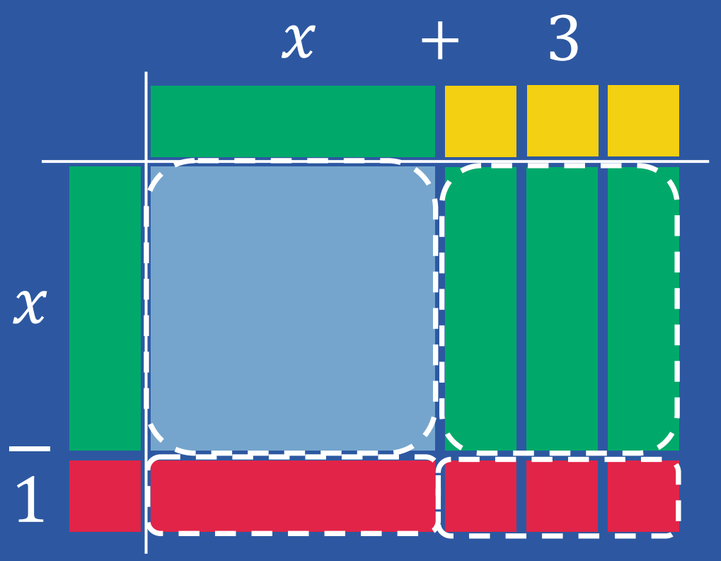
Abstract

$$4(x+3)$$
$$= 4(x) + 4(3)$$
$$= 4x + 12$$

BINOMIAL MULTIPLICATION

$(x + 3)(x - 1)$

Concrete



$x^2 - x + 3x - 3$

$x^2 + 2x - 3$

Representational

	x	+ 3
x	x^2	3x
− 1	$-x$	-3

$x^2 - x + 3x - 3$

$x^2 + 2x - 3$

Abstract

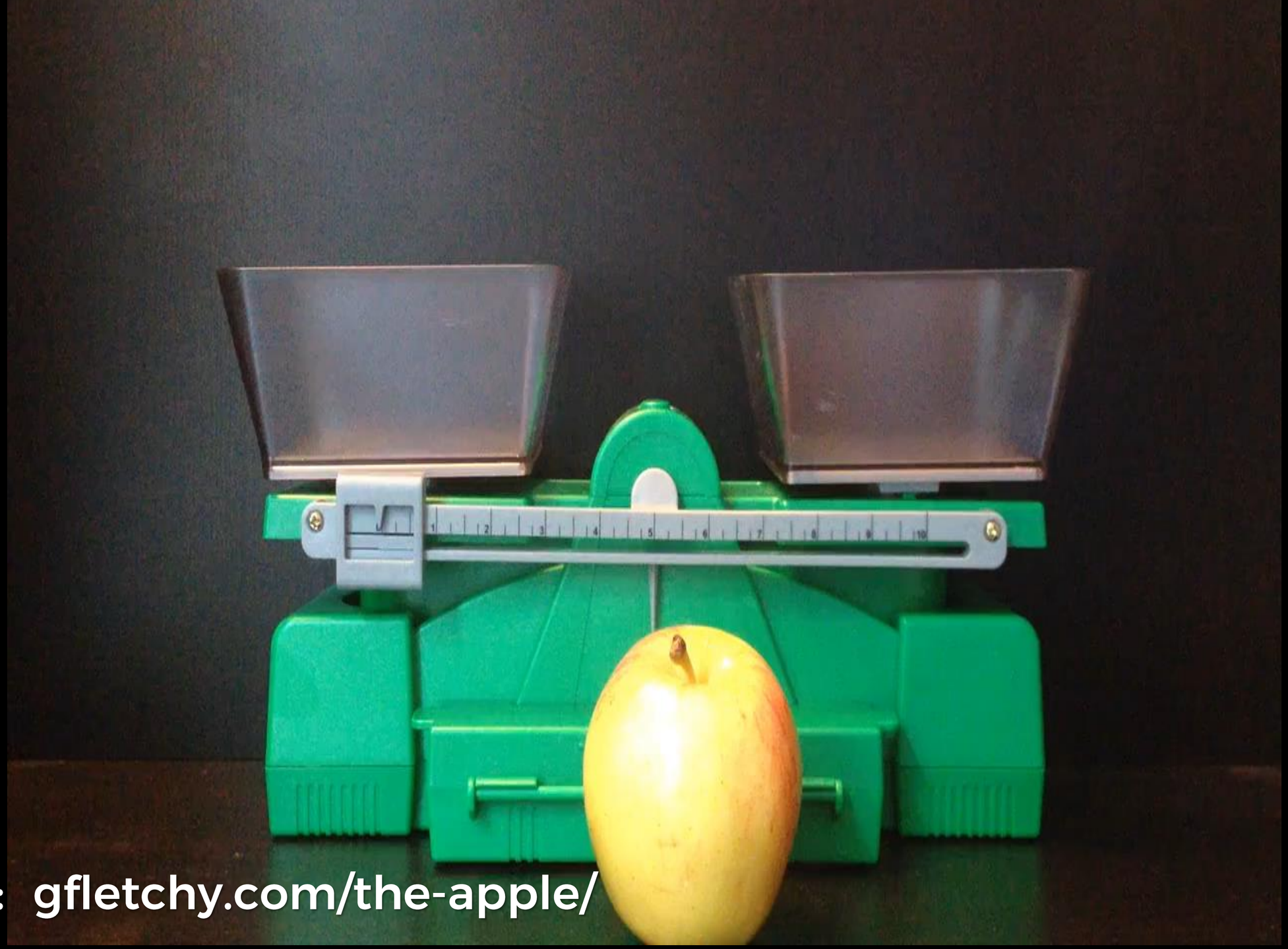
$(x + 3)(x - 1)$

$= x^2 - x + 3x - 3$

$= x^2 + 2x - 3$

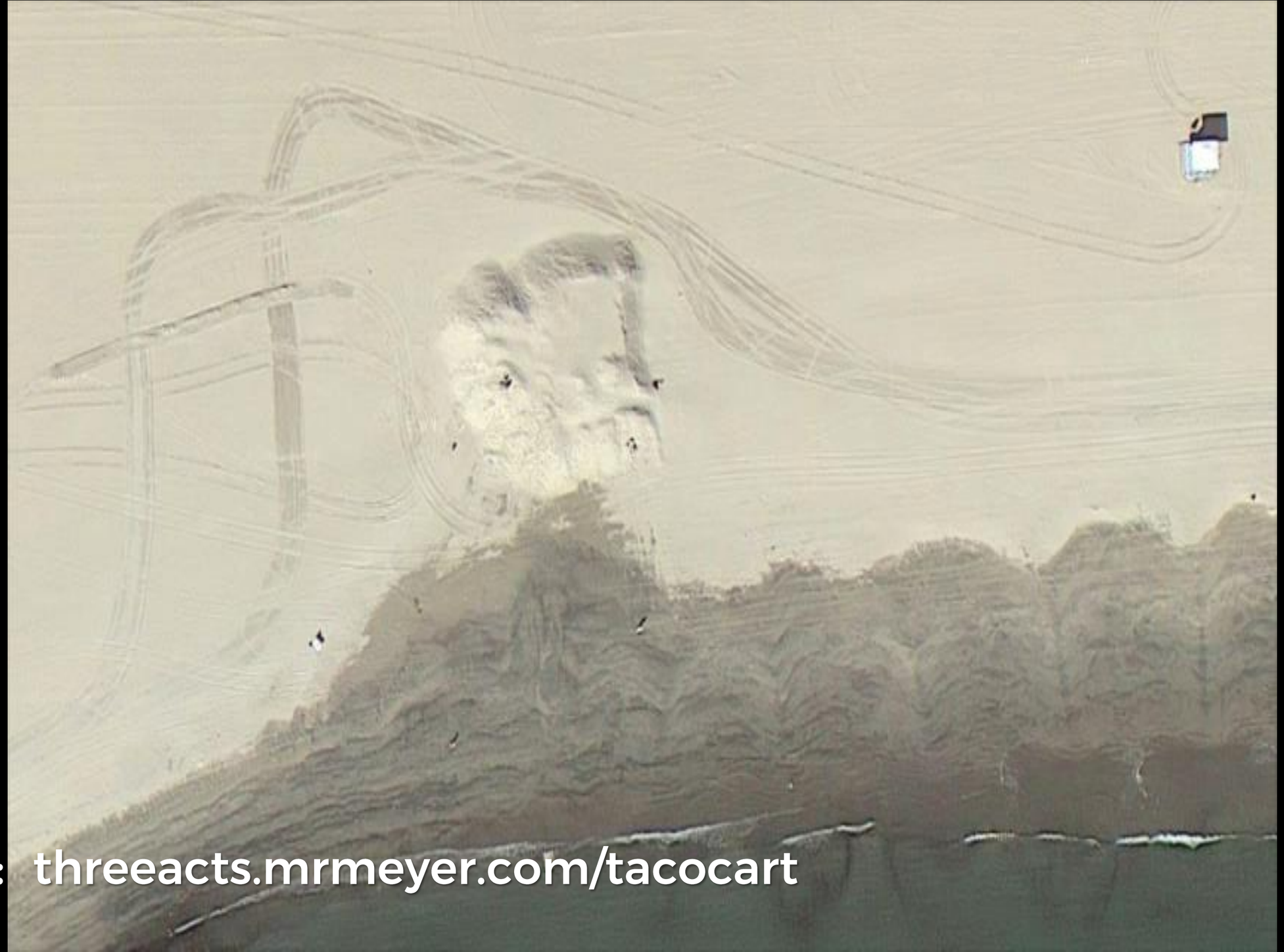
STICKY ATTRIBUTES

- [x] SIMPLE
- [x] UNEXPECTED
- [x] CONCRETE
- [ ] CREDIBLE
- [ ] EMOTIONAL
- [ ] STORIES

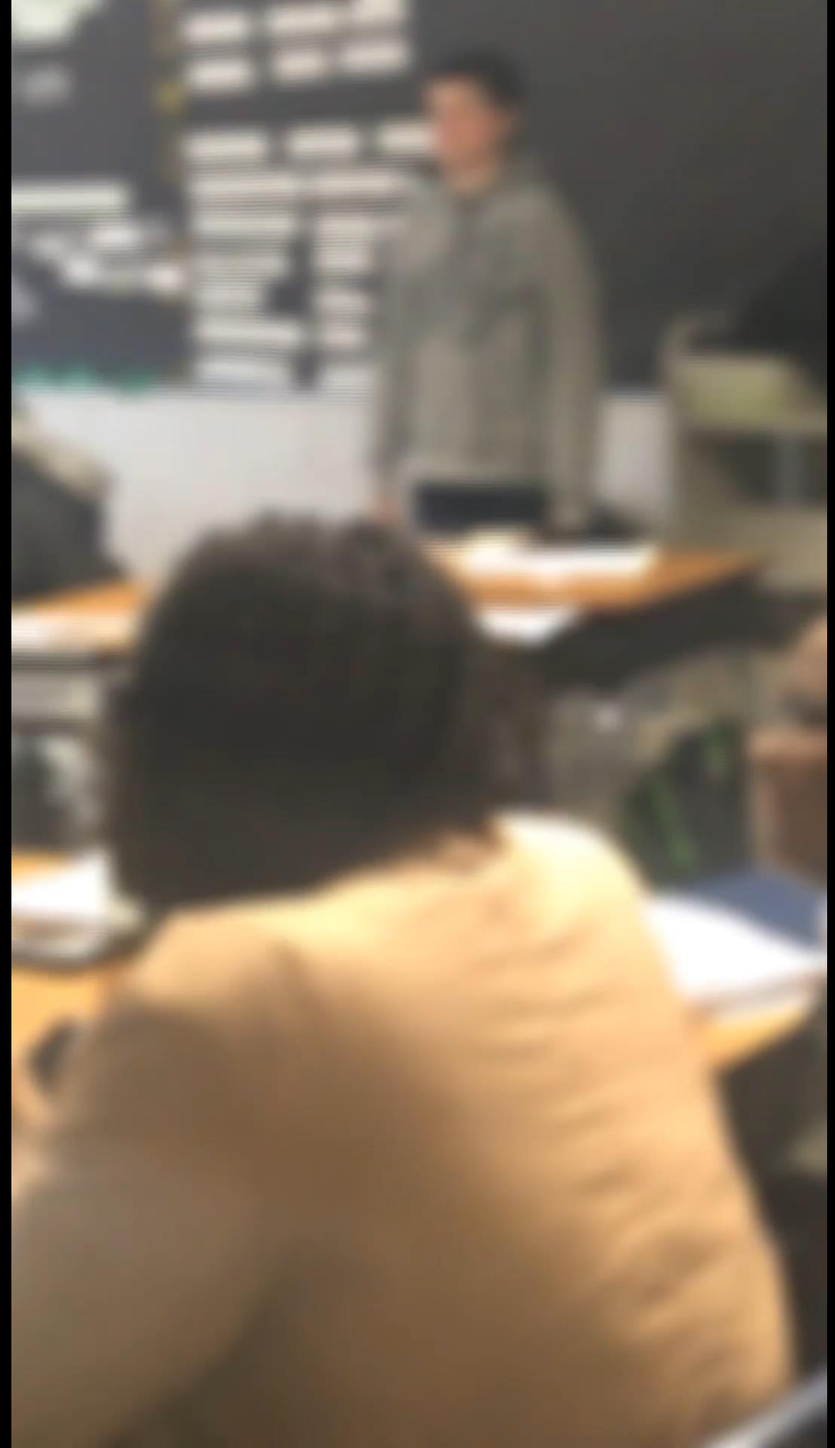


Source: gfletchy.com/the-apple/

Source: JJ Martinez



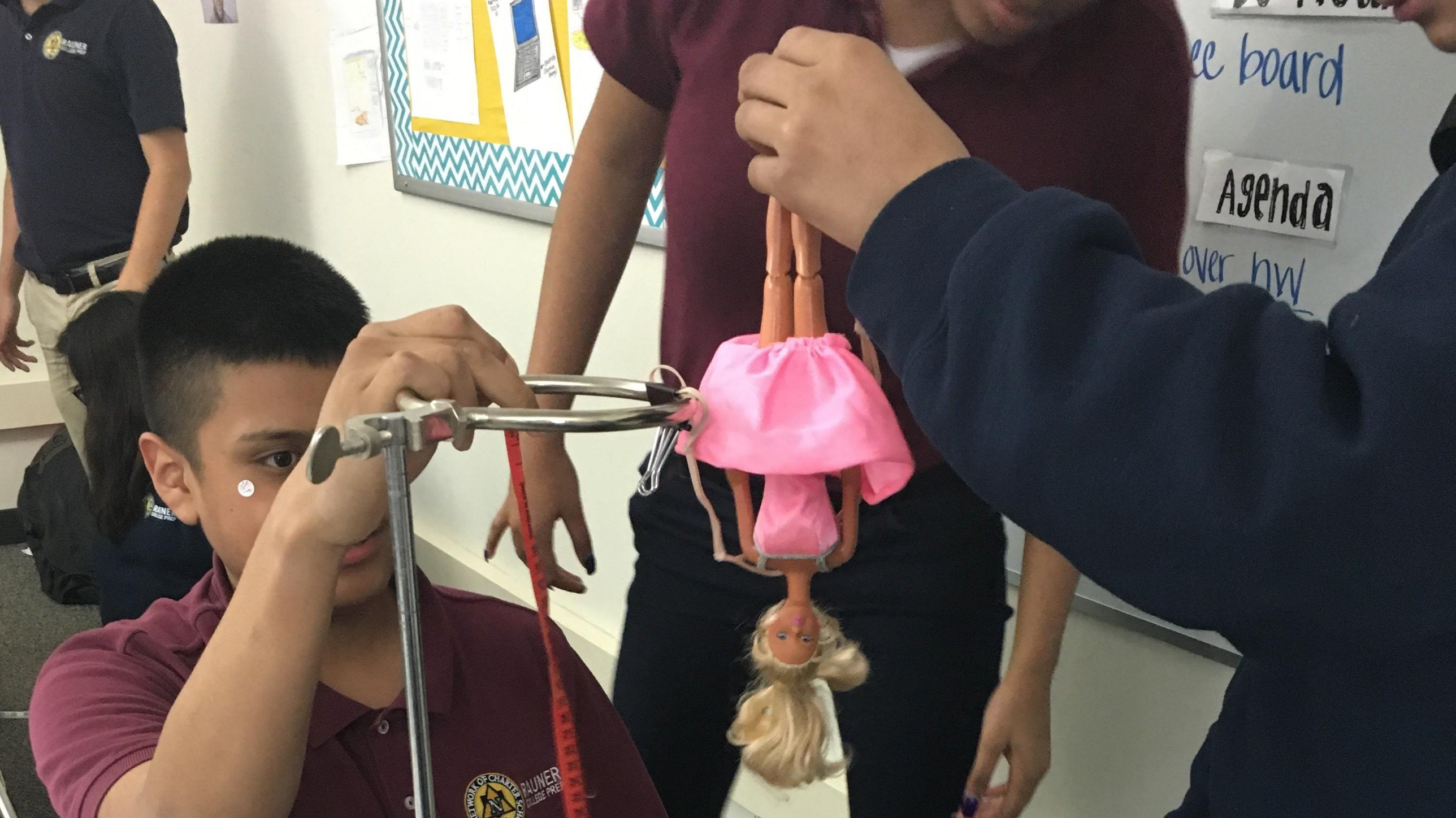
Source: threeacts.mrmeyer.com/tacocart



Source:
Jenise Sexton

Source: Tom Ward

Source: Tom Ward


Agenda

Source:
Fawn Nguyen


Division
Pain Relief Fever Reduction
NSAID
200 Tablets 200 mg
Functions
Pain Reliever/ Fever Reducer
Caffeine-Free
200 tablets
325 mg each
Extra Strength
Perimeter
Pain Reliever/ Fever Reducer
200 Capsules 500 mg. each

Act 1 Engaging Opener

Act 2 Get Info. Solve Problem.

Act 3 Big Reveal

Source: estimation180.com

We Will Rock You
Queen — Greatest Hits I
0:00

Source: estimation180.com

STICKY ATTRIBUTES

- [x] SIMPLE
- [x] UNEXPECTED
- [x] CONCRETE
- [x] CREDIBLE
- [ ] EMOTIONAL
- [ ] STORIES

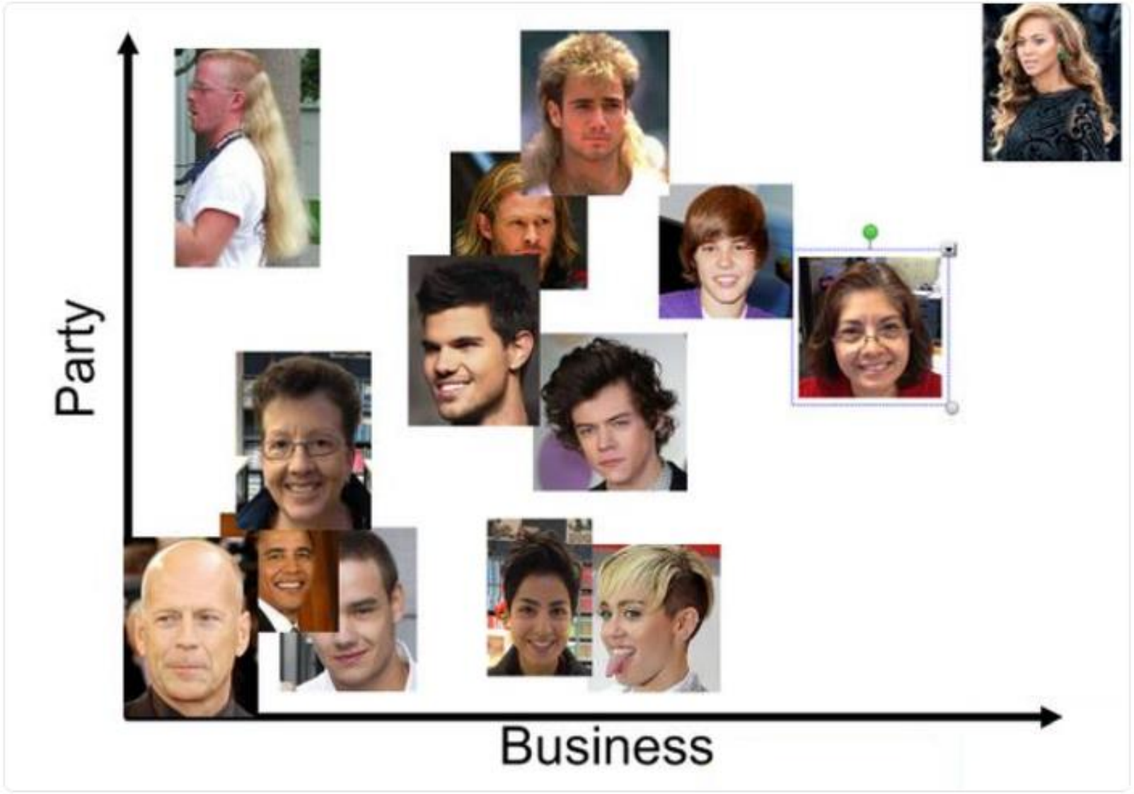
RobertKaplinsky.com

Source: mrvaudrey.com

Matt Vaudrey
@MrVaudrey

Following

Things I never thought I'd say: "So you're saying that Thor has less party than Justin Bieber, but more than Obama?"



RETWEETS 4 LIKES 7

GREEN BAY

ARIZONA

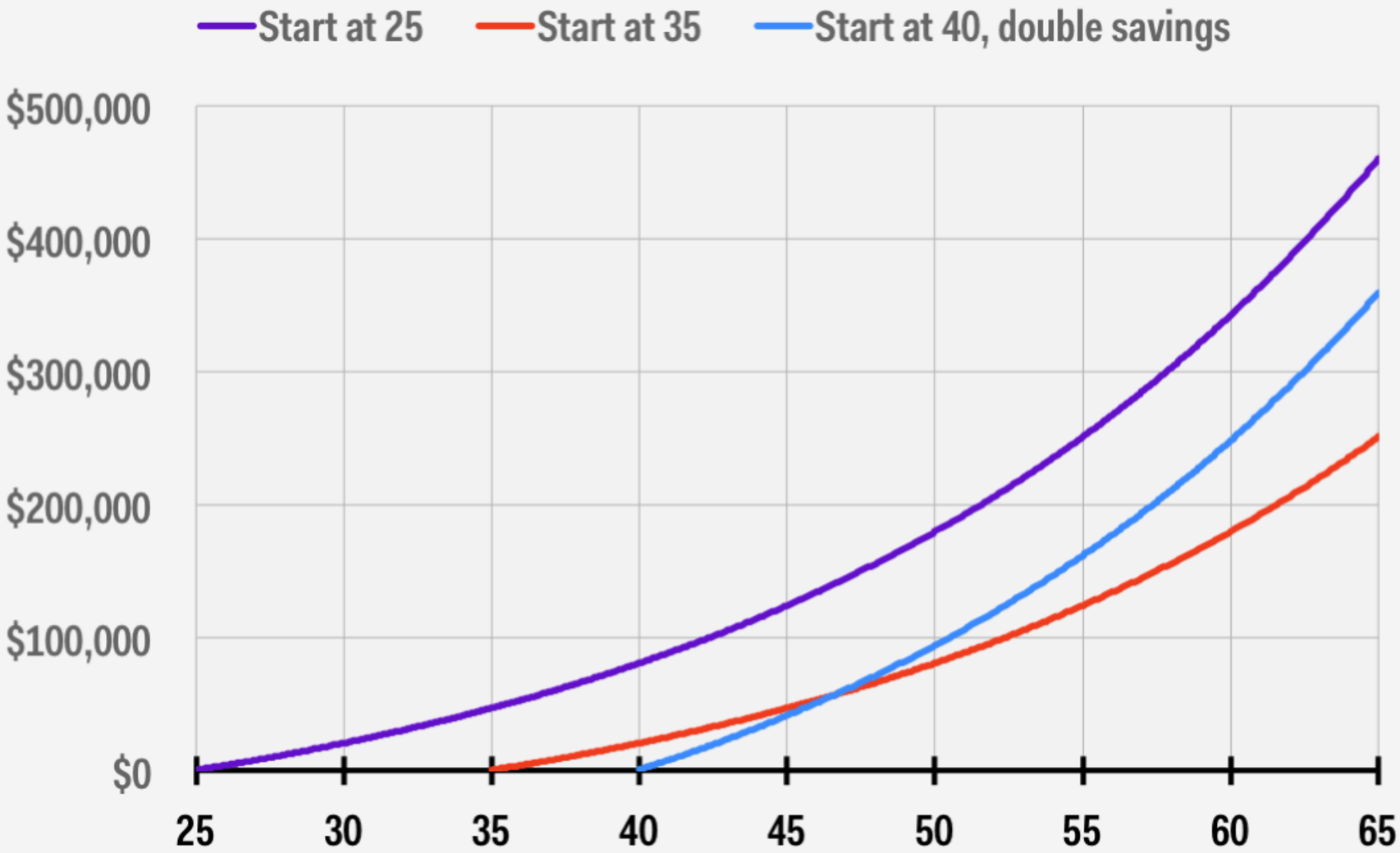
	7	6	3	2	1	9	8	5	4	0
2	Vila	ROB S	SHEP	ROB S	SHEP CO.	PAPA	K+R	Vila	ROB S	DB
7	DB	DB	DB	K+R	ROB S	BILL	SHEP CO	SHEP	SHEP CO.	DB.
8	K+R	ROB S	KB	CHRIS C	PAPA	RICK	ROB S	SHEP CO	ROB S	KB
3	ROB S	SHEP	ROB S	DB	BILL	CHRIS C	SCHWEITZER LOCK	Vila	SHEP	SHEP CO.
4	SHEP CO	DB	SHEP	RICK	ROB S	BILL	THE SCHWEITZ	THE SCHWEITZ	THE SCHWEITZ	THE SCHWEITZ
9	PAPA	ROB S	CHRIS C	CHRIS C	CHRIS C	KB	THE SCHWEITZ	DB	BILL	SHEP
0	DB.	SHEP CO	K+R	RICK	DB	ROB S	DB	Vila	RICK	Vila
5	BILL	DB	ROB S	ROB S	Vila	Vila	ROB S	KB	ROB S	K+R
				Vila	ROB		DB		Vila	SHEP

· PAYOUTS ·

1ST QUARTER	$25
HALFTIME	$50
3RD QUARTER	$75
FINAL	$100

$2 SQUARES

Start saving in your 20s



BUSINESS INSIDER

Source: robertkaplinsky.com/lessons

tangible > magnitude

STICKY ATTRIBUTES

- [x] SIMPLE
- [x] UNEXPECTED
- [x] CONCRETE
- [x] CREDIBLE
- [x] EMOTIONAL
- [ ] STORIES

RobertKaplinsky.com

Source: robertkaplinsky.com/lessons

Patrick Peterson Hasn't 'Gotten Around' to Cashing $15 Million Bonus Check

KYLE NEWPORT

AUGUST 25, 2014

Source: robertkaplinsky.com/lessons

20. Sports Cornerback Patrick Peterson did not deposit a $15,361,000 signing bonus check for 27 days. Assuming a 2% interest rate, how much money did he lose by not cashing the check immediately?

Source: robertkaplinsky.com/lessons

Source: If You Hopped Like A Frog by David M. Schwartz

The Doorbell Rang

by Pat Hutchins

IMPORTANCE OF CONTEXT

- Play four songs
- Tapped out
- Write down song names
- Share answers with neighbors
- Listen again with song names

SONG #1

SONG #2

SONG #3

SONG #4

SONG #1

Itsy Bitsy Spider

SONG #2

Wheels On The Bus

SONG #3

Row Row Row Your Boat

SONG #4

Take Me Out To The Ballgame

Robert Kaplinsky
@robertkaplinsky

Random favor: please listen to me tapping out 4 songs and try to guess the name. Should take < 2 min. It's not easy!

Recognizing Tapped Songs

Please listen to each of the four songs, type in the name of the song, and the click submit. You may have no clue about what the song is called. If that happens, just write something like, "I don't...

docs.google.com

RETWEET
1

2:47 PM - 13 Jun 2017

TAKEAWAYS (PART ONE)

- Of 192 people surveyed:
  - Itsy Bitsy Spider: ~41%
  - Wheels on the Bus: ~29%
  - Row Your Boat: ~25%
  - Take Me Out to the Ballgame: ~3%

TAKEAWAYS (PART TWO)

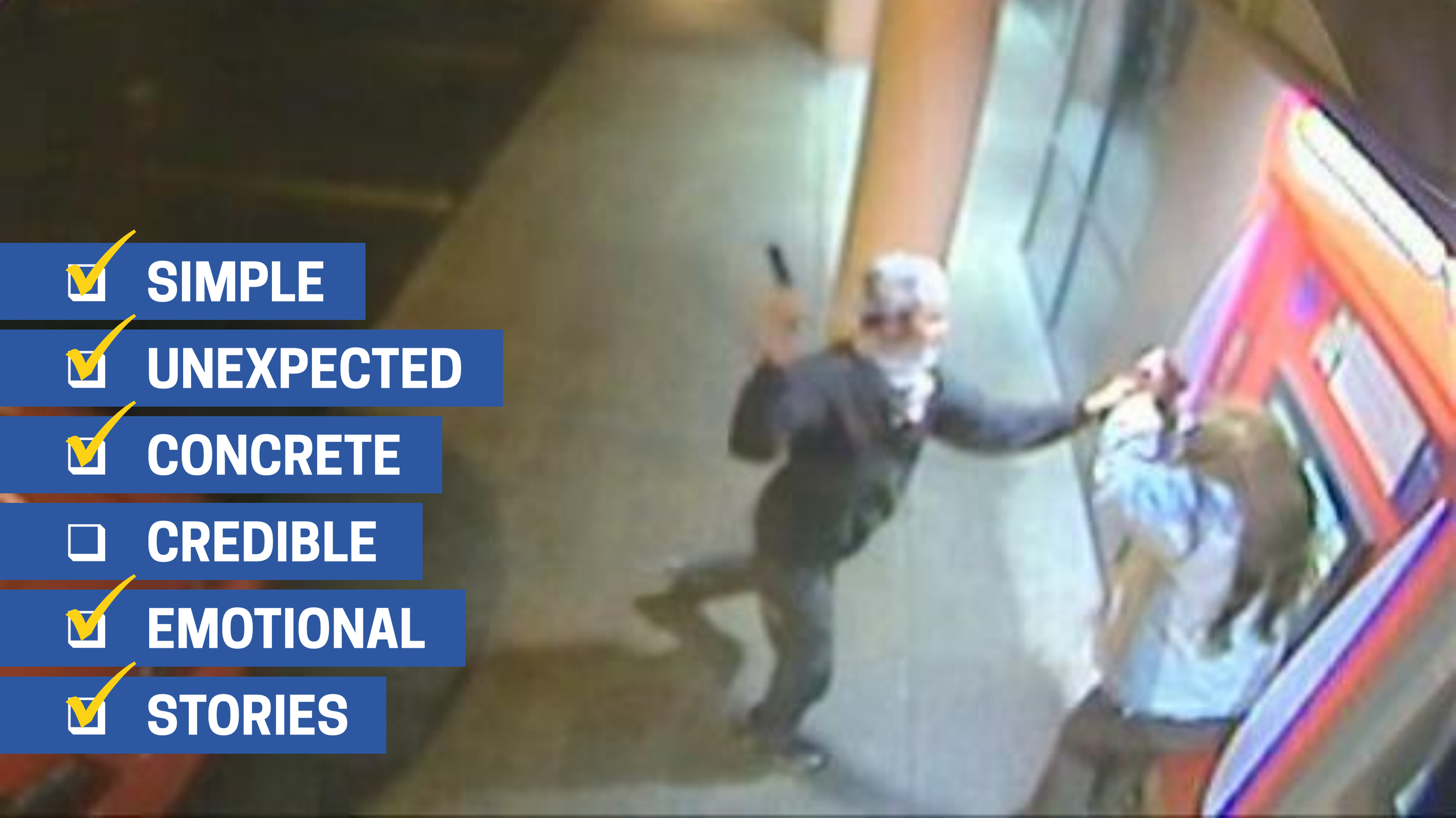
- Many said, “I’m sorry. I don’t know.”
- Many said, “I’m not good at this.”
- Many said, “I don’t like this.”

CURSE OF KNOWLEDGE

STICKY ATTRIBUTES

- ☑ SIMPLE
- ☑ UNEXPECTED
- ☑ CONCRETE
- ☑ CREDIBLE
- ☑ EMOTIONAL
- ☑ STORIES

RobertKaplinsky.com


SIMPLE
UNEXPECTED
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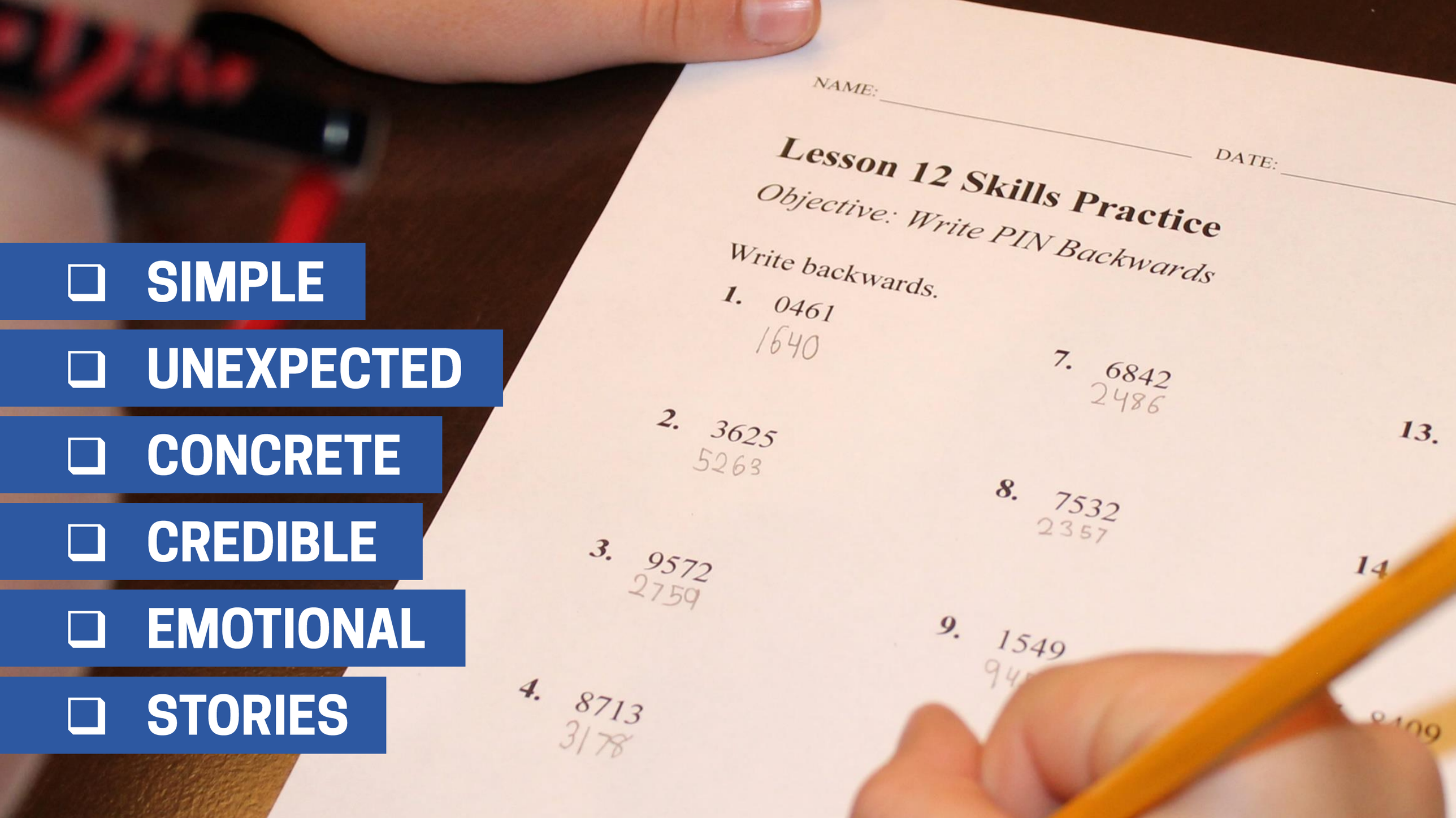
STORIES



- ❑ SIMPLE
- ❑ UNEXPECTED
- ❑ CONCRETE
- ❑ CREDIBLE
- ❑ EMOTIONAL
- ❑ STORIES

DISCUSSION TIME

- Which of the attributes (simple, unexpected, concrete, credible, emotional, and stories) resonates most with you and why?
- How can we apply these attributes to how we teach mathematics?

GOALS

- ☑ WHAT IS INTELLIGENCE?
- ☑ WHY DON'T STUDENTS REMEMBER?
- ☐ WHAT MATHEMATICS IS IMPORTANT?
- ☐ WHAT ABOUT WHAT WE USED TO DO?

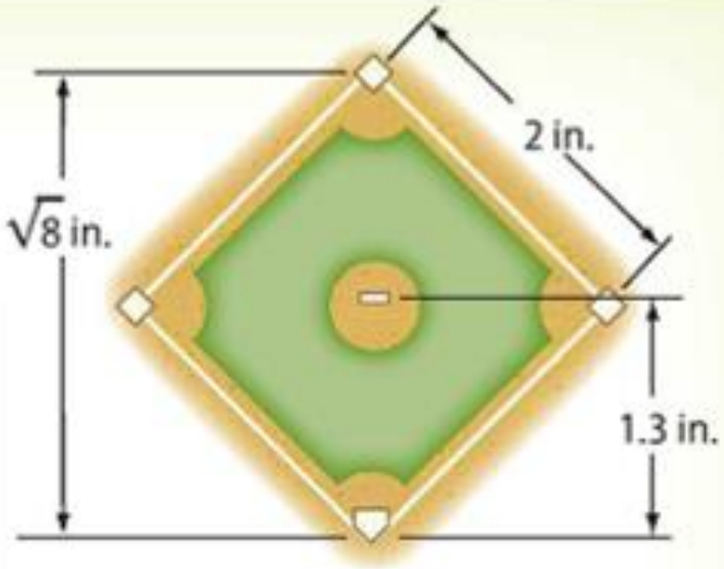
Real-World Link

Common Core State Standards

Content Standards
8.NS.1, 8.NS.2, 8.EE.2

Mathematical Practices
1, 3, 4, 6

Sports Major League baseball has rules for the dimensions of the baseball diamond. A model of the diamond is shown.



1. On the model, the distance from the pitching mound to home plate is 1.3 inches. Is 1.3 a rational number? Explain.

2. On the model, the distance from first base to second base is 2 inches. Is 2 a rational number? Explain.

3. The distance from home plate to second base is $\sqrt{8}$ inches. Using a calculator, find $\sqrt{8}$. Does it appear to terminate or repeat?

Real-World Link

Common Core State Standards

Content Standards
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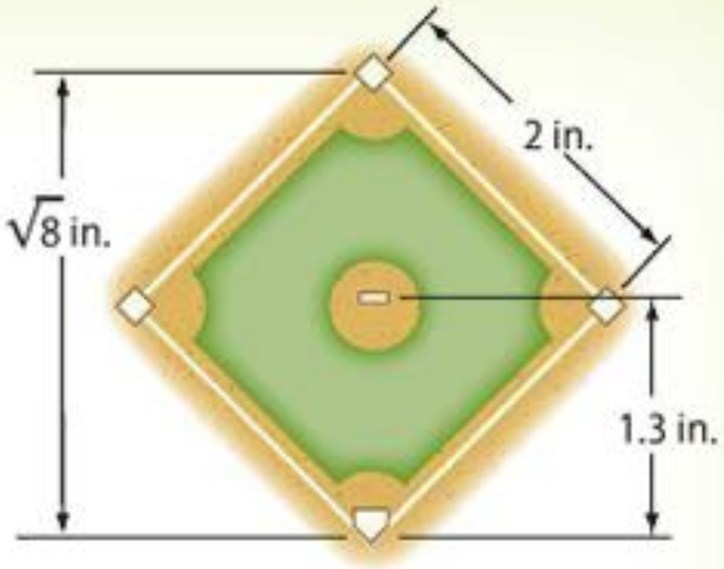

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3. The distance from home plate to second base is $\sqrt{8}$ inches. Using a calculator, find $\sqrt{8}$. Does it appear to terminate or repeat?

Doritos® & Cheetos® Mix

20 Singles

DORITOS® Nacho Cheese Flavored Tortilla Chips 1 OZ. EA. DORITOS® COOL RANCH® Flavored Tortilla Chips 1 OZ. EA. CHEETOS® Puffs Cheese Flavored Snacks ⅞ OZ. EA. CHEETOS® Crunchy Cheese Flavored Snacks 1 OZ. EA.

20 INDIVIDUAL BAGS: ⅞ OZ. EACH, 1 OZ. EACH, TOTAL NET WT. 19⅝ OZ. (1 LB. 3⅝ OZ.) 556.3 g

⚠ WARNING: PREVENT ENTANGLEMENT AND STRANGULATION. KEEP THIS BAG AWAY FROM YOUNG CHILDREN. IT IS NOT A TOY.

THINKING TIME

- Why did many of you expect there to be five of each?
- Why was it not five of each?
- How might they decide on this combination?

Classic Mix

20 Singles

LAY'S® Classic Potato Chips, DORITOS® Nacho Cheese Flavored Tortilla Chips, DORITOS® COOL RANCH® Flavored Tortilla Chips, CHEETOS® Crunchy Cheese Flavored Snacks, SUNCHIPS® Original Multigrain Snacks, FRITOS® Original Corn Chips (All 1 OZ. Each)

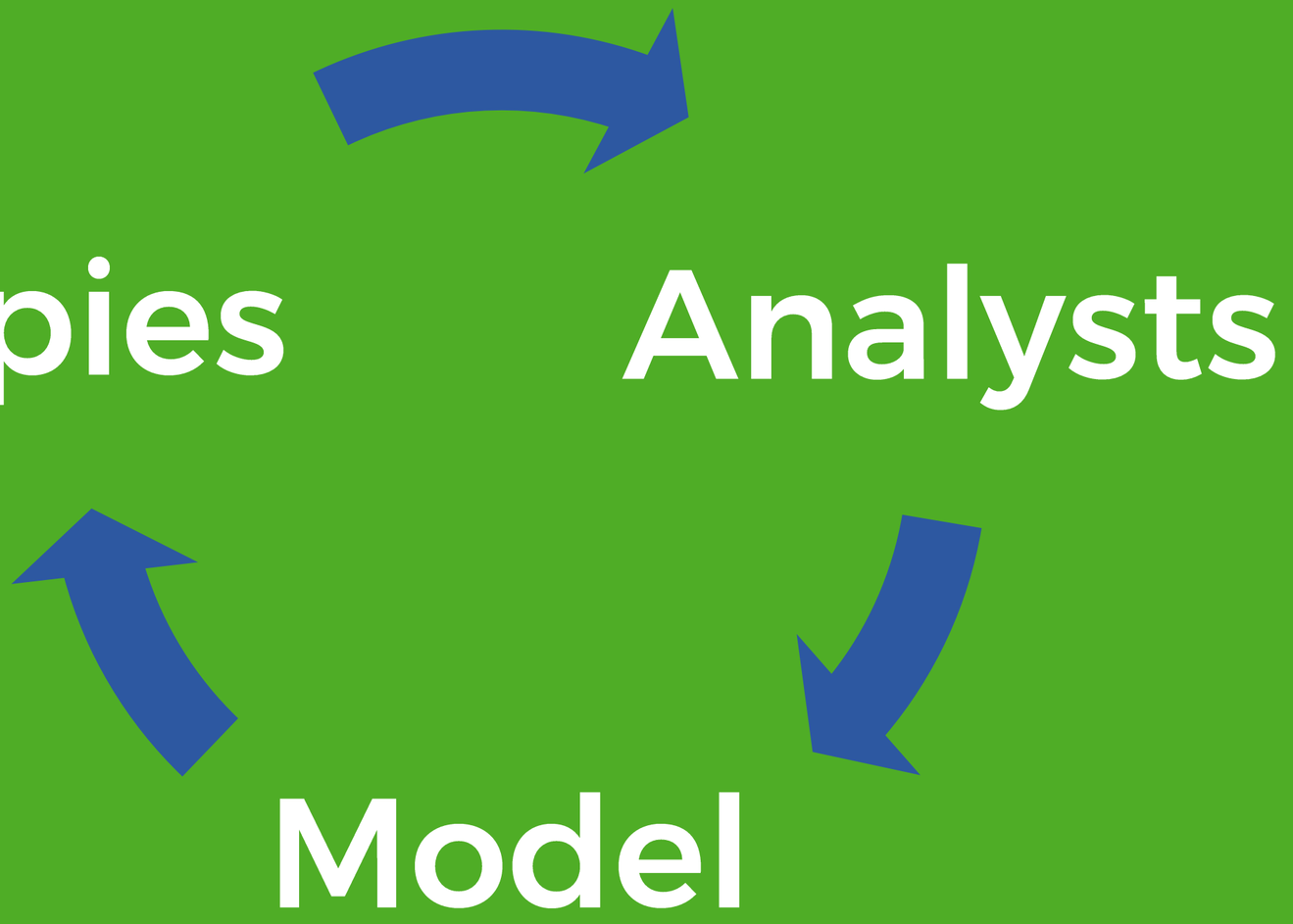
20 INDIVIDUAL BAGS: 1 OZ. EACH, TOTAL NET WT. 20 OZ. (1 LB. 4 OZ.) 567 g

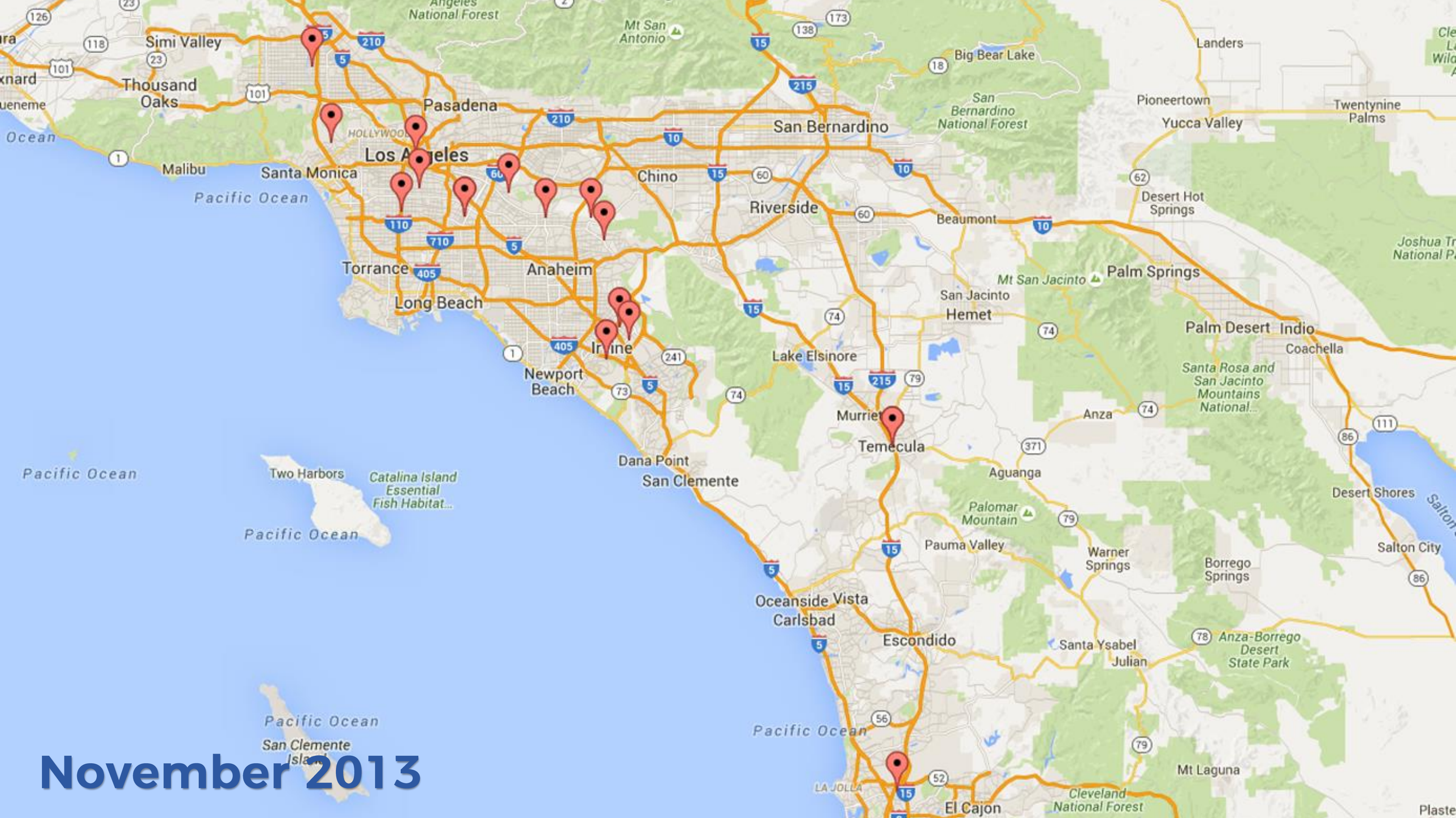
⚠ WARNING: PREVENT ENTANGLEMENT AND STRANGULATION. KEEP THIS BAG AWAY FROM YOUNG CHILDREN. IT IS NOT A TOY.

MATH MODELING

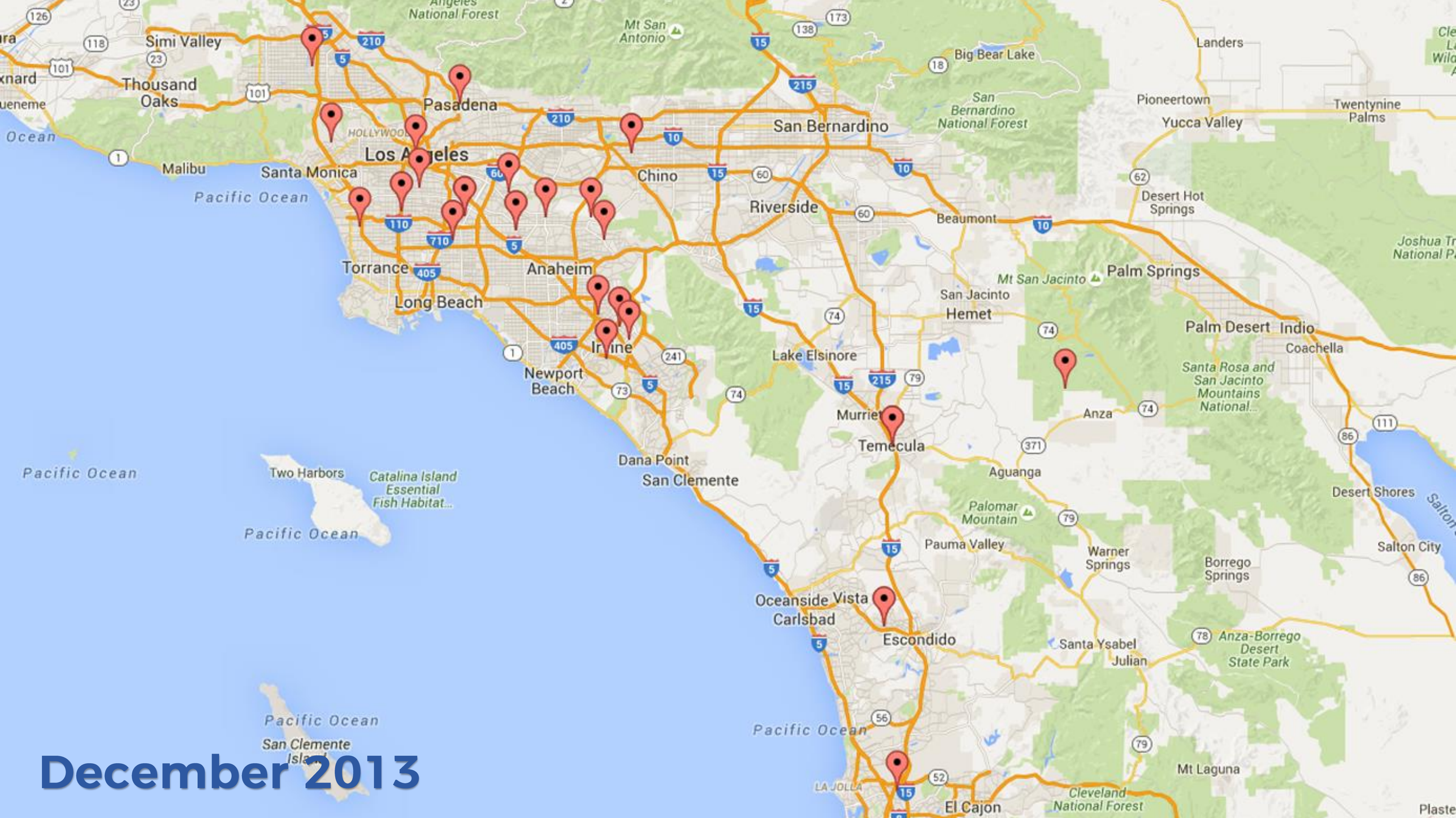
- ❑ HOW DO WE MAKE SENSE OF MATH MODELING?
- ❑ IS IT JUST ANSWERING QUESTIONS?
- ❑ HOW DO YOU PROFIT FROM MATH MODELING?
- ❑ HOW DO WE HELP OUR STUDENTS IMPROVE?


CENTRAL INTELLIGENCE AGENCY
UNITED STATES OF AMERICA

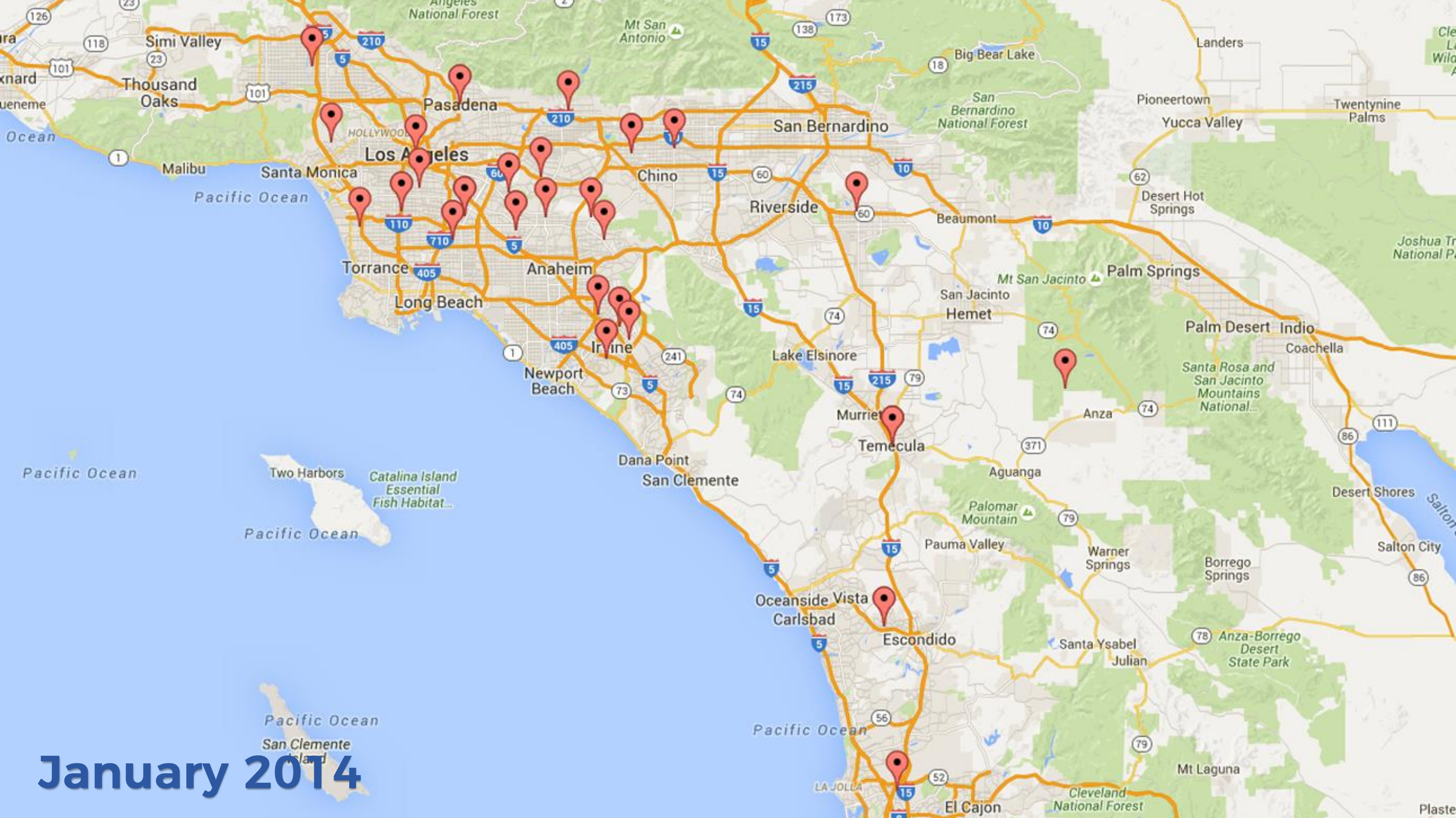

Spies
Analysts
Model



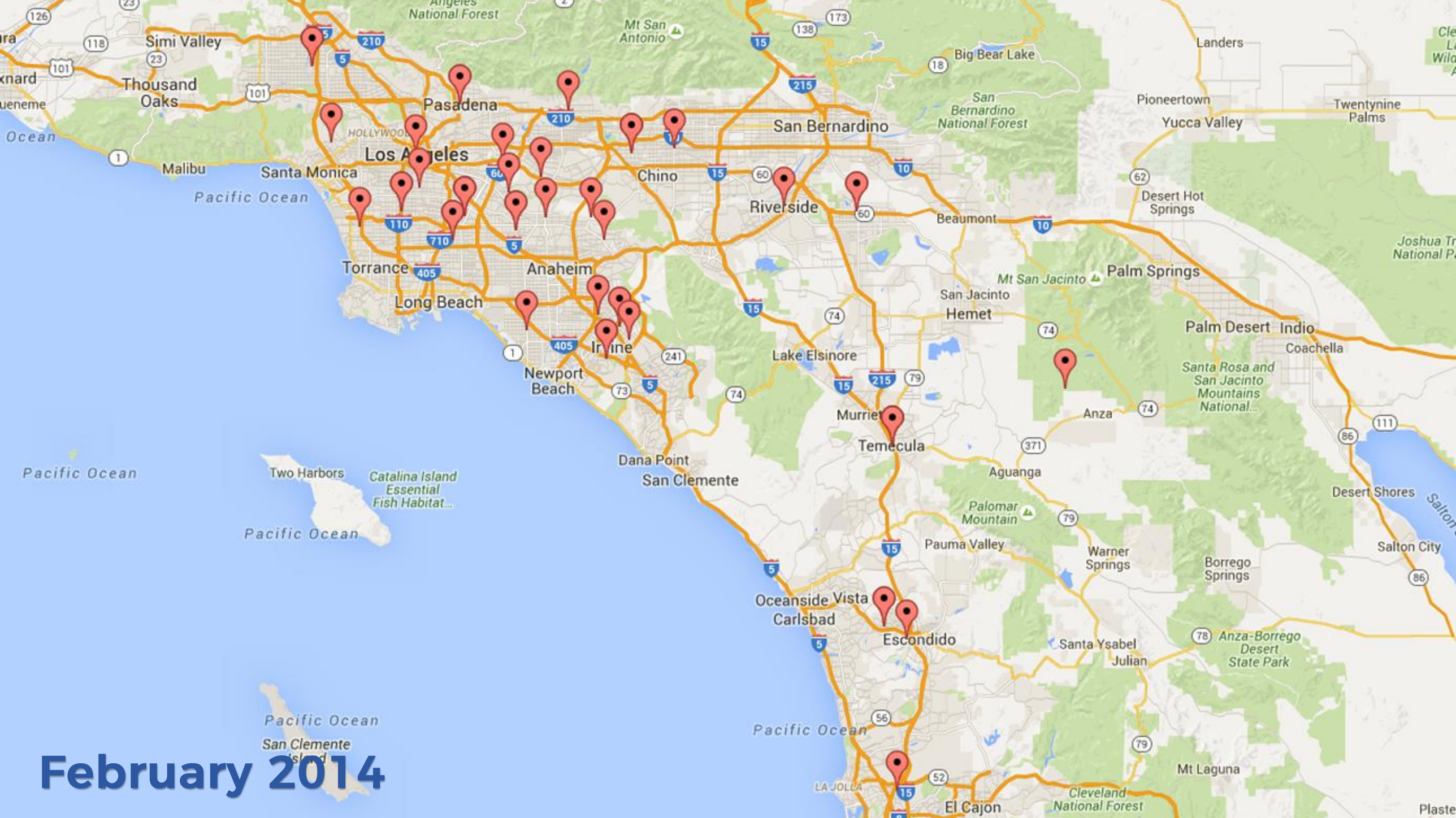
November 2013



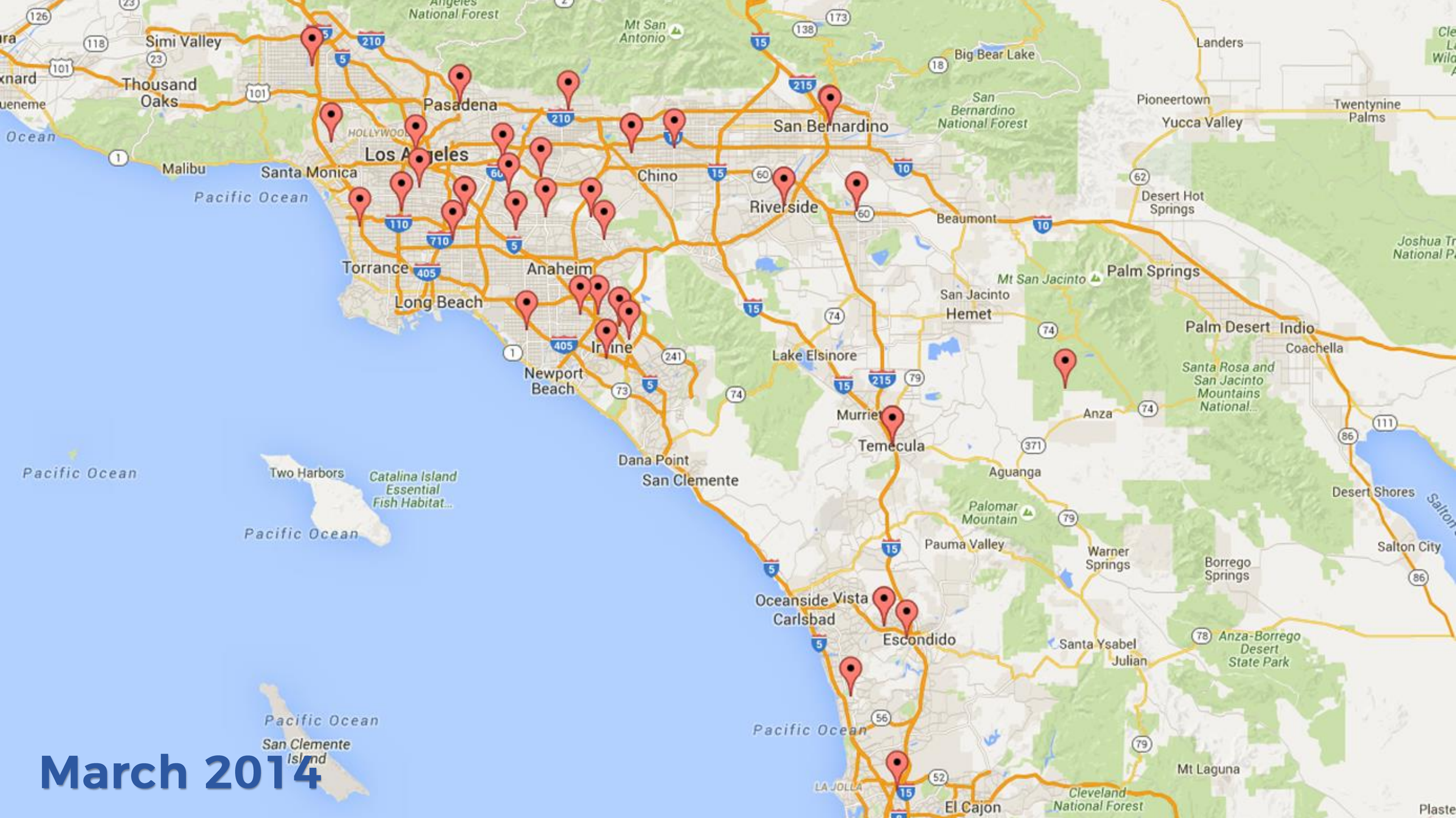
December 2013



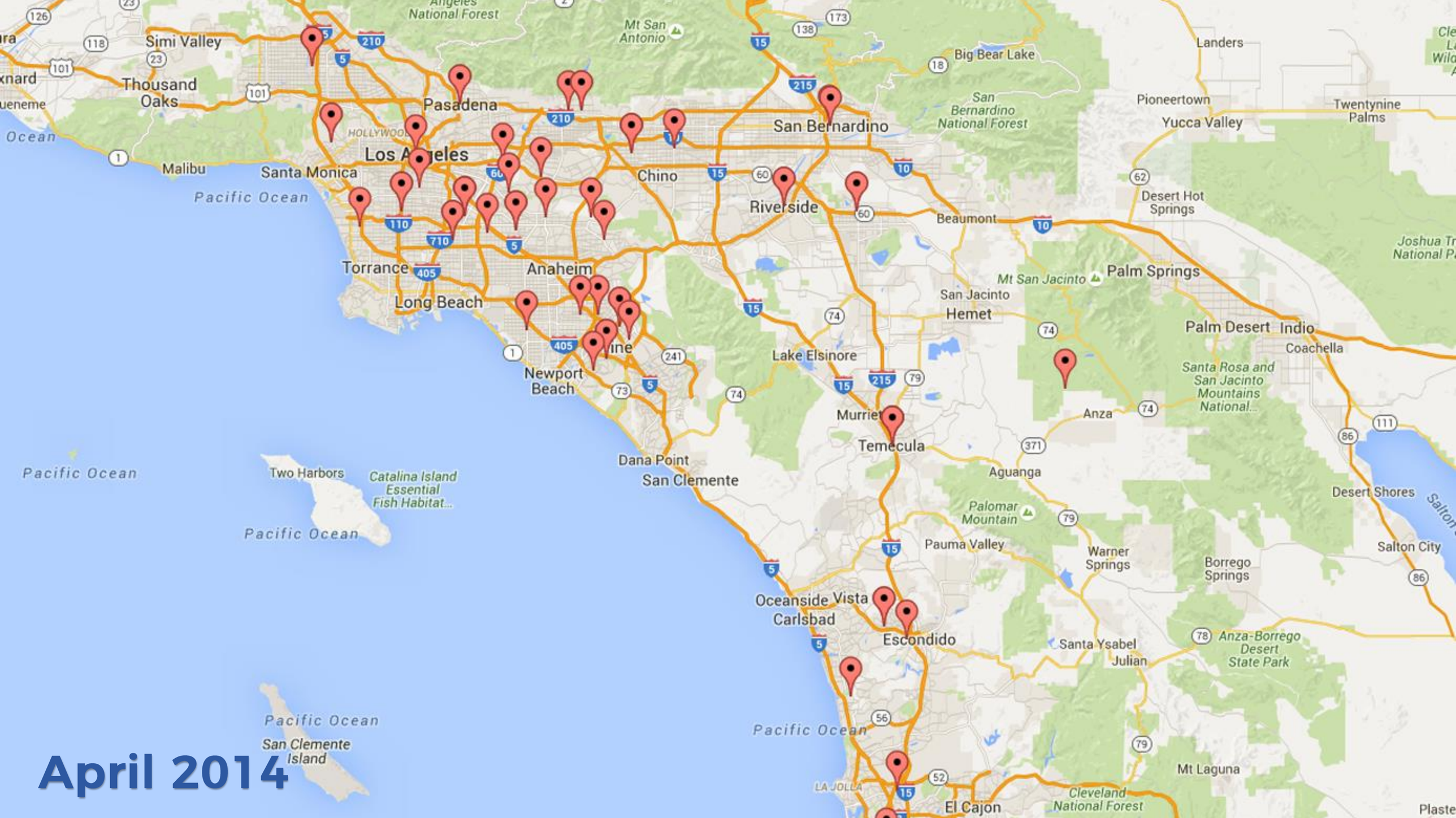
January 2014



February 2014


Simi Valley
Thousand Oaks
Pasadena
Los Angeles
Malibu
Santa Monica
Pacific Ocean
Torrance
Long Beach
Anaheim
Irvine
Newport Beach
Chino
San Bernardino
Riverside
Beaumont
Mt San Antonio
Big Bear Lake
Landers
Pioneertown
Yucca Valley
Twentynine Palms
Desert Hot Springs
Palm Springs
San Jacinto
Hemet
Lake Elsinore
Murrieta
Temecula
Palm Desert
Indio
Coachella
Anza
Aguanga
Dana Point
San Clemente
Two Harbors
Catalina Island Essential Fish Habitat...
Oceanside
Vista
Carlsbad
Escondido
Pauma Valley
Warner Springs
Borrego Springs
Salton City
Desert Shores
Julian
Santa Ysabel
Mt Laguna
El Cajon
Cleveland National Forest
Anza-Borrego Desert State Park
San Clemente Island

March 2014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Pasadena
Los Angeles
Malibu
Santa Monica
Pacific Ocean
Chino
San Bernardino
Riverside
Big Bear Lake
Landers
Pioneertown
Yucca Valley
Twentynine Palms
Desert Hot Springs
Beaumont
Palm Springs
Mt San Jacinto
San Jacinto
Hemet
Palm Desert
Indio
Coachella
Lake Elsinore
Murrieta
Temecula
Anza
Aguanga
Torrance
Anaheim
Long Beach
Newport Beach
Dana Point
San Clemente
Two Harbors
Catalina Island Essential Fish Habitat...
Oceanside
Vista
Carlsbad
Escondido
Pauma Valley
Warner Springs
Borrego Springs
Salton City
Desert Shores
Santa Ysabel
Julian
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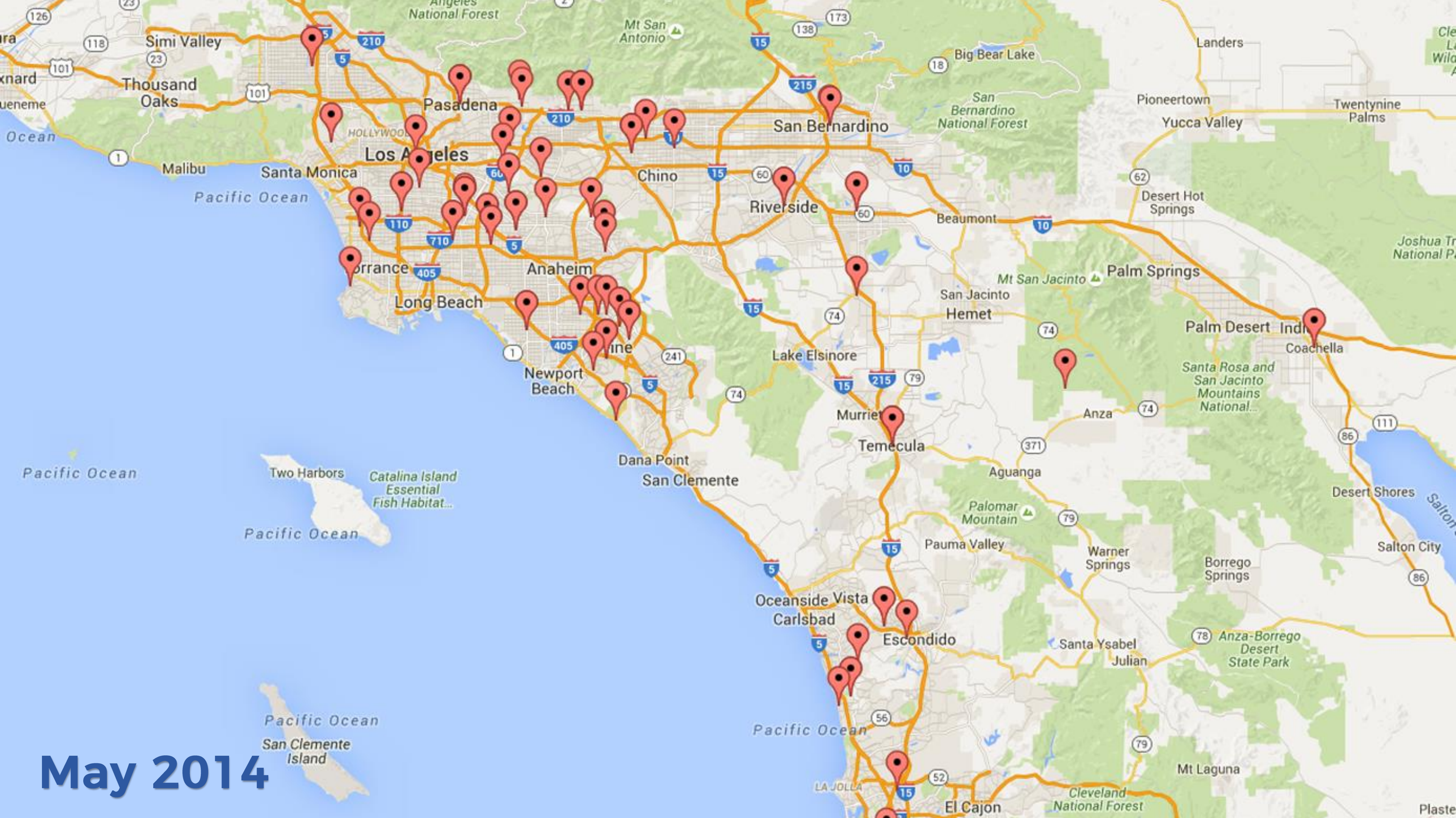
El Cajon
Cleveland National Forest
San Clemente Island
Santa Rosa and San Jacinto Mountains National...

April 2014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San Clemente Island
Mt San Antonio
Mt San Jacinto
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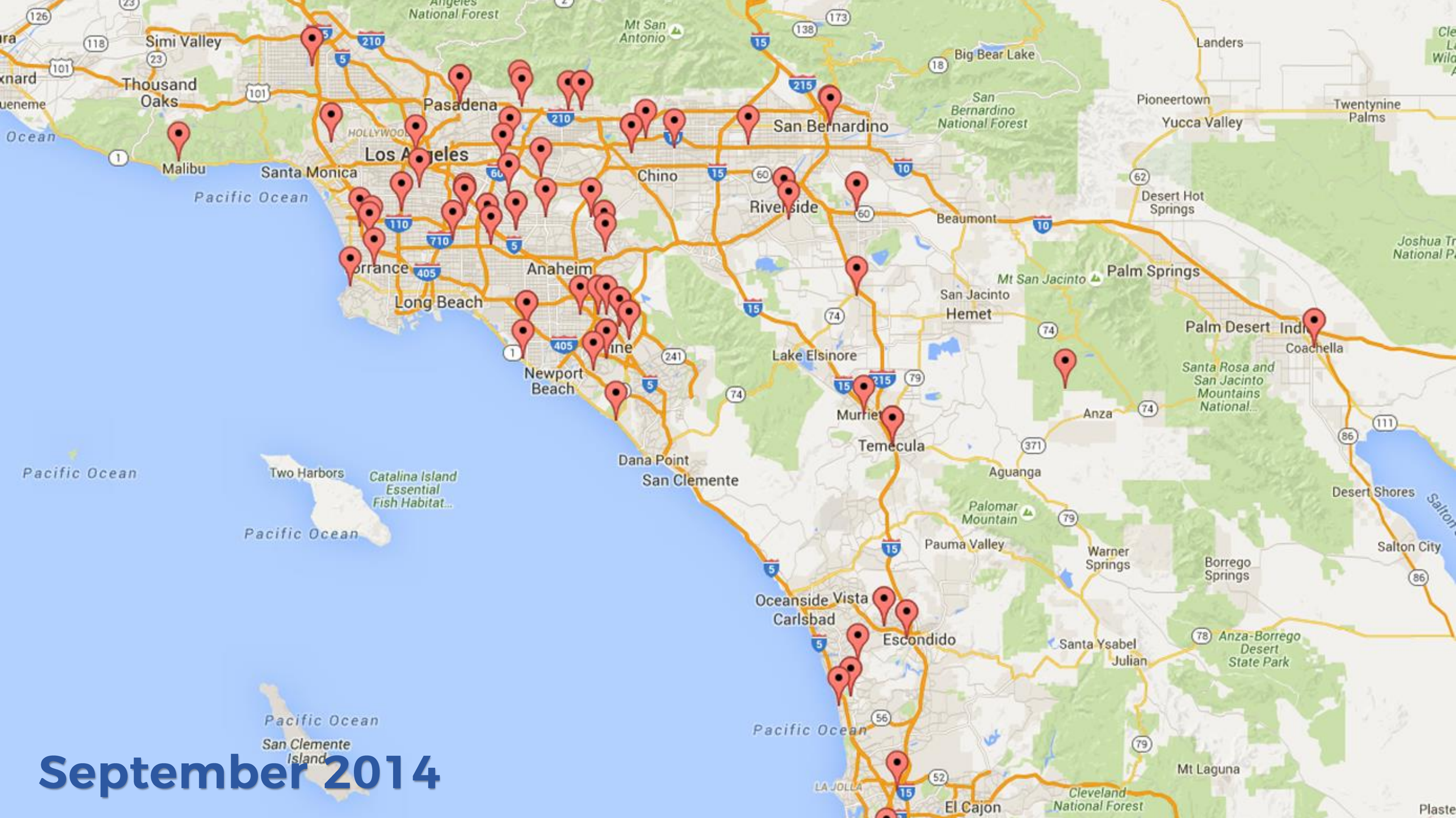
Santa Rosa and San Jacinto Mountains National...
San Bernardino National Forest
Cleveland National Forest
LA JOLLA
HOLLYWOOD



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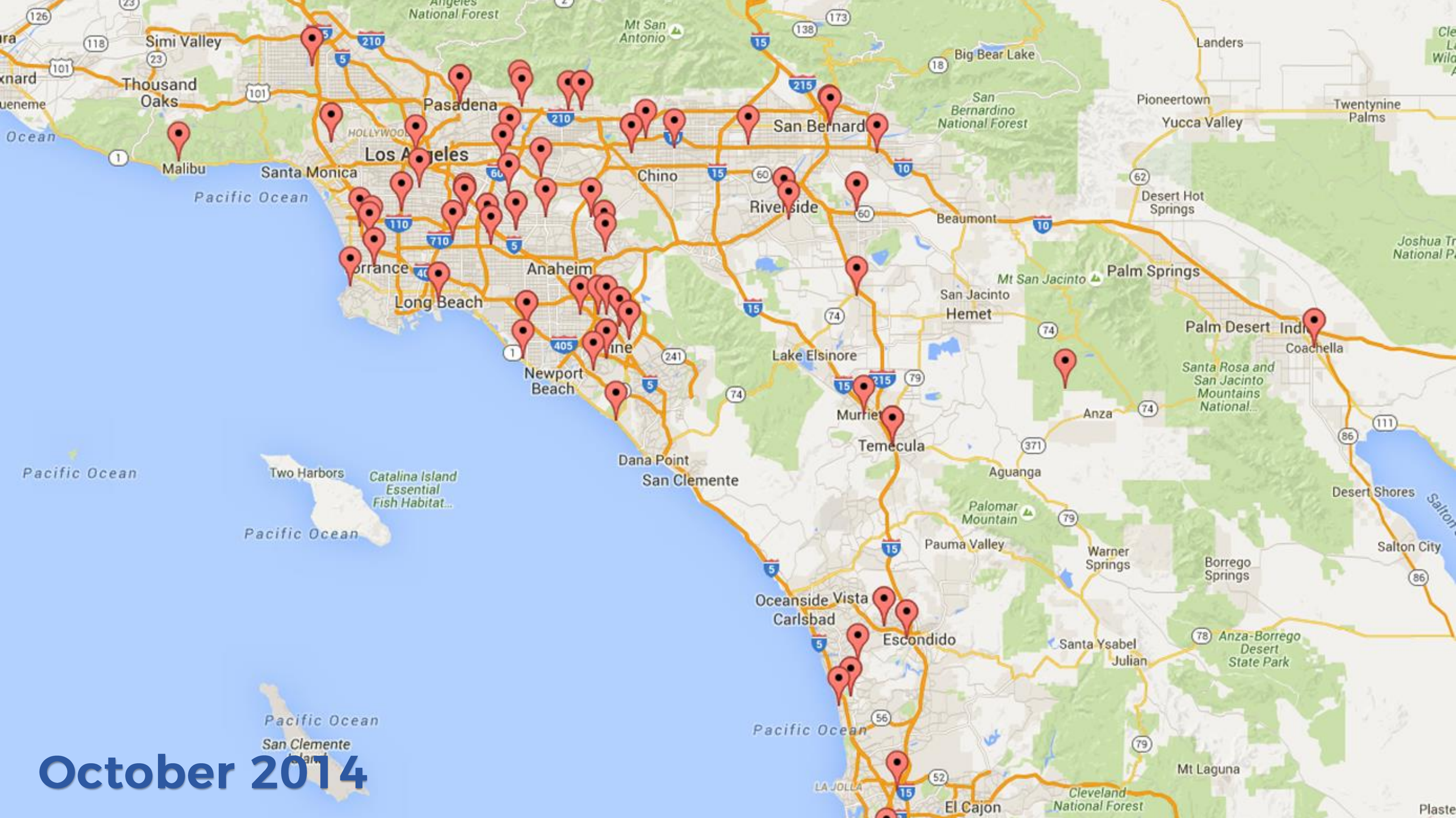

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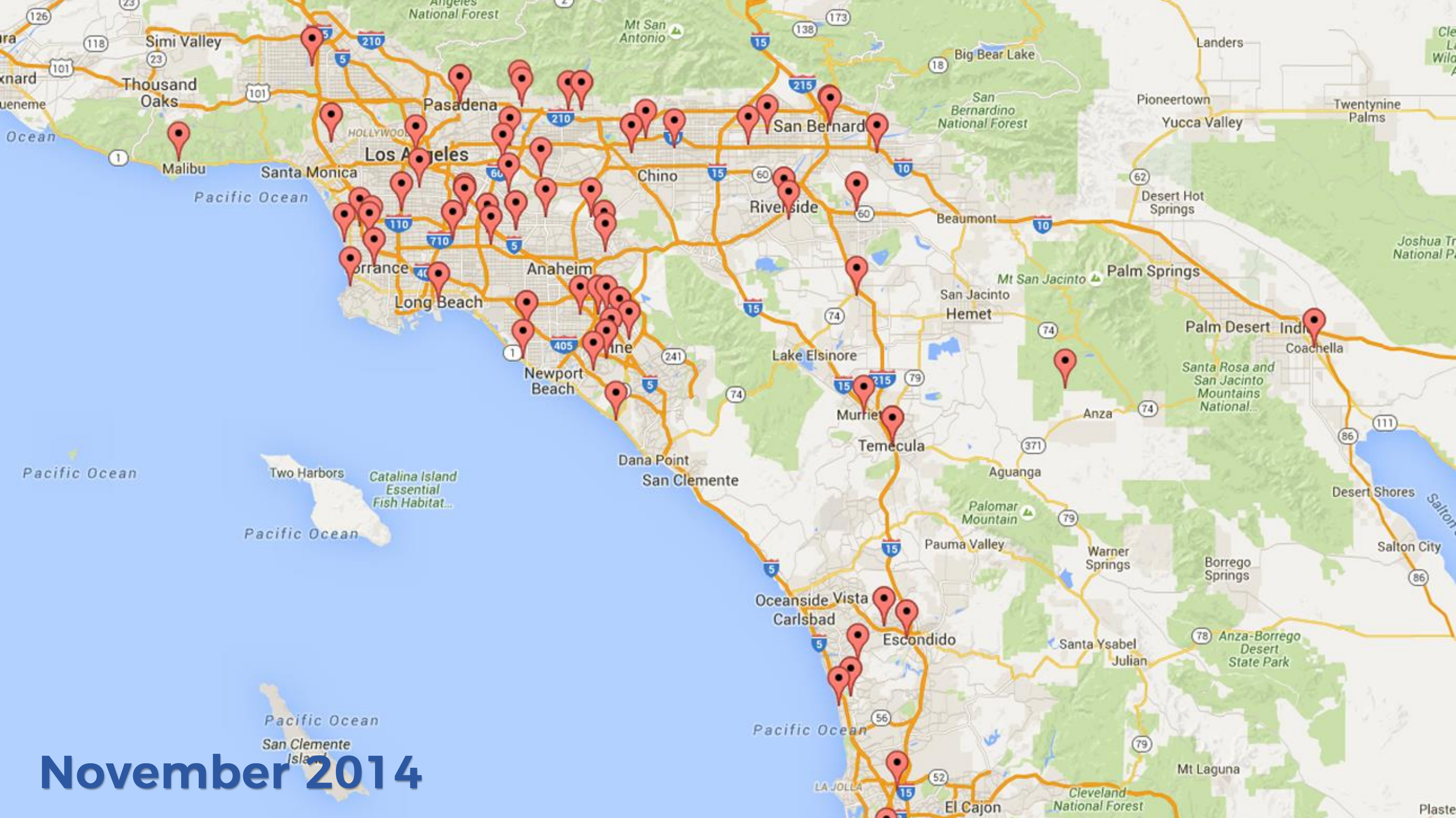

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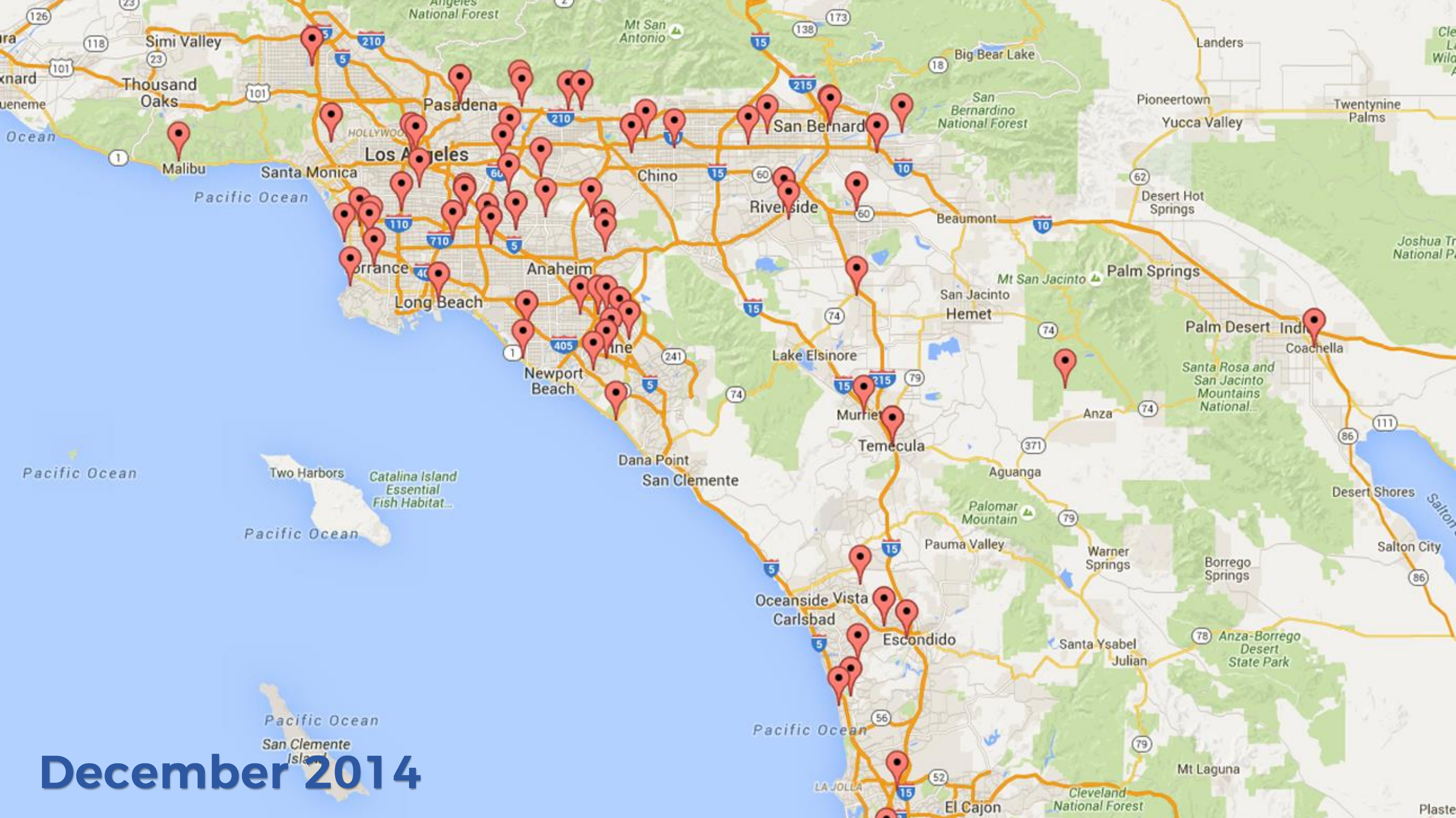

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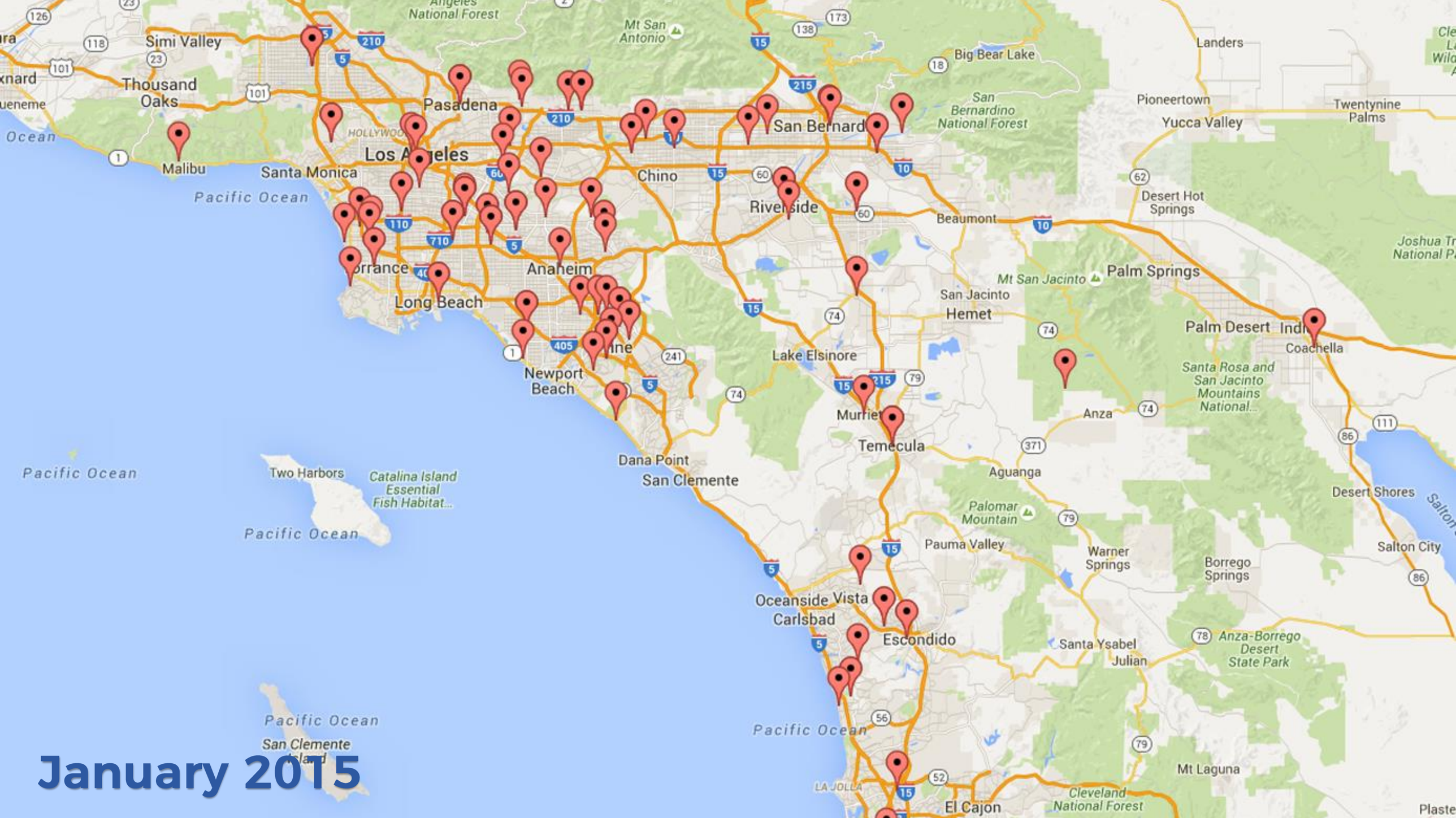

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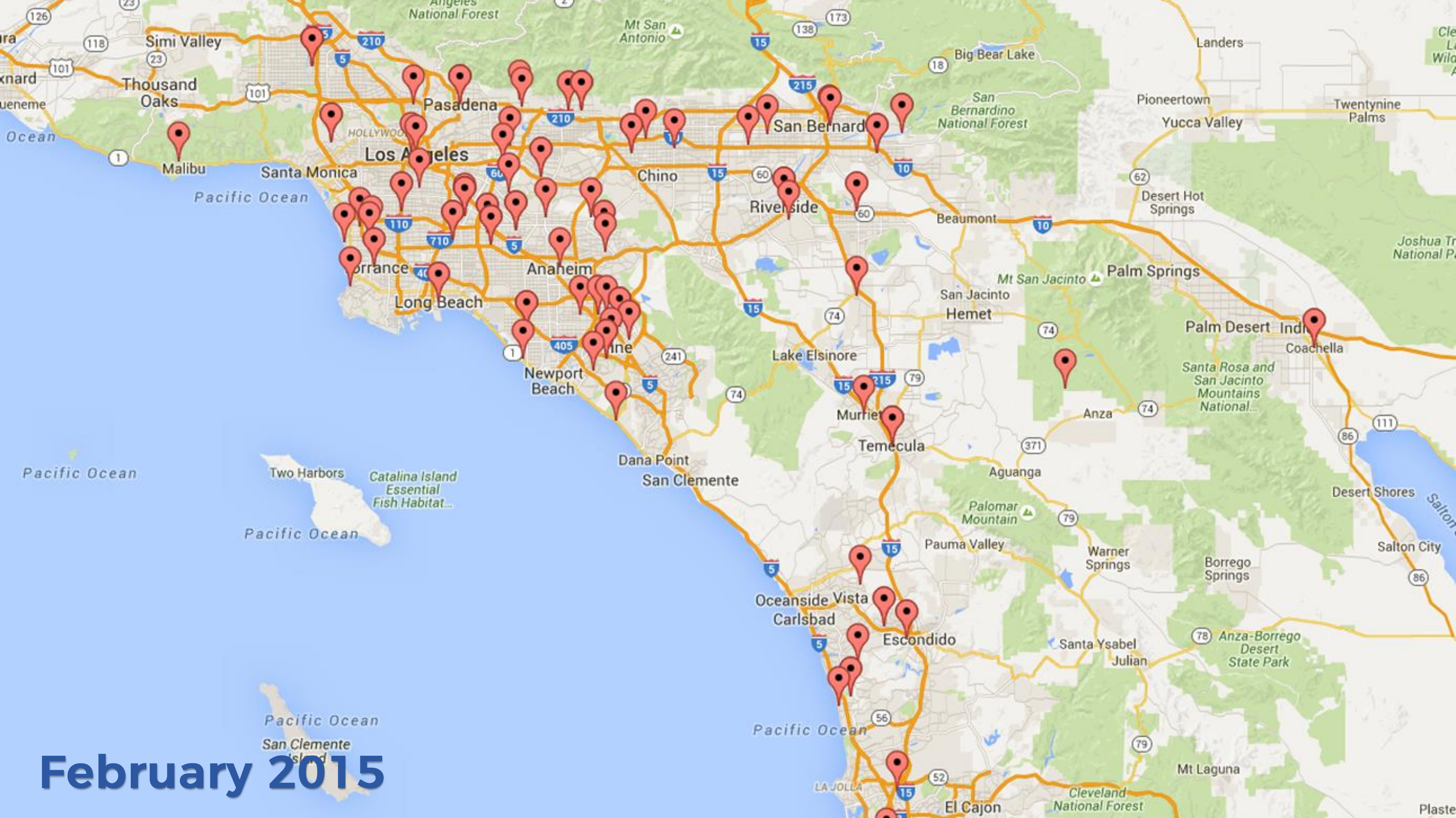

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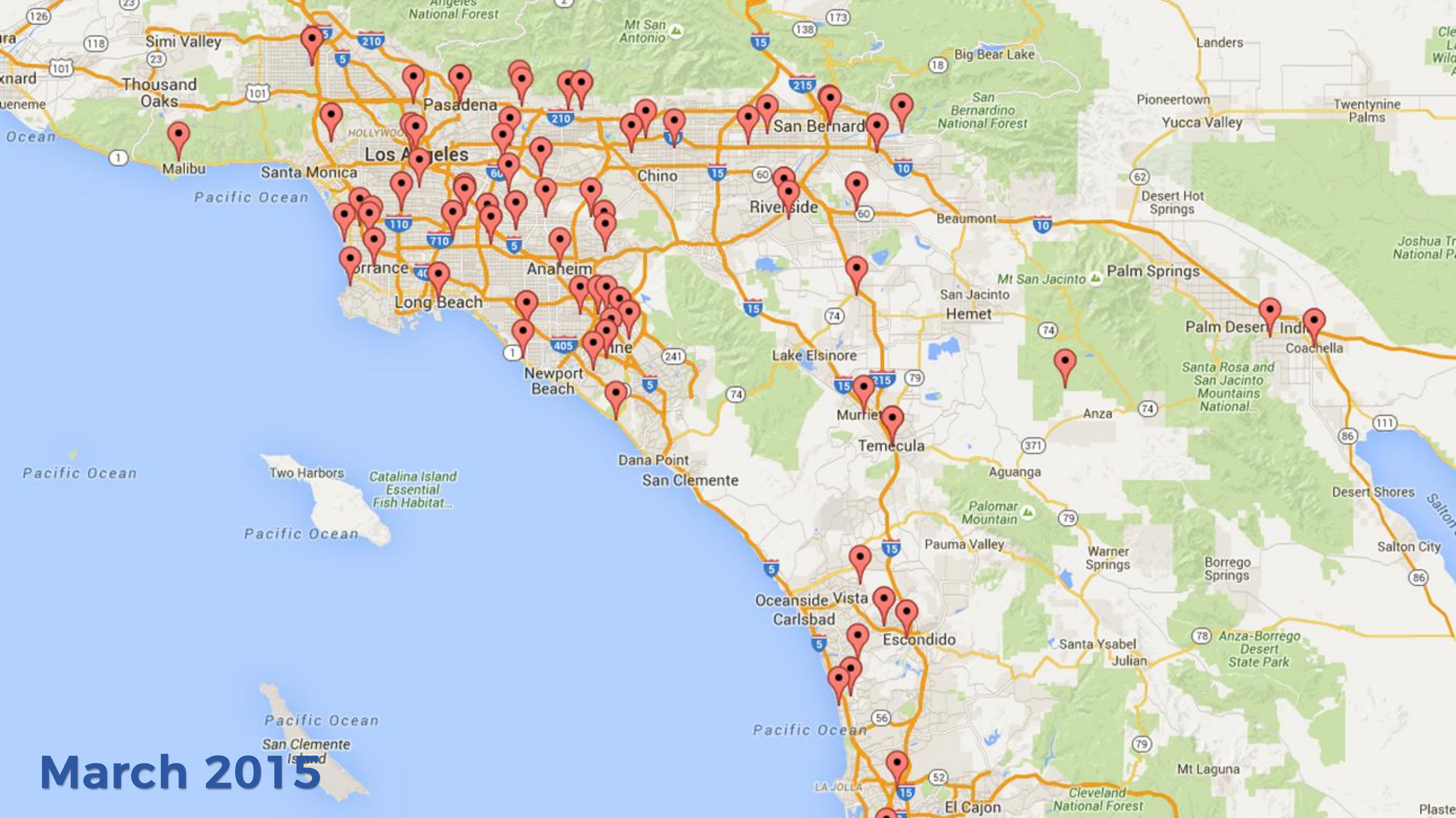
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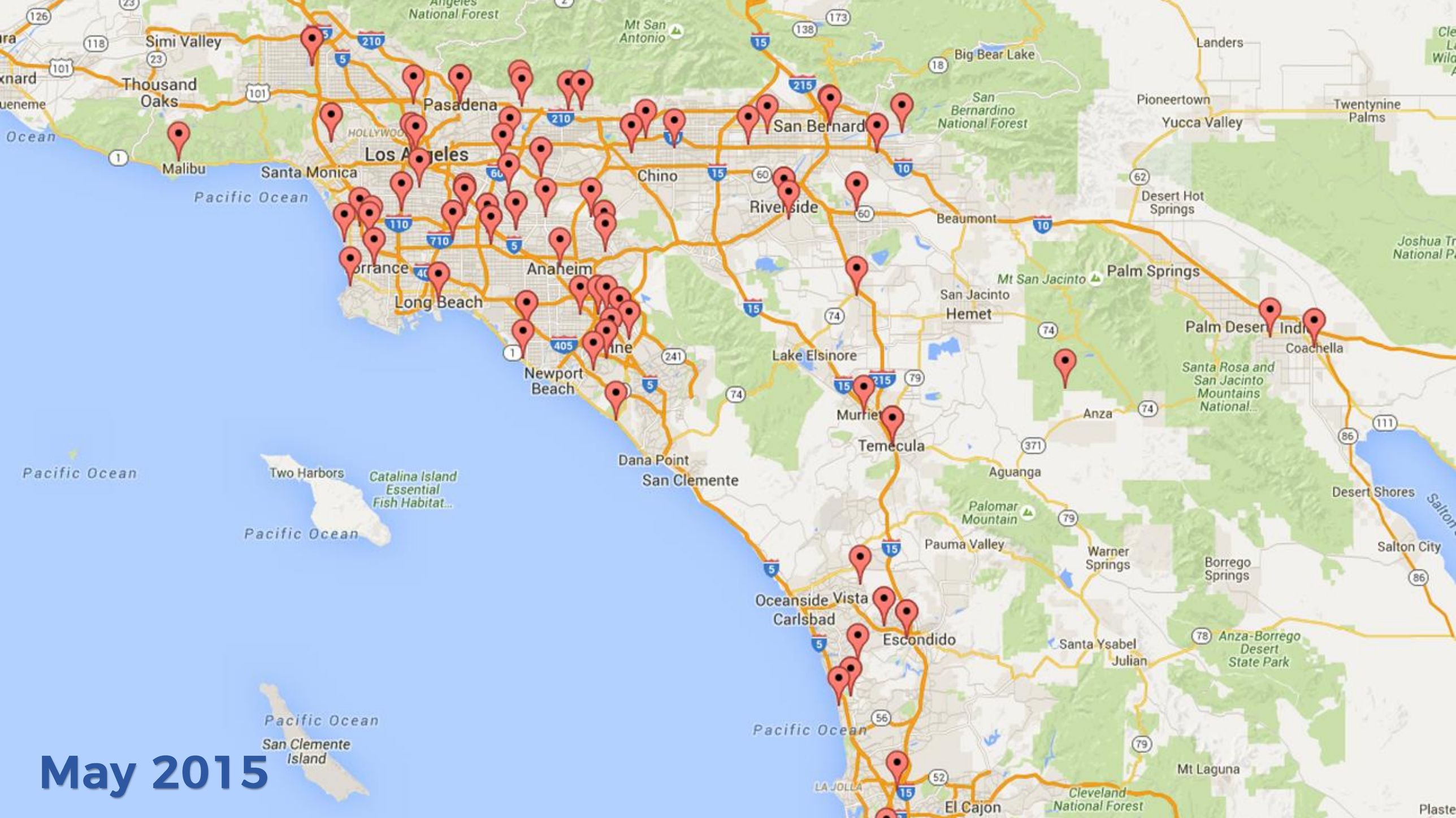
March 2015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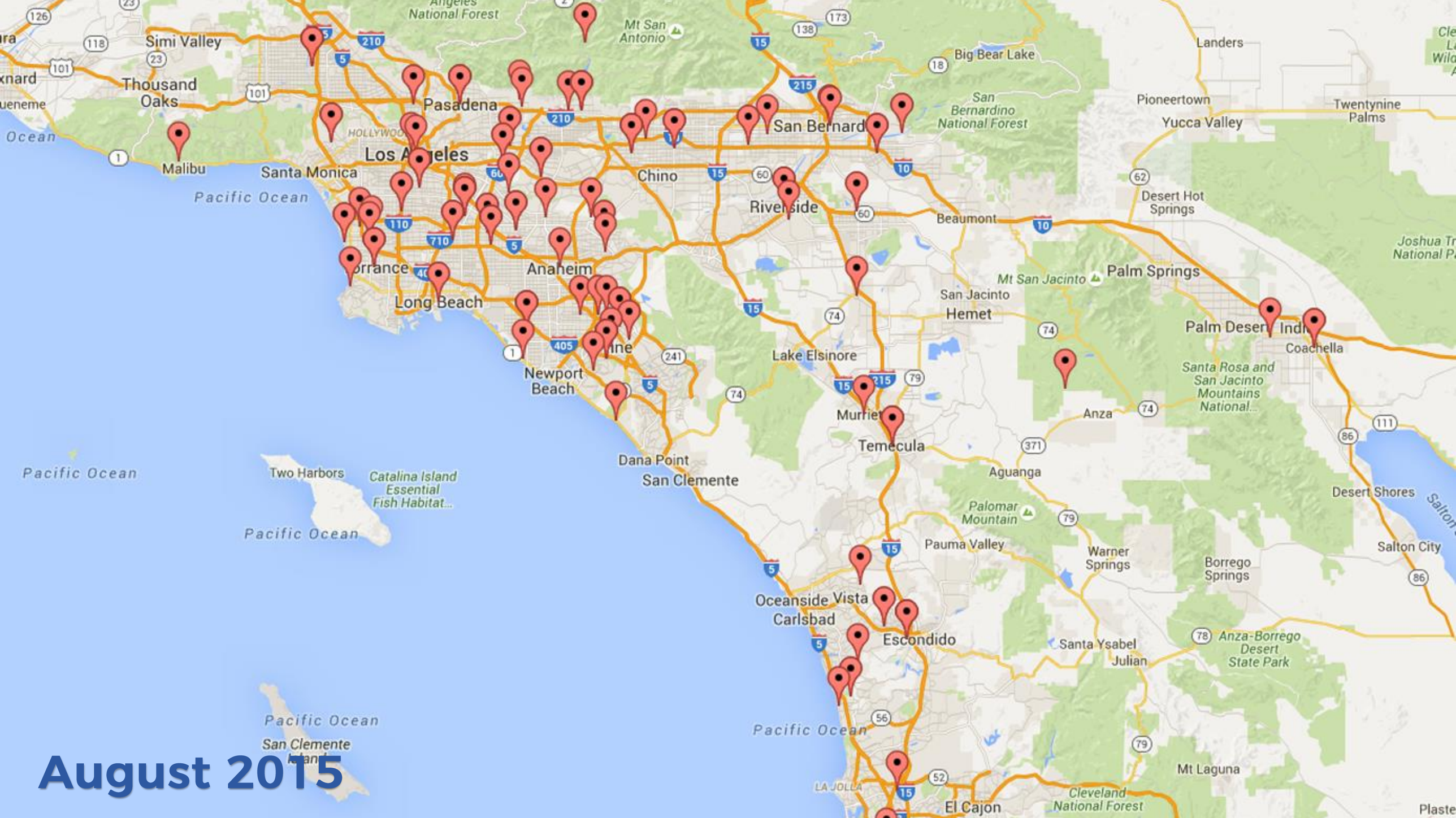
El Cajon
LA JOLLA
Mt San Antonio
San Bernardino National Forest
Angeles National Forest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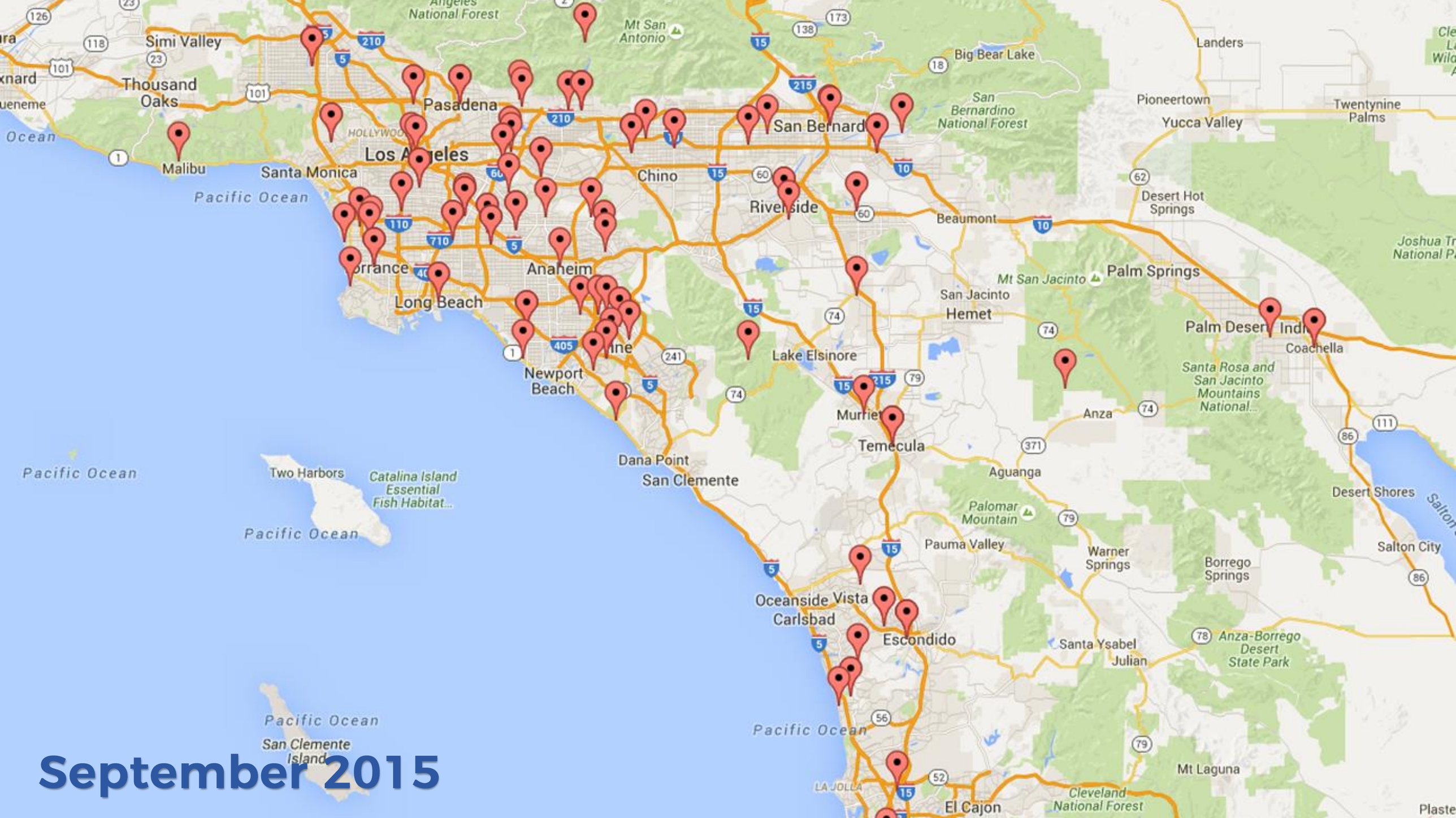
Mt San Jacinto
Mt San Antonio
Angeles National Forest
San Bernardino National Forest
Two Harbors
Catalina Island Essential Fish Habitat...
Pacific Ocean
LA JOLLA

August 2015



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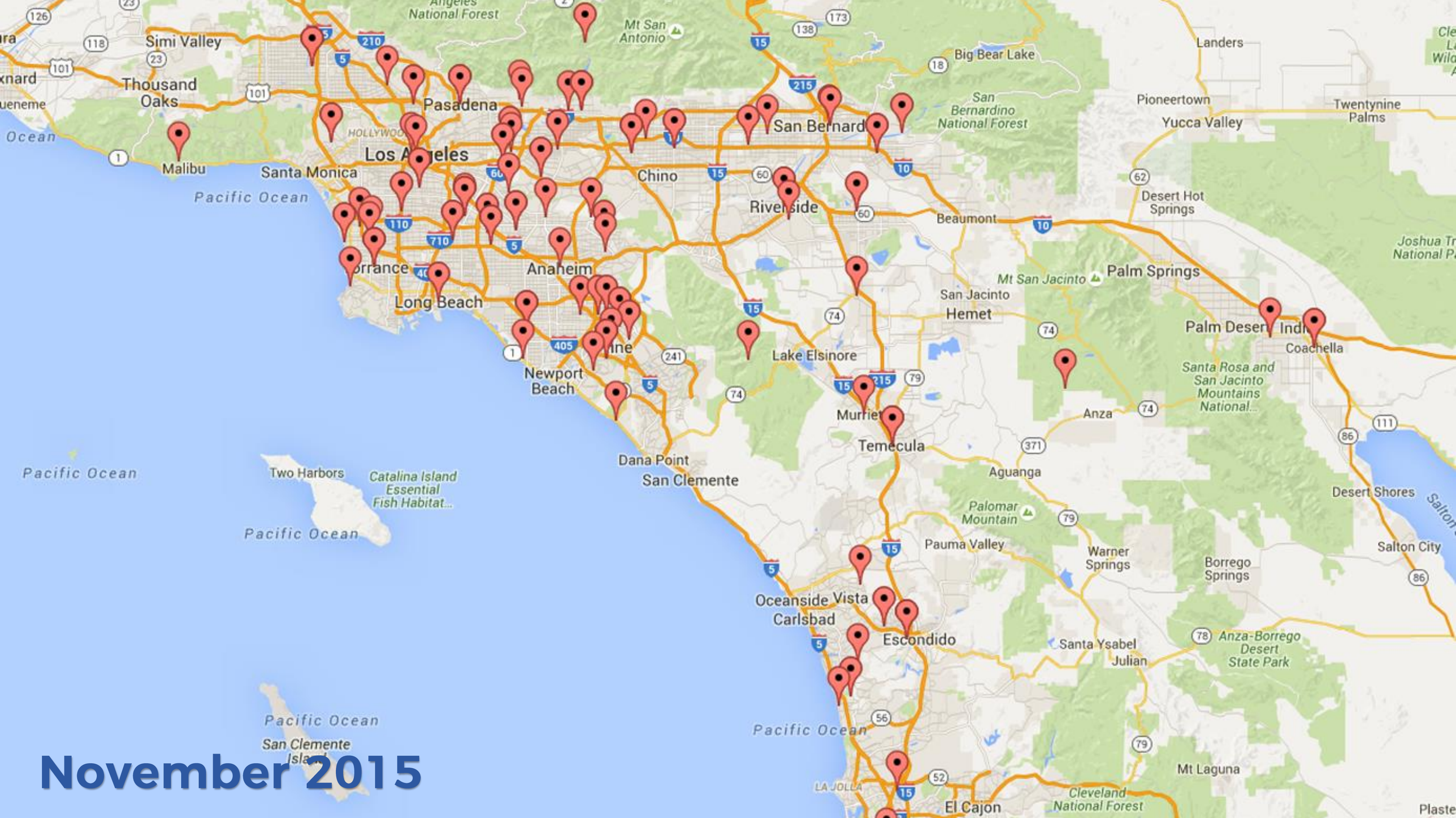
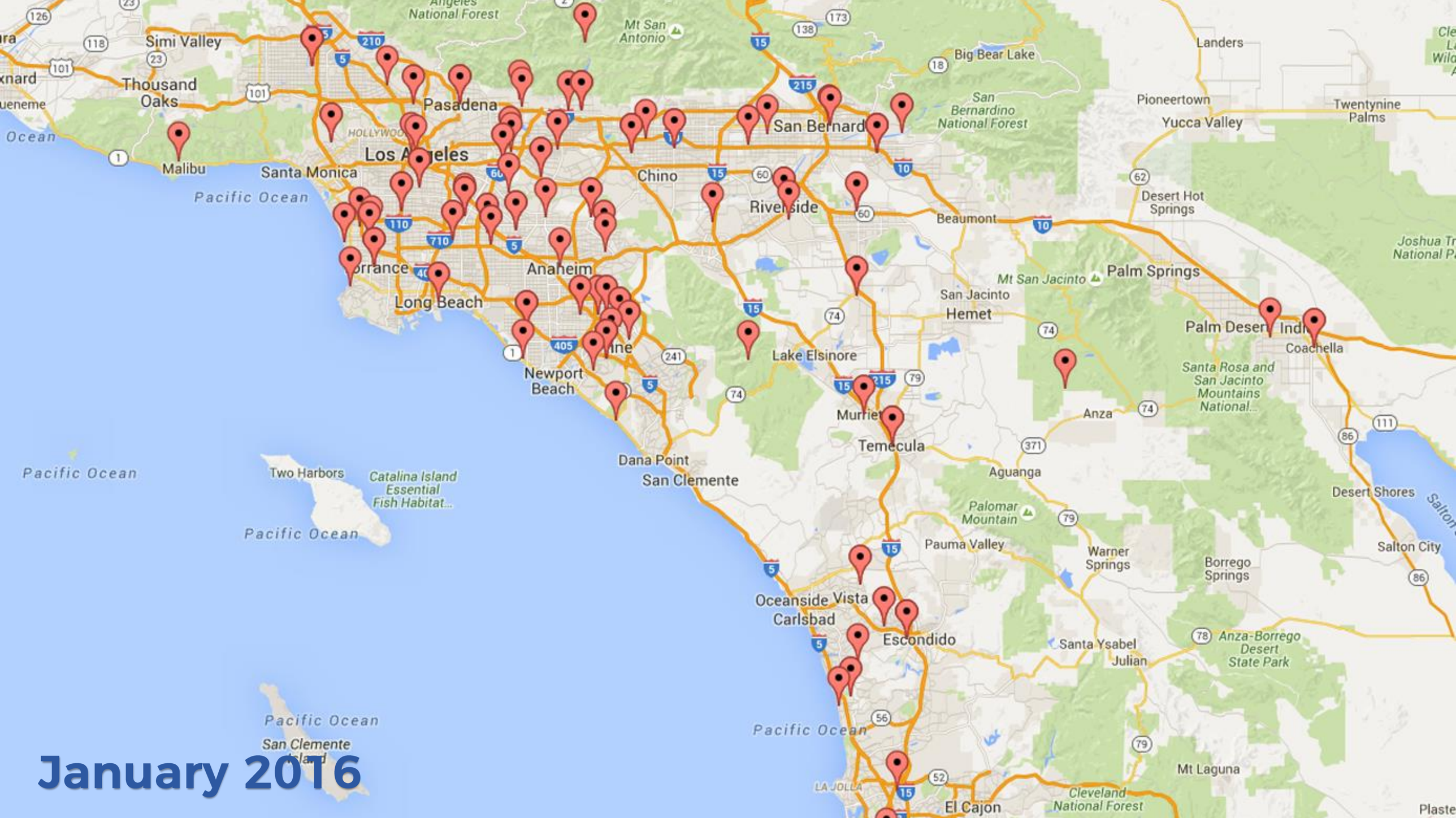


November 2015



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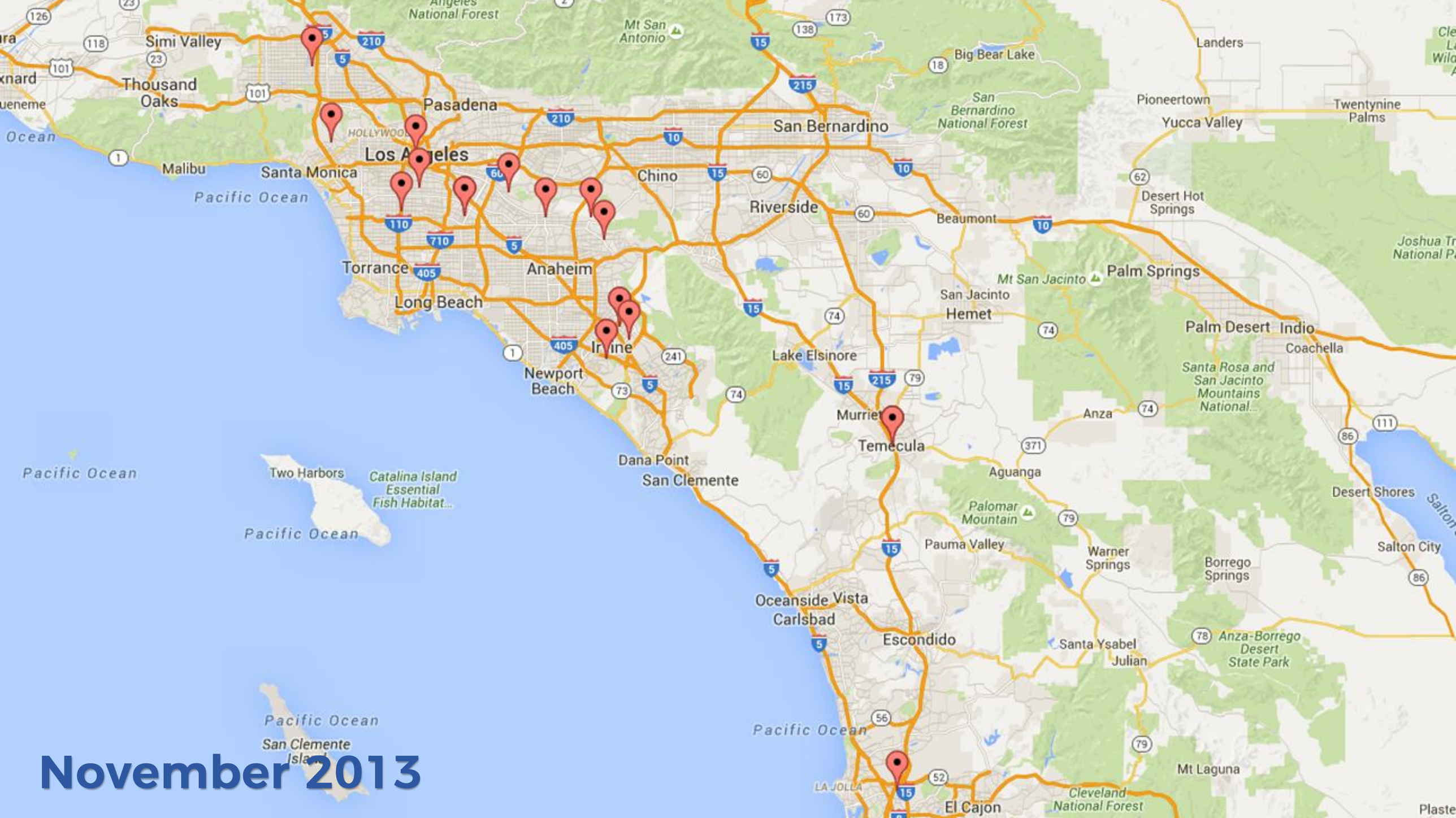
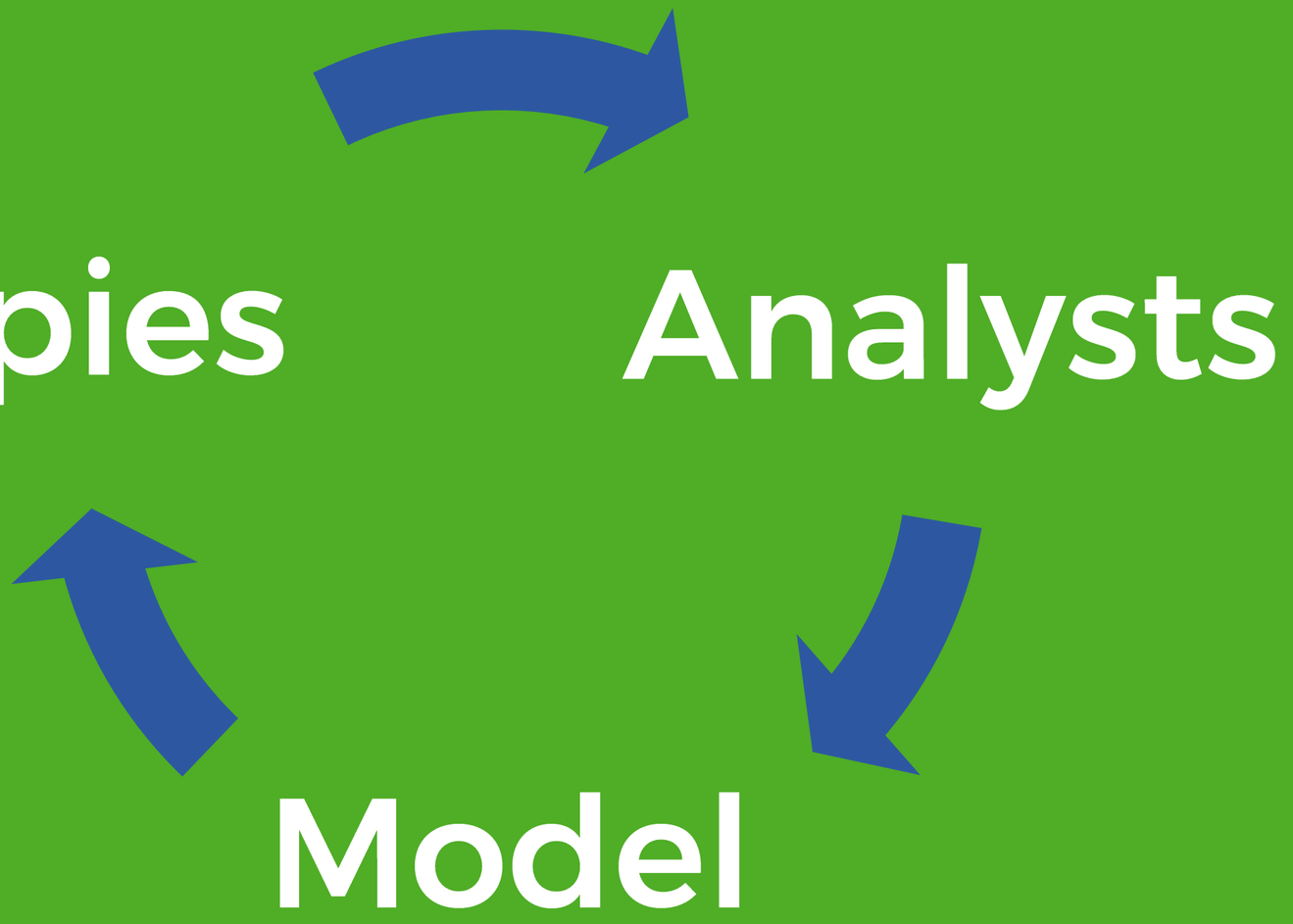


November 2013


Spies
Analysts
Model

All models are wrong, but some are useful.

GEORGE E. P. BOX

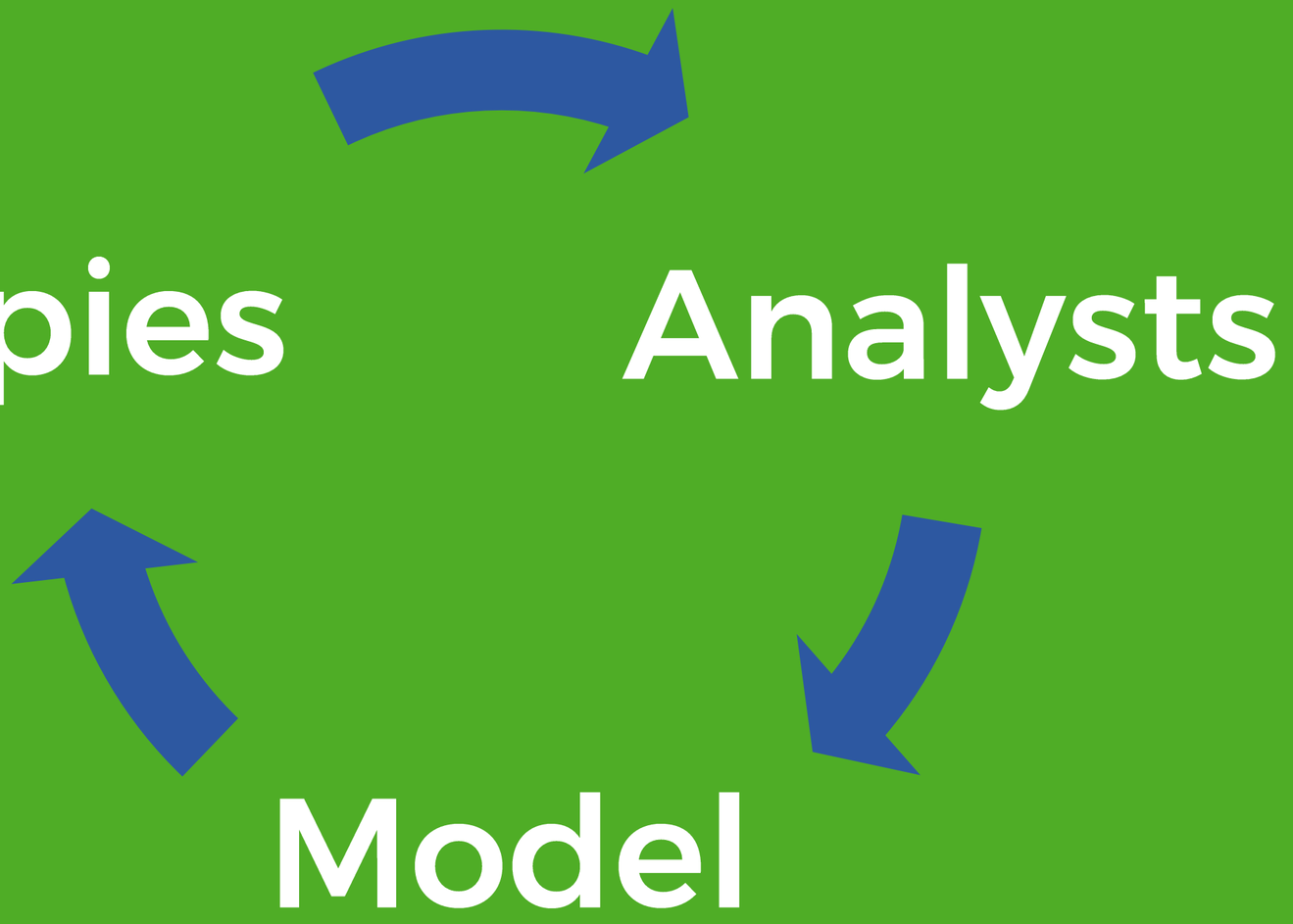
Classic Mix

20 Singles

LAY'S® Classic Potato Chips, DORITOS® Nacho Cheese Flavored Tortilla Chips, DORITOS® COOL RANCH® Flavored Tortilla Chips, CHEETOS® Crunchy Cheese Flavored Snacks, SUNCHIPS® Original Multigrain Snacks, FRITOS® Original Corn Chips (All 1 OZ. Each)

20 INDIVIDUAL BAGS: 1 OZ. EACH, TOTAL NET WT. 20 OZ. (1 LB. 4 OZ.) 567 g

⚠ WARNING: PREVENT ENTANGLEMENT AND STRANGULATION. KEEP THIS BAG AWAY FROM YOUNG CHILDREN. IT IS NOT A TOY.


Spies
Analysts
Model

THINKING TIME

RobertKaplinsky.com

Robert Kaplinsky
@robertkaplinsky

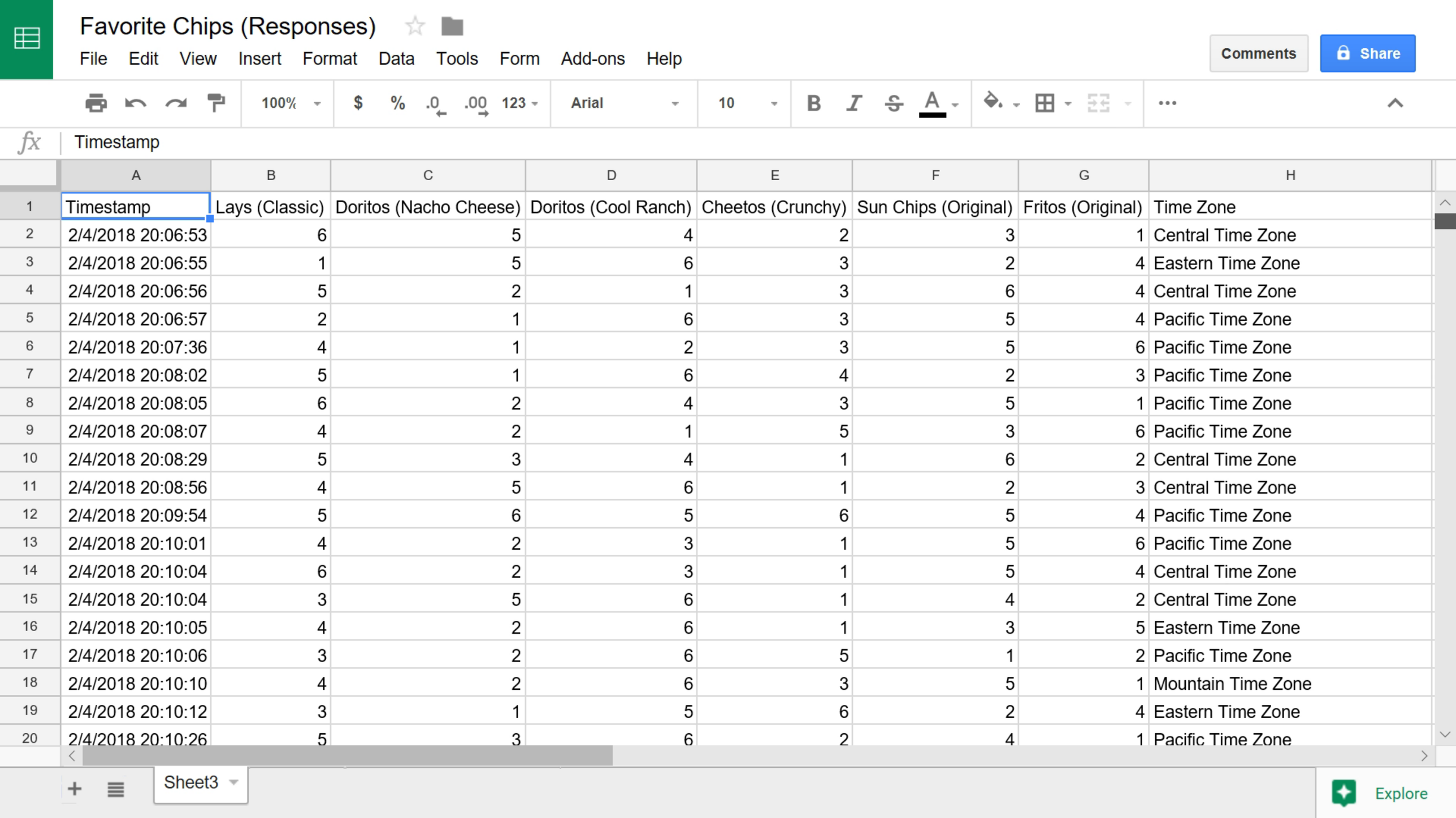
Hey #MTBoS, can you do me a favor and complete this 3 question anonymous survey about your favorite chips? I need data for a presentation. Please RT.
goo.gl/forms/etPtujII… #iteachmath

Favorite Chips
Please complete this anonymous survey. I'll be using this data in a presentation.
docs.google.com

8:05 PM - 4 Feb 2018

63 Retweets **45** Likes

18 63 45



	A	B	C	D	E	F	G	H
1	Timestamp	Lays (Classic)	Doritos (Nacho Cheese)	Doritos (Cool Ranch)	Cheetos (Crunchy)	Sun Chips (Original)	Fritos (Original)	Time Zone
2	2/4/2018 20:06:53	6	5	4	2	3	1	Central Time Zone
3	2/4/2018 20:06:55	1	5	6	3	2	4	Eastern Time Zone
4	2/4/2018 20:06:56	5	2	1	3	6	4	Central Time Zone
5	2/4/2018 20:06:57	2	1	6	3	5	4	Pacific Time Zone
6	2/4/2018 20:07:36	4	1	2	3	5	6	Pacific Time Zone
7	2/4/2018 20:08:02	5	1	6	4	2	3	Pacific Time Zone
8	2/4/2018 20:08:05	6	2	4	3	5	1	Pacific Time Zone
9	2/4/2018 20:08:07	4	2	1	5	3	6	Pacific Time Zone
10	2/4/2018 20:08:29	5	3	4	1	6	2	Central Time Zone
11	2/4/2018 20:08:56	4	5	6	1	2	3	Central Time Zone
12	2/4/2018 20:09:54	5	6	5	6	5	4	Pacific Time Zone
13	2/4/2018 20:10:01	4	2	3	1	5	6	Pacific Time Zone
14	2/4/2018 20:10:04	6	2	3	1	5	4	Central Time Zone
15	2/4/2018 20:10:04	3	5	6	1	4	2	Central Time Zone
16	2/4/2018 20:10:05	4	2	6	1	3	5	Eastern Time Zone
17	2/4/2018 20:10:06	3	2	6	5	1	2	Pacific Time Zone
18	2/4/2018 20:10:10	4	2	6	3	5	1	Mountain Time Zone
19	2/4/2018 20:10:12	3	1	5	6	2	4	Eastern Time Zone
20	2/4/2018 20:10:26	5	3	6	2	4	1	Pacific Time Zone

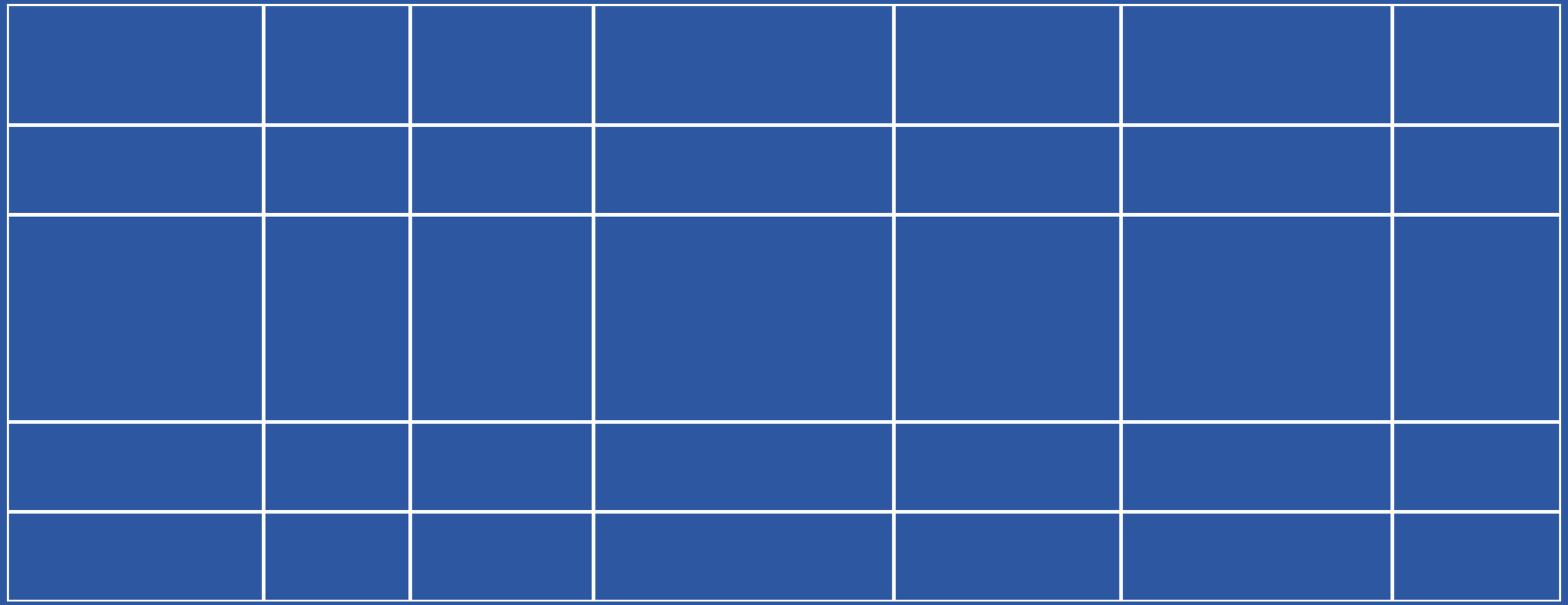
THINKING TIME

- The available data includes:
  - Lays, Nacho Cheese Doritos, Cool Ranch Doritos, Cheetos, Sun Chips, and Fritos ranked from 1 to 6
  - Geographic region: West, Central, or Eastern

ANALYSTS' JOB FOR THE TOP 1

1. Count all the first place votes for each chip type.
2. Divide the total first place votes for each chip type by the total number of votes.
3. Multiply that fraction by 20 to find how many bags there would be in a twenty pack, rounding as necessary.

ANALYSTS' EXAMPLE



ANALYSTS' JOB FOR THE TOP 4

1. Count all the first, second, third, and fourth place votes for each chip type.
2. Multiply the first place votes by four, the second place votes by three, the third place votes by two, and the fourth place votes by one.
3. Add the weighted votes for each chip type and divide by the total number of weighted votes.
4. Divide the weighted votes for each chip type by the total number of votes.
5. Multiply that fraction by 20 to find how many bags there would be in a twenty pack, rounding as necessary.

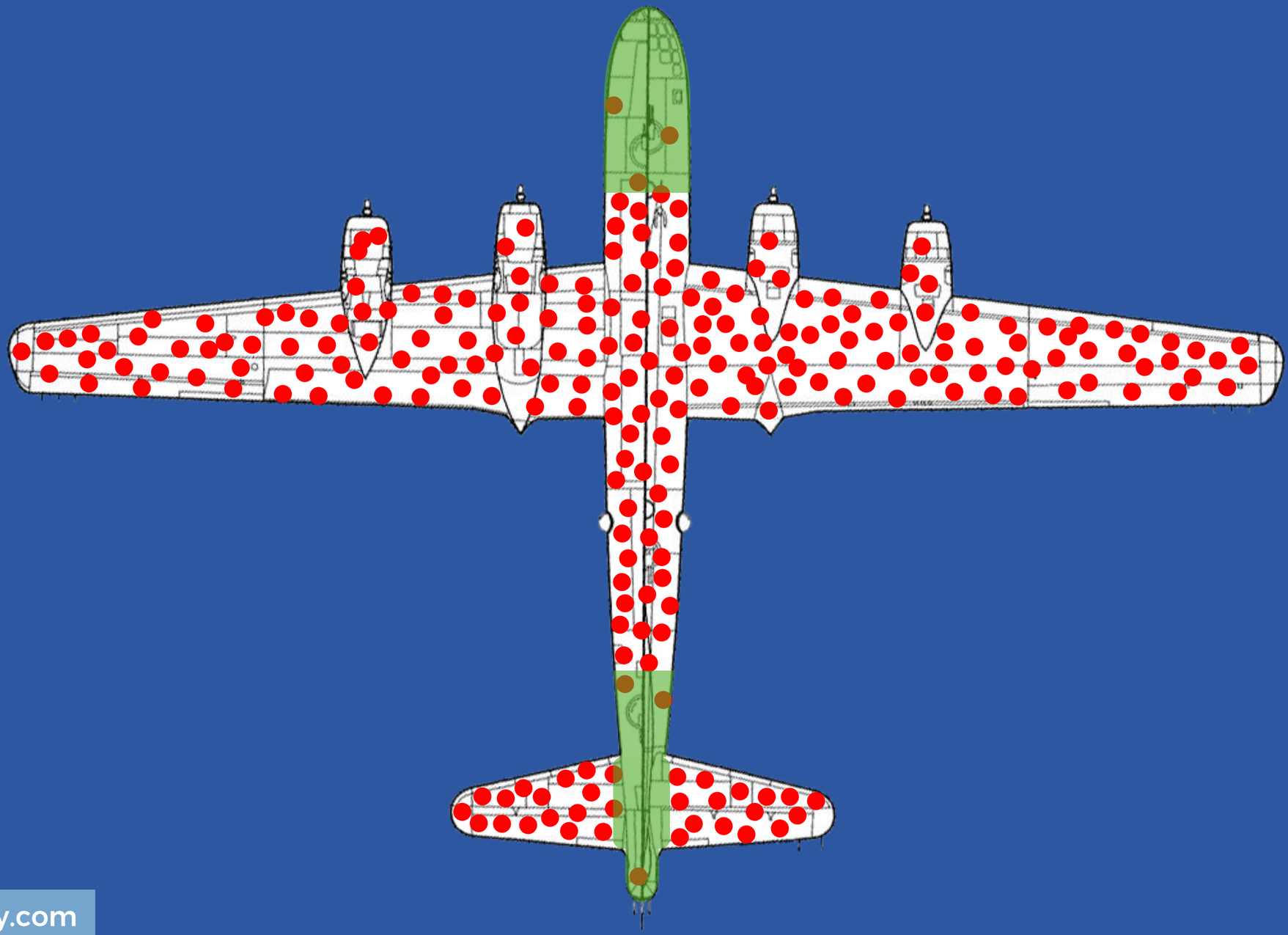
ANALYSTS' EXAMPLE

CHIP BAG RESULTS

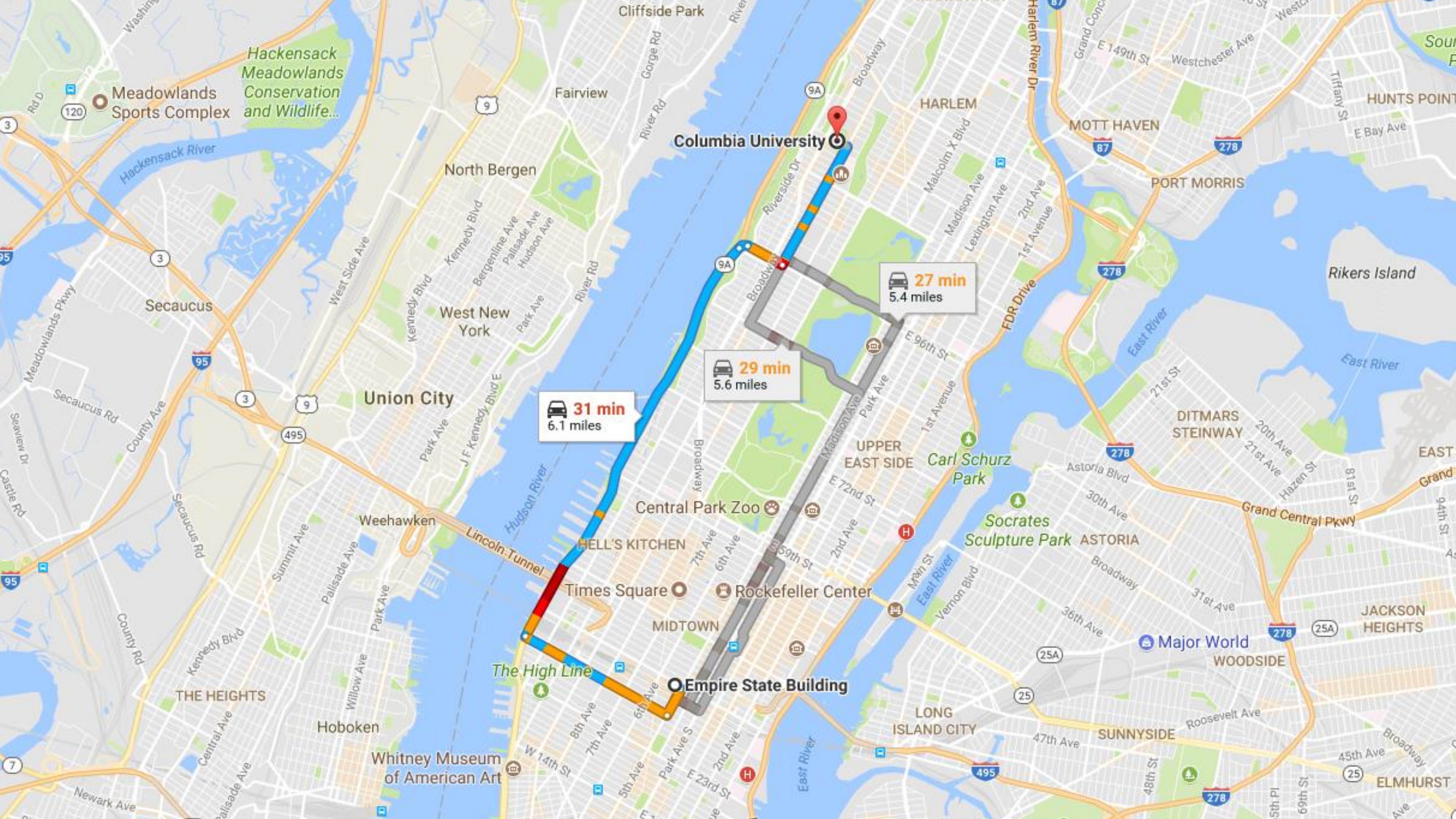
MATH MODELING

- [x] HOW DO WE MAKE SENSE OF MATH MODELING?
- [ ] IS IT JUST ANSWERING QUESTIONS?
- [ ] HOW DO YOU PROFIT FROM MATH MODELING?
- [ ] HOW DO WE HELP OUR STUDENTS IMPROVE?


224612



- ~~How do we protect our planes?~~
- ~~Which parts of the plane are being hit by the most bullets?~~
- Which parts of the plane are the most critical to protect?


Columbia University
Empire State Building
31 min
6.1 miles
29 min
5.6 miles
27 min
5.4 miles
Meadowlands Sports Complex
Hackensack Meadowlands Conservation and Wildlife...
Hackensack River
Cliffside Park
Fairview
North Bergen
Secaucus
West New York
Union City
Weehawken
Lincoln Tunnel
Hudson River
Hoboken
THE HEIGHTS
Whitney Museum of American Art
The High Line
HELL'S KITCHEN
Times Square
Rockefeller Center
MIDTOWN
Central Park Zoo
UPPER EAST SIDE
HARLEM
MOTT HAVEN
HUNTS POINT
PORT MORRIS
Rikers Island
East River
Carl Schurz Park
Socrates Sculpture Park
ASTORIA
DITMARS STEINWAY
JACKSON HEIGHTS
Major World
WOODSIDE
LONG ISLAND CITY
SUNNYSIDE
ELMHURST
Grand Central Pkwy
FDR Drive
Harlem River Dr
Broadway
Riverside Dr
E 96th St
E 72nd St
59th St
W 14th St
E 23rd St

- ~~How do we find the fastest route for each customer?~~
- How do we find the fastest route for each customer without impacting our other customers?

Classic Mix

20 Singles

4 LAY'S® Classic Potato Chips, 4 DORITOS® Nacho Cheese Flavored Tortilla Chips, 2 DORITOS® COOL RANCH® Flavored Tortilla Chips, 4 CHEETOS® Crunchy Cheese Flavored Snacks, 2 SUNCHIPS® Original Multigrain Snacks, 4 FRITOS® Original Corn Chips (All 1 OZ. Each)

20 INDIVIDUAL BAGS: 1 OZ. EACH, TOTAL NET WT. 20 OZ. (1 LB. 4 OZ.) 567 g

⚠ WARNING: PREVENT ENTANGLEMENT AND STRANGULATION. KEEP THIS BAG AWAY FROM YOUNG CHILDREN. IT IS NOT A TOY.

- ~~How many of each flavor should we put in a package?~~
- ~~How many of each flavor should we put in a package for each region?~~
- How can we determine if the extra cost of creating different packages will make us more money?

Mathematically proficient students who can apply what they know are comfortable making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later.

CCSS MATH PRACTICE 4

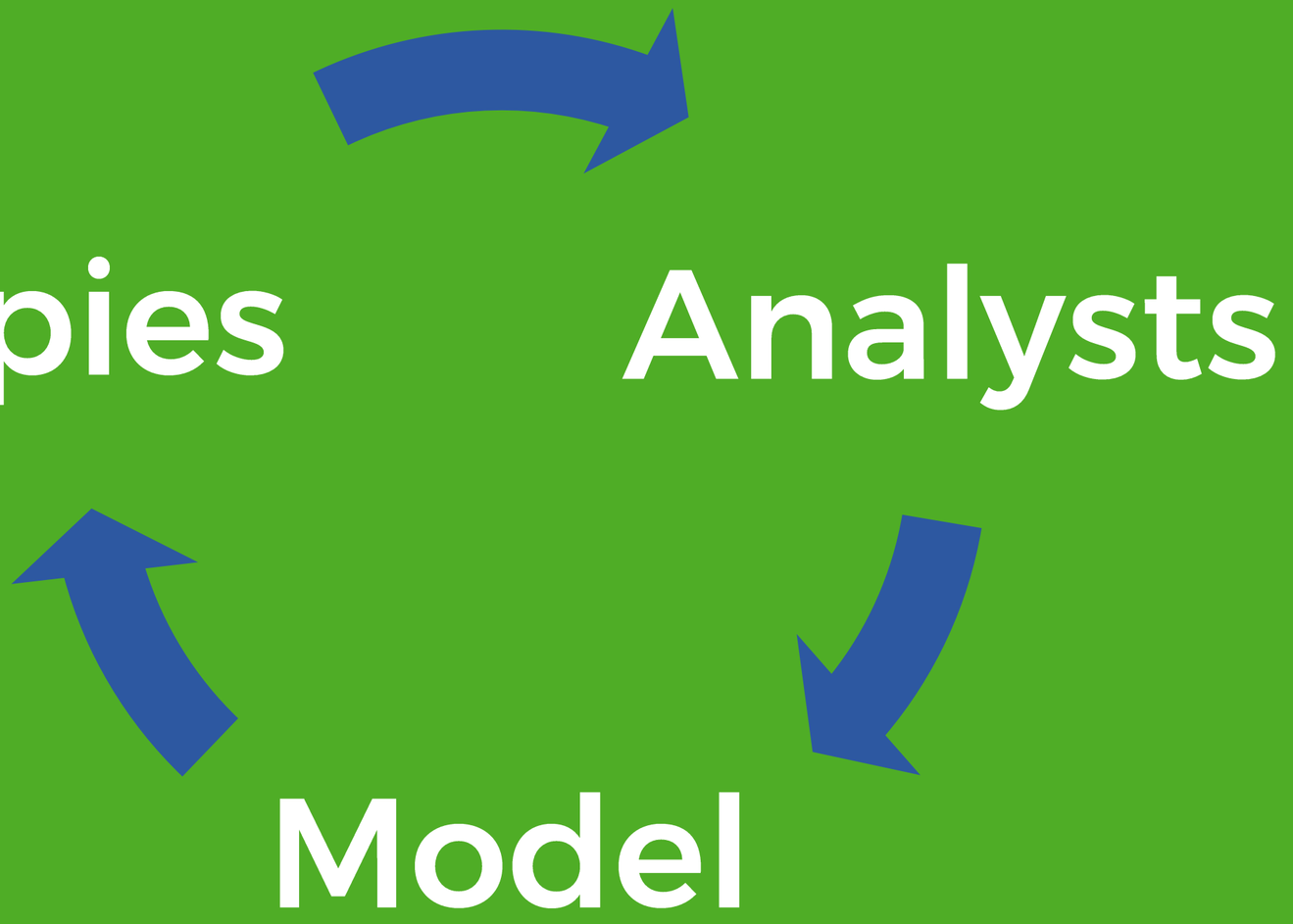
They routinely interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.

CCSS MATH PRACTICE 4

MATH MODELING

- [x] HOW DO WE MAKE SENSE OF MATH MODELING?
- [x] IS IT JUST ANSWERING QUESTIONS?
- [ ] HOW DO YOU PROFIT FROM MATH MODELING?
- [ ] HOW DO WE HELP OUR STUDENTS IMPROVE?


TARGET
TARGET PARKING


Spies
Analysts
Model

THINKING TIME

RobertKaplinsky.com

They used 25 products for a pregnancy prediction' score including:

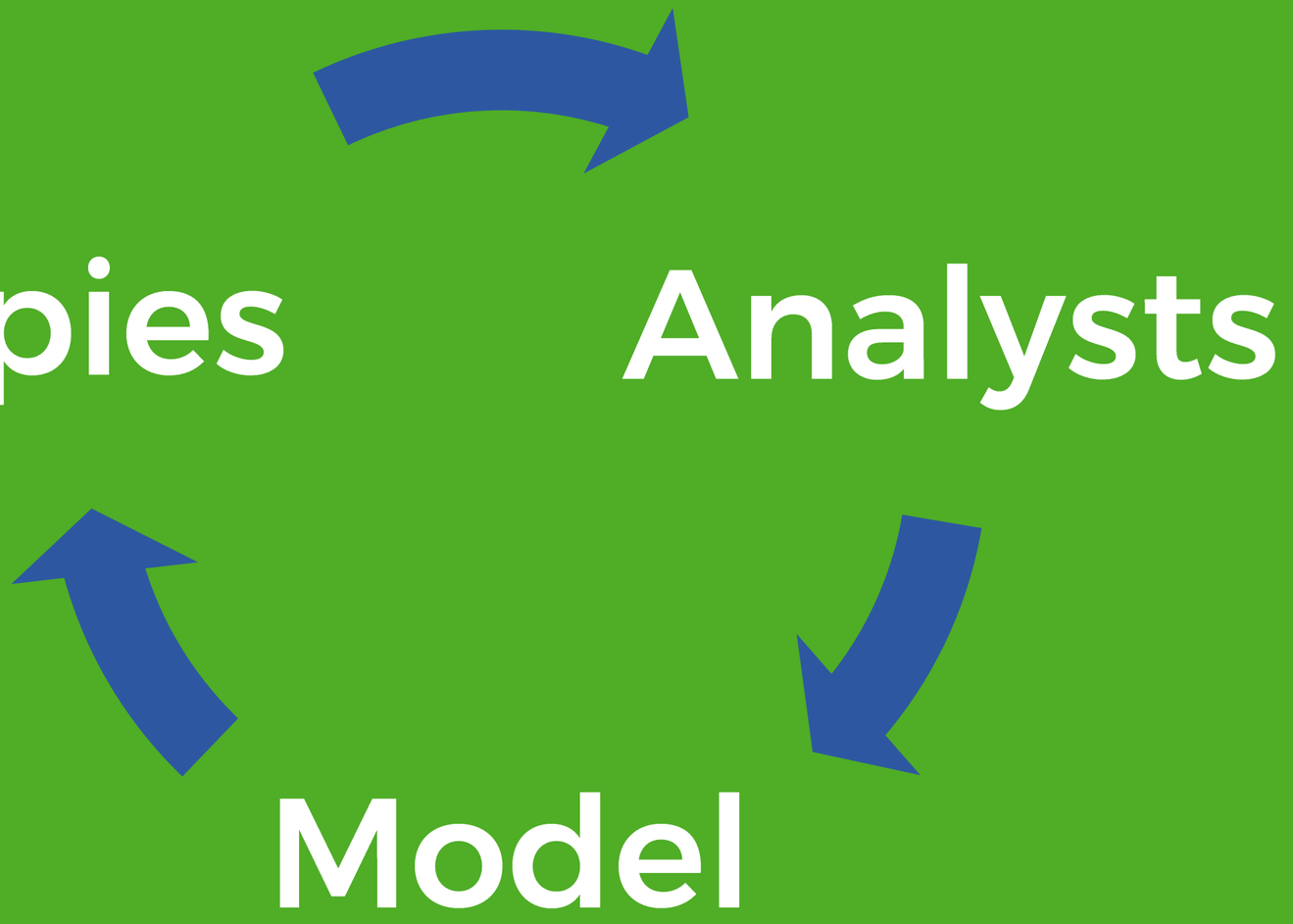
- unscented lotion
- mineral supplements
- cotton balls

Source: New York Times

ANALYSTS' EXAMPLE

1. Add the number of bottles of unscented lotion, jars of mineral supplements, and bags of cotton balls.
2. Multiply that times the day of the week.
3. Click your heels twice.
4. Repeat the phrase "There's no place like home!"


UNITED


Spies
Analysts
Model

THINKING TIME

RobertKaplinsky.com

Priority is determined by:

- passenger's fare class
- itinerary
- frequent flyer program membership
- check-in time

Source: United Airlines

Search

Robert | Home

Robert Kaplinsky

- News Feed
- Messenger
- Watch
- Marketplace

Explore

- Pages
- Events
- Groups
- Friend Lists
- On This Day 3
- Insights
- Games 7
- Fundraisers
- Live Video
- Pokes
- See More...

Create

Ad · Page · Group · Event · Fundraiser

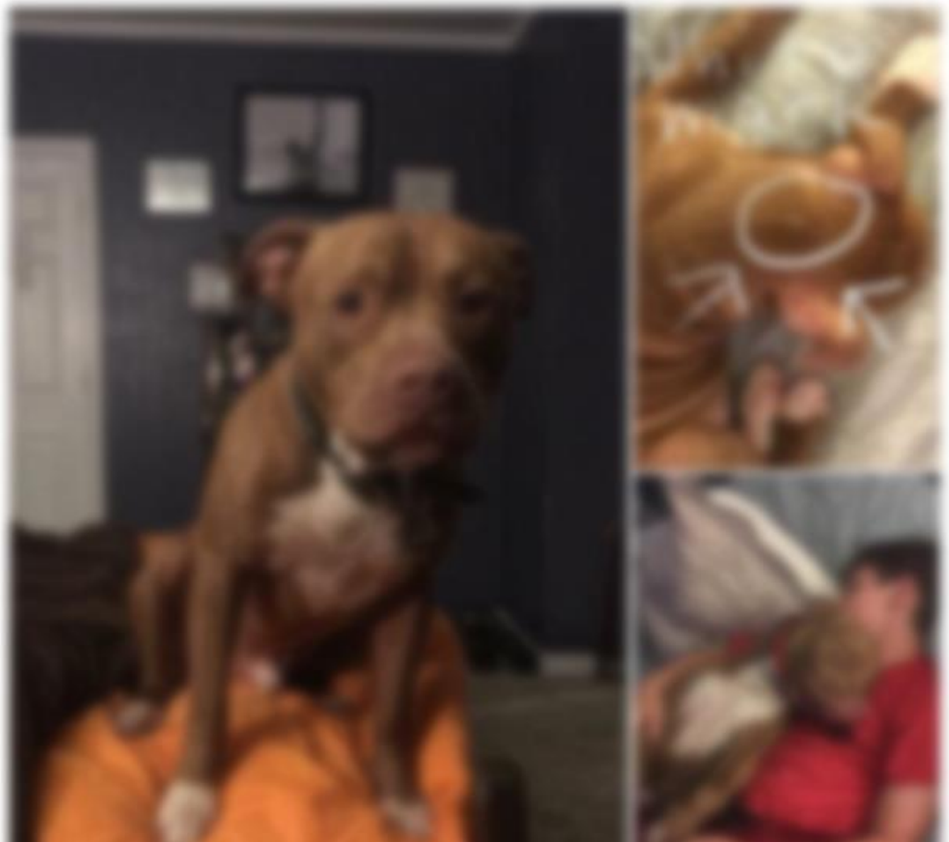
Make Post | Photo/Video Album | Live Video

What's on your mind, Robert?

Photo/Video | Feeling/Activity | ...

[redacted] shared Jennifer Tune Jernigan's post.

[redacted]



[redacted]

Trending

[redacted]

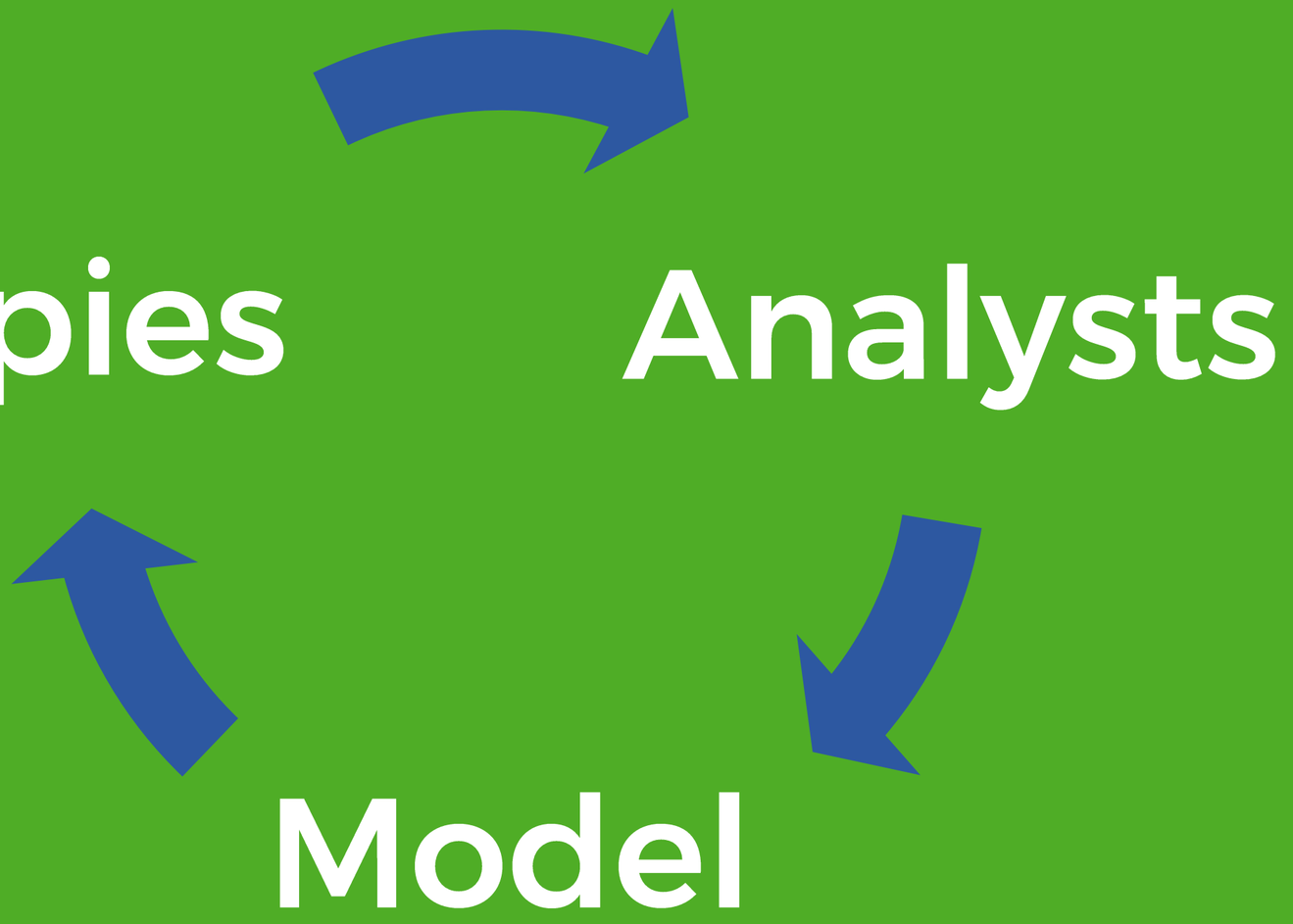
Watchlist: Latest Episodes

[redacted]

[redacted]

See All

Sponsored Create Ad


Spies
Analysts
Model

THINKING TIME

RobertKaplinsky.com

The stories that show in your News Feed are influenced by:

- friends you interact with the most
- the number of comments and likes a post receives
- what kind of story it is (ex: photo, video, status update)

Source: Facebook

PRIME

Prime members save on
eys at Whole Foods

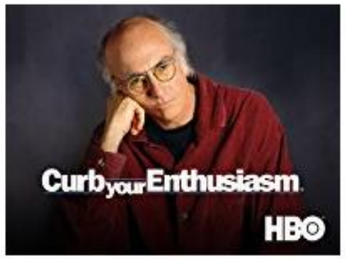
FRESH

NOW AVAILABLE
Try our selection

WHOLE FOODS MARKET

VIDEO

Recommended for you:
Curb Your Enthusiasm Seaso...



MUSIC

Recommended for you:
The Hamilton Mixtape [Expli...

MEET ALEXA

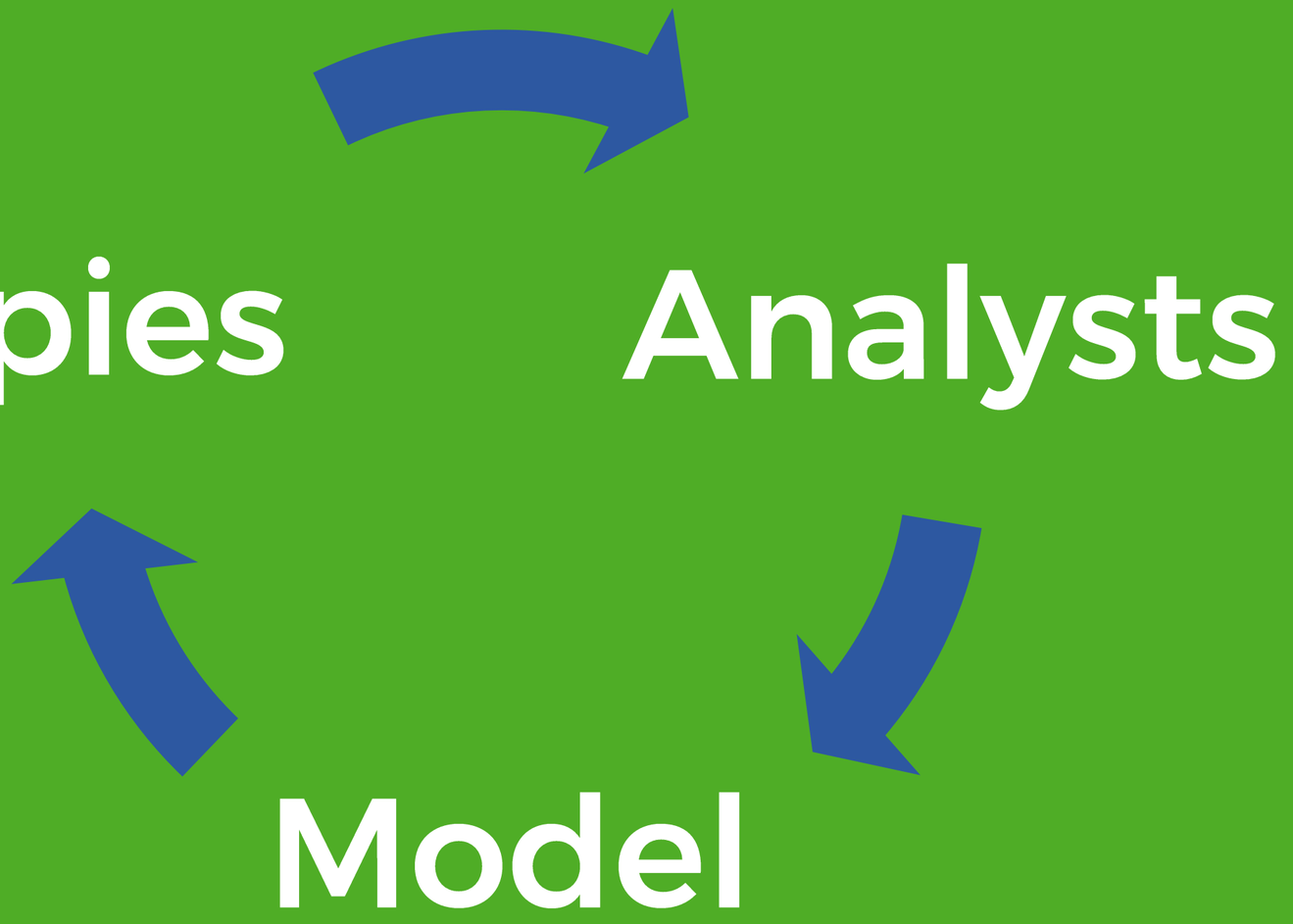
Voice control your world with
Echo & Alexa devices

RECENT VIEWS

View your browsing history

Related to items you've viewed

See more


Spies
Analysts
Model

THINKING TIME

RobertKaplinsky.com

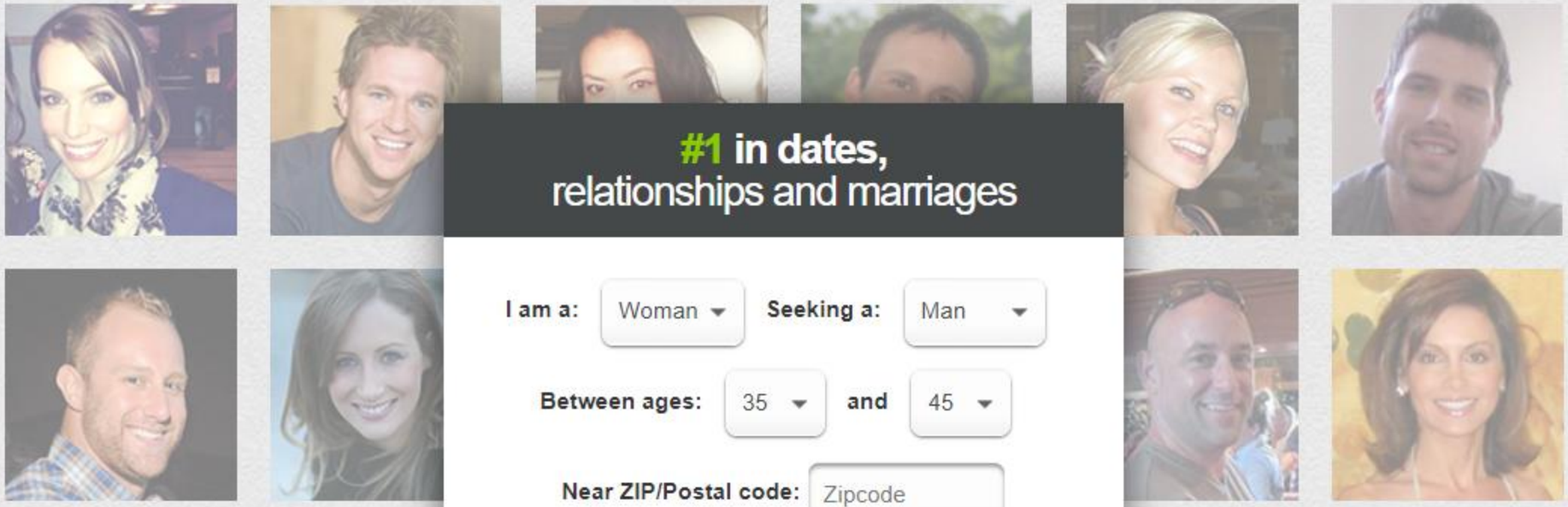
Amazon's recommendation system is based on:

- what a user has bought in the past
- which items they have in their shopping cart
- items they've rated and liked
- what other customers have viewed and purchased

Source: Fortune

match Member Sign In »

Take the free personality test from Chemistry.com »



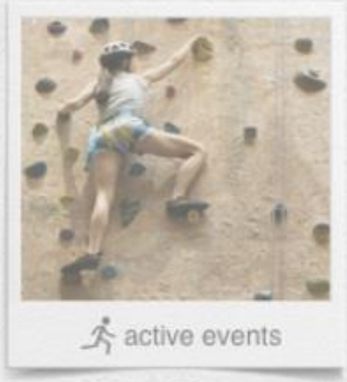
#1 in dates, relationships and marriages

I am a: Woman Seeking a: Man

Between ages: 35 and 45

Near ZIP/Postal code: Zipcode

View Photos »

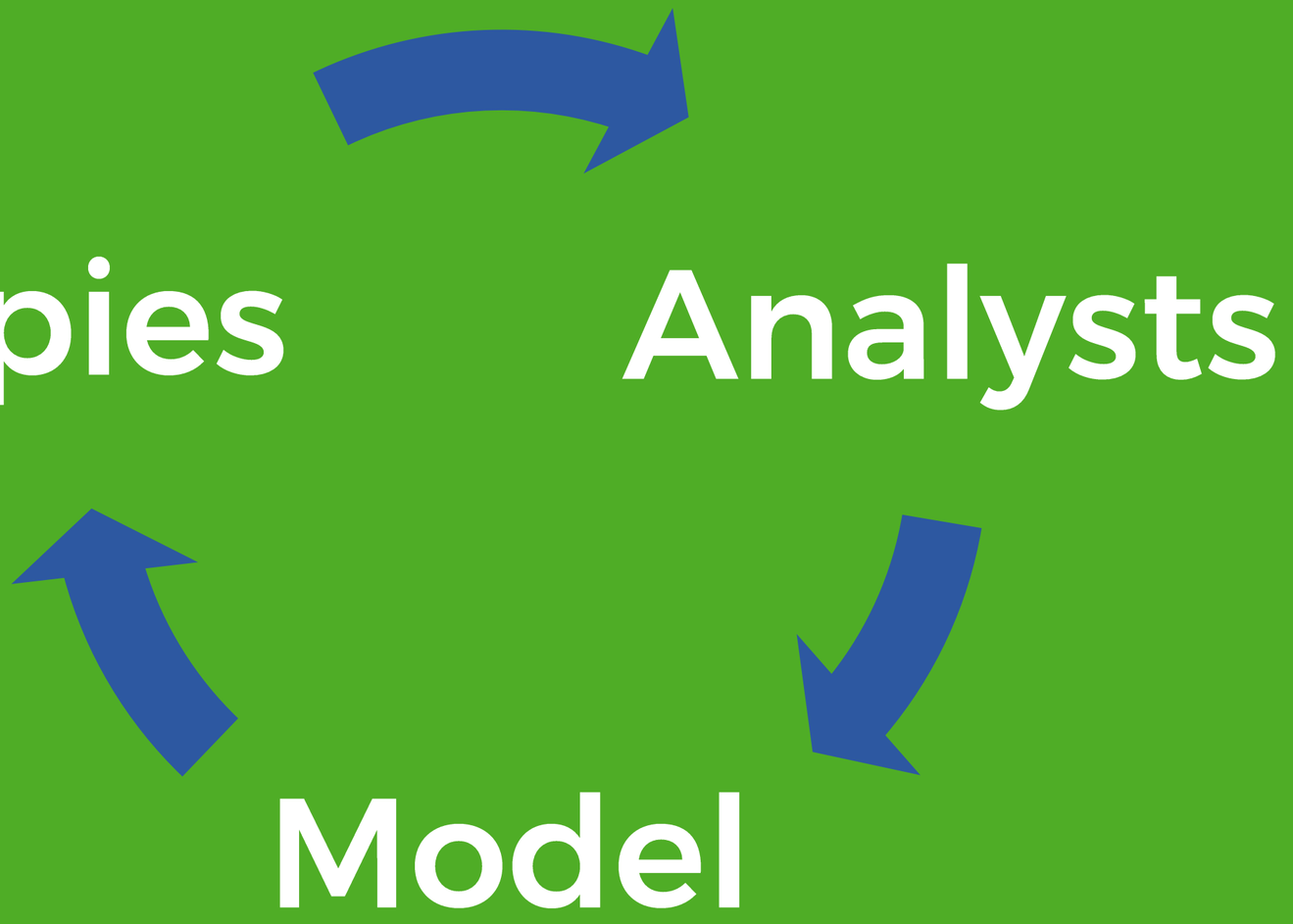


Do fun stuff, meet cool people

match events

THINKING TIME

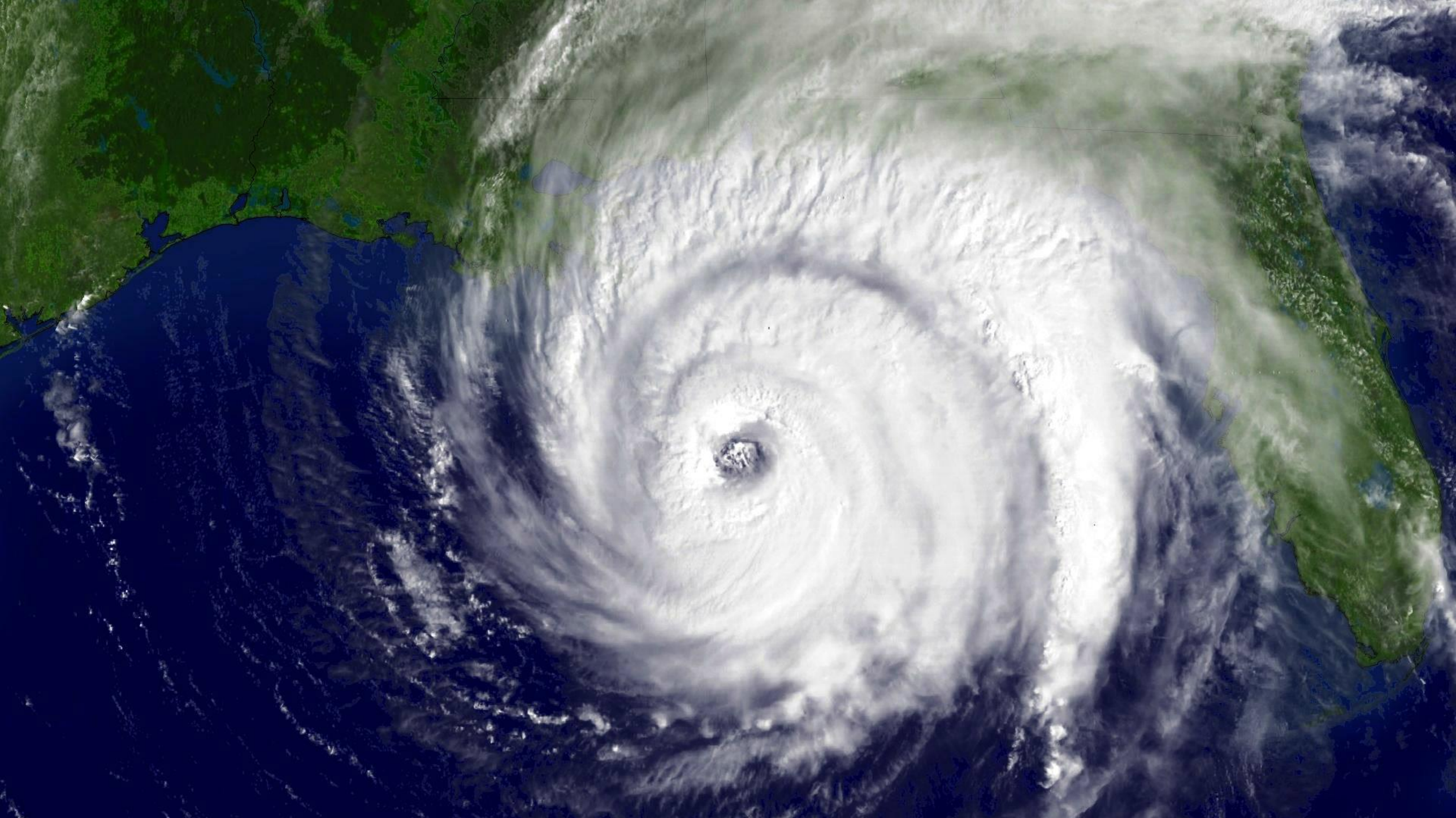
RobertKaplinsky.com


Spies
Analysts
Model

The four main components of the equations are:

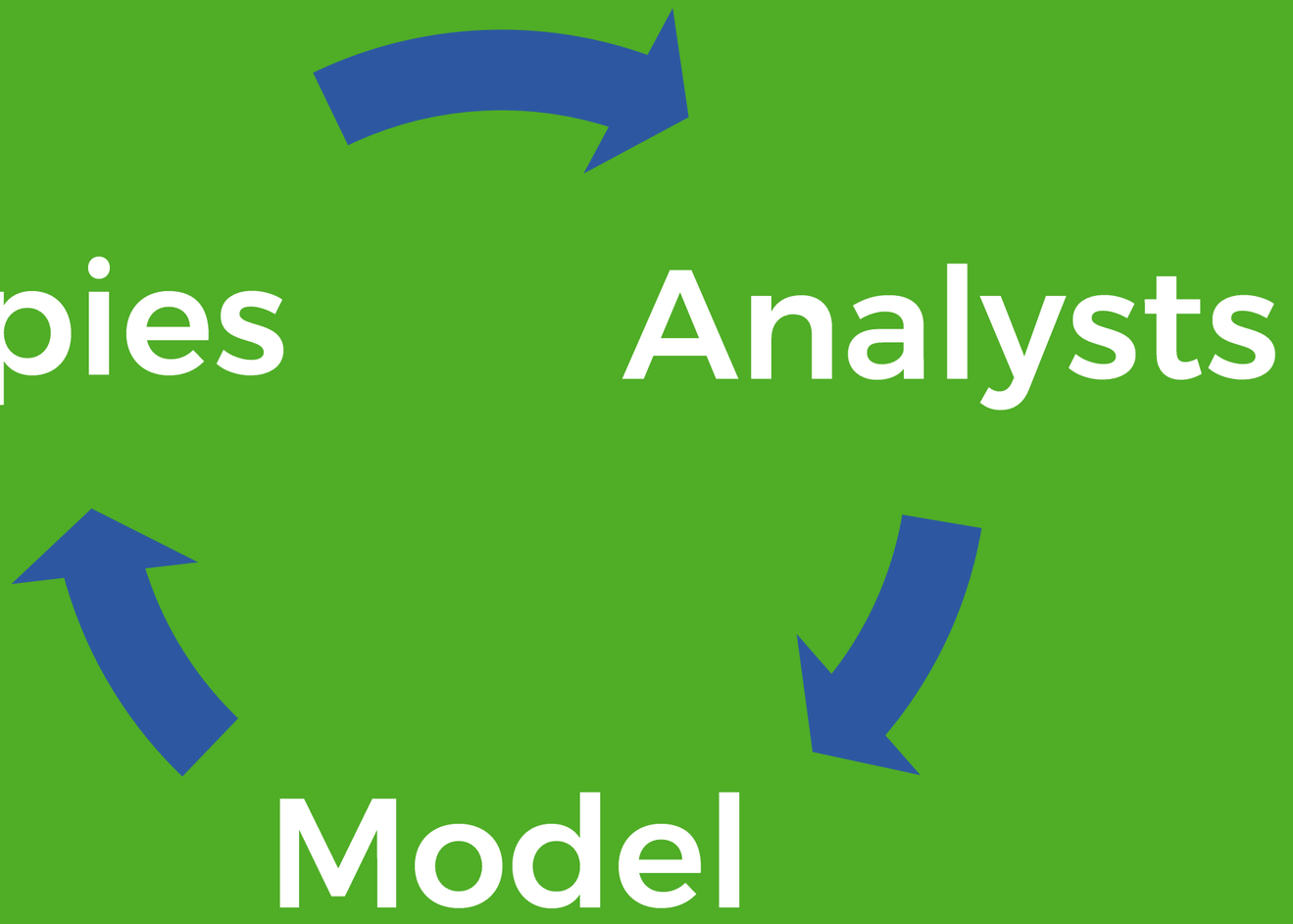
- what you say
- what you do
- what people like you do
- historical data

Source: Mashable



THINKING TIME

RobertKaplinsky.com


Spies
Analysts
Model


WAFFLE HOUSE
WAFFLE HOUSE

The index has three levels:

- Green: full menu - restaurant has power and damage is limited.
- Yellow: limited menu - no power or only power from a generator, or food supplies may be low.
- Red: the restaurant is closed - indicating severe damage.

Source: Wikipedia

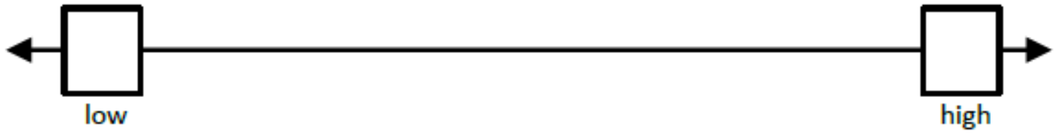
MORE EXAMPLES

- How does US News and World Reports rank colleges?
- How does Google know which results to show?
- How do sports teams know who to draft?
- How does SpaceX make boosters land standing up?
- How does Zillow estimate home prices?
- How does Pandora know what music to play?
- How did the BCS rank college football teams?
- How do they figure out who should speak at a conference?

MATH MODELING

- [x] HOW DO WE MAKE SENSE OF MATH MODELING?
- [x] IS IT JUST ANSWERING QUESTIONS?
- [x] HOW DO YOU PROFIT FROM MATH MODELING?
- [ ] HOW DO WE HELP OUR STUDENTS IMPROVE?

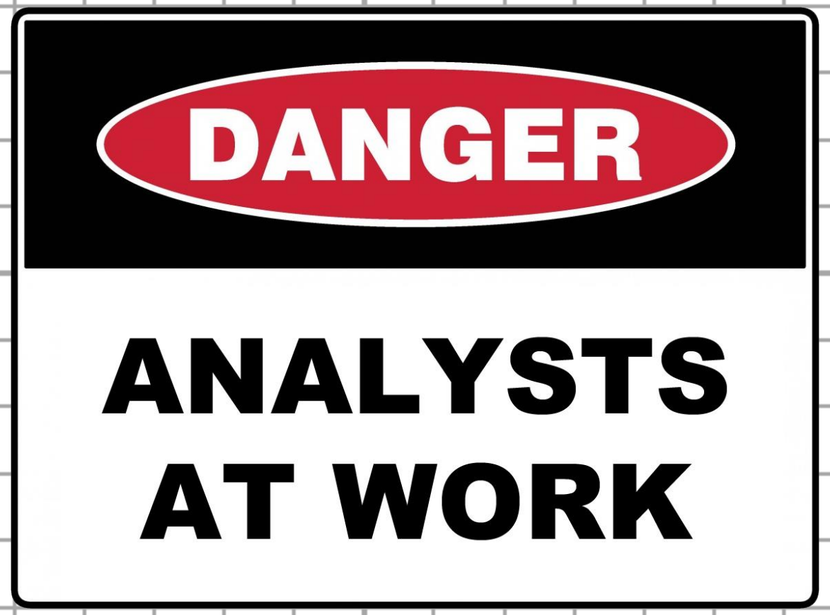
Name: _____ Period: _____ Date: _____

What problem are you trying to figure out?	What estimates do you have?
	 Place your estimate on the number line.
What info do you already know about the problem?	**What info do you need about the problem?**

TOP SECRET! SPIES ONLY

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

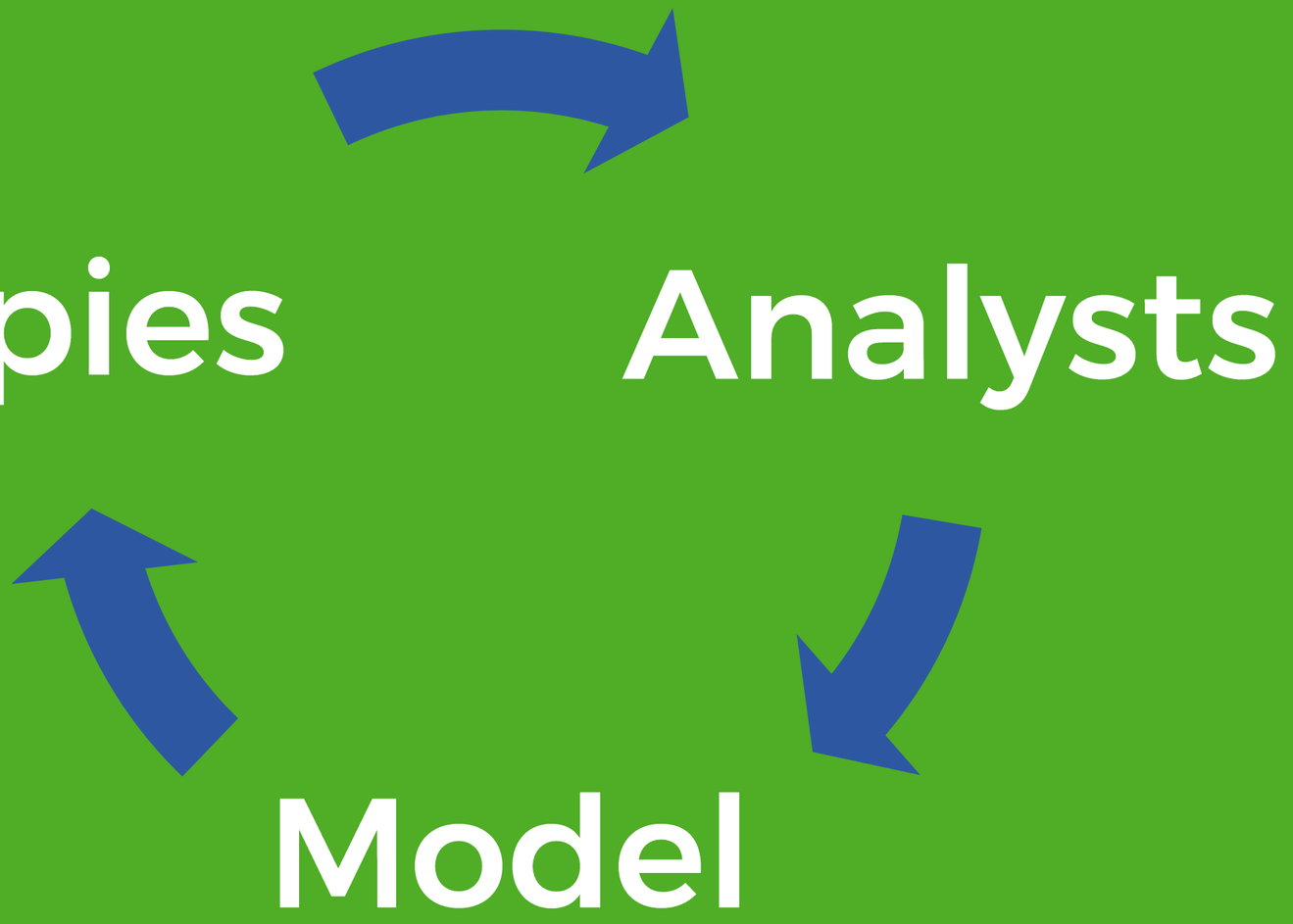
Your work



MODELING EXAMPLES

- ❑ ELEMENTARY SCHOOL
- ❑ MIDDLE SCHOOL
- ❑ HIGH SCHOOL

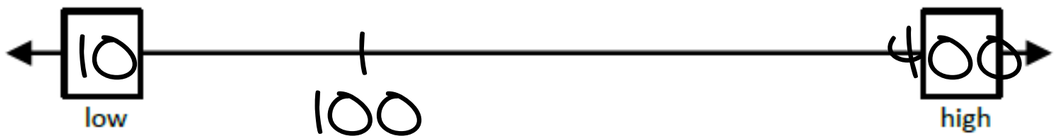

WYFF4.COM
Coca-Cola


Spies
Analysts
Model

THINKING TIME

RobertKaplinsky.com

Name: _____ Period: _____ Date: _____

What problem are you trying to figure out?	What estimates do you have?
How many beverage choices are there?	 Place your estimate on the number line.
What info do you already know about the problem?	**What info do you need about the problem?**
• There are main flavors and added flavors. • Lemonade is yummy.	• How many main flavors are there? • How many added flavors are there? • Can we mix them all together?
What is your conclusion? How did you reach that conclusion?	

COUNT ALL


1
8
16
24
27
32
40
46
no caffeine
2
3
4
5
6
7
9
10
11
12
13
14
15
17
18
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20
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22
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25
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31
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34
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36
37
38
39
41
42
43
44
45
47
48
49
50
51
52
53
low/no calories
54
62
69
76
84
92
95
103
111
117
125
55
56
57
58
59
60
61
63
64
65
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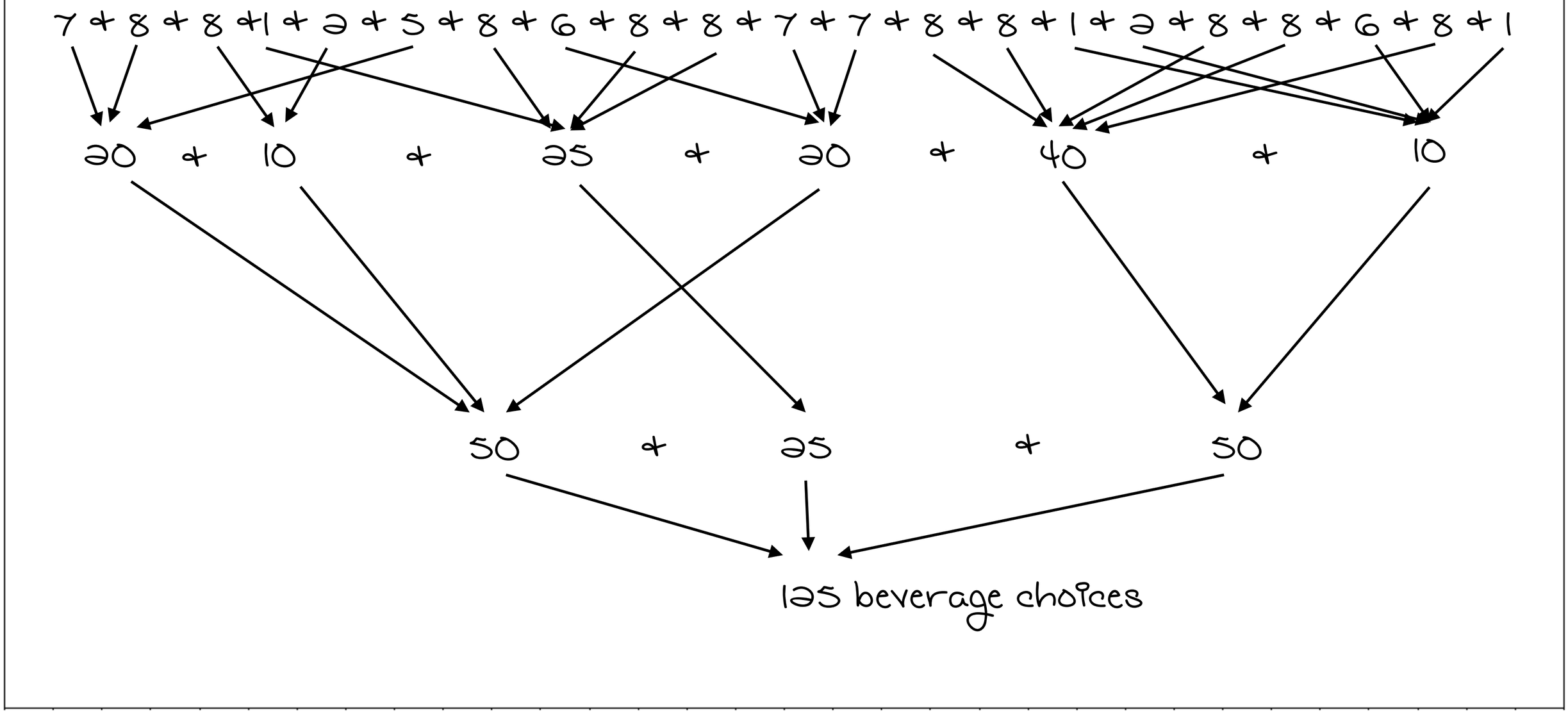
123
124

COUNT GROUPS

INVENTED STRATEGY


7 + 8 + 8 + 1 + 2 + 5 + 8 + 6 + 8 + 8 + 7 + 7 + 8 + 8 + 1 + 2 + 8 + 8 + 6 + 8 + 1
20 + 10 + 25 + 20 + 40 + 10
50 + 25 + 50
125 beverage choices

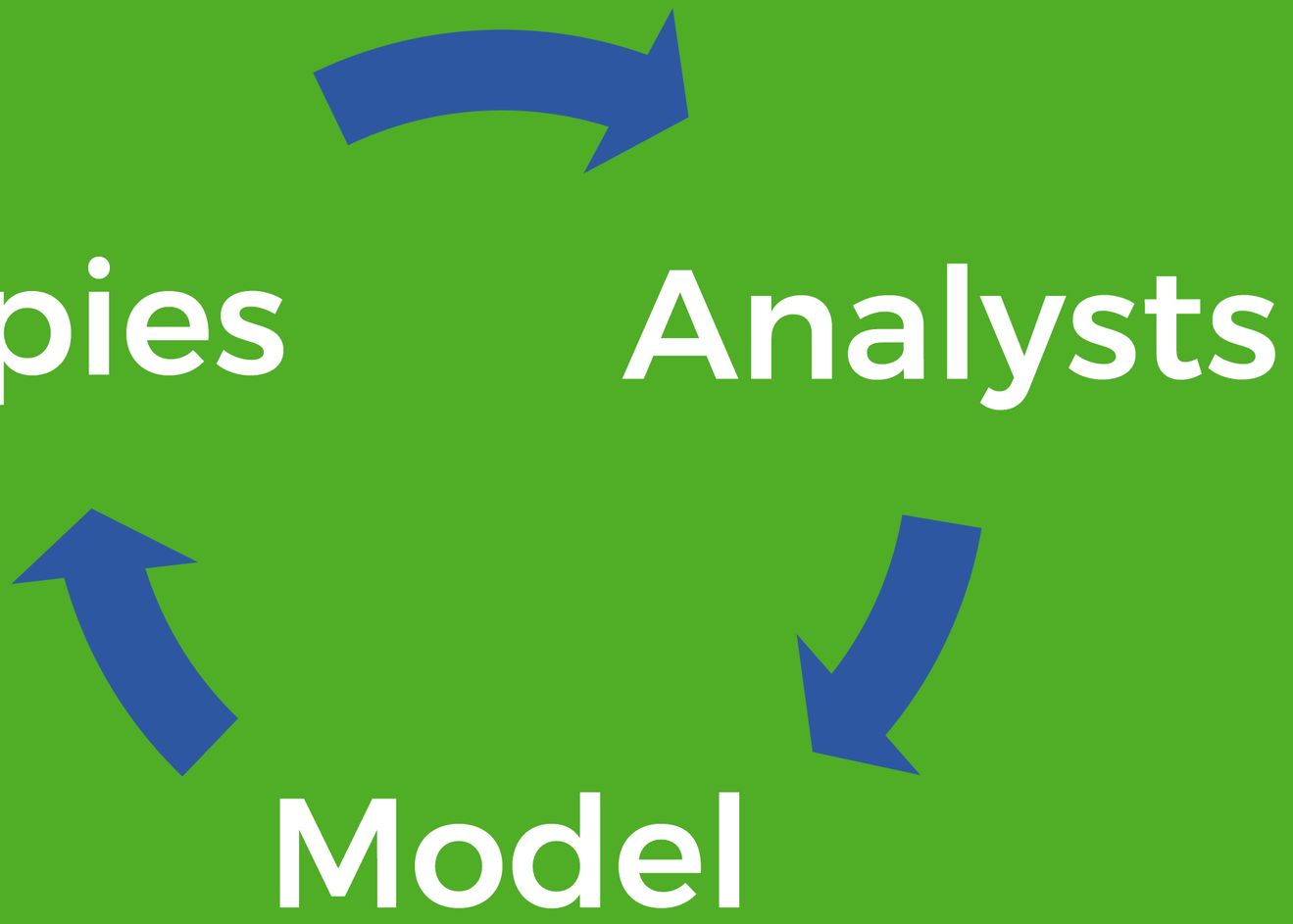
The main attraction for a busload of Dover fifth-graders was supposed to be the Museum of Fine Arts, but that all changed when they stopped by Kelly's Roast Beef and got a glimpse of their soda-drinking future.

At the entrance of Kelly's sat a sleek Coca-Cola Freestyle fountain crafted to resemble an old-fashioned vending machine, but with a twist: a touchscreen computer embedded in the machine gives customers the option of 125 flavors. You can quench your thirst with a Coke or a Sprite, or try something more exotic — Sprite with Grape or a Hi-C Orange Vanilla.

MODELING EXAMPLES

- [x] ELEMENTARY SCHOOL
- [ ] MIDDLE SCHOOL
- [ ] HIGH SCHOOL

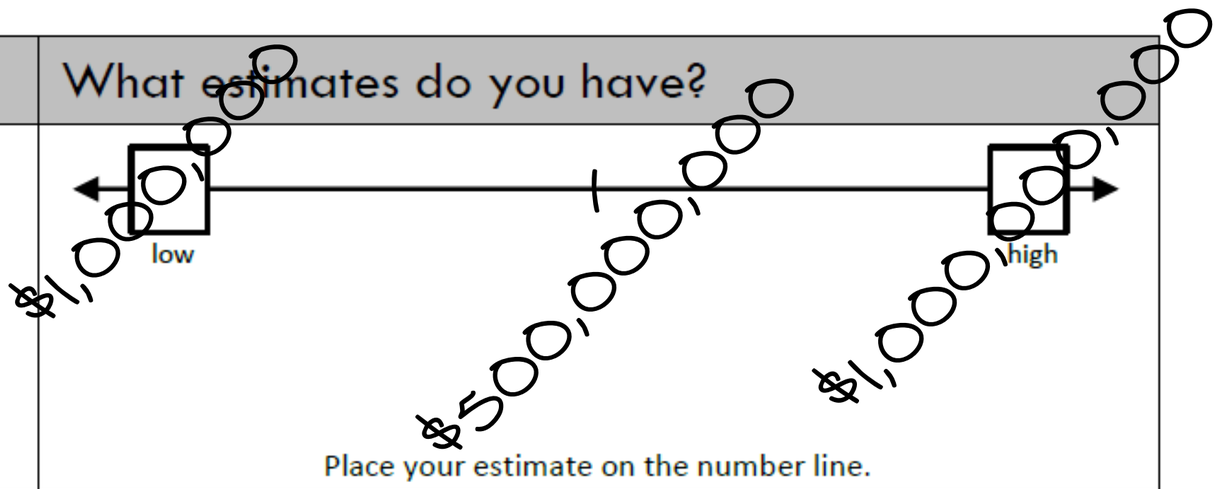

IVE
FOX NEWS
Junction


Spies
Analysts
Model

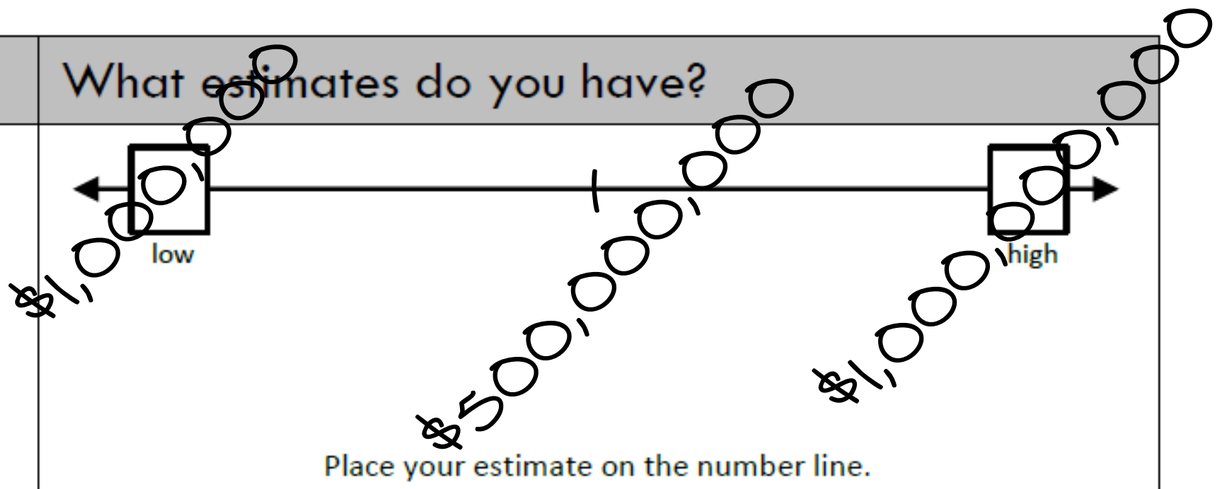
THINKING TIME

RobertKaplinsky.com

Name: _____ Period: _____ Date: _____

What problem are you trying to figure out?	What estimates do you have?
How much money was that?	 Place your estimate on the number line.
What info do you already know about the problem?	**What info do you need about the problem?**
• There is a lot of money. • It is in a pile. • It is in bundles.	• Is it all the same denomination? • ~~How much does one bill weigh?~~ • ~~How much does all the money weigh?~~
What is your conclusion? How did you reach that conclusion?	

Name: _____ Period: _____ Date: _____

What problem are you trying to figure out?	What estimates do you have?
How much money was that?	 Place your estimate on the number line.
What info do you already know about the problem?	**What info do you need about the problem?**
• There is a lot of money. • It is in a pile. • It is in bundles.	• Is it all the same denomination? • How many rows and columns are there? • How many bills are in one stack?
What is your conclusion? How did you reach that conclusion?	


PGR
SIEDO

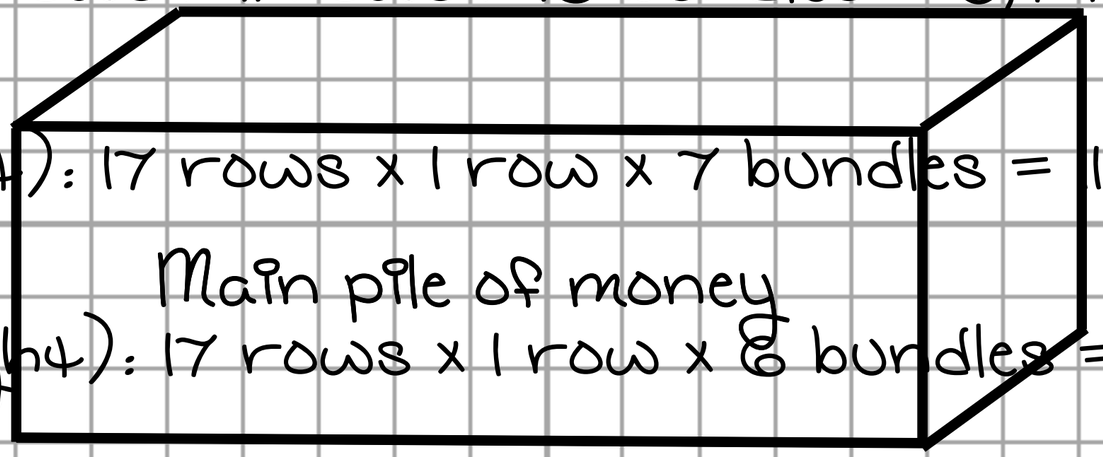

PGR
SIEDO
PGR
SIEDO

Your work

Main pile: 34 rows x 11 rows across x 10 bundles = 3,740 bundles

Small pile (left): 17 rows x 1 row x 7 bundles = 119 bundles

Small pile (right): 17 rows x 1 row x 8 bundles = 102 bundles



Total bundles: 3,740 + 119 + 102 = 3,961 bundles

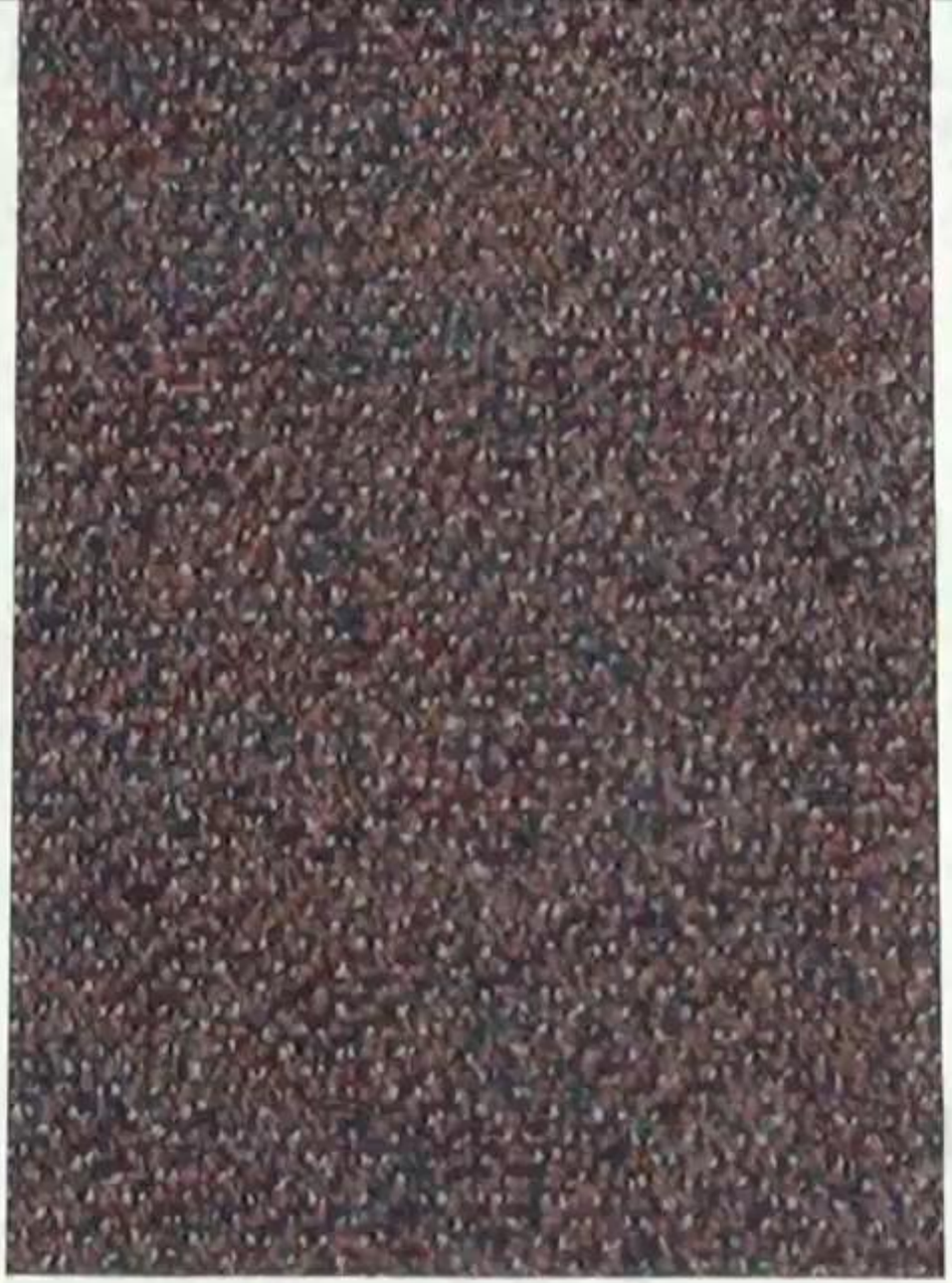
Total money: 3,961 bundles x $50,000 per bundle = $198,050,000

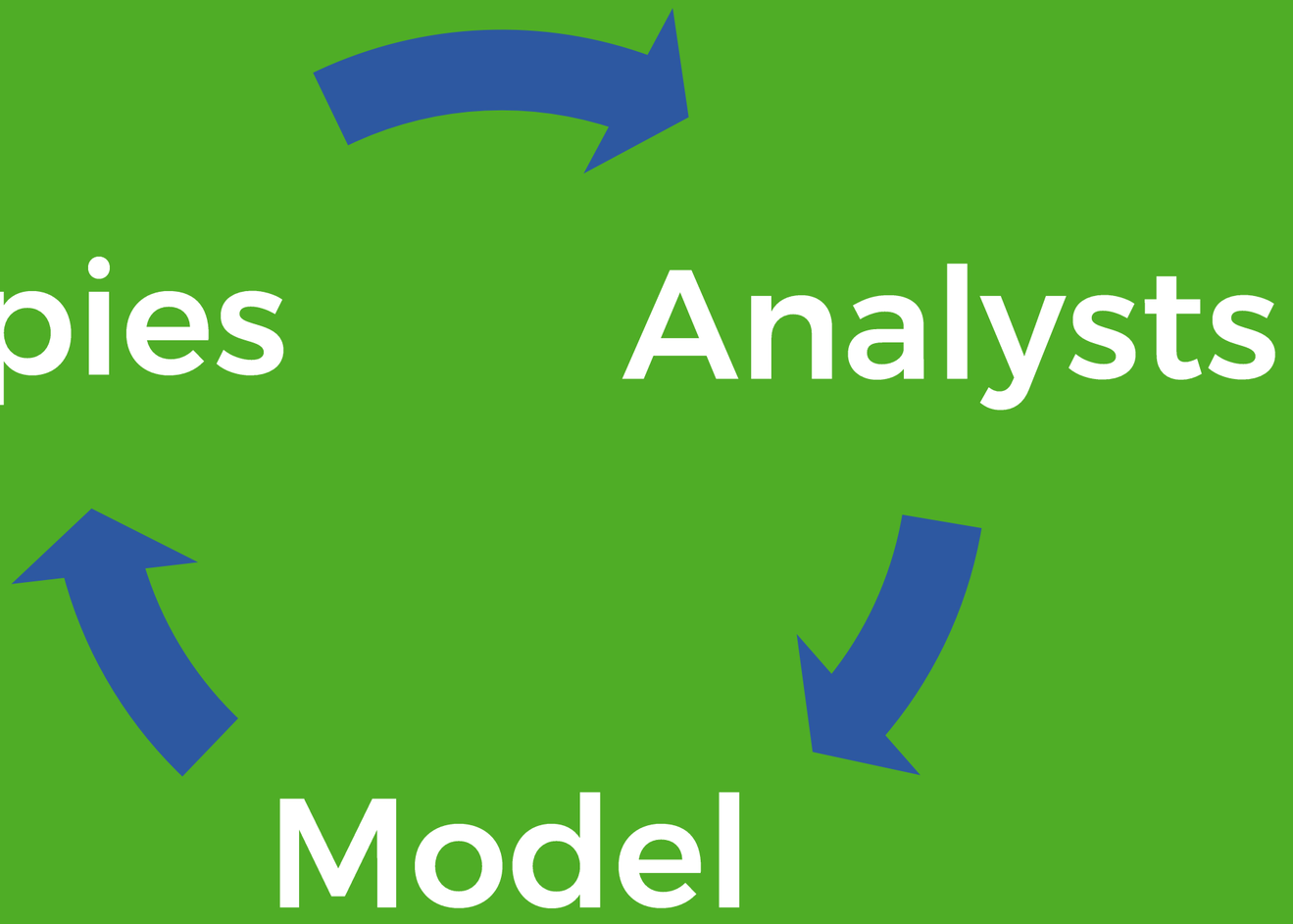

FOX
FOX NEWS

MODELING EXAMPLES

- [x] ELEMENTARY SCHOOL
- [x] MIDDLE SCHOOL
- [ ] HIGH SCHOOL


NON-STAGGERED
STAGGERED

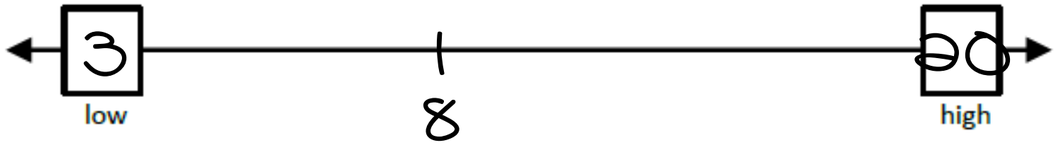



Spies
Analysts
Model

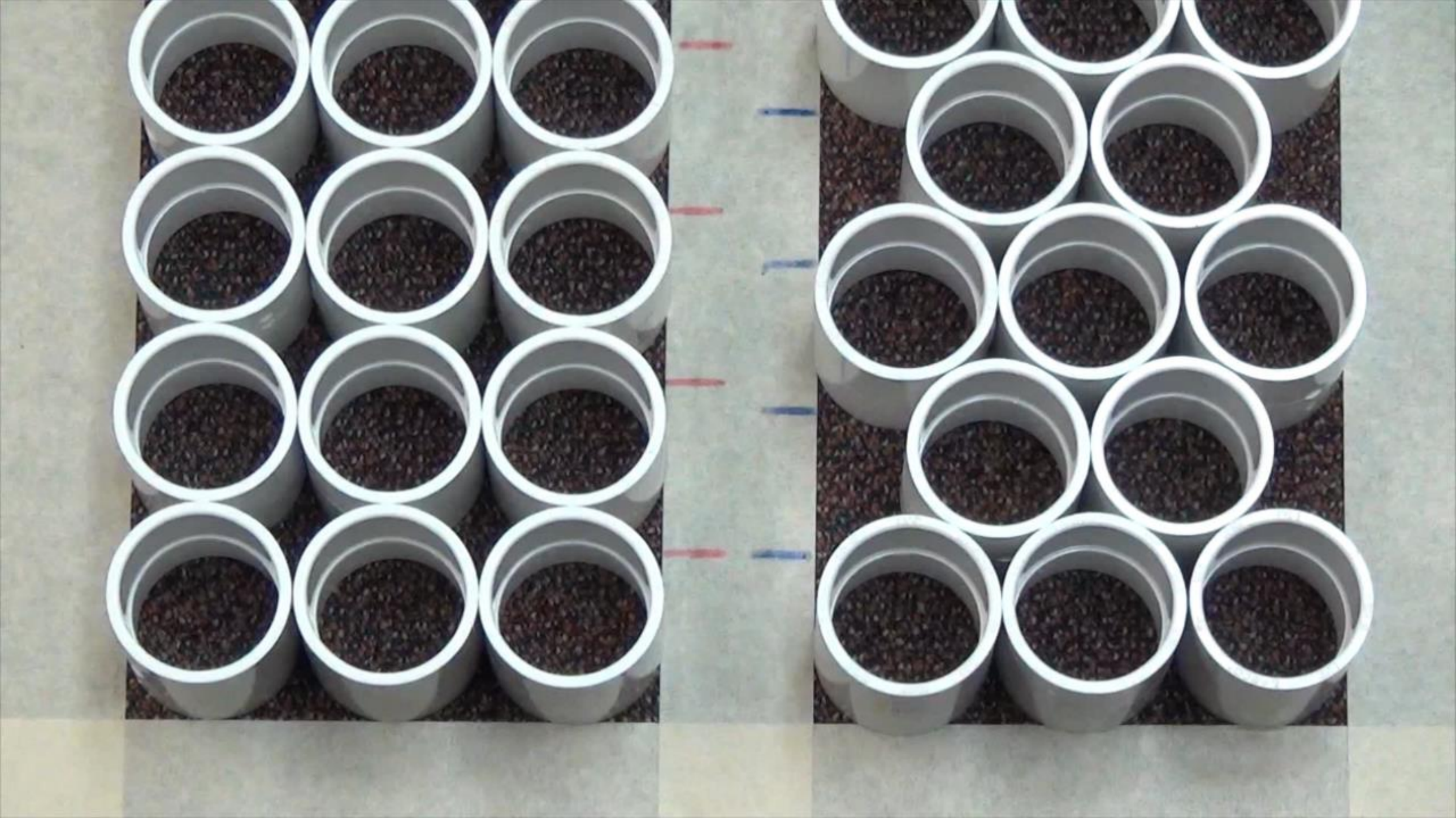
THINKING TIME

RobertKaplinsky.com

Name: _____ Period: _____ Date: _____

What problem are you trying to figure out?	What estimates do you have?
How much shorter are 20 layers of non-staggered pipes?	 (in inches) Place your estimate on the number line.
What info do you already know about the problem?	**What info do you need about the problem?**
• One pile of pipes is staggered. • One pile of pipes is not staggered. • We have to compare 20 layers of each.	• What are the dimensions of a pipe? • What units are we using to measure?
What is your conclusion? How did you reach that conclusion?	


6
7

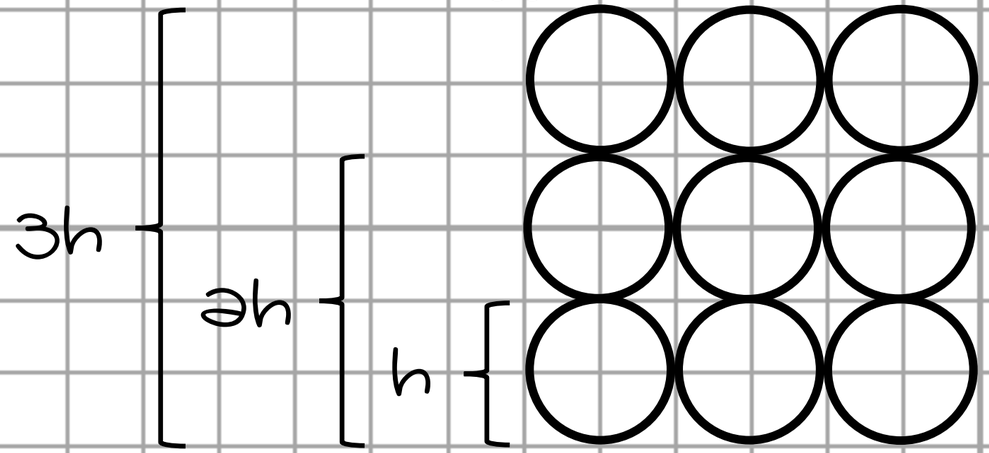


THINKING TIME

RobertKaplinsky.com

Your work

Non-staggered pipes



1 pipe = h cm

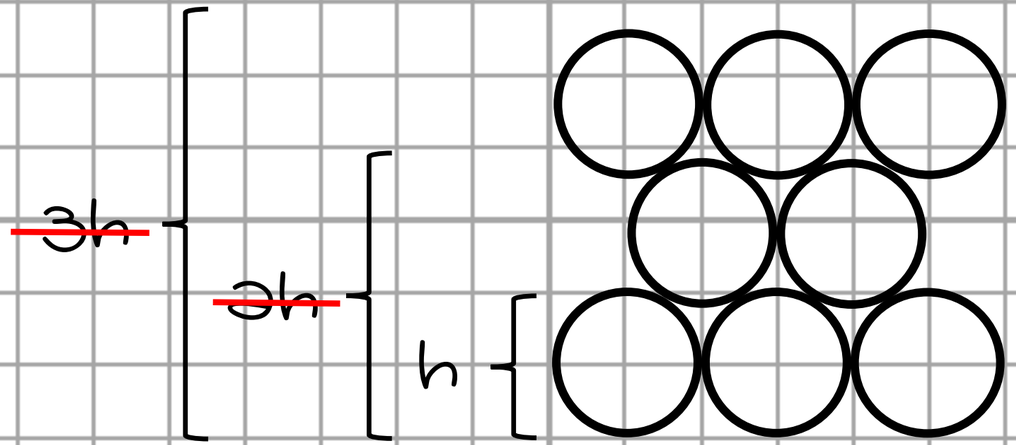
2 pipes = 2h cm

3 pipes = 3h cm

⋮

20 pipes = 20h cm

Staggered pipes



1 pipe = h cm

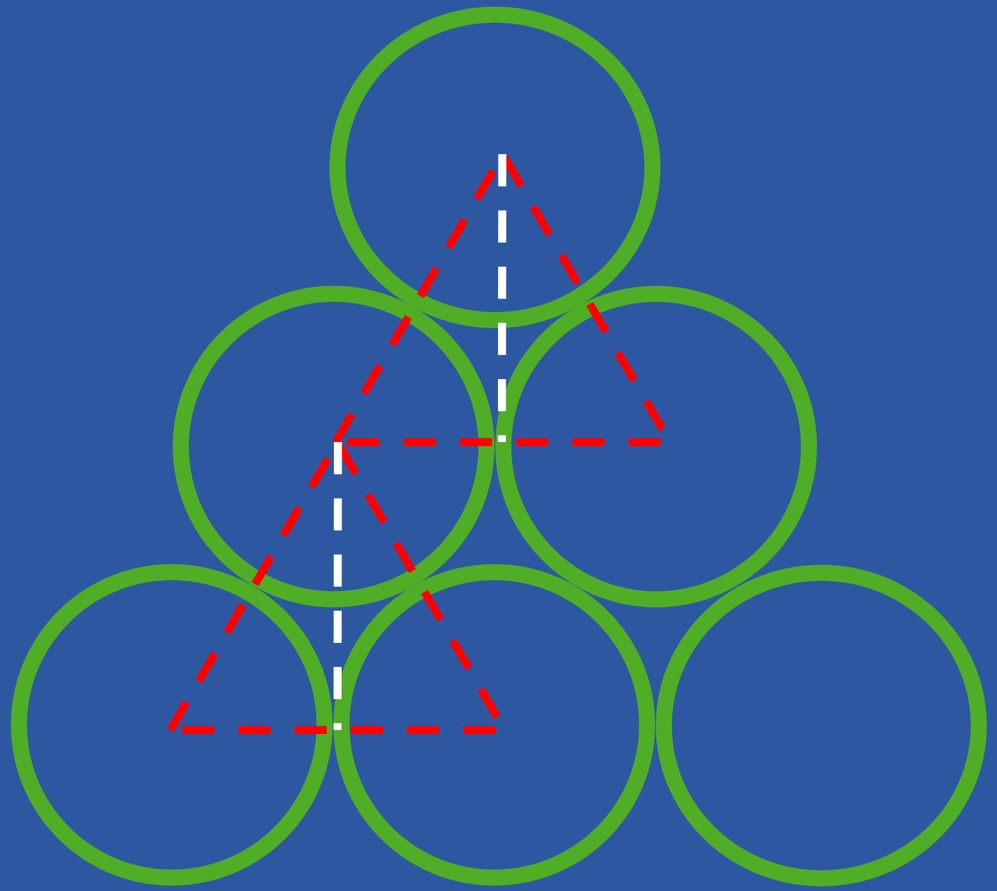
2 pipes = ?? cm

3 pipes = ?? cm

⋮

20 pipes = ?? cm

STAGGERED PIPES



MODELING EXAMPLES

- [x] ELEMENTARY SCHOOL
- [x] MIDDLE SCHOOL
- [x] HIGH SCHOOL

MATH MODELING

- ☑ HOW DO WE MAKE SENSE OF MATH MODELING?
- ☑ IS IT JUST ANSWERING QUESTIONS?
- ☑ HOW DO YOU PROFIT FROM MATH MODELING?
- ☑ HOW DO WE HELP OUR STUDENTS IMPROVE?

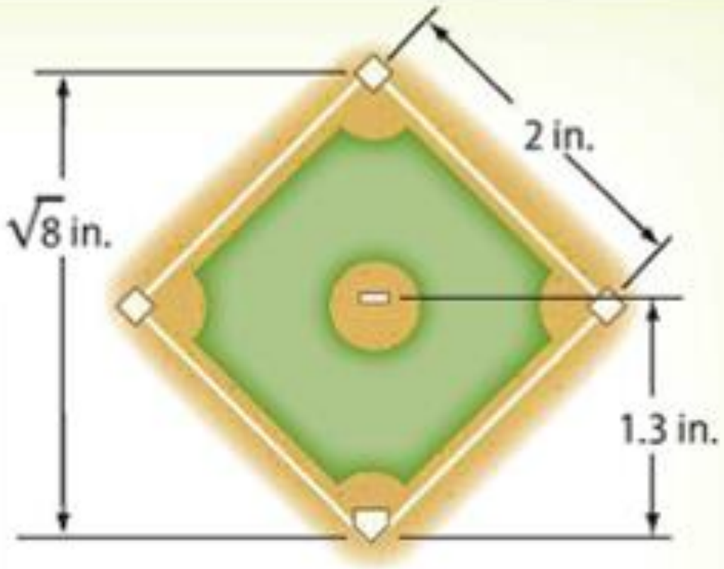
Real-World Link

Common Core State Standards

Content Standards
8.NS.1, 8.NS.2, 8.EE.2

Mathematical Practices
1, 3, 4, 6

Sports Major League baseball has rules for the dimensions of the baseball diamond. A model of the diamond is shown.



1. On the model, the distance from the pitching mound to home plate is 1.3 inches. Is 1.3 a rational number? Explain.

2. On the model, the distance from first base to second base is 2 inches. Is 2 a rational number? Explain.

3. The distance from home plate to second base is $\sqrt{8}$ inches. Using a calculator, find $\sqrt{8}$. Does it appear to terminate or repeat?

Real-World Link

Common Core State Standards

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Mathematical Practices
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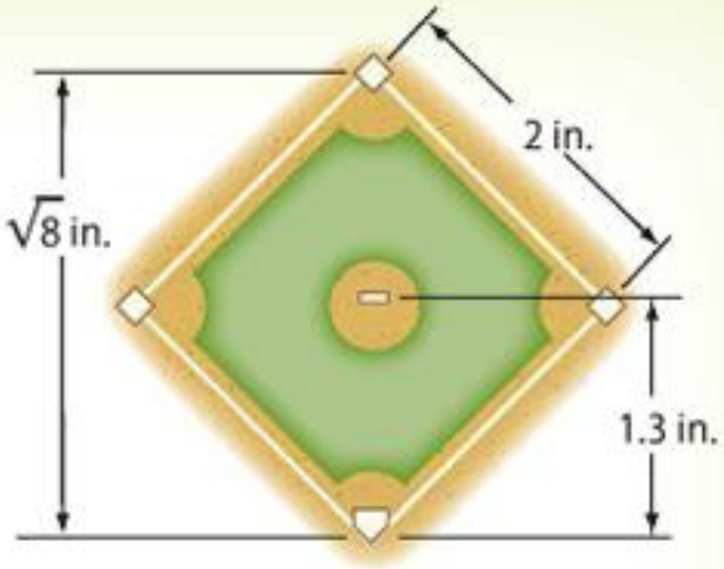

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3. The distance from home plate to second base is $\sqrt{8}$ inches. Using a calculator, find $\sqrt{8}$. Does it appear to terminate or repeat?


2009
NETFLIX
DATE: 09·21·09
PAY TO THE ORDER OF: BellKor's Pragmatic Chaos
$ 1,000,000 00
AMOUNT: ONE MILLION 00/100
FOR The Netflix Prize
Reed Hastings

DISCUSSION TIME

- What previous understandings of mathematical modeling were confirmed?
- How has your understanding of mathematical modeling shifted?
- What would you recommend math teachers do differently?

GOALS

- ☑ WHAT IS INTELLIGENCE?
- ☑ WHY DON'T STUDENTS REMEMBER?
- ☑ WHAT MATHEMATICS IS IMPORTANT?
- ☐ WHAT ABOUT WHAT WE USED TO DO?

Student Name	ID Number	Perf. Level	Scaled Score	Mathematics Clusters (Clusters where the percent correct is shown in bold represent proficiency for that cluster.)											
				Rational numbers		Exponents, powers, and roots		Quantitative relationships and evaluating expressions		Multi-step problems, graphing, and functions		Measurement and geometry		Statistics, data analysis, and probability	
				Number Correct	Percent Correct	Number Correct	Percent Correct	Number Correct	Percent Correct	Number Correct	Percent Correct	Number Correct	Percent Correct	Number Correct	Percent Correct
[redacted]	[redacted]	ADV	476	13	93%	8	100%	8	80%	14	93%	12	92%	5	100%
[redacted]	[redacted]	ADV	464	13	93%	7	88%	8	80%	15	100%	11	85%	5	100%
[redacted]	[redacted]	ADV	453	10	71%	8	100%	10	100%	14	93%	11	85%	5	100%
[redacted]	[redacted]	ADV	453	13	93%	8	100%	9	90%	12	80%	11	85%	5	100%
[redacted]	[redacted]	ADV	444	14	100%	7	88%	8	80%	13	87%	10	77%	5	100%
[redacted]	[redacted]	ADV	444	12	86%	8	100%	8	80%	15	100%	10	77%	4	80%
[redacted]	[redacted]	ADV	444	13	93%	8	100%	8	80%	14	93%	9	69%	5	100%
[redacted]	[redacted]	ADV	435	12	86%	6	75%	9	90%	14	93%	10	77%	5	100%
[redacted]	[redacted]	ADV	435	12	86%	6	75%	8	80%	14	93%	11	85%	5	100%
[redacted]	[redacted]	ADV	435	13	93%	7	88%	9	90%	12	80%	10	77%	5	100%
[redacted]	[redacted]	ADV	427	13	93%	6	75%	9	90%	12	80%	10	77%	5	100%
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[redacted]	[redacted]	ADV	421	13	93%	6	75%	6	60%	14	93%	10	77%	5	100%
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[redacted]	[redacted]	ADV	414	12	86%	6	75%	8	80%	11	73%	11	85%	5	100%
[redacted]	[redacted]	ADV	414	12	86%	8	100%	8	80%	13	87%	8	62%	4	80%
[redacted]	[redacted]	PRO	408	11	79%	6	75%	9	90%	11	73%	10	77%	5	100%
[redacted]	[redacted]	PRO	402	12	86%	8	100%	9	90%	8	53%	11	85%	3	60%
[redacted]	[redacted]	PRO	402	8	57%	7	88%	8	80%	13	87%	10	77%	5	100%
[redacted]	[redacted]	PRO	402	13	93%	6	75%	7	70%	13	87%	8	62%	4	80%
[redacted]	[redacted]	PRO	402	11	79%	5	63%	7	70%	11	73%	12	92%	5	100%
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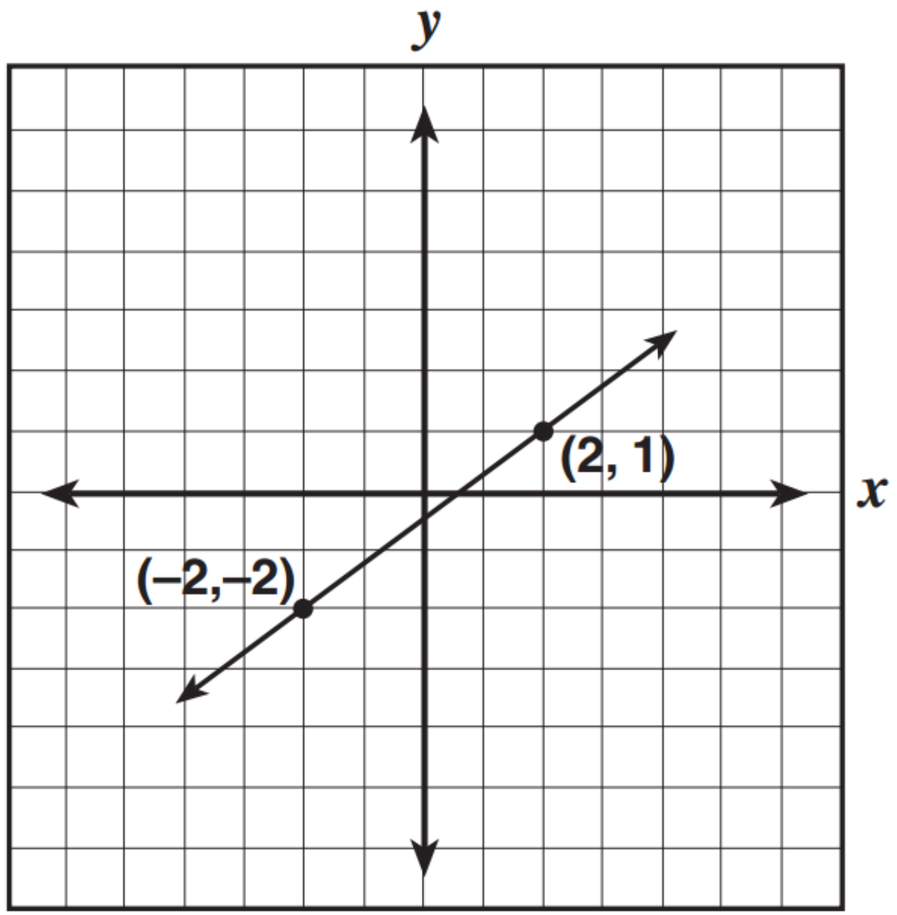
[redacted]	[redacted]	PRO	402	13	93%	7	88%	7	70%	11	73%	8	62%	5	100%
[redacted]	[redacted]	PRO	396	10	71%	6	75%	9	90%	14	93%	7	54%	4	80%
[redacted]	[redacted]	PRO	396	12	86%	8	100%	6	60%	9	60%	11	85%	4	80%

52 What is the slope of this line?



A $\frac{1}{2}$

B $\frac{3}{4}$

C 1

D $\frac{4}{3}$

Source: California Released Test Questions (7th Grade Math)


X-RAY
VISION

Student Name	ID Number	Perf. Level	Scaled Score	Mathematics Clusters (Clusters where the percent correct is shown in bold represent proficiency for that cluster.)											
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[redacted]		ADV	464	13	93%	7	88%	8	80%	15	100%	11	85%	5	100%
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[redacted]		[redacted]	[redacted]	[redacted]	[redacted]	8	100%	[redacted]	[redacted]	[redacted]	[redacted]	11	85%	5	100%
[redacted]		[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	10	77%	5	100%
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[redacted]		[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	9	69%	5	100%
[redacted]		[redacted]	[redacted]	12	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	10	77%	5	100%
[redacted]		[redacted]	[redacted]	12	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	11	85%	5	100%
[redacted]		[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	10	77%	5	100%
[redacted]		[redacted]	[redacted]	[redacted]	[redacted]	6	75%	[redacted]	[redacted]	[redacted]	[redacted]	10	77%	5	100%
[redacted]		[redacted]	[redacted]	[redacted]	[redacted]	7	88%	[redacted]	[redacted]	[redacted]	[redacted]	11	85%	5	100%
[redacted]		ADV	[redacted]	[redacted]	[redacted]	5	63%	[redacted]	[redacted]	[redacted]	93%	10	77%	5	100%
[redacted]		ADV	[redacted]	[redacted]	93%	6	75%	6	[redacted]	[redacted]	93%	10	77%	5	100%
[redacted]		ADV	421	11	79%	5	63%	9	90%	13	87%	11	85%	5	100%
[redacted]		ADV	414	12	86%	6	75%	8	80%	11	73%	11	85%	5	100%
[redacted]		ADV	414	12	86%	8	100%	8	80%	13	87%	8	62%	4	80%
[redacted]		PRO	408	11	79%	6	75%	9	90%	11	73%	10	77%	5	100%
[redacted]		PRO	402	12	86%	8	100%	9	90%	8	53%	11	85%	3	60%
[redacted]		PRO	402	8	57%	7	88%	8	80%	13	87%	10	77%	5	100%
[redacted]		PRO	402	13	93%	6	75%	7	70%	13	87%	8	62%	4	80%
[redacted]		PRO	402	11	79%	5	63%	7	70%	11	73%	12	92%	5	100%
[redacted]		PRO	402	13	93%	7	88%	9	90%	10	67%	7	54%	5	100%
[redacted]		PRO	402	13	93%	7	88%	7	70%	11	73%	8	62%	5	100%
[redacted]		PRO	396	10	71%	6	75%	9	90%	14	93%	7	54%	4	80%
[redacted]		PRO	396	12	86%	8	100%	6	60%	9	60%	11	85%	4	80%

X-RAY VISION PROBLEMS

- [x] WHY DO WE NEED THEM?
- [ ] WHY ARE THEY DIFFERENT?
- [ ] HOW DO YOU IMPLEMENT THEM?
- [ ] HOW DO YOU CREATE YOUR OWN?

PROBLEM ONE

Solve for x.

$$21 + x = 70$$

PROBLEM TWO

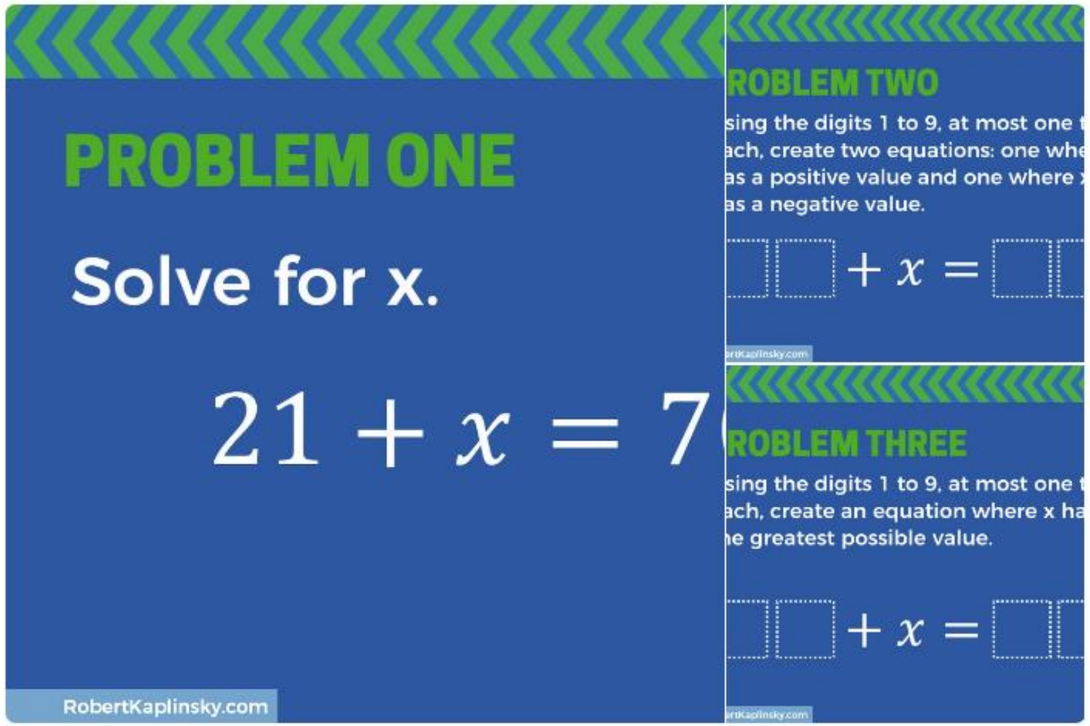
Using the digits 1 to 9, at most one time each, create two equations: one where x has a positive value and one where x has a negative value.

PROBLEM THREE

Using the digits 1 to 9, at most one time each, create an equation where x has the greatest possible value.

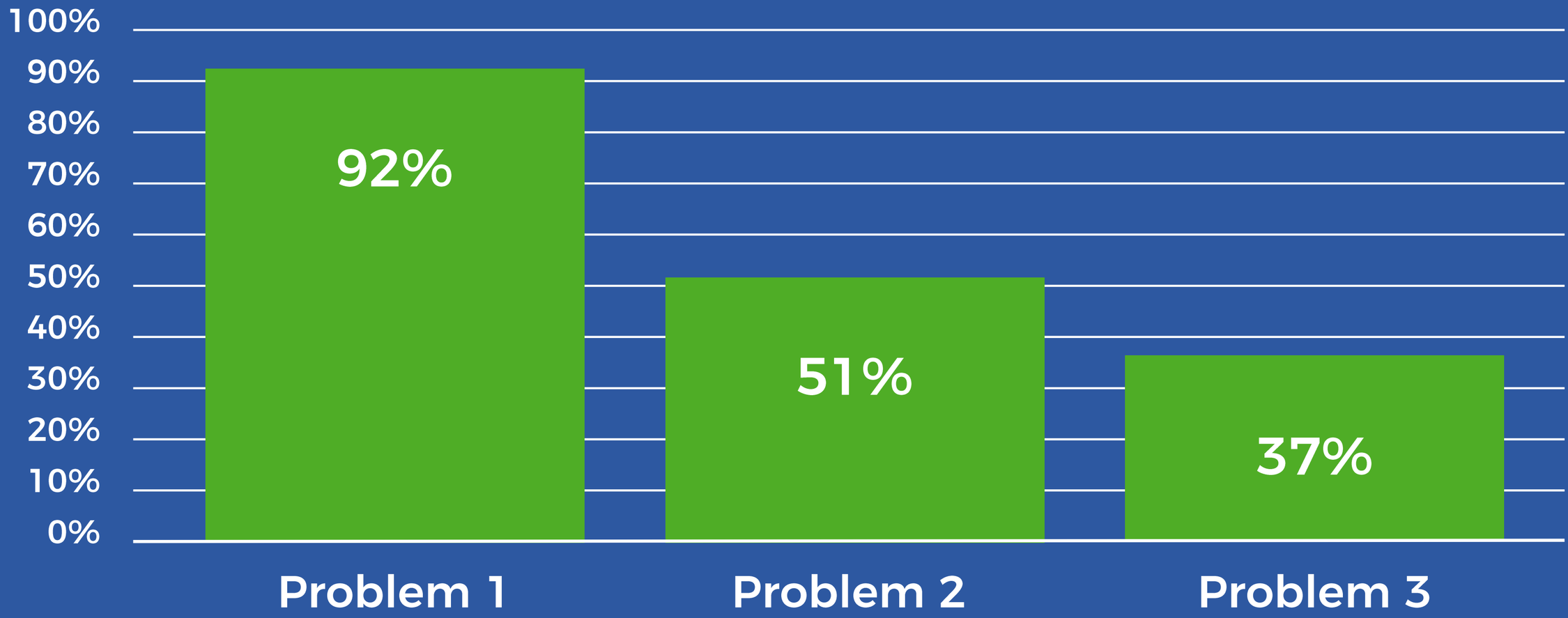
Robert Kaplinsky
@robertkaplinsky

MS & HS #MTBoS Ts, please ask your Ss these 3 ?s and put the % who answered correctly here: docs.google.com/forms/d/e/1FAI …. Answers at top of form.



RETWEETS 36 LIKES 54

PROBLEM RESULTS

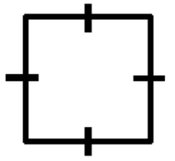


Depth of Knowledge Matrix - Secondary Math

Topic	Dividing Fractions	Solving Two-Step Equations	Exponents	Solving Equations with Variables on Both Sides
CCSS Standard(s)	• 6.NS.1	• 7.EE.4a	• 8.EE.1	• 8.EE.8 • A-REI.3
DOK 1 Example	Evaluate. $\frac{4}{9} \div \frac{2}{5}$	Solve for x. $2x + 3 = 9$	Evaluate. 3^4	Solve for x. $3x + 2 = -2x + 4$
DOK 2 Example	Use the digits 1 to 9, at most one time each, to fill in the boxes to make two different pairs of fractions that have a quotient of 2/3. $\frac{\square}{\square} \div \frac{\square}{\square} = \frac{2}{3}$	Use the digits 1 to 9, at most one time each, to create two equations: one where x has a positive value and one where x has a negative value. $\square x + \square = \square$	Use the digits 1 to 9, at most one time each, to fill in the boxes to make two true number sentences. $\square^{\square} = 64$	Use the digits 1 to 9, at most <u>two</u> times each, to fill in the boxes to make an equation with no solutions. $\square x + \square = \square x + \square$
DOK 3 Example	Use the digits 1 to 9, at most one time each, to fill in the boxes to make two fractions that have a quotient that is as close to 4/11 as possible. $\frac{\square}{\square} \div \frac{\square}{\square}$	Use the digits 1 to 9, at most one time each, to create an equation where x has the greatest possible value. $\square x + \square = \square$	Use the digits 1 to 9, at most one time each, to fill in the boxes to make a result that has the greatest value possible. $\square^{\square} = \square\square\square$	Use the digits 1 to 9, at most one time each, to fill in the boxes so that the solution is closest to zero. $\square x + \square = \square x + \square$

Version 1.5

Depth of Knowledge Matrix - Secondary Math

Topic	Geometric Proofs	Complex Numbers	Trigonometric Functions	Definite Integral
CCSS Standard(s)	• G-CO.11	• N-CN.2	• F-TF.3	• N/A
DOK 1 Example	Add one geometric marking to demonstrate the quadrilateral is a square. 	Multiply the binomials. $(3+4i)(2+3i)$	Evaluate. $\sin\frac{\pi}{3}$	Solve. $\int_2^6 x^3\,dx$
DOK 2 Example	Use exactly 5 geometric markings to show that a quadrilateral is a square.	Use the integers -9 to 9, at most one time each, to fill in the boxes twice: once to make a positive real number product and once to make a negative real number product. $(\square+\square i)(\square+\square i)$	Use the digits 1 to 9, at most one time each, to fill in the boxes and make two true number sentences. $\sin\frac{\square\pi}{\square}=0$	Use the digits 1 to 9, at most one time each, to fill in the boxes and make a positive and a negative solution. $\int_{\square}^{\square} x^{\square}\,dx$
DOK 3 Example	What is the least number of geometric markings needed to demonstrate that a quadrilateral is a square?	Use the integers -9 to 9, at most one time each, to fill in the boxes and make a real number product with the greatest value. $(\square+\square i)(\square+\square i)$	Use the digits 1 to 9, at most one time each, so that the function has the greatest possible value. $\sin\frac{\square\pi}{\square}=\frac{\sqrt{\square}}{\square}$	Use the digits 1 to 9, at most one time each, to fill in the boxes and make a solution that is as close to 100 as possible. $\int_{\square}^{\square} x^{\square}\,dx$

DOK ONE

6. $9 + a = 46$

DOK TWO

11. Anton walked 8.9 miles of his 13.5-mile goal for this week. Use the equation $m + 8.9 = 13.5$ to find which path Anton should walk so that he meets his goal for the week.

Path Lengths	
Meadow Path	3.2 miles
Circle Path	4.2 miles
Oak Tree Path	4.6 miles

DOK THREE

14. Reasoning Kyle bought a movie ticket for $8.45 and a drink for $1.80. He had just enough money remaining to buy a large popcorn. How much money did Kyle start with? Write an equation to show your reasoning. © MP.2

Cost of Popcorn	
Small	$2.85
Medium	$3.75
Large	$4.75
Extra Large	$4.85

X-RAY VISION PROBLEMS

- [x] WHY DO WE NEED THEM?
- [x] WHY ARE THEY DIFFERENT?
- [ ] HOW DO YOU IMPLEMENT THEM?
- [ ] HOW DO YOU CREATE YOUR OWN?

IMPLEMENTATION

- Open Middle Worksheet

First attempt: Points: _____/2 attempt _____/2 explanation

What did you learn from this attempt? How will your strategy change on your next attempt?

Name: _____ Period: _____ Date: _____

First attempt: Points: ____/2 attempt ____/2 explanation

What did you learn from this attempt? How will your strategy change on your next attempt?

Second attempt: Points: ____/2 attempt ____/2 explanation

IMPLEMENTATION

- Open Middle Worksheet
- Classwork
  - Single problem for entire class
  - Extensions menu

QUESTION #1

Use the digits 1 to 9, at most one time each, to create an equation where x has the greatest possible value.

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

4 points

QUESTION #2

Solve for x.

$$3x + 7 = 19$$

1 point

QUESTION #3

Use the digits 1 to 9, at most one time each, to create two equations: one where x has a positive value and one where x has a negative value.

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

2 points

QUESTION #4

Use the digits 1 to 9, at most one time each, to make each equation true.

$$\square + a = \square$$

SOLVING EQUATIONS EXTENSION MENU

You must earn <u>at least 12 points</u> by doing the problems of your choice. Circle the questions you

QUESTION #5

Use the digits 1 to 9, at most one time each, to create an equation where x has the greatest possible value.

IMPLEMENTATION

- Open Middle Worksheet
- Classwork
  - Single problem for entire class
  - Extensions menu
- Homework
- Assessments

X-RAY VISION PROBLEMS

- [x] WHY DO WE NEED THEM?
- [x] WHY ARE THEY DIFFERENT?
- [x] HOW DO YOU IMPLEMENT THEM?
- [ ] HOW DO YOU CREATE YOUR OWN?

STEP ONE

- Find a One-Operation Problem
  - Addition
  - Subtraction
  - Multiplying
  - Dividing
  - Exponents (including square root)
  - Trigonometric functions

ADDING 2-DIGIT NUMBERS

Solve.

$$41 + 36 =$$

MULTIPLYING FRACTIONS

Solve.

$$\frac{3}{7} \times \frac{2}{9} =$$

THINKING TIME

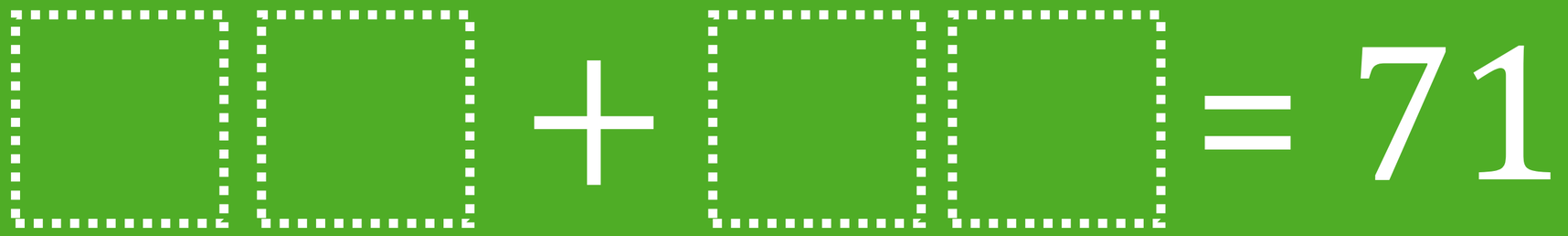
RobertKaplinsky.com

STEP TWO

- Go from DOK 1 to DOK 2
  - Strategically remove some information from the problem to prevent immediate calculation
  - Increase the quantity of solutions needed to increase the need to look for patterns

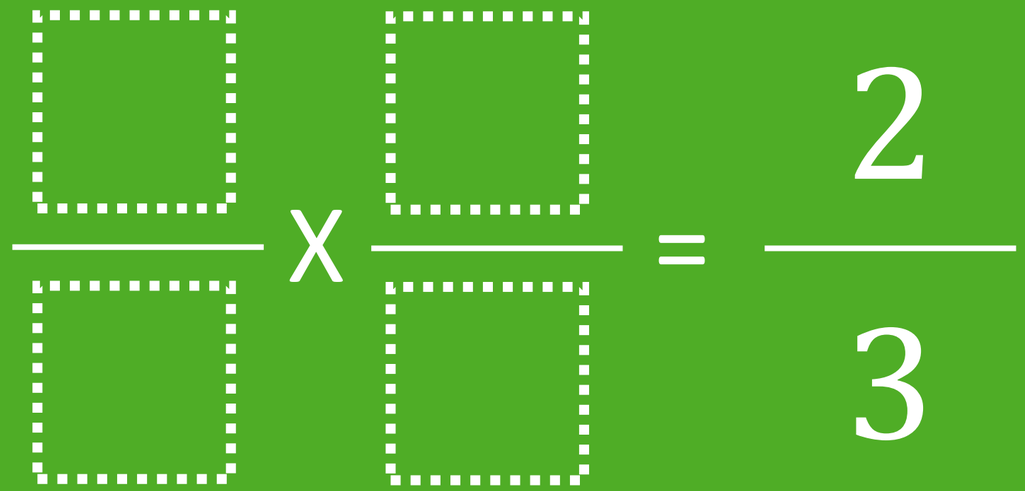
ADDING 2-DIGIT NUMBERS

Using the digits 1 to 9, at most one time each, fill in the boxes to make two different pairs of two-digit numbers that have a sum of 71.



MULTIPLYING FRACTIONS

Using the digits 1 to 9, at most one time each, fill in the boxes to make two different pairs of fractions that have a product of 2/3.



THINKING TIME

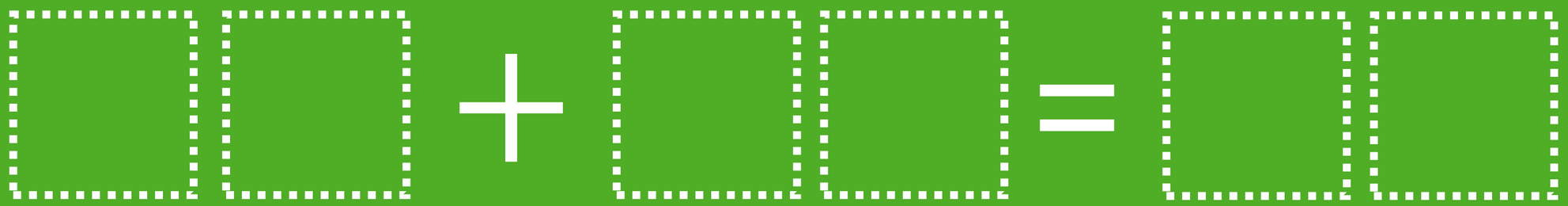
- Go from DOK 1 to DOK 2
  - Strategically remove some information from the problem to prevent immediate calculation
  - Increase the quantity of solutions needed to increase the need to look for patterns

STEP THREE

- Go from DOK 2 to DOK 3
  - Introduce the need to optimize the solution by making the greatest or least product / sum / difference / quotient / answer.
  - Another optimization option is make the answer closest to a specific value.

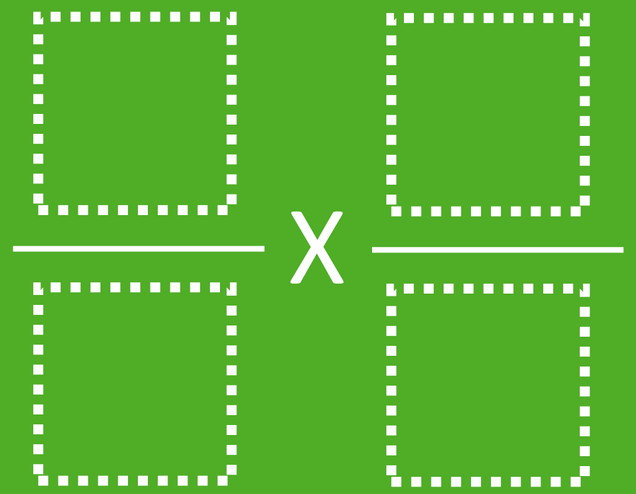
ADDING 2-DIGIT NUMBERS

Using the digits 1 to 9, at most one time each, fill in the boxes to make the smallest sum.



MULTIPLYING FRACTIONS

Using the digits 1 to 9, at most one time each, fill in the boxes to make two fractions that have a product that is as close to 4/11 as possible.



THINKING TIME

- Go from DOK 2 to DOK 3
  - Introduce the need to optimize the solution by making the greatest or least product / sum / difference / quotient / answer.
  - Another optimization option is make the answer closest to a specific value.

3 Steps to Increase Math DOK Levels

Step 1: Find a One-Operation Problem

- Procedural problems with one operation are easiest to modify.
- Other problems may also be modified but may not be as easy.

Adding 2-Digit Numbers
Solve.

$41 + 36 = \_\_\_$

Multiplying Fractions
Solve.

$\frac{3}{7} \times \frac{2}{9} = \_\_\_$

Trigonometry
Solve.

$\sin \frac{\pi}{3} = \_\_\_$

Step 2: Go from DOK 1 to DOK 2

- Strategically remove some information from the problem to prevent immediate calculation
- Increase the quantity of solutions needed to increase the need to look for patterns

Adding 2-Digit Numbers
Using the digits 1 to 9, at most one time each, fill in the boxes

Multiplying Fractions
Using the digits 1 to 9, at most one time each, fill in the boxes

Trigonometry
Using the digits 1 to 9, at most one time each, fill in the boxes

X-RAY VISION PROBLEMS

- ☑ WHY DO WE NEED THEM?
- ☑ WHY ARE THEY DIFFERENT?
- ☑ HOW DO YOU IMPLEMENT THEM?
- ☑ HOW DO YOU CREATE YOUR OWN?

Open Middle @openmiddle · Jan 11

Open Middle
@openmiddle

Hey @openmiddle fans, we want to hear from you. Why do you use our problems with your students? Share your success stories or lessons learned.

RETWEETS	LIKES
7	6

2:10 PM - 11 Jan 2017

8 7 6 •••

1 2 •••

DISCUSSION TIME

- How can x-ray vision problems like the kinds on openmiddle.com spot misconceptions that may often go unnoticed?
- How do Open Middle problems build both procedural skills and conceptual understanding?

GOALS

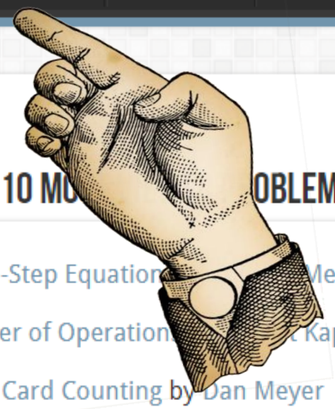
- ☑ WHAT IS INTELLIGENCE?
- ☑ WHY DON'T STUDENTS REMEMBER?
- ☑ WHAT MATHEMATICS IS IMPORTANT?
- ☑ WHAT ABOUT WHAT WE USED TO DO?

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.estimation180.com/lessons.html
- Graham Fletcher (Elementary and Middle School)
  gfletchy.com/3-act-lessons

Open Middle

Challenging math problems worth solving



THE TOP 10 MO OBLEMS OF 2016

1. Two-Step Equation Mendivil, Daniel Luevanos, and Robert Kaplinsky
2. Order of Operation Kaplinsky with answer from Michael Fenton and his students
3. Dot Card Counting by Dan Meyer
4. Rational and Irrational Numbers by Bryan Anderson
5. One Solution, No Solutions, Infinite Solutions by Bryan Anderson
6. Multiplying a Two-Digit Number by a Single-Digit Number by Robert Kaplinsky
7. Exponents and Order of Operations by Zack Miller
8. Converting Between Fractions and Decimals by Robert Kaplinsky
9. Interpretting Percentages by Robert Kaplinsky
10. Two-Step Equations 3 by Erick Lee

WHAT ARE PEOPLE SAYING ABOUT OPEN MIDDLE?

Search

OPEN MIDDLE WORKSHEET

Download the Open Middle Worksheet (Regular): Version 1.2

Download the Open Middle Worksheet (Large): Version 1.1

BROWSE BY DEPTH OF KNOWLEDGE LEVEL

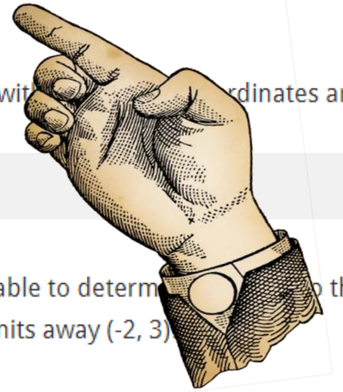
DOK 2: Skills and Concepts

DOK 3: Strategic Thinking

BROWSE BY COMMON CORE STATE STANDARDS

- Kindergarten (10)
  - Counting & Cardinality (2)
  - Geometry (2)
  - Number & Operations in Base Ten (1)
  - Operations & Algebraic Thinking (5)

EQUIDISTANT POINTS



Directions: How many points wit[illegible]rdinates are 5 units away from (-2, 3)?

Hint

Which methods are available to determ[illegible]o this problem? What shape is defined by *all* of the points that are 5 units away (-2, 3)

Answer

12 points: (-5, 7), (-7, 3), (-5, -1), (-2, -2), (3, 3), (1, -1), (-2, 8), (1, 7), (2,6), (-6, -6), (-6, 0), and (2, 0)

Source: Dylan Kane

Search

OPEN MIDDLE WORKSHEET

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Download the Open Middle Worksheet (Large): Version 1.1

BROWSE BY DEPTH OF KNOWLEDGE LEVEL

DOK 2: Skills and Concepts

DOK 3: Strategic Thinking

BROWSE BY COMMON CORE STATE STANDARDS

- Kindergarten (10)
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Robert Kaplinsky

Home

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.

Search

Type and hit enter ...

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Do you like the ideas you're reading? If so, you'll love having the best ones sent to you via email!

Enter your information below and I'll send you a short email each Tuesday about an idea you can use with your students right away.

If you live in the United States, enter your zip code and I'll use it to let you know about events near you.

First Name

Lessons

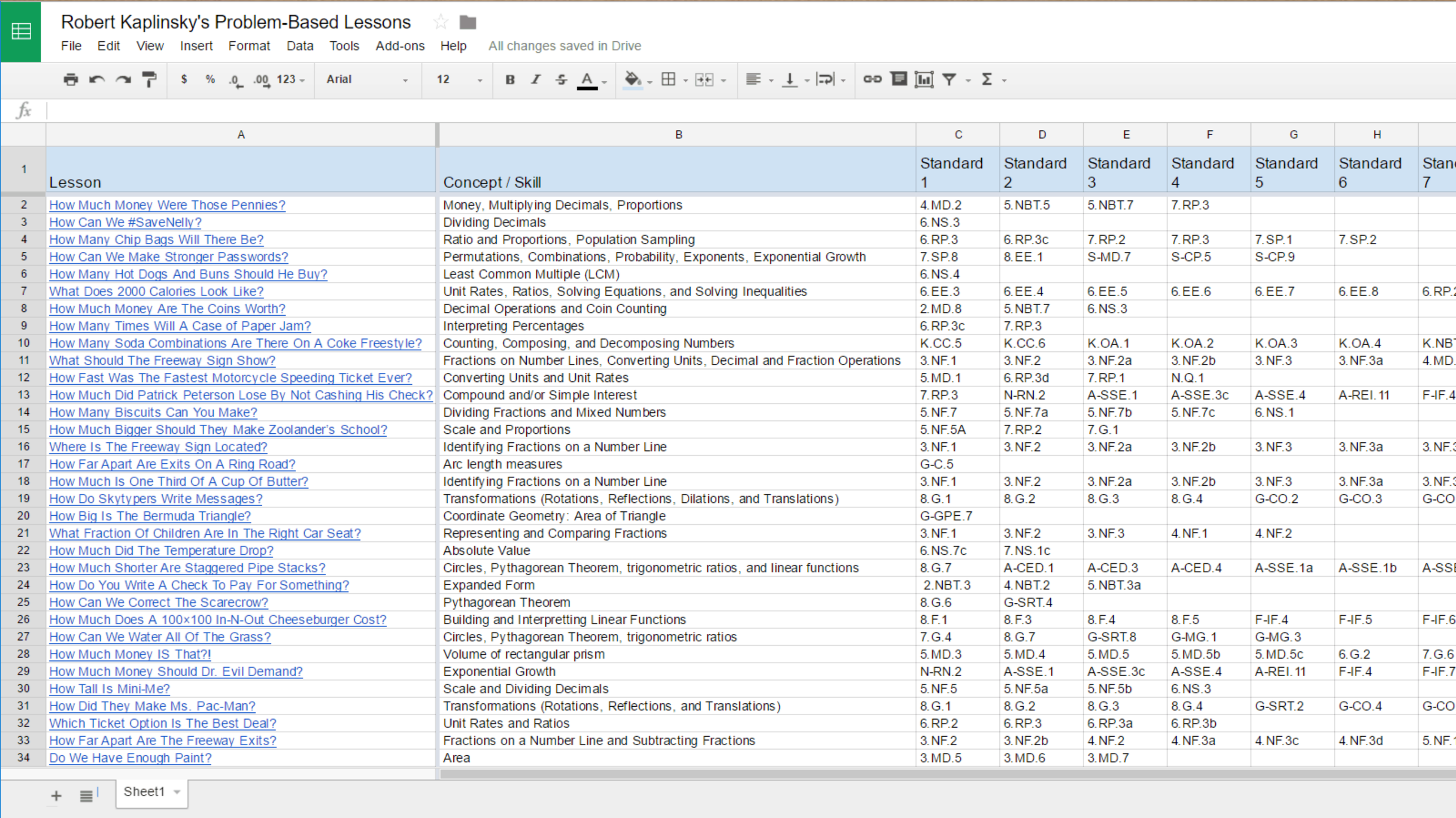
View all | Kinder | 1st | 2nd | 3rd | 4th | 5th | 6th | 7th | 8th | Alg 1 | Geo | Alg 2

How Much Money Were Those Pennies?

How Can We #SaveNelly?

How Many Chip Bags Will There Be?

How Can We Make Stronger Passwords?



Robert Kaplinsky's Problem-Based Lessons

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

Arial 12

	A	B	C	D	E	F	G	H	
1	Lesson	Concept / Skill	Standard 1	Standard 2	Standard 3	Standard 4	Standard 5	Standard 6	Stan 7
2	How Much Money Were Those Pennies?	Money, Multiplying Decimals, Proportions	4.MD.2	5.NBT.5	5.NBT.7	7.RP.3			
3	How Can We #SaveNelly?	Dividing Decimals	6.NS.3						
4	How Many Chip Bags Will There Be?	Ratio and Proportions, Population Sampling	6.RP.3	6.RP.3c	7.RP.2	7.RP.3	7.SP.1	7.SP.2	
5	How Can We Make Stronger Passwords?	Permutations, Combinations, Probability, Exponents, Exponential Growth	7.SP.8	8.EE.1	S-MD.7	S-CP.5	S-CP.9		
6	How Many Hot Dogs And Buns Should He Buy?	Least Common Multiple (LCM)	6.NS.4						
7	What Does 2000 Calories Look Like?	Unit Rates, Ratios, Solving Equations, and Solving Inequalities	6.EE.3	6.EE.4	6.EE.5	6.EE.6	6.EE.7	6.EE.8	6.RP.2
8	How Much Money Are The Coins Worth?	Decimal Operations and Coin Counting	2.MD.8	5.NBT.7	6.NS.3				
9	How Many Times Will A Case of Paper Jam?	Interpreting Percentages	6.RP.3c	7.RP.3					
10	How Many Soda Combinations Are There On A Coke Freestyle?	Counting, Composing, and Decomposing Numbers	K.CC.5	K.CC.6	K.OA.1	K.OA.2	K.OA.3	K.OA.4	K.NBT
11	What Should The Freeway Sign Show?	Fractions on Number Lines, Converting Units, Decimal and Fraction Operations	3.NF.1	3.NF.2	3.NF.2a	3.NF.2b	3.NF.3	3.NF.3a	4.MD.
12	How Fast Was The Fastest Motorcycle Speeding Ticket Ever?	Converting Units and Unit Rates	5.MD.1	6.RP.3d	7.RP.1	N.Q.1			
13	How Much Did Patrick Peterson Lose By Not Cashing His Check?	Compound and/or Simple Interest	7.RP.3	N-RN.2	A-SSE.1	A-SSE.3c	A-SSE.4	A-REI.11	F-IF.4
14	How Many Biscuits Can You Make?	Dividing Fractions and Mixed Numbers	5.NF.7	5.NF.7a	5.NF.7b	5.NF.7c	6.NS.1		
15	How Much Bigger Should They Make Zoolander's School?	Scale and Proportions	5.NF.5A	7.RP.2	7.G.1				
16	Where Is The Freeway Sign Located?	Identifying Fractions on a Number Line	3.NF.1	3.NF.2	3.NF.2a	3.NF.2b	3.NF.3	3.NF.3a	3.NF.3
17	How Far Apart Are Exits On A Ring Road?	Arc length measures	G-C.5						
18	How Much Is One Third Of A Cup Of Butter?	Identifying Fractions on a Number Line	3.NF.1	3.NF.2	3.NF.2a	3.NF.2b	3.NF.3	3.NF.3a	3.NF.3
19	How Do Skytypers Write Messages?	Transformations (Rotations, Reflections, Dilations, and Translations)	8.G.1	8.G.2	8.G.3	8.G.4	G-CO.2	G-CO.3	G-CO
20	How Big Is The Bermuda Triangle?	Coordinate Geometry: Area of Triangle	G-GPE.7						
21	What Fraction Of Children Are In The Right Car Seat?	Representing and Comparing Fractions	3.NF.1	3.NF.2	3.NF.3	4.NF.1	4.NF.2		
22	How Much Did The Temperature Drop?	Absolute Value	6.NS.7c	7.NS.1c					
23	How Much Shorter Are Staggered Pipe Stacks?	Circles, Pythagorean Theorem, trigonometric ratios, and linear functions	8.G.7	A-CED.1	A-CED.3	A-CED.4	A-SSE.1a	A-SSE.1b	A-SSE
24	How Do You Write A Check To Pay For Something?	Expanded Form	2.NBT.3	4.NBT.2	5.NBT.3a				
25	How Can We Correct The Scarecrow?	Pythagorean Theorem	8.G.6	G-SRT.4					
26	How Much Does A 100×100 In-N-Out Cheeseburger Cost?	Building and Interpretting Linear Functions	8.F.1	8.F.3	8.F.4	8.F.5	F-IF.4	F-IF.5	F-IF.6
27	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-MG.3		
28	How Much Money IS That?!	Volume of rectangular prism	5.MD.3	5.MD.4	5.MD.5	5.MD.5b	5.MD.5c	6.G.2	7.G.6
29	How Much Money Should Dr. Evil Demand?	Exponential Growth	N-RN.2	A-SSE.1	A-SSE.3c	A-SSE.4	A-REI.11	F-IF.4	F-IF.7
30	How Tall Is Mini-Me?	Scale and Dividing Decimals	5.NF.5	5.NF.5a	5.NF.5b	6.NS.3			
31	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-SRT.2	G-CO.4	G-CO
32	Which Ticket Option Is The Best Deal?	Unit Rates and Ratios	6.RP.2	6.RP.3	6.RP.3a	6.RP.3b			
33	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.NF.3c	4.NF.3d	5.NF.1
34	Do We Have Enough Paint?	Area	3.MD.5	3.MD.6	3.MD.7				

Sheet1

Scary & Dangerous

WHAT DO WE KNOW ABOUT EDUCATION?

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