

THE FOUR STEPS TO CREATE A CLASSROOM WHERE STUDENTS ARE EXCITED TO LEARN MATHEMATICS

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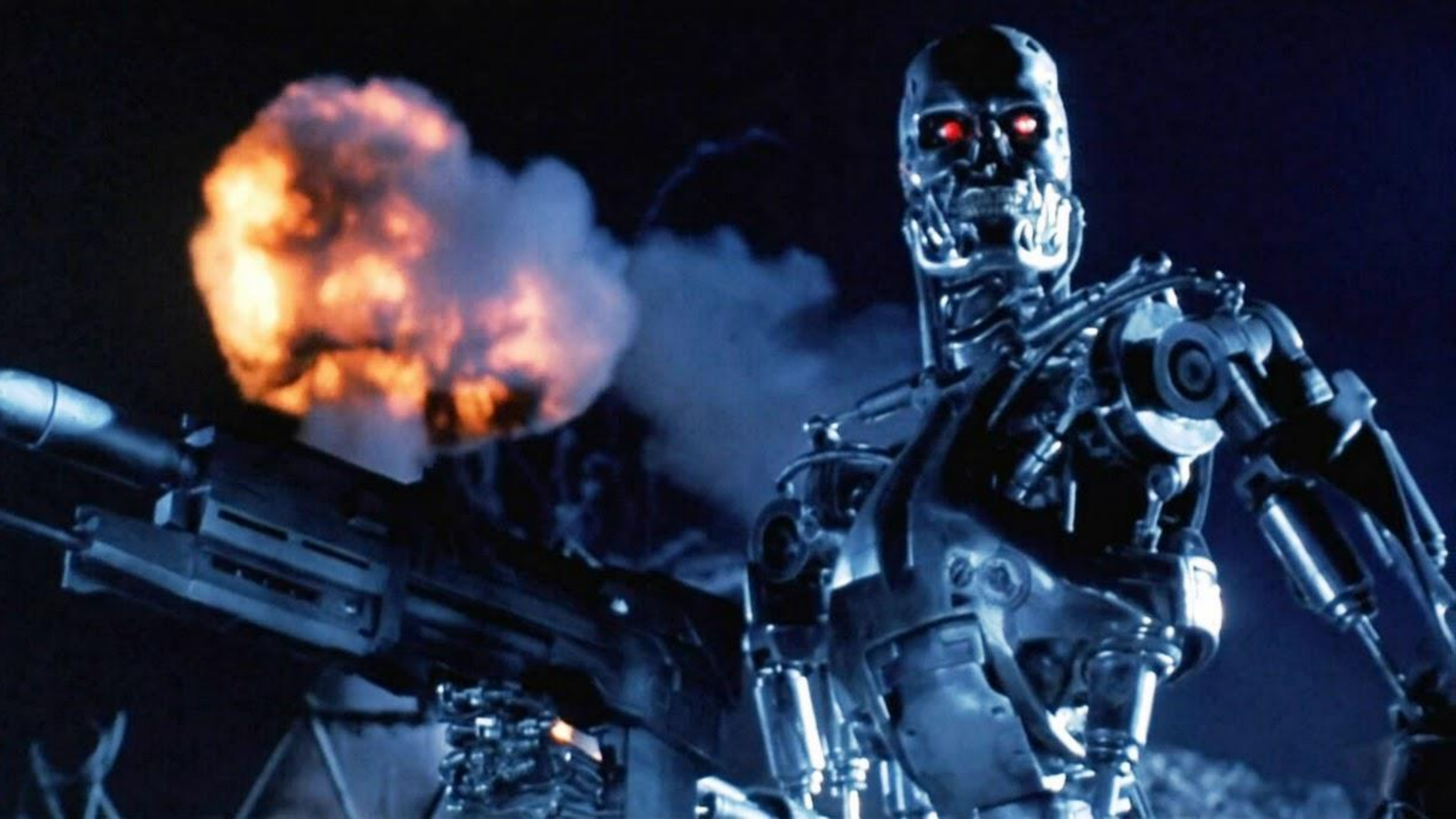




paradigm shift

GOALS

- CORRECT ANSWERS = UNDERSTANDING?**
- MAKE OUR LESSONS UNFORGETTABLE**
- RECONSIDER USING WORD PROBLEMS**
- MAKE MATH CHALLENGING + ACCESSIBLE**





11 a 12 a 13 o i 14 a i 15 o i 16 b 17 f

21 k 22 d 23 v 24 o i 25 m 26 f 27 g

31 f 32 i 33 i o 34 i j 35 k 36 l 37 m

41 w 42 o 43 o 44 g 45 a 46 e 47 f

54 p 55 p 56 p 57 l

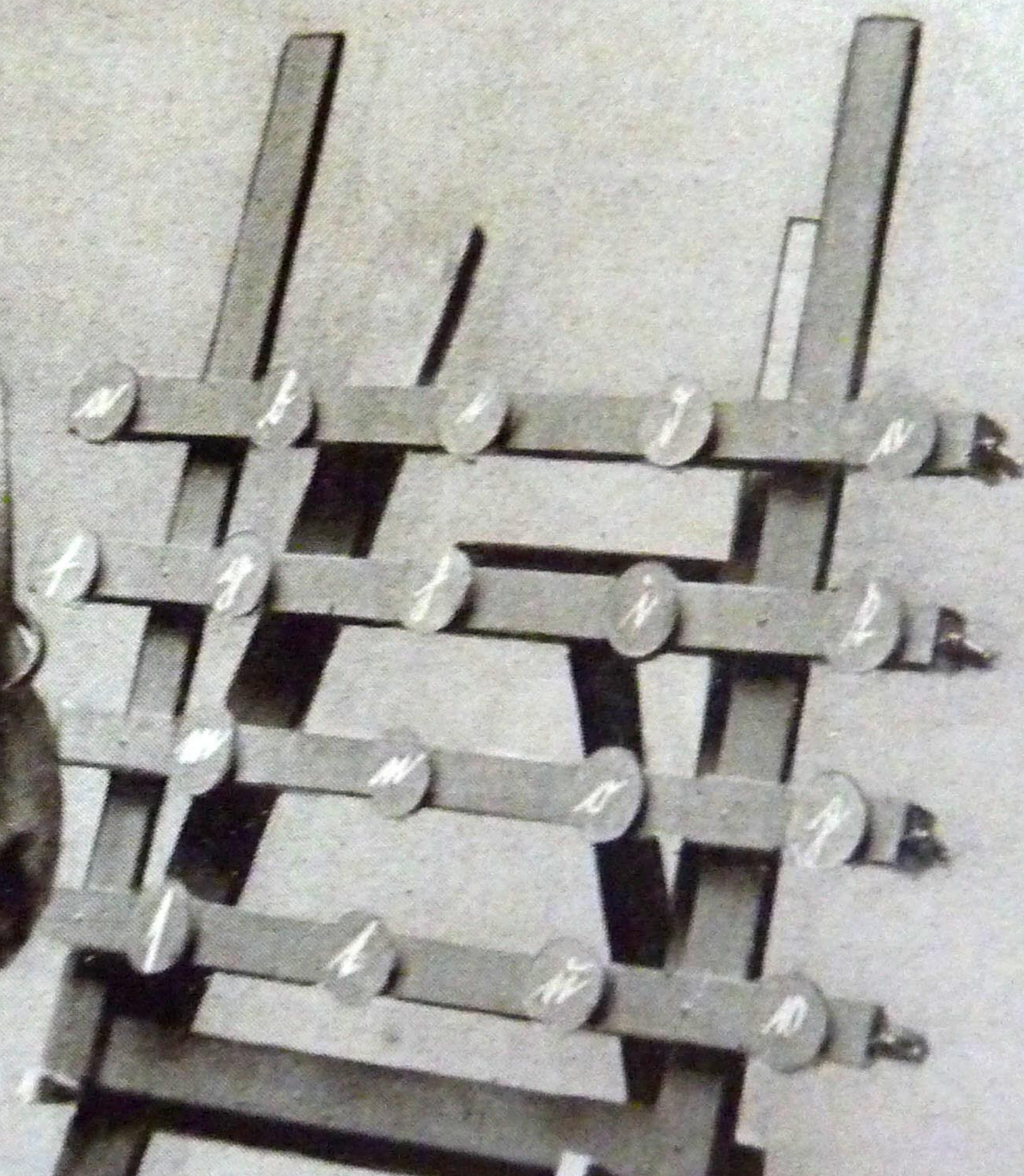
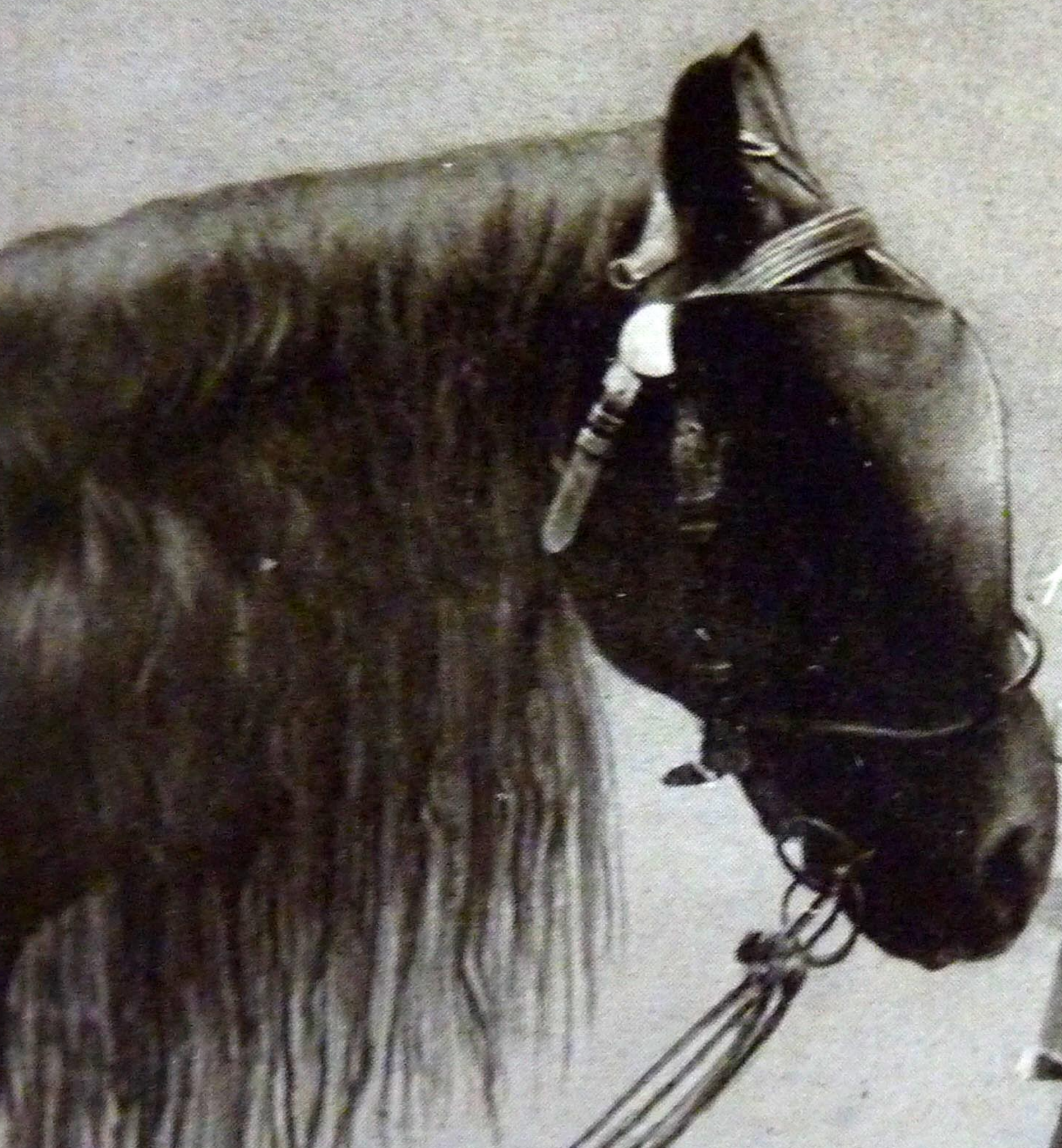
64 o 65 a 66 a 67 g

$$\frac{2}{3} + \frac{3}{4} =$$

$$26743 : 8 =$$

$$712986 \times 3 =$$

Handwritten text on the white saddle cloth, possibly a name or number.





Yes... no... uh...

yes... maybe?

MANY STUDENTS

CHINESE ROOM



见体配字母的常套



见体配字母的常套

DISCUSSION TIME

- How is it possible for students to get correct answers yet not understand what they did?
- How can we tell if the problems we use are Chinese room and horse proof?

GOALS

- CORRECT ANSWERS = UNDERSTANDING?**
- MAKE OUR LESSONS UNFORGETTABLE**
- RECONSIDER USING WORD PROBLEMS**
- MAKE MATH CHALLENGING + ACCESSIBLE**



February 28 · [Profile]



If a thief 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

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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

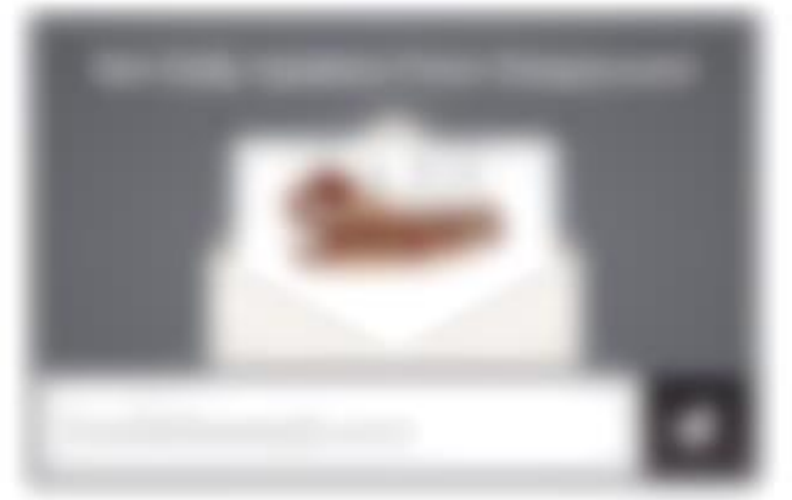


ORIGIN

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:



If a thief forces you to take money out of an ATM, do not argue or resist.





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

7. 6842

2486

2. 3625

5263

8. 7532

2357

3. 9572

2759

9. 1549

9415

4. 8713

3178

13.

14.

8109

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.

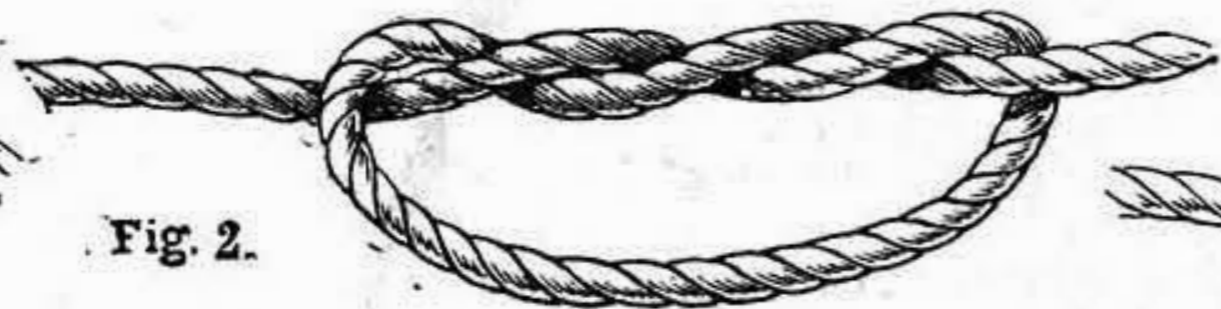


Fig. 2.



Fig. 2a.



Fig. 3.



Fig. 5.



Fig. 4.

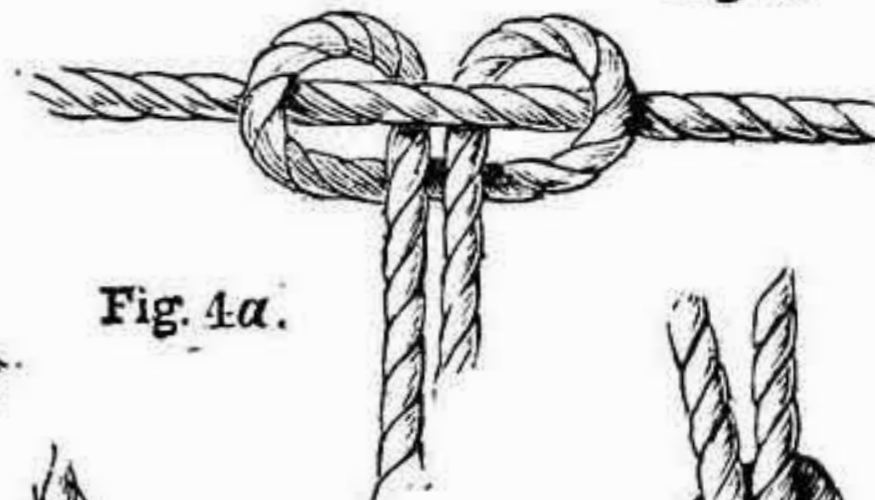


Fig. 4a.



Fig. 14.

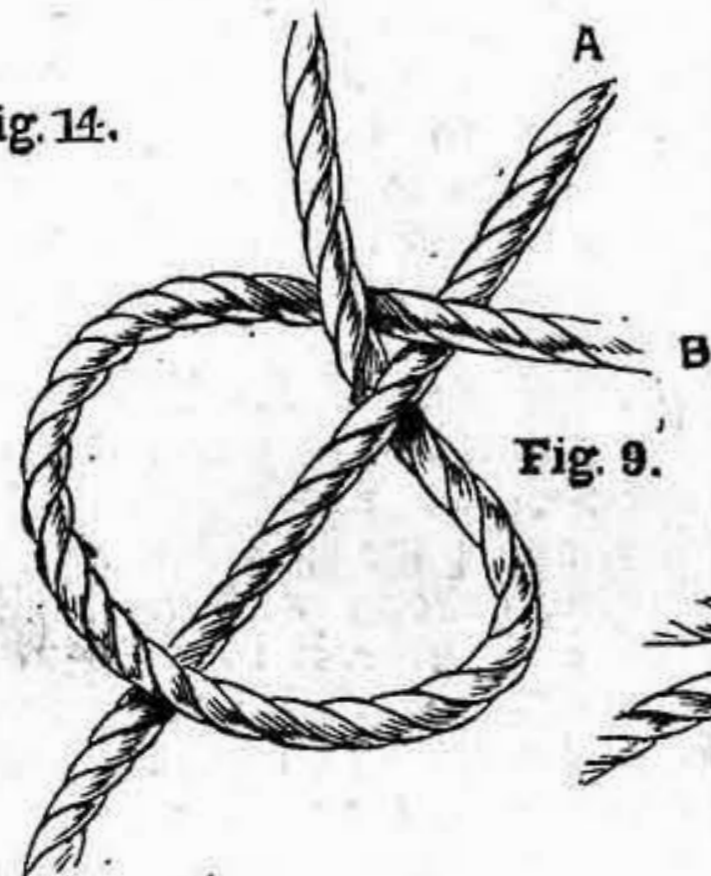


Fig. 9.



Fig. 6.

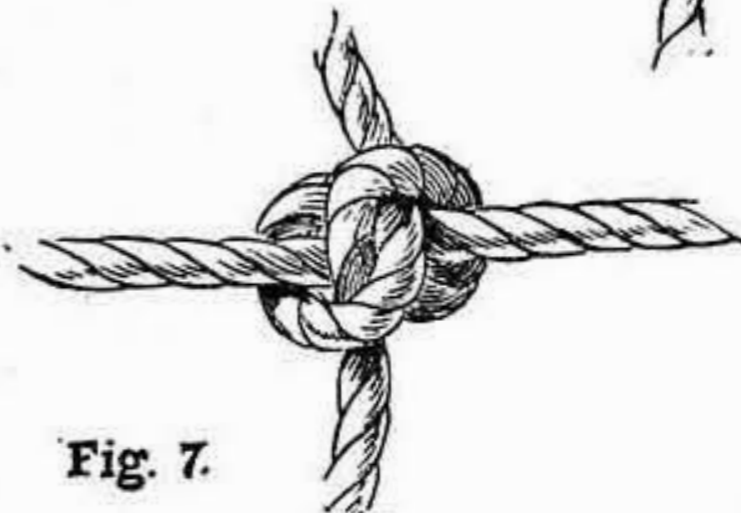


Fig. 7.



Fig. 8.



Fig. 10.




Fig. 11.



Fig. 13.

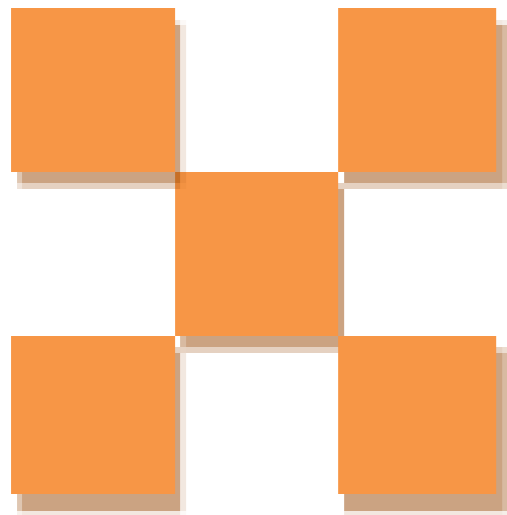


Fig. 12.

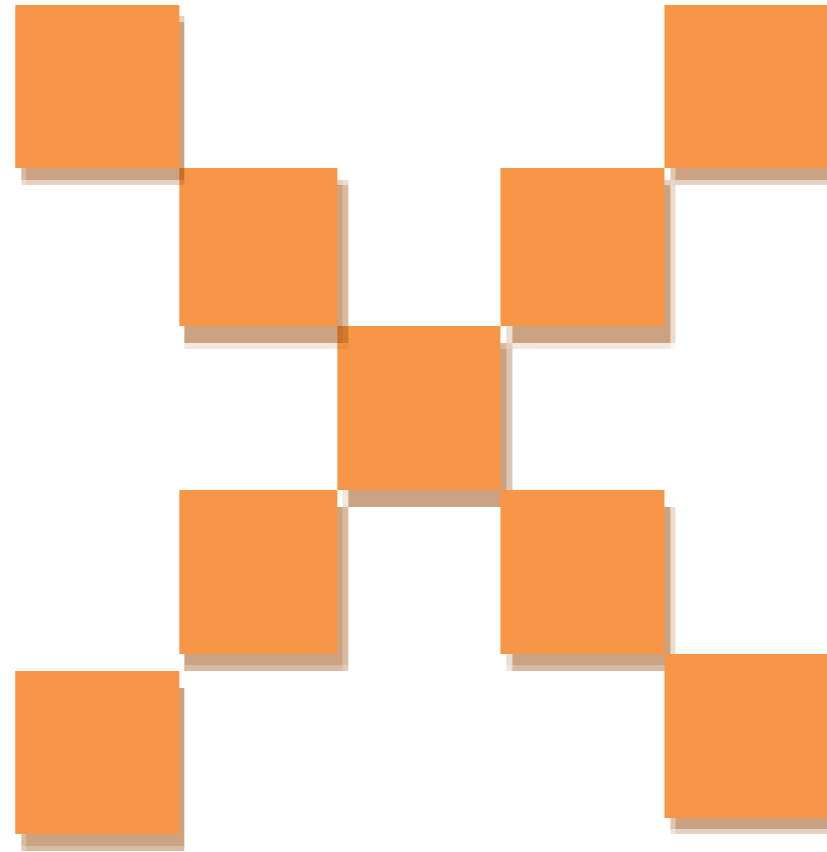


If math is the aspirin,
then how do you
create the headache?

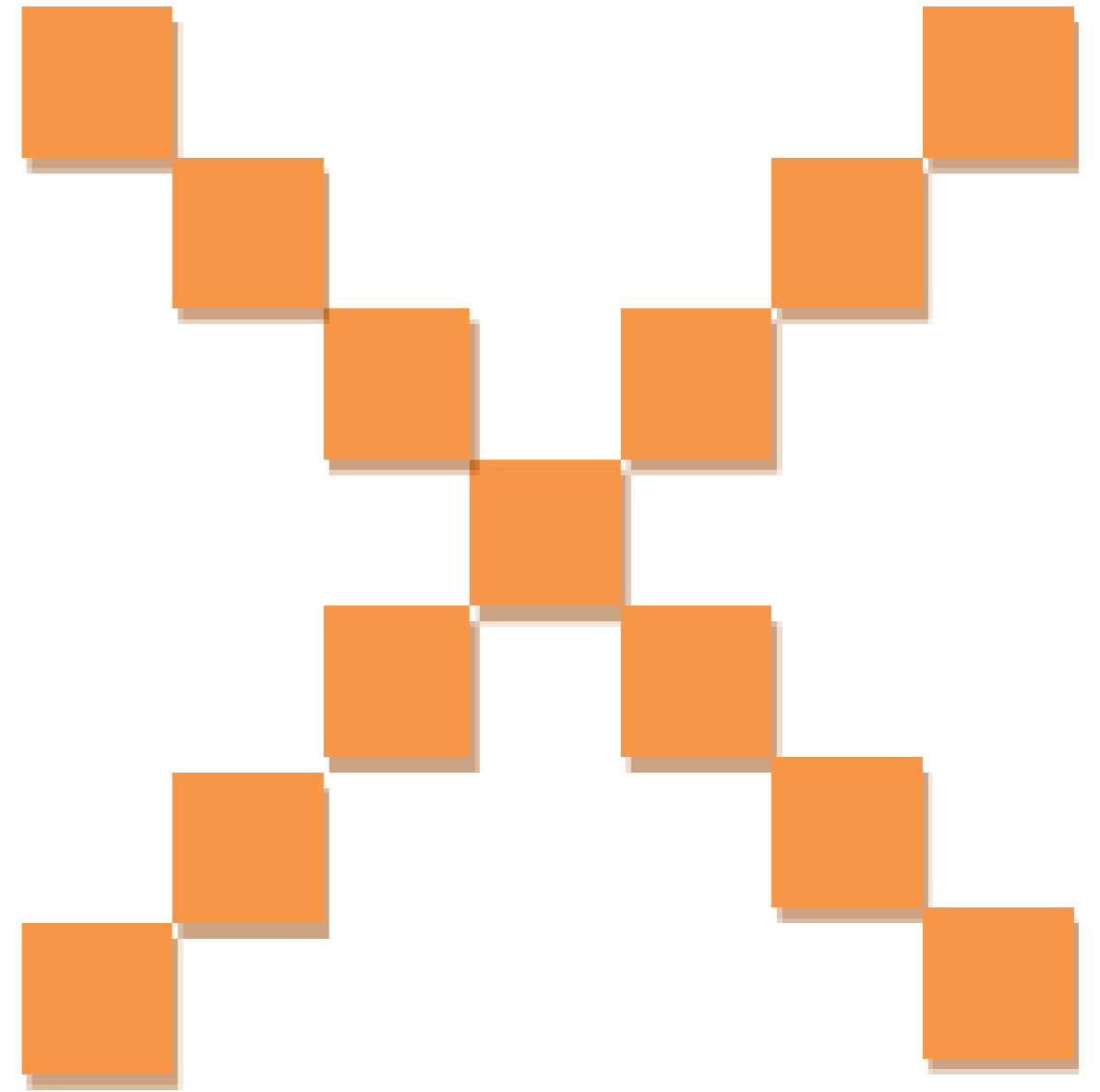
DAN MEYER



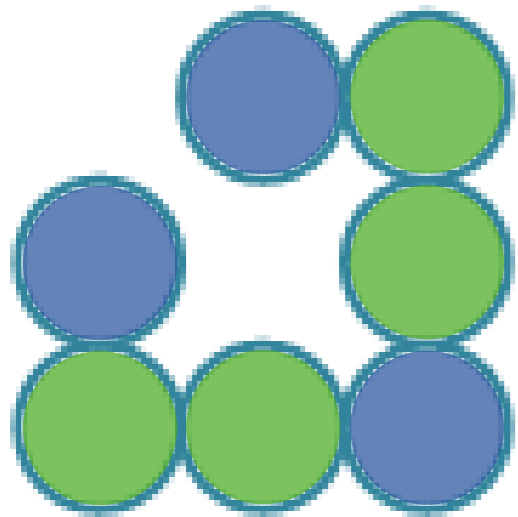
Step 1



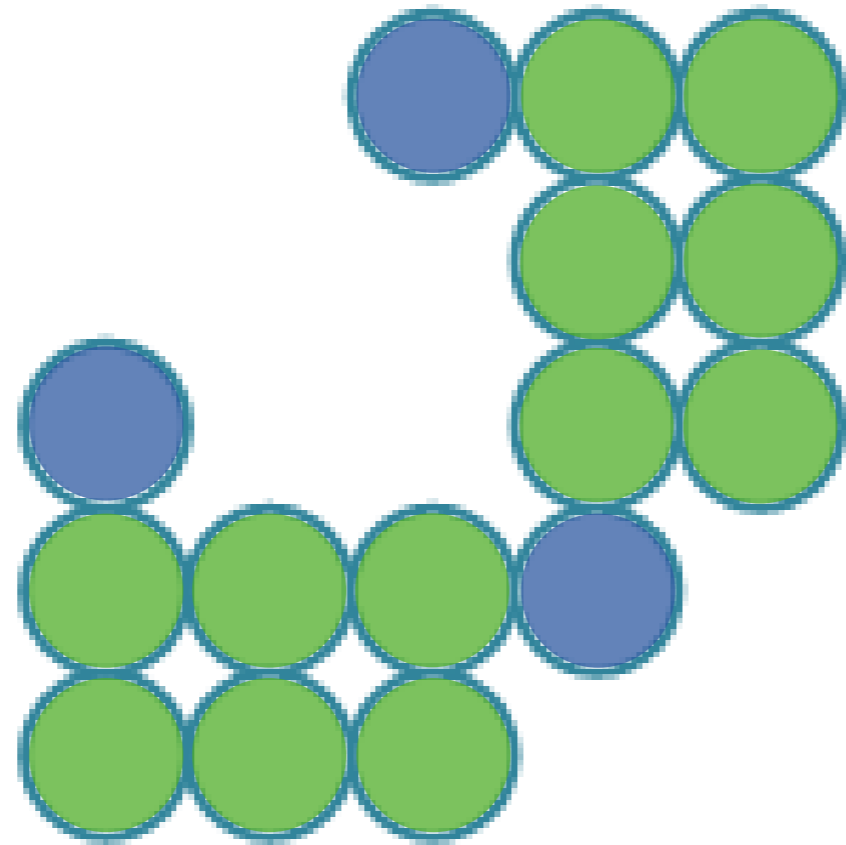
Step 2



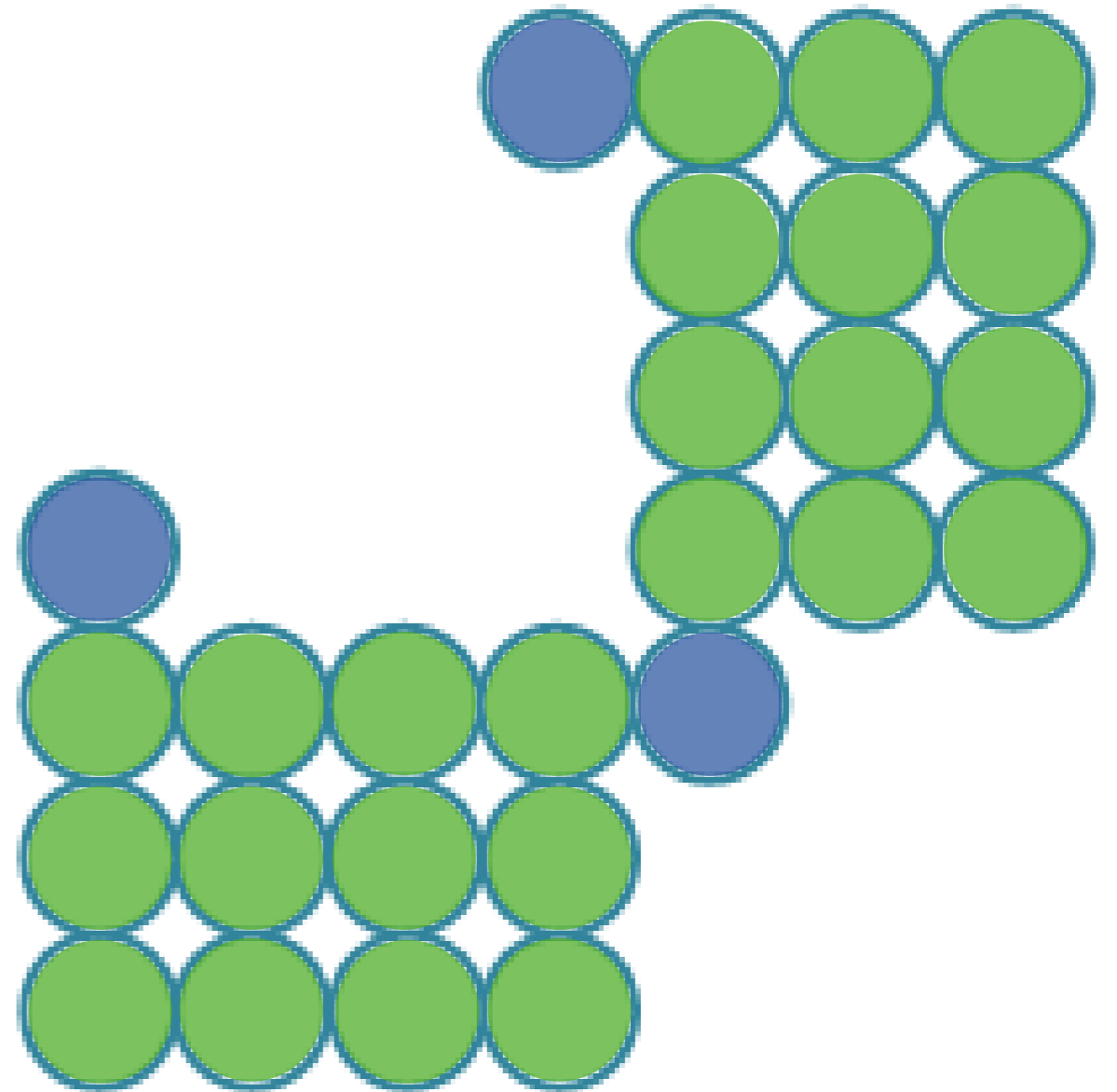
Step 3



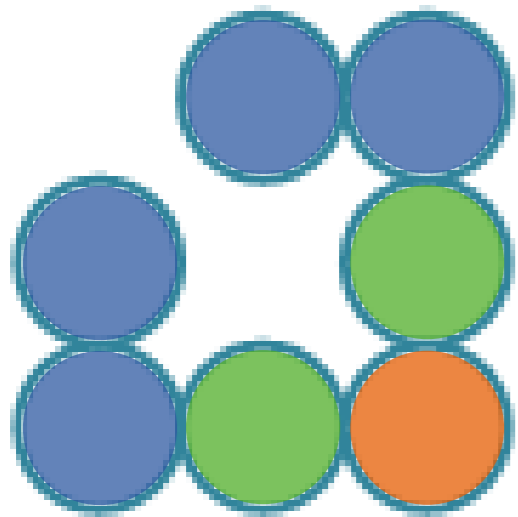
Step 1



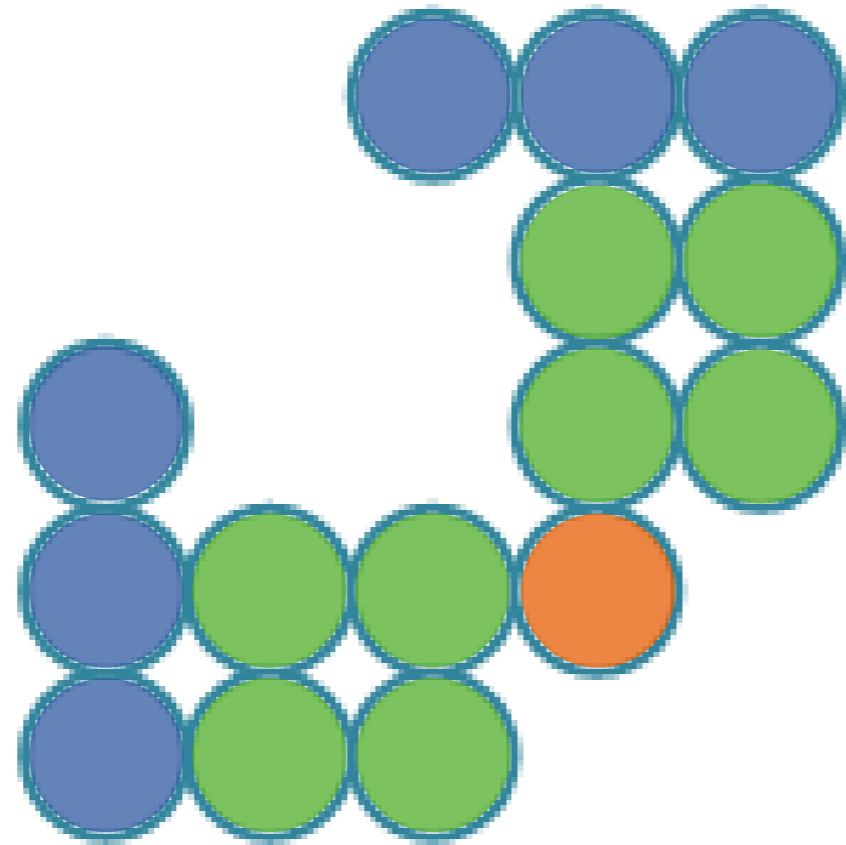
Step 2



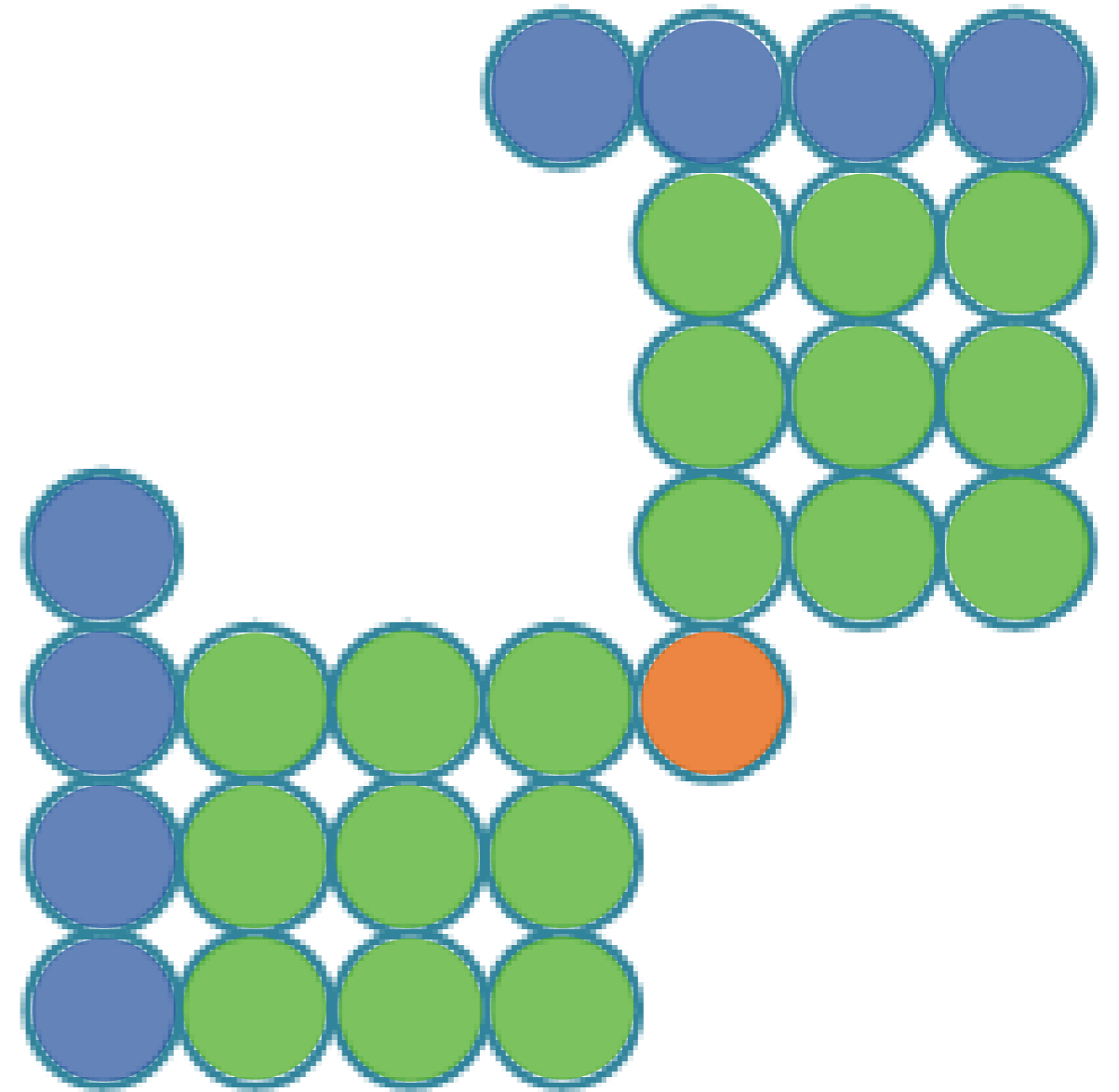
Step 3



Step 1



Step 2



Step 3

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

Next

Skip the practice round.





Questions Asked: 0

Your Partner: fghfgh

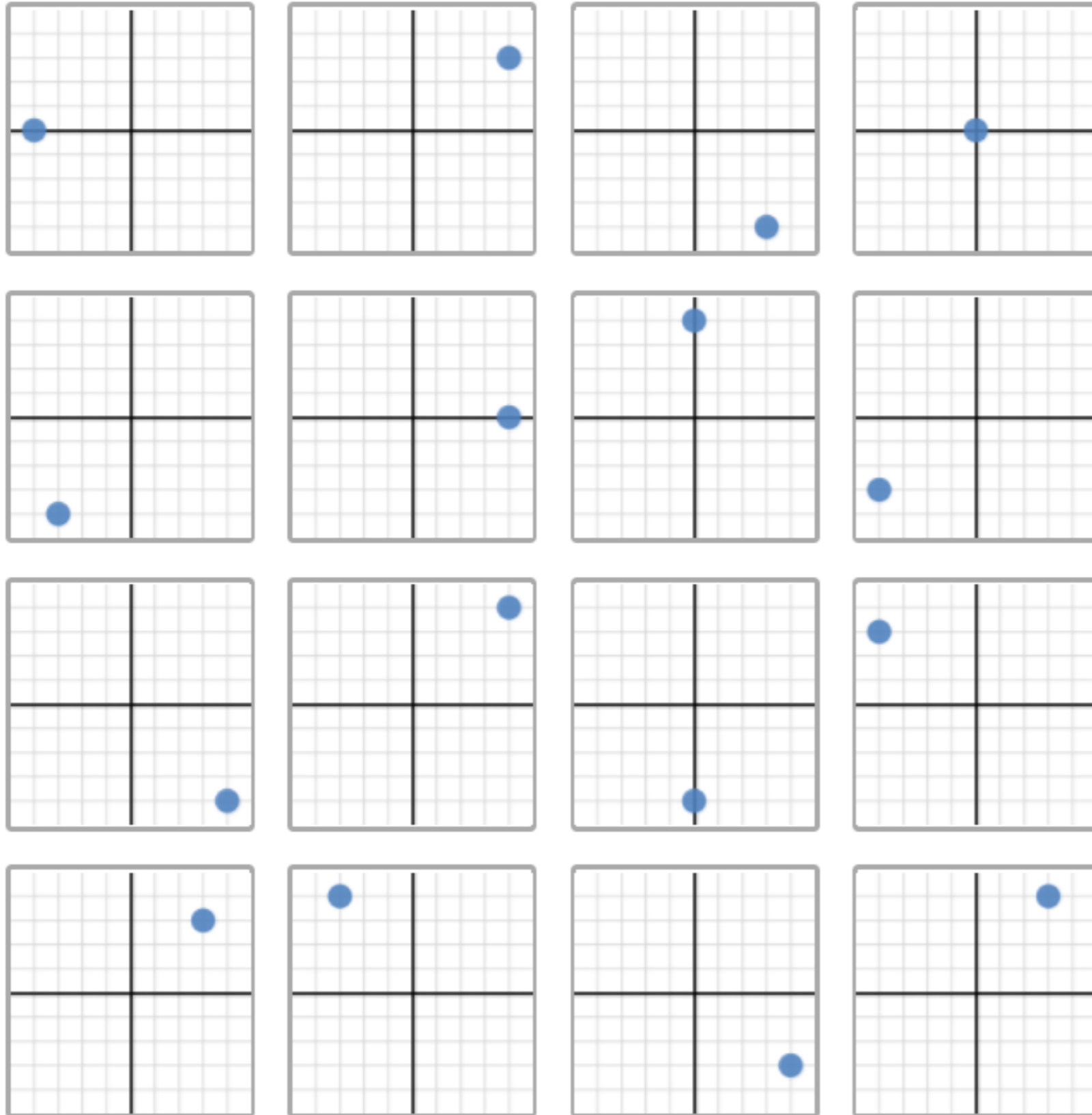
Your challenge: figure out which graph your partner picked. Ask a "yes" or "no" question about the graph.



Send

Questions Asked: 0

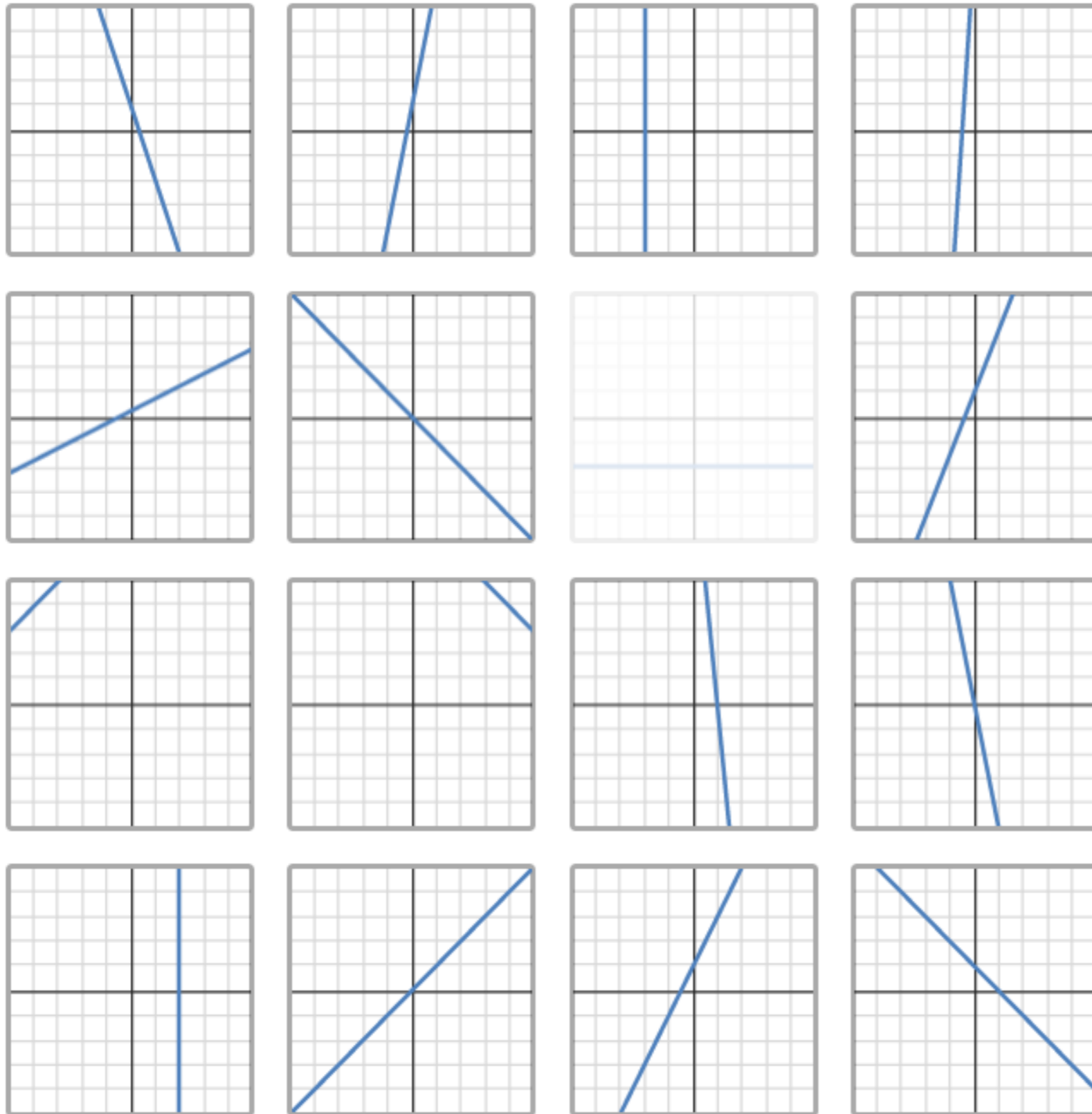
Your Partner: ghjhgj



Your challenge: figure out which graph your partner picked. Ask a "yes" or "no" question about the graph.



Send



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

Questions Asked: 0

Your Partner: Robert Kaplinsky



Your challenge: figure out which graph your partner picked. Ask a "yes" or "no" question about the graph.



Send



Source: robertkaplinsky.com/lessons

100,000,000,000,000,000
400,000,000,000,000,000



Source: robertkaplinsky.com/lessons

STICKY ATTRIBUTES

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



5% Charged

9:02

Friday, July 11

9:06

10% Charged

9:10

14% Charged

9:14

19% Charged

9:18

24% Charged

9:22

28% Charged

9:26

33% Charged

9:30

38% Charged

9:34

42% Charged

THINKING TIME

9:38

47% Charged

9:42

52% Charged

9:46

56% Charged

9:50

61% Charged

9:54

65% Charged

9:58

70% Charged

10:02

74% Charged

10:06

78% Charged

10:10

82% Charged

10:14

84% Charged

10:18

87% Charged

10:22

89% Charged

10:26

90% Charged

10:30

92% Charged

10:34

93% Charged

10:38

94% Charged

10:42

95% Charged

10:46

96% Charged

10:50

97% Charged

10:54

97% Charged

10:58

98% Charged

11:02

98% Charged

11:06

98% Charged

11:10

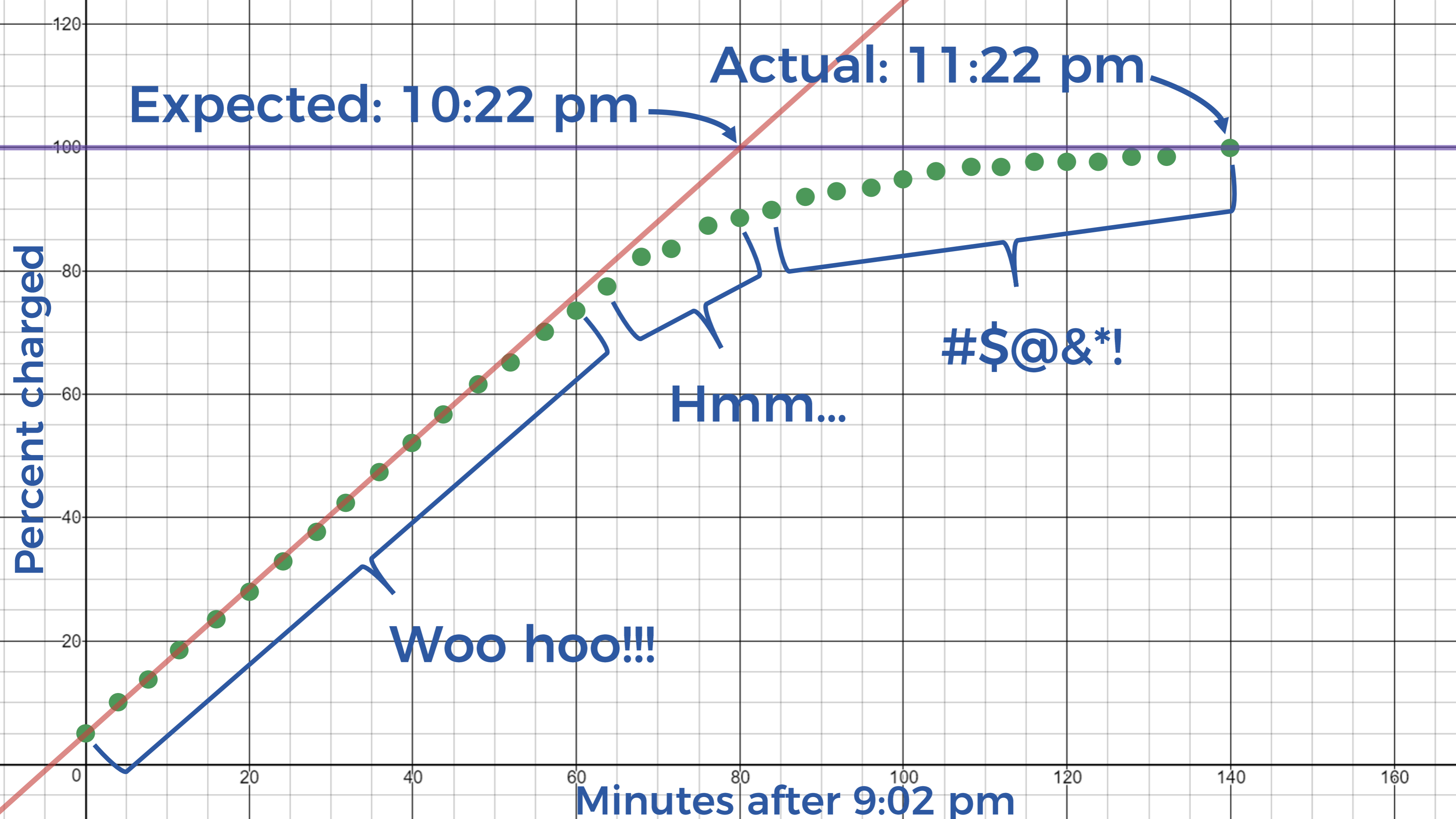
99% Charged

11:14

99% Charged

11:22

100% Charged



Expected: 10:22 pm

Actual: 11:22 pm

Percent charged

Hmm...

#\$@&*!

Woo hoo!!!

Minutes after 9:02 pm

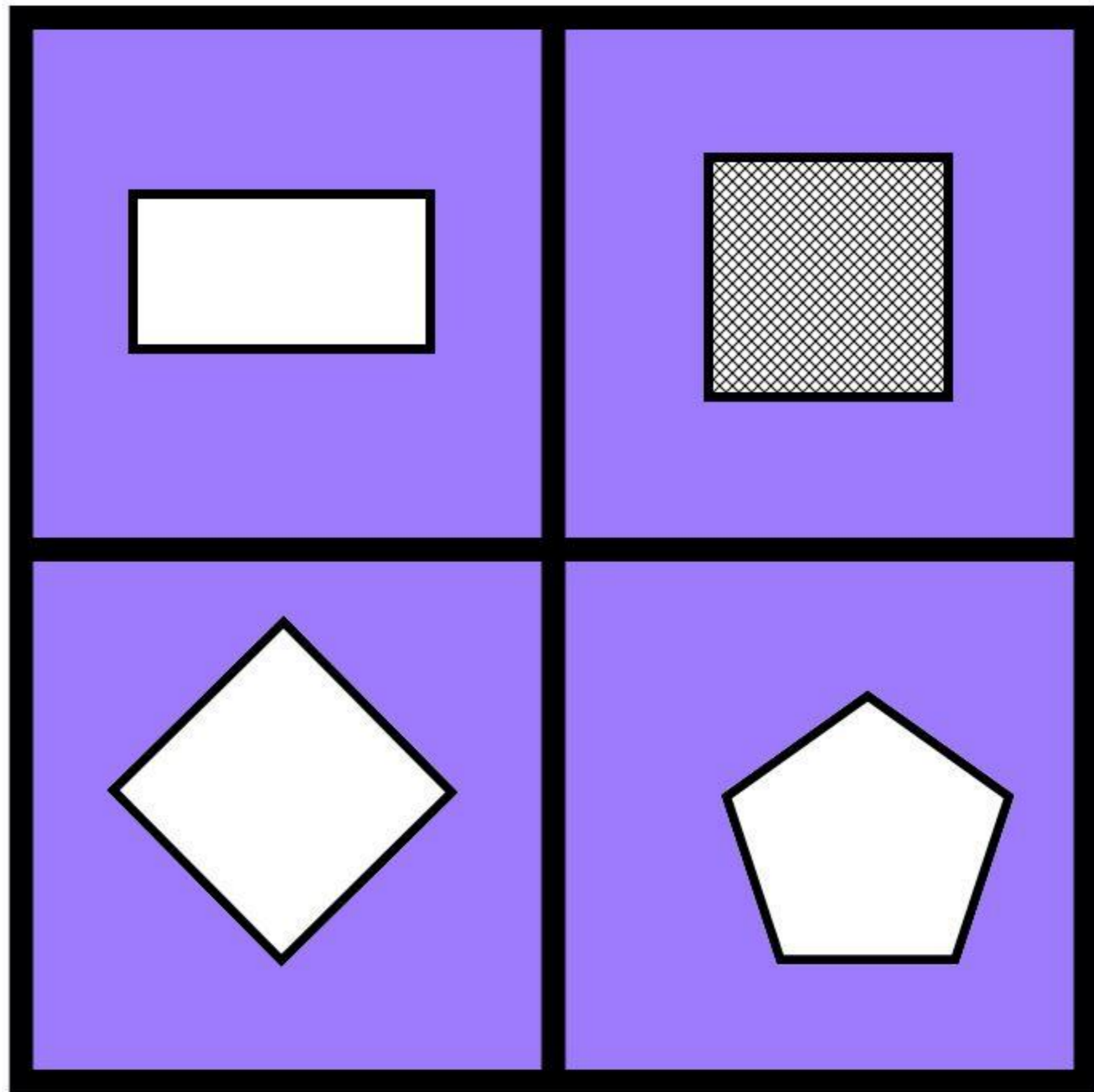
UNEXPECTED

❑ PATTERN BREAKING

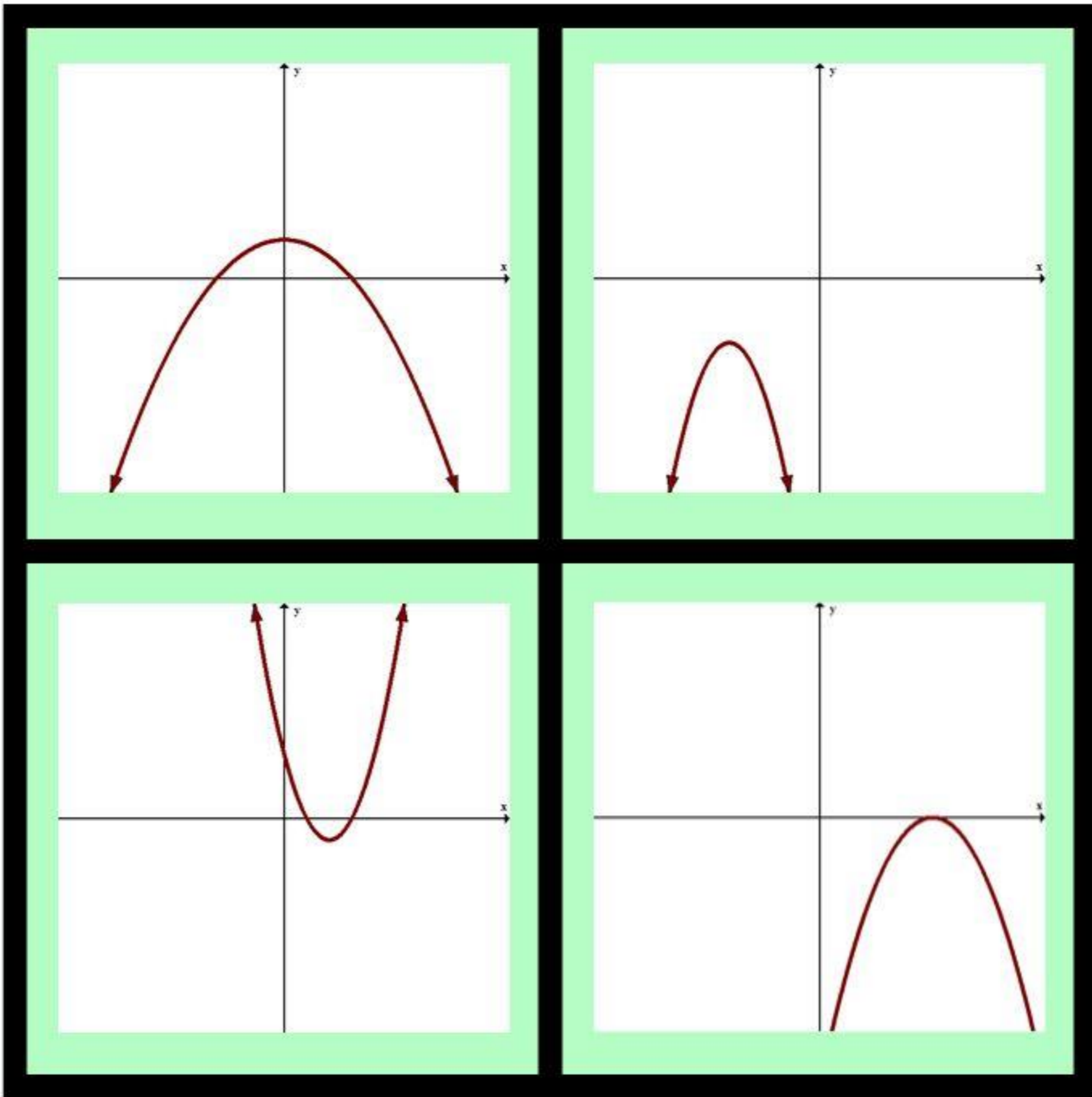
❑ COUNTERINTUITIVE

❑ KNOWLEDGE GAPS

❑ OPEN MIDDLE







UNEXPECTED

PATTERN BREAKING

COUNTERINTUITIVE

KNOWLEDGE GAPS

OPEN MIDDLE

*SURFACE AREA OF A
SPHERE FORMULA
DEMONSTRATION*

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

$$\approx 1$$

$$\frac{1}{2}$$

$$\frac{1}{16}$$

$$\frac{1}{8}$$

$$\frac{1}{32}$$

$$\frac{1}{128}$$

$$\frac{1}{64}$$

$$\frac{1}{4}$$



Source: Kyle Pearce - [youtube.com/watch?v=Yr53Ji4SZDg](https://www.youtube.com/watch?v=Yr53Ji4SZDg)

UNEXPECTED

PATTERN BREAKING

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



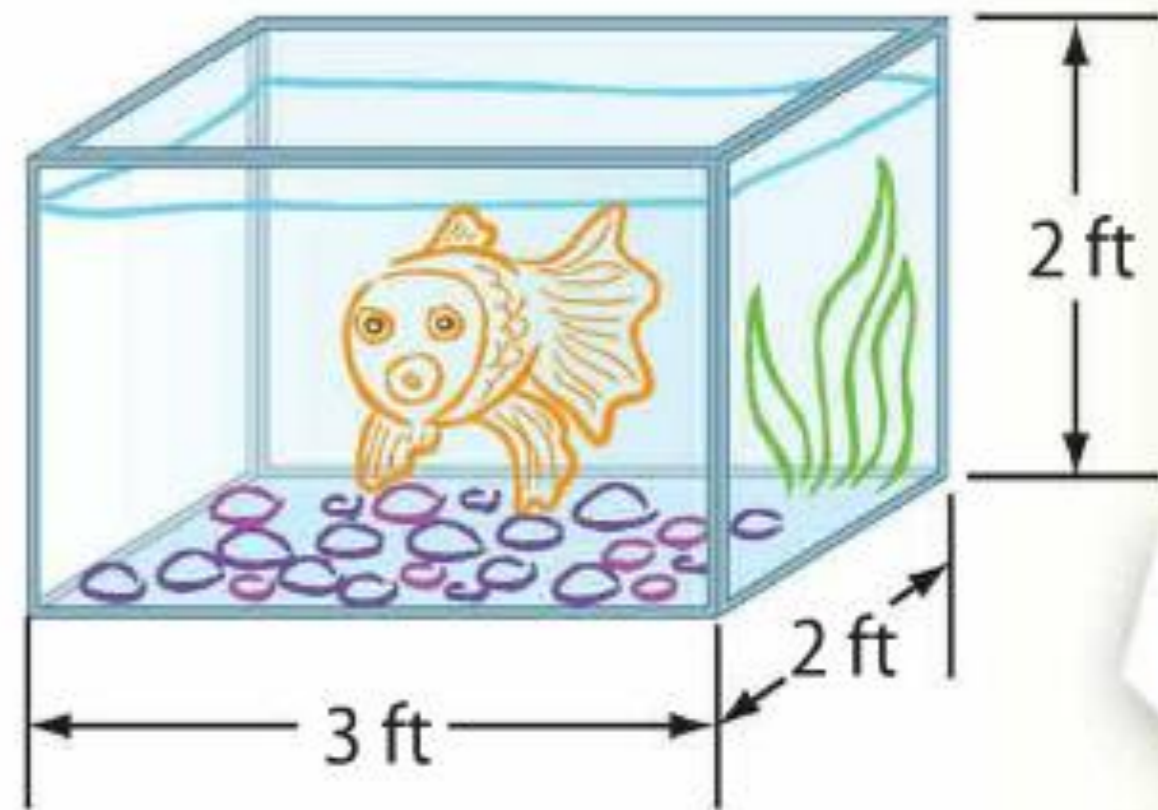
Aquarium The dimensions of an aquarium are shown.

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

2. What is the height of the aquarium? _____

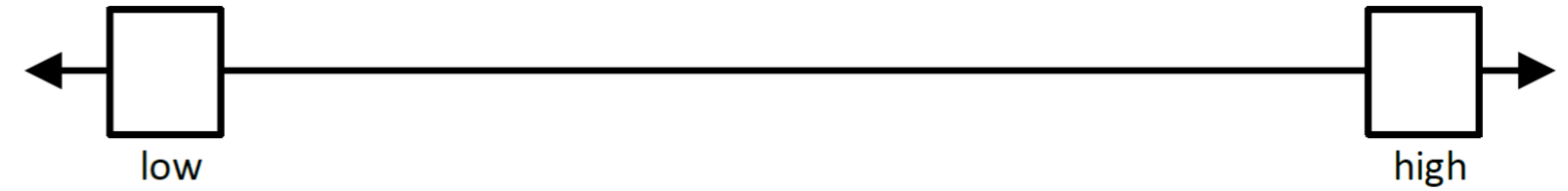
3. Fill in the blanks to find the volume.

$$\underline{\hspace{2cm}} \times \underline{\hspace{2cm}} \times \underline{\hspace{2cm}} = 12 \text{ ft}^3$$



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

PATTERN BREAKING

COUNTERINTUITIVE

KNOWLEDGE GAPS

OPEN MIDDLE





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.

<hr/>	

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

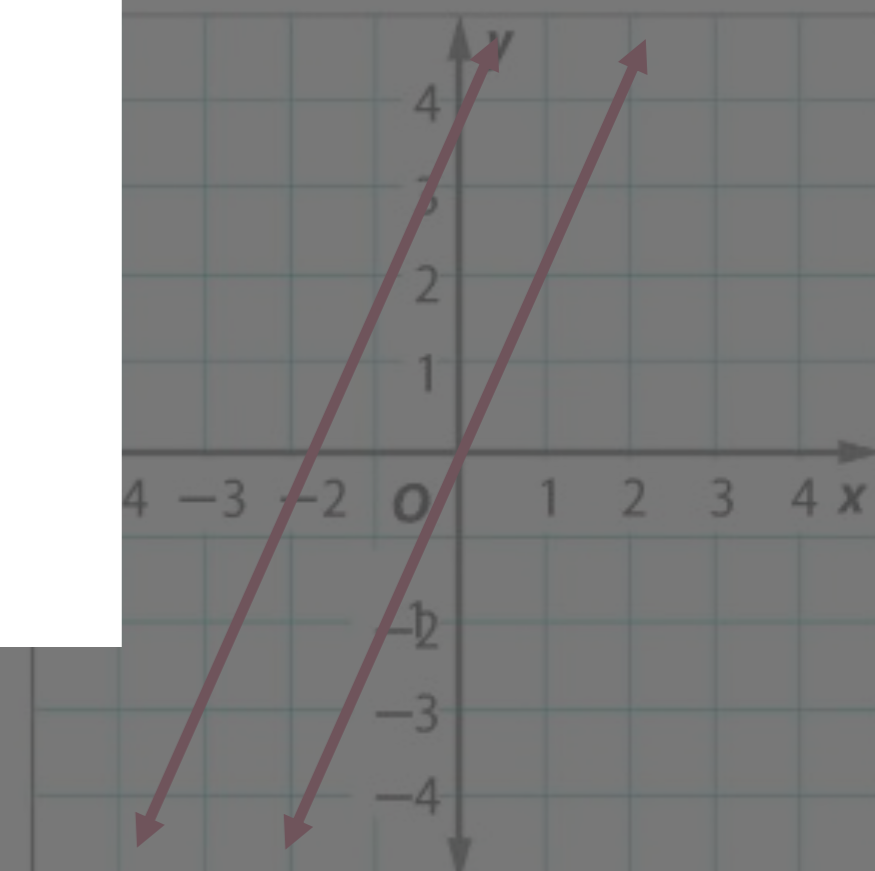
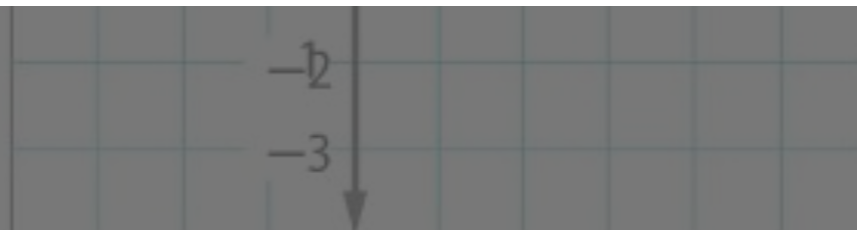
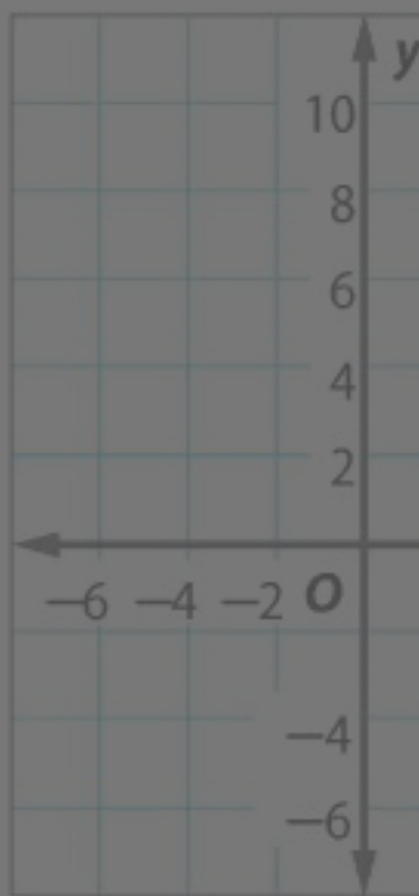
Independent Practice

Solve each system

1. $y = x$

$y = 2x - 4$

Show your work.



$$0 \neq 4$$

$$y = 2x$$

$$y - 2x = 4$$

$$y = 2x$$

THIS UNIT NOT LABELED FOR INDIVIDUAL RETAIL SALE

1/2 cup	4 Tbsp
1/4 cup	2 Tbsp
2 Tbsp	1/4 cup
1 Tbsp	1/2 cup

1 cup = 16 Tbsp

Ralphs

grade AA
butter

NET WT. 4 OZ. (113g)

THIS UNIT NOT LABELED FOR INDIVIDUAL RETAIL SALE.

Ingredients: Pasteurized Cream, Salt.

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

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

1 FIRST QUALITY 1

grade AA

Grade AA
butter
Ralphs

THIS UNIT NOT LABELED FOR INDIVIDUAL RETAIL SALE.

Ingredients: Pasteurized Cream, Salt.

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

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

1 FIRST QUALITY 1

Grade AA
butter
Ralphs

THIS UNIT NOT LABELED FOR INDIVIDUAL RETAIL SALE.

Ingredients: Pasteurized Cream, Salt.

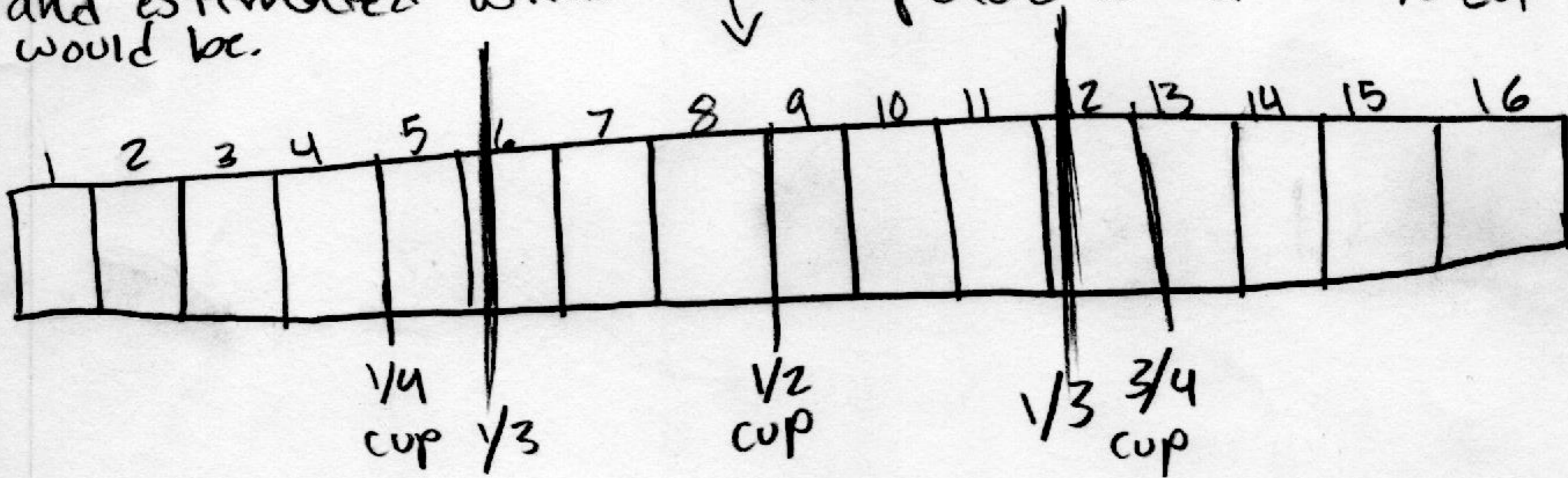
DISTRIBUTED BY: RALPHS GROCERY CO. LOS ANGELES, CALIF. 90054

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

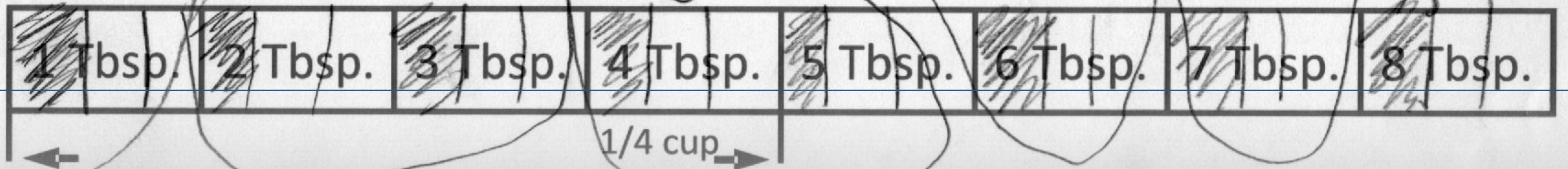
1 FIRST QUALITY 1

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

I reached my answer by drawing a picture of 16 flbsp and estimated where on the picture would the $\frac{1}{3}$ cup would be.



I also divided 16 by 3. $\rightarrow 3 \overline{)16} \begin{array}{r} 5 \\ \underline{15} \\ 1 \end{array}$



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 $\frac{1}{3}$ 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 $\frac{1}{3}$ of a cup of butter is 5.33 or $5\frac{1}{3}$ 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

SIMPLE

UNEXPECTED

CONCRETE

CREDIBLE

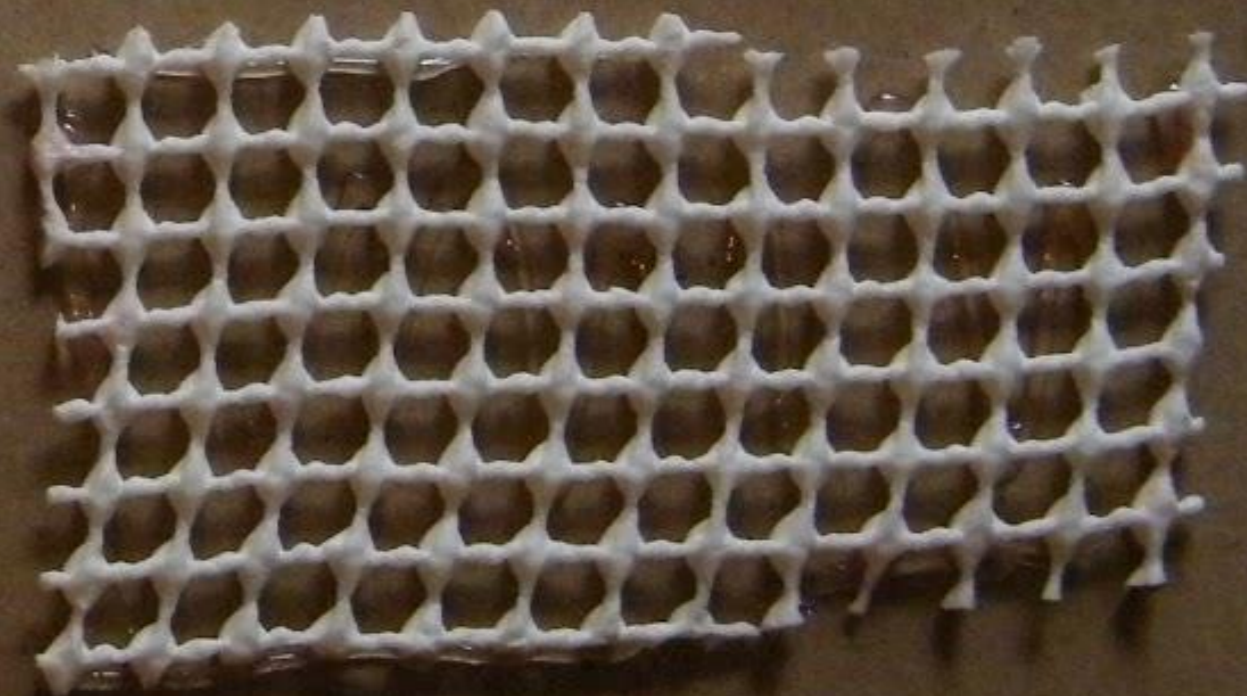
EMOTIONAL

STORIES

Soft



bumpy



Yellow the stinky socks,

Yellow the fragrant flowers,

Scratch and Sniff!

Scratch and Sniff!

Source: Color Dog





HunterDouglas

HunterDouglas

WINDOW FASHIONS

Window fashions that express your style

FOOD & PAPER

COMPOST

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

VICTORIA

NAME: _____

DATE: _____

PERIOD: _____

Lesson 7 Skills Practice

Objective: Divide Decimals by Decimals

Divide.

1. $4.86 \div 0.2$

7. $2.25 \div 0.15$

13. $7.52 \div 0.74$

2. $628.2 \div 34.9$

8. $421.6 \div 0.4$

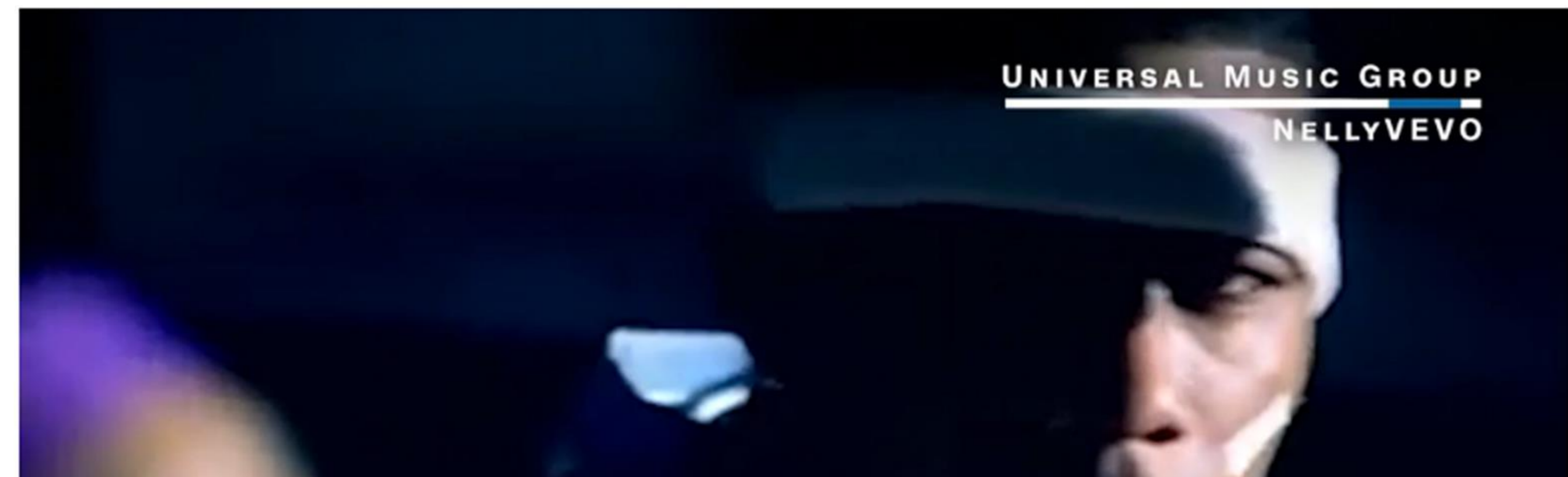
14. $0.105 \div 0.6$



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)

B.M.

V

1 4

mf -or (3)

pizz.

Stretching, Compressing, and Reflecting Sine and Cosine Graphs

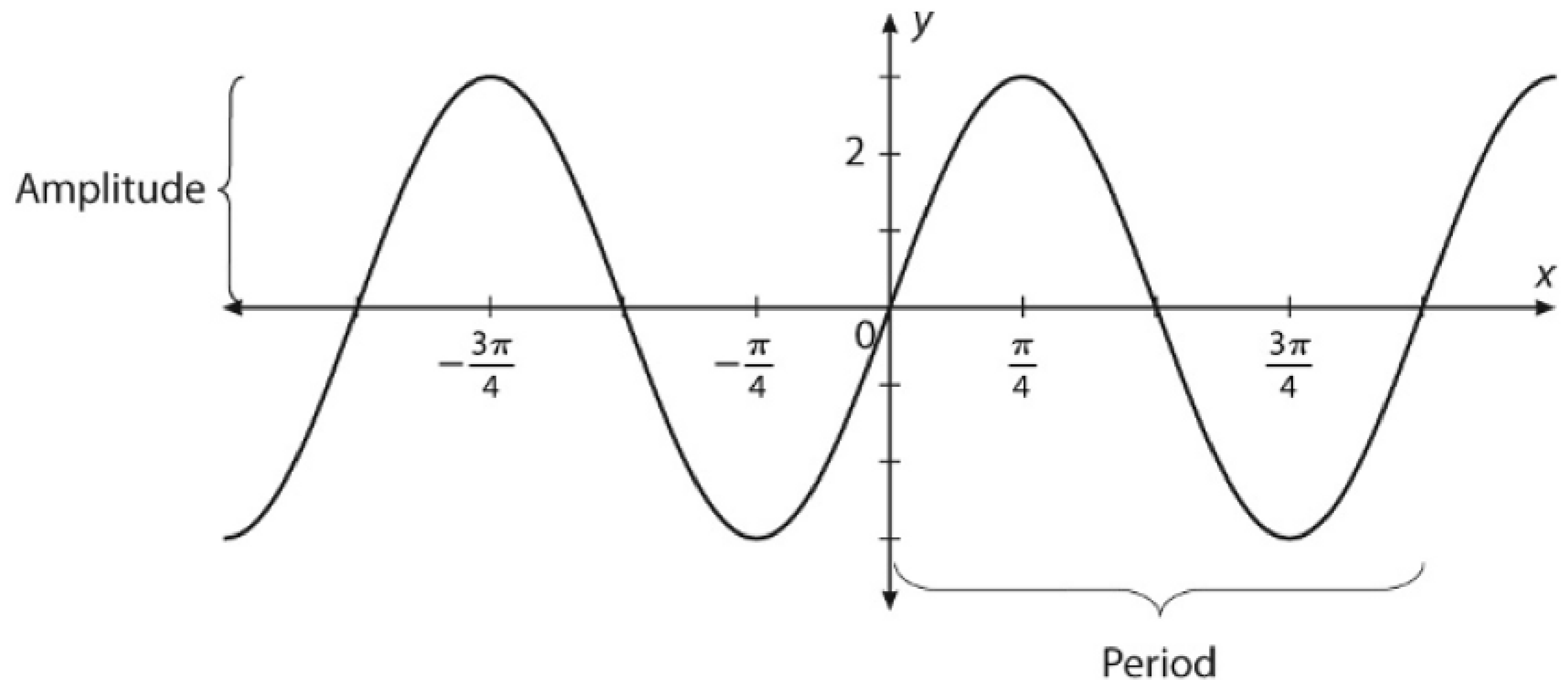
Reteach

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


$$\text{Amplitude} = |a|$$

$$\text{Period} = 2\pi \cdot b$$

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



Example Write the function shown in the graph above.



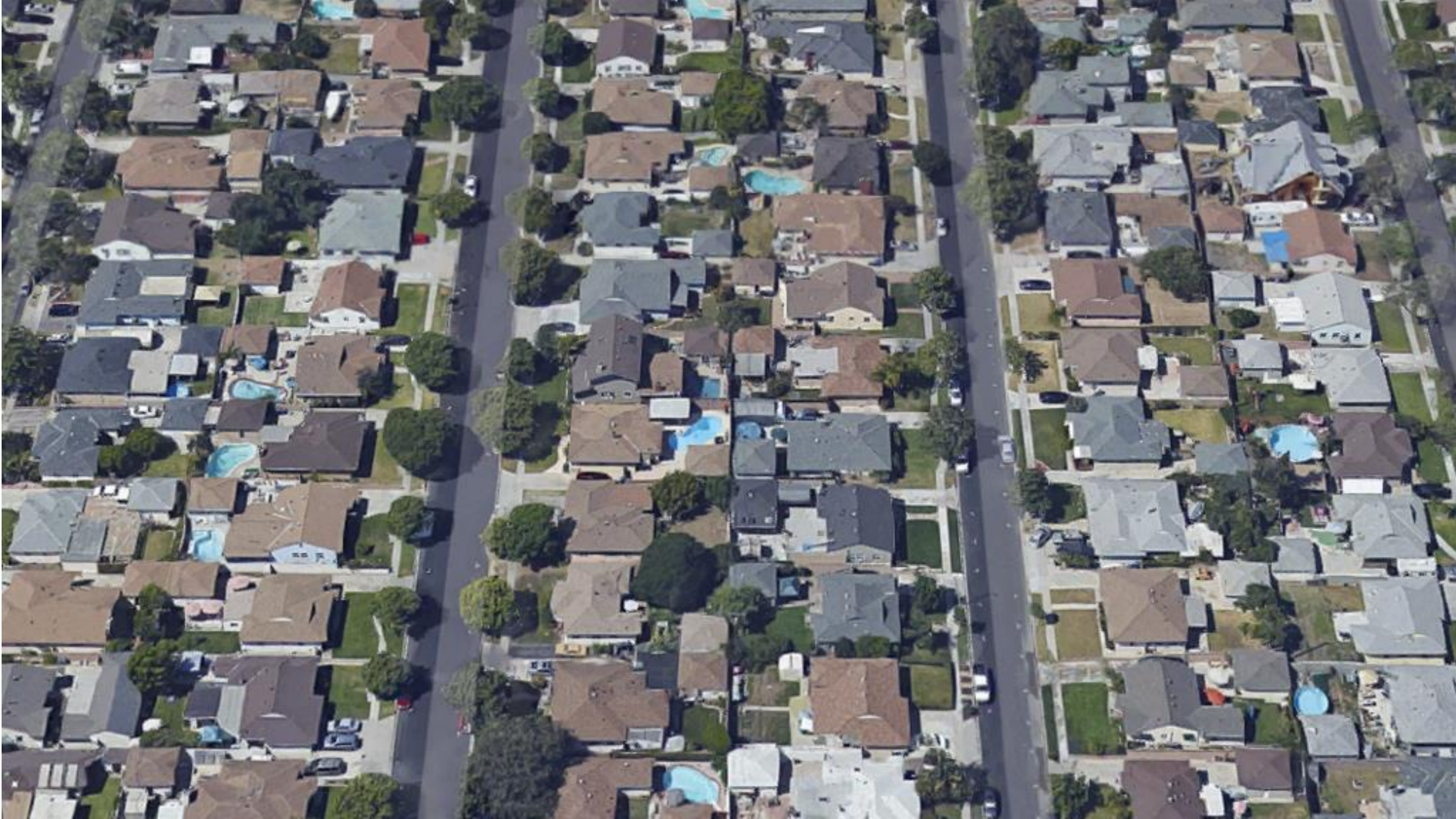
distance from camera

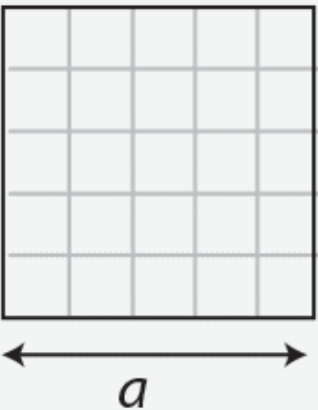
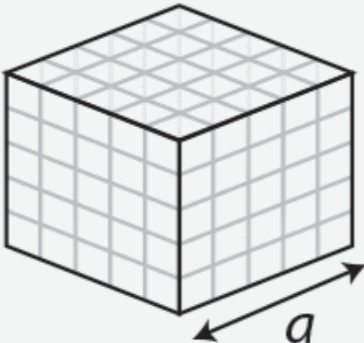
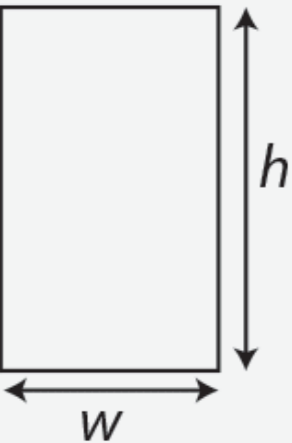
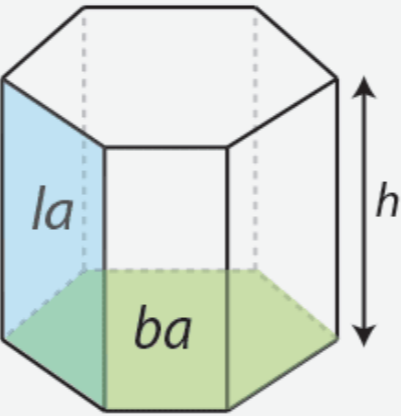
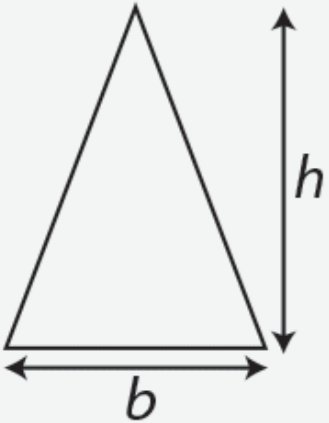
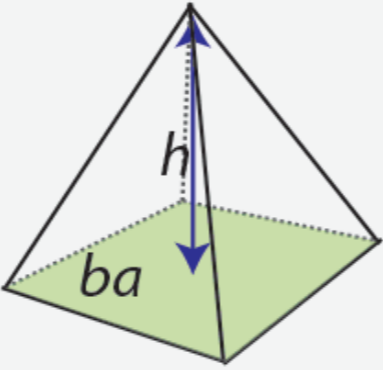

adam poetzel

Source: graphingstories.com

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

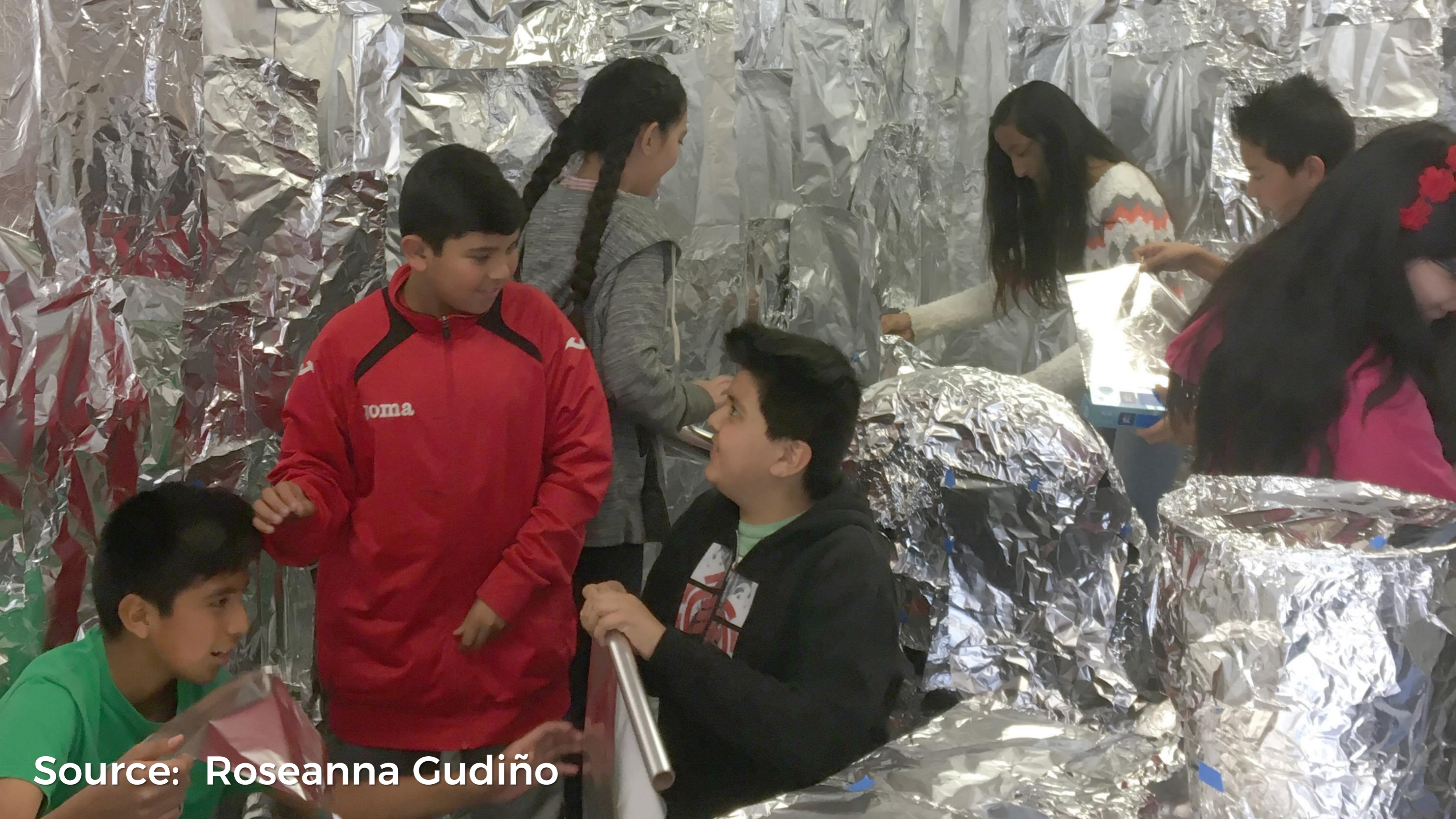
TOO MANY STUDENTS



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



Source: robertkaplinsky.com/lessons

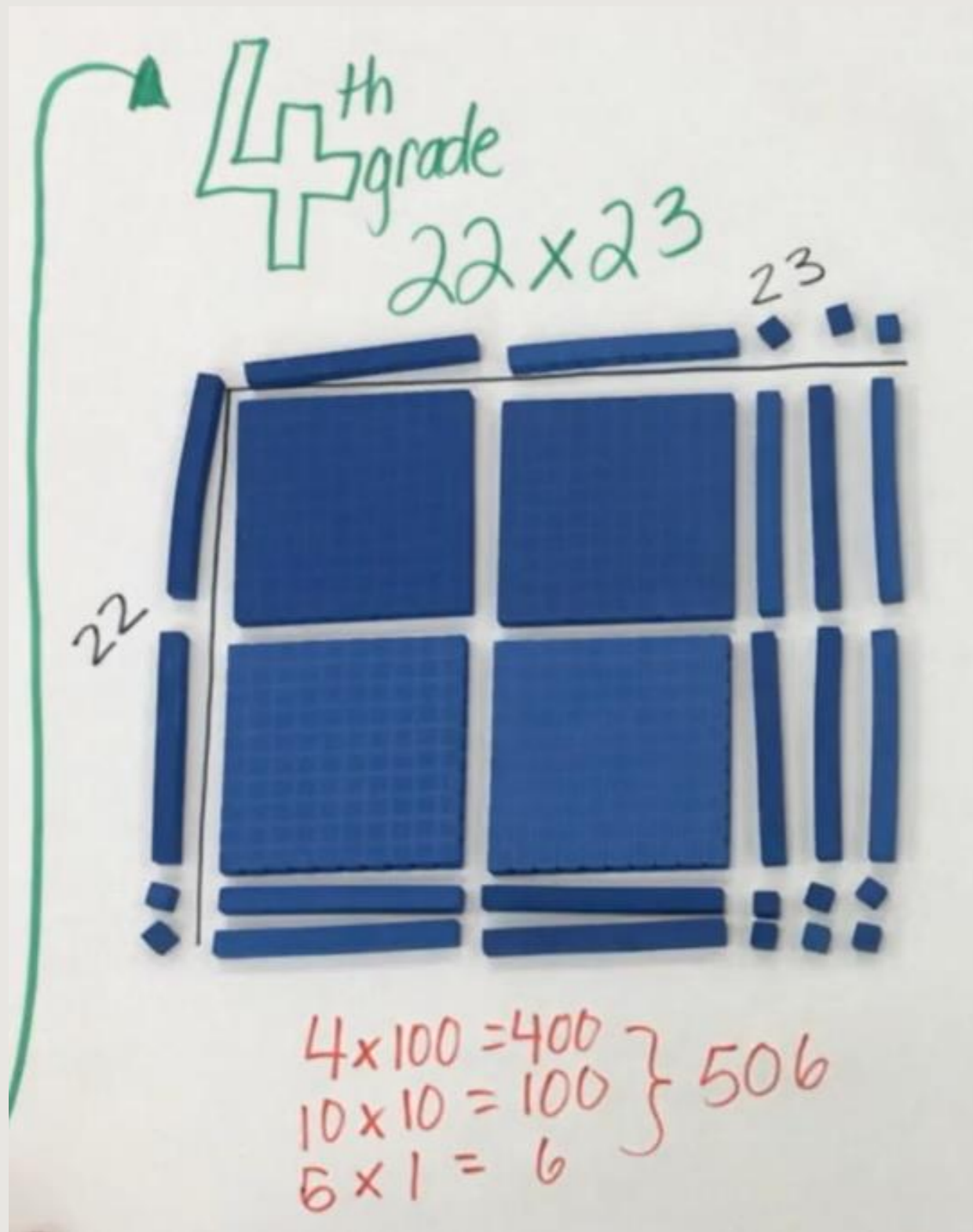


Source: Roseanna Gudiño



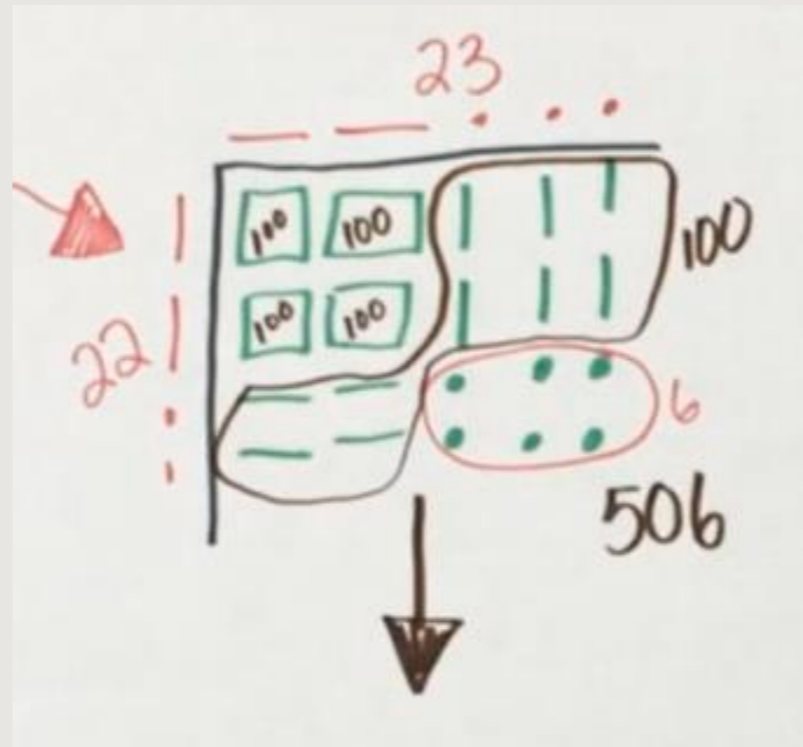
The progression of
multiplication



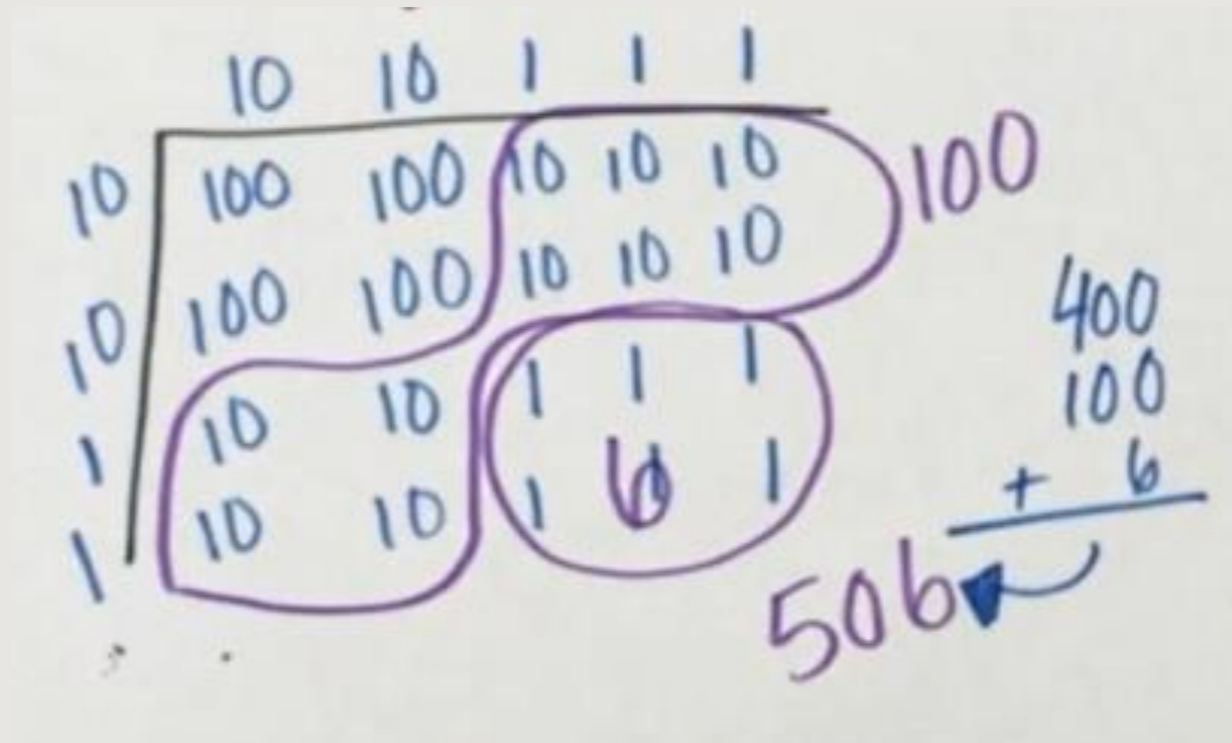


Concrete

Source: gfletchy.com




Representational



Abstract

MY OLD METHODS

$$4(x + 3)$$


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

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

$$\mathbf{F} \quad x(x)$$

$$\mathbf{O} \quad x(-1)$$

$$\mathbf{I} \quad 3(x)$$

$$\mathbf{L} \quad 3(-1)$$

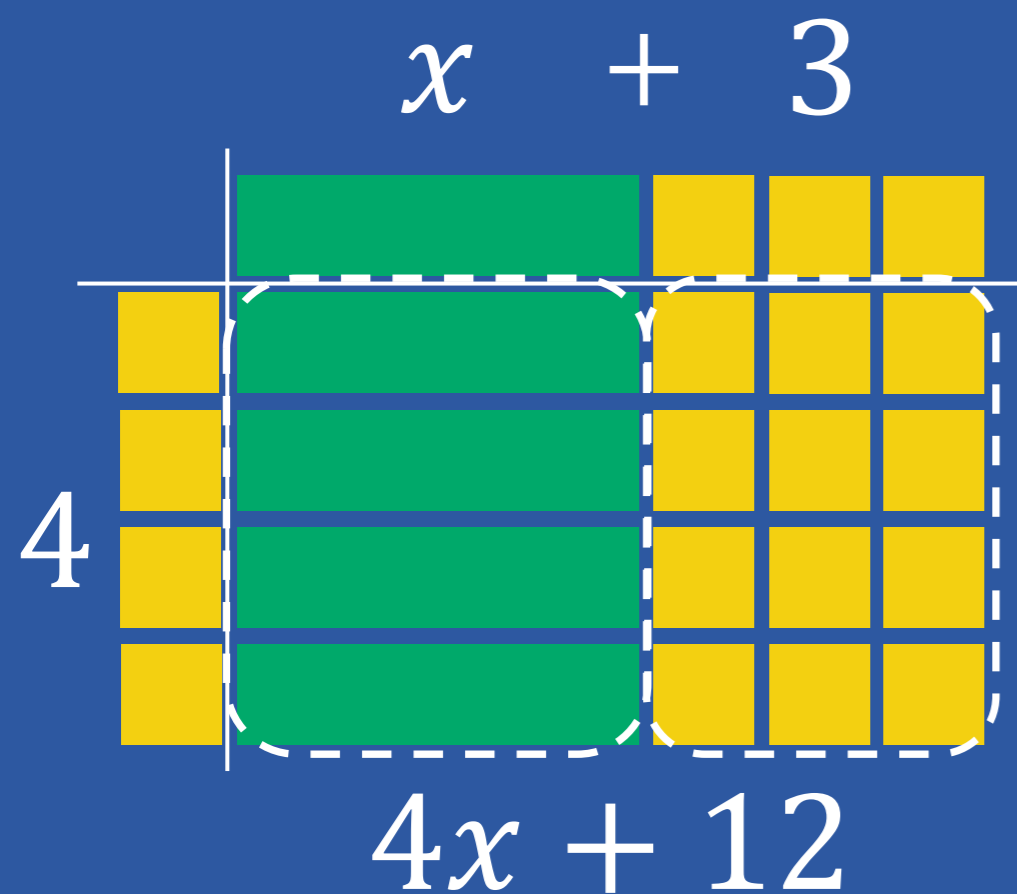
$$= x^2 - x + 3x - 3$$

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

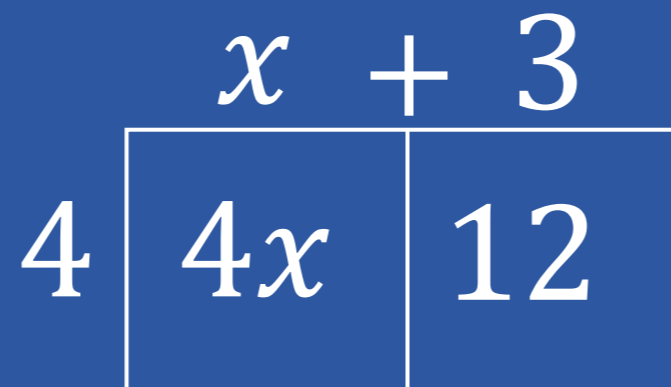
DISTRIBUTIVE PROPERTY

$$4(x + 3)$$

Concrete



Representational



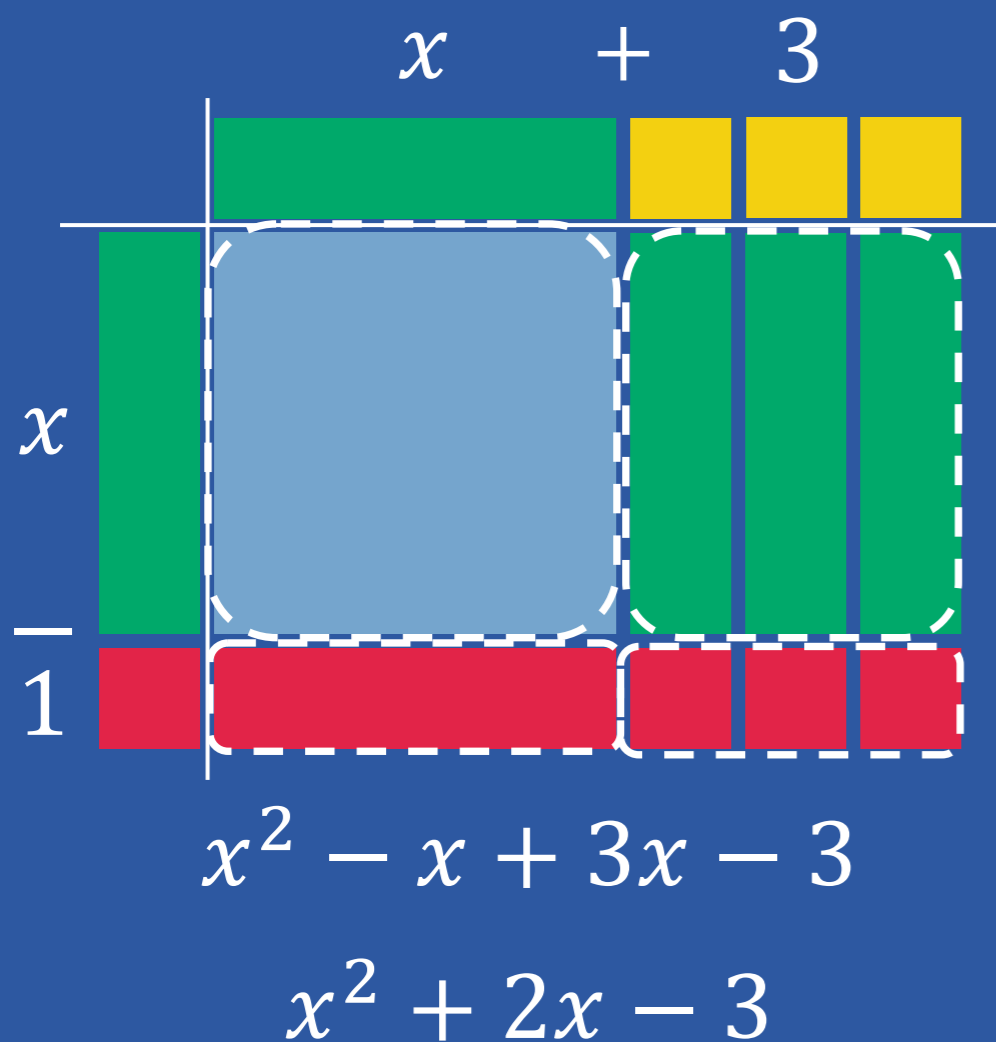
Abstract

$$\begin{aligned} &4(x + 3) \\ &= 4(x) + 4(3) \\ &= 4x + 12 \end{aligned}$$

BINOMIAL MULTIPLICATION

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

Concrete



Representational

$x + 3$

x	x^2	$3x$
-1	$-x$	-3

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

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

Abstract

$$\begin{aligned}(x + 3)(x - 1) \\ &= x^2 - x + 3x - 3 \\ &= x^2 + 2x - 3\end{aligned}$$

STICKY ATTRIBUTES

SIMPLE

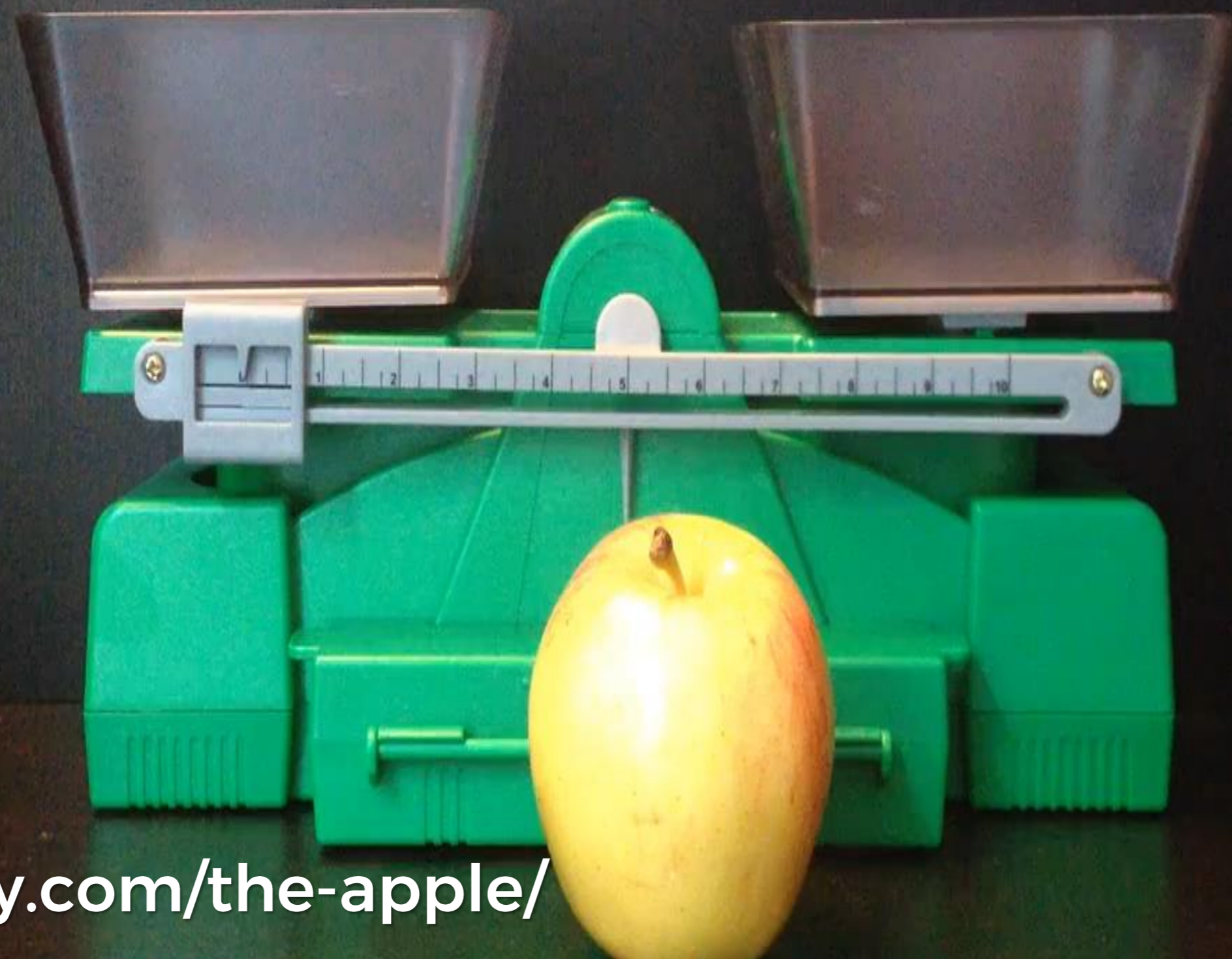
UNEXPECTED

CONCRETE

CREDIBLE

EMOTIONAL

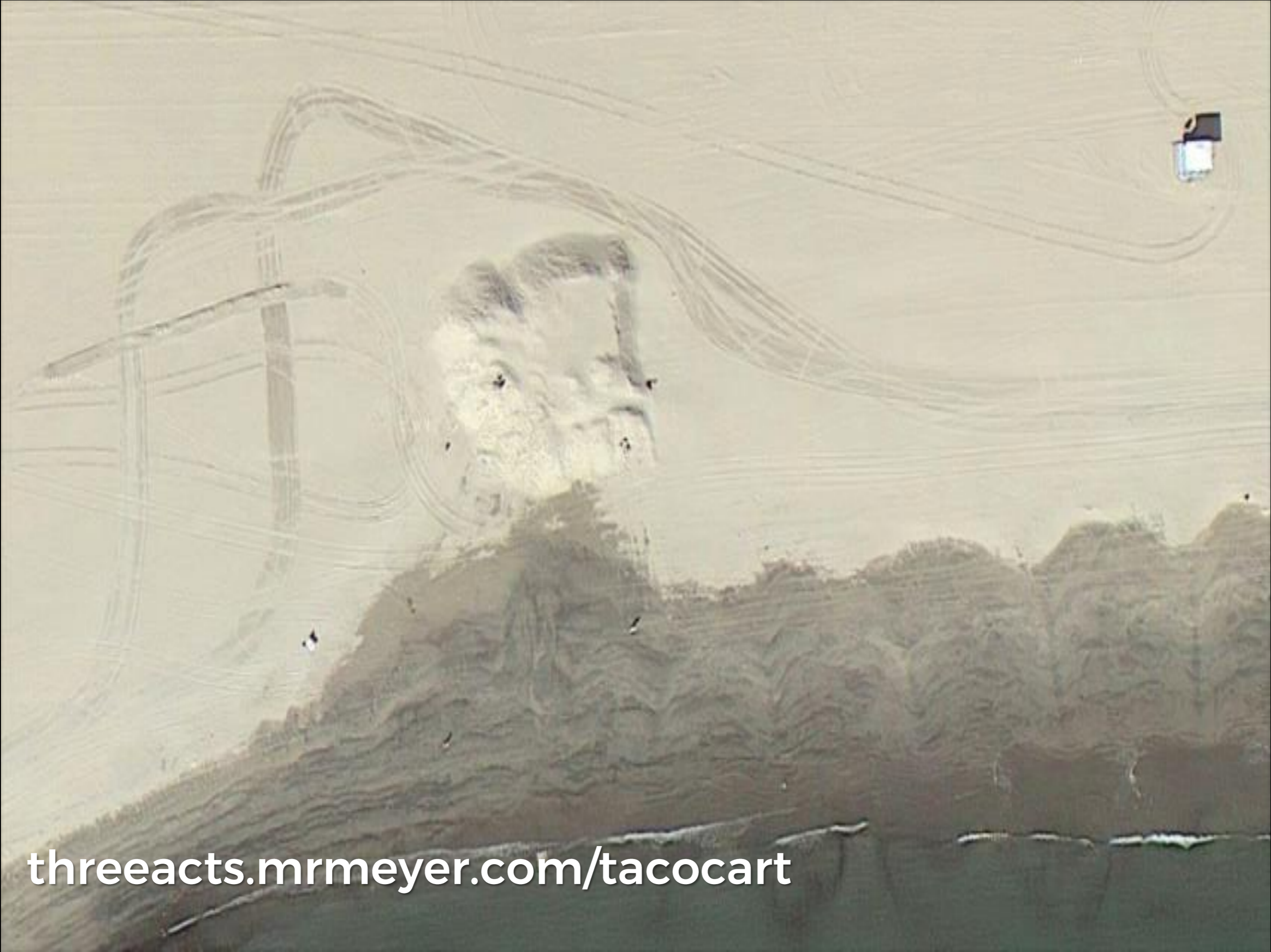
STORIES



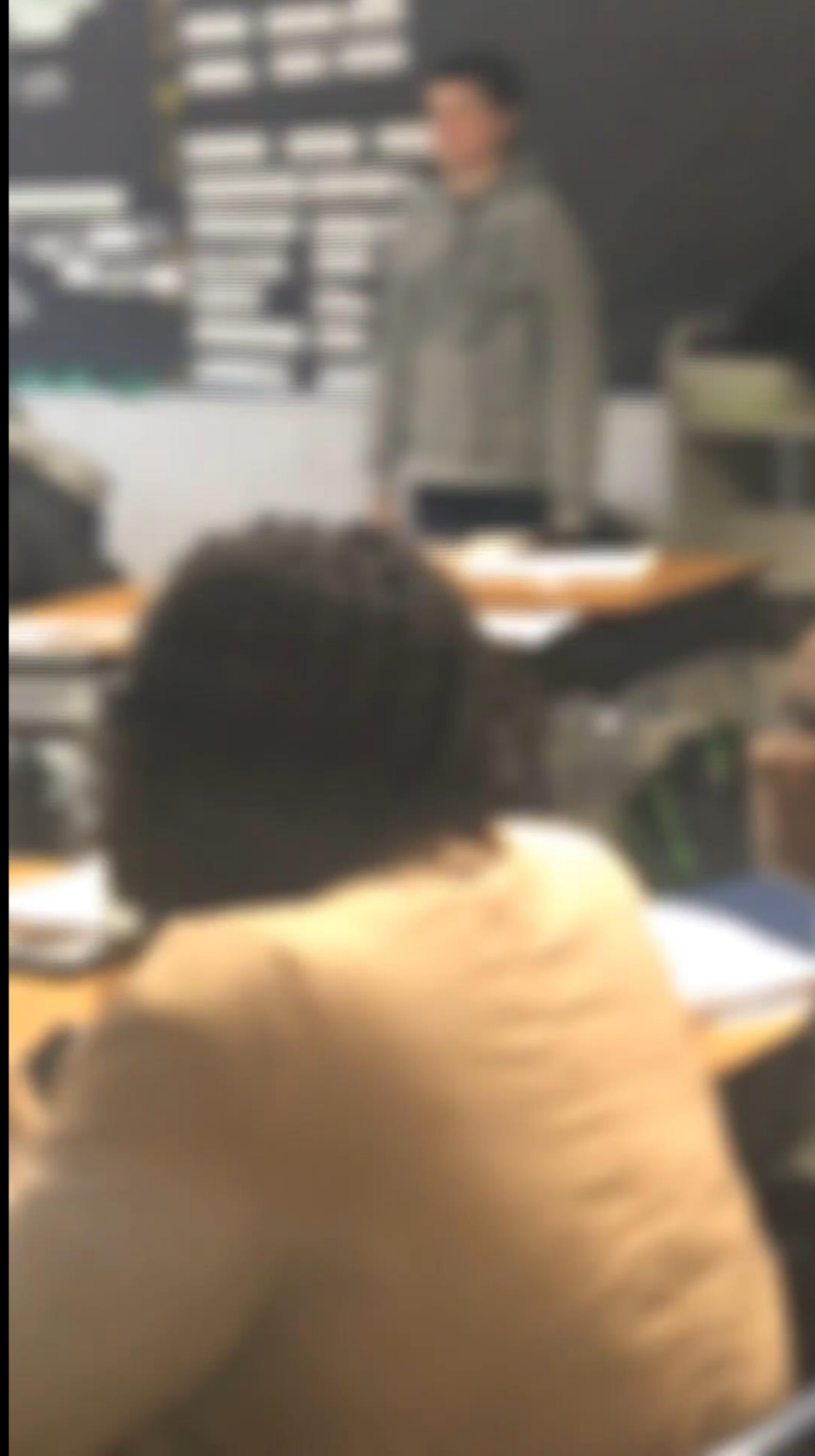
Source: gfletchy.com/the-apple/



Source: JJ Martinez



Source: threeacts.mrmeyer.com/tacocart



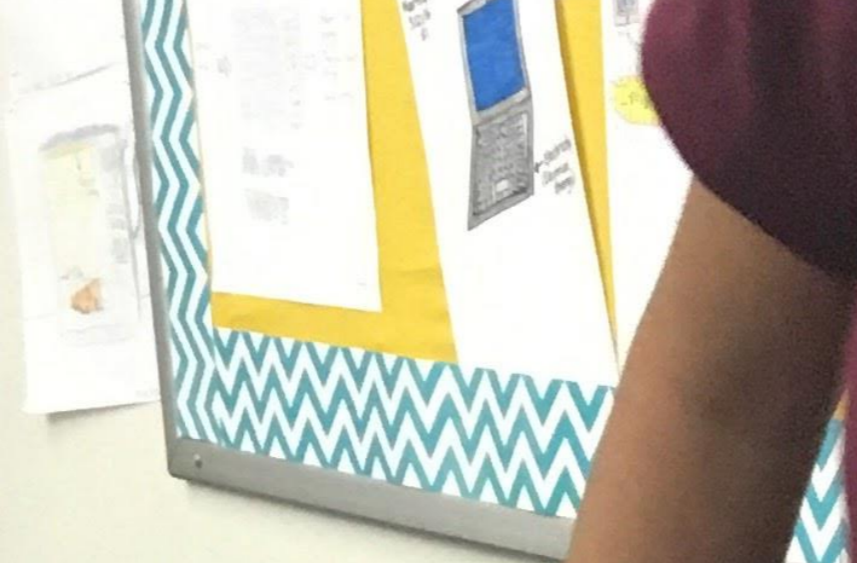
**Source:
Jenise Sexton**



Source: Tom Ward



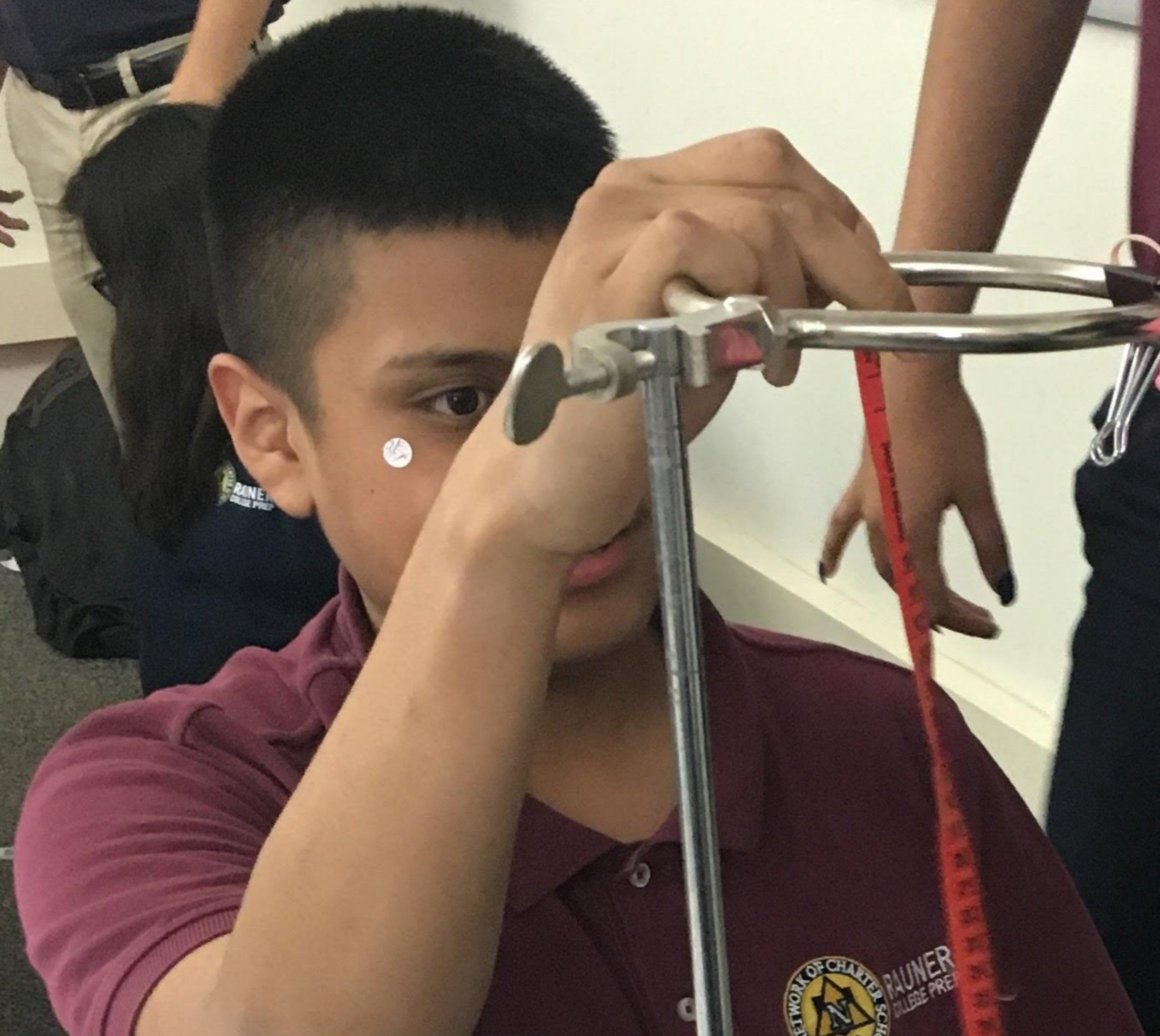
Source: Tom Ward



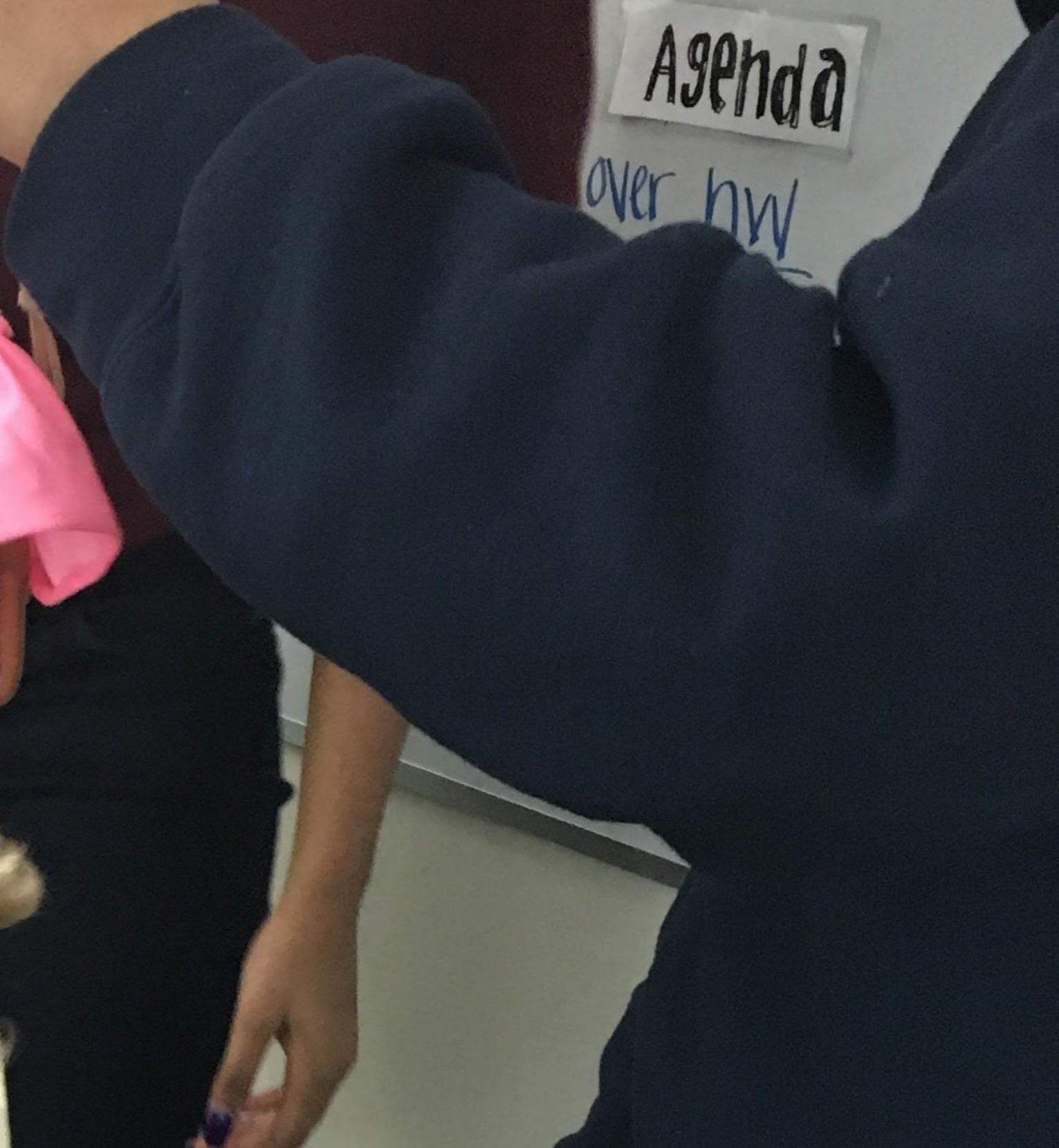
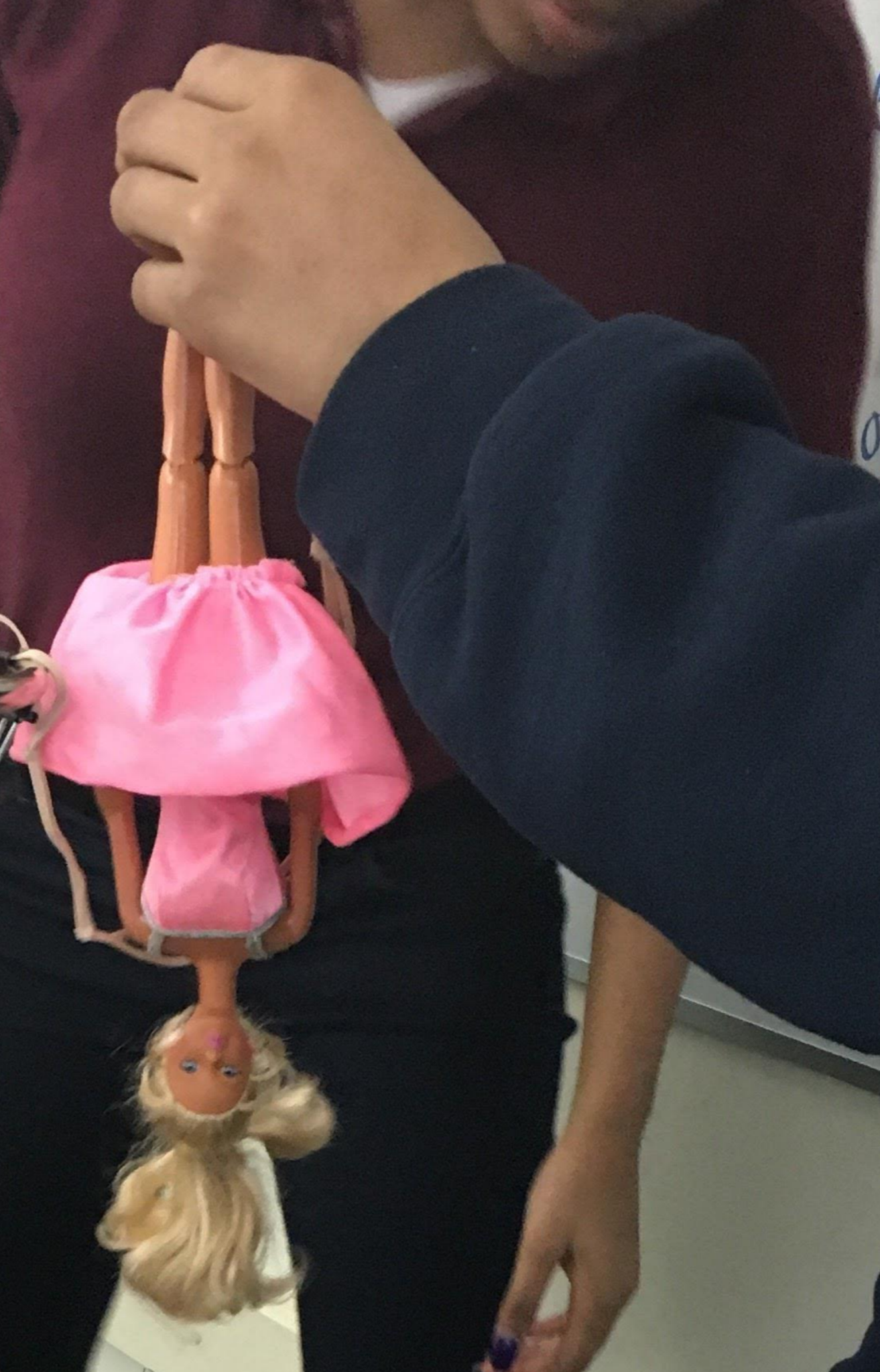
ee board

Agenda

over hwy

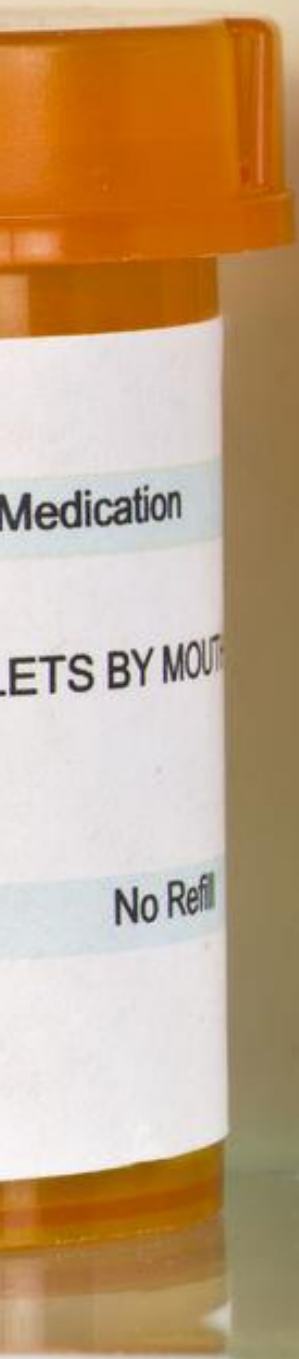


NETWORK OF CHARTER SCHOOLS
RAUNER
COLLEGE PREP





**Source:
Fawn Nguyen**



Medication
TAKEN BY MOUTH
No Refill



Division

Pain Relief Fever Reduction

NSAID

200 Tablets 200 mg



Functions

Pain Reliever/ Fever Reducer
Caffeine-Free

200 tablets
325 mg each

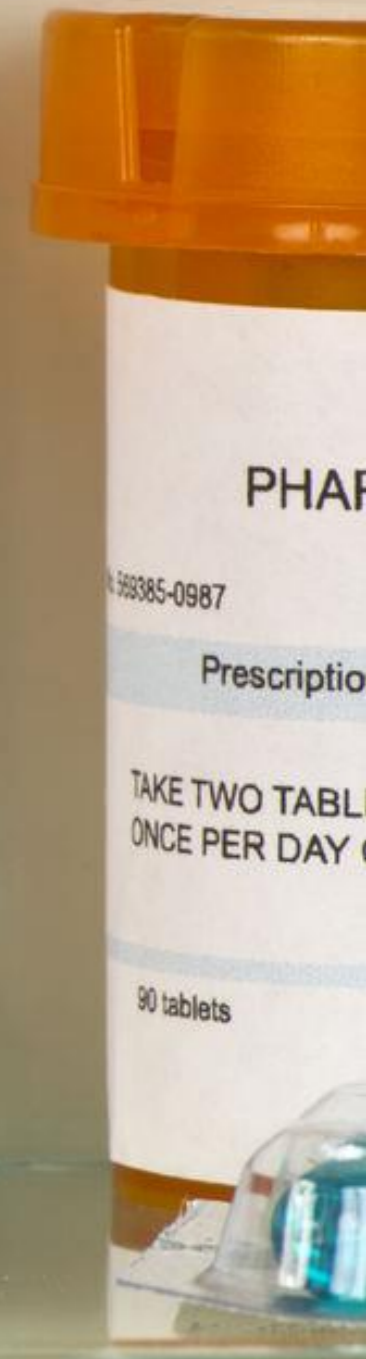


Extra Strength

Perimeter

Pain Reliever/ Fever Reducer

200 Capsules 500 mg. each



PHAR
368385-0987
Prescription
TAKE TWO TABLETS
ONCE PER DAY
90 tablets

Act 1 Engaging Opener

Act 2 Get Info. Solve Problem.

Act 3 Big Reveal

STICKY ATTRIBUTES

SIMPLE

UNEXPECTED

CONCRETE

CREDIBLE

EMOTIONAL

STORIES







Source: mrvaudrey.com

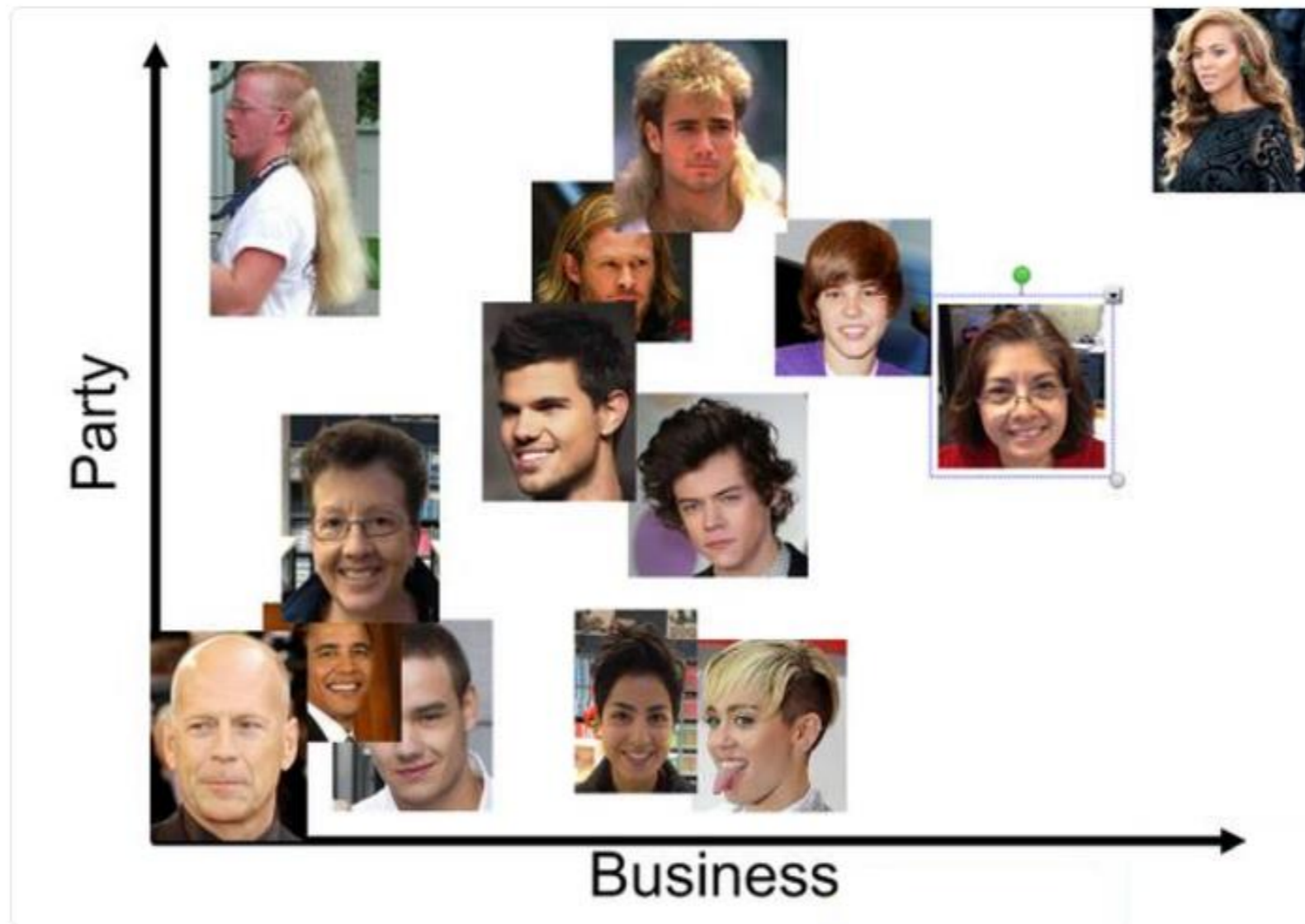


Matt Vaudrey
@MrVaudrey

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



STICKY ATTRIBUTES

SIMPLE

UNEXPECTED

CONCRETE

CREDIBLE

EMOTIONAL

STORIES

11:35 34°



abc 7 Chicago.com

Source: robertkaplinsky.com/lessons

20. Crime Two men used ropes made from sheets to escape from a tall prison in Chicago. If they needed to make a total of 150 feet of rope and each sheet made 6 feet of rope, how many sheets did they need?



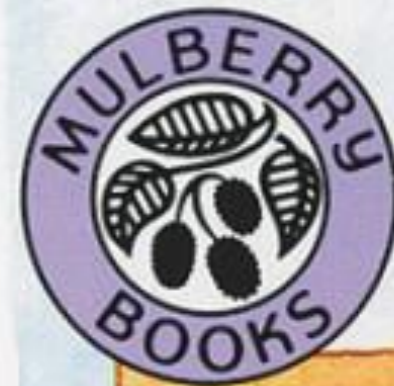
If you were as strong as an **ANT**...



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

The Doorbell Rang

by Pat Hutchins



DO YOU

SEE IT?

Via: Sara VanDerWerf

RobertKaplinsky.com



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!

	<p>Recognizing Tapped Songs</p> <p>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..."</p> <p>docs.google.com</p>
---	--

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.”

COURSE OF KNOWLEDGE

Context



Dissertation

Executive Summary

Formulas

Abstract

STICKY ATTRIBUTES

SIMPLE

UNEXPECTED

CONCRETE

CREDIBLE

EMOTIONAL

STORIES

SIMPLE

UNEXPECTED

CONCRETE

CREDIBLE

EMOTIONAL

STORIES



SIMPLE

UNEXPECTED

CONCRETE

CREDIBLE

EMOTIONAL

STORIES

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
9415

13.

14

8109

DISCUSSION TIME

- Why are urban legends so much easier to remember?
- How can we use that knowledge to make math easier to remember too?


GOALS

CORRECT ANSWERS = UNDERSTANDING?

MAKE OUR LESSONS UNFORGETTABLE

RECONSIDER USING WORD PROBLEMS

MAKE MATH CHALLENGING + ACCESSIBLE



Why do we
have word
problems?

MILNE'S
INDUCTIVE ALGEBRA

Milne's Inductive Algebra © 1881

183. DIRECTIONS FOR SOLVING.—*Represent one of the unknown quantities by x , and from the conditions of the problem find an expression for each of the other quantities given.*

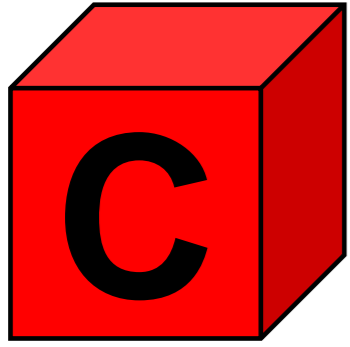
Find from the problem two expressions that are equal, and express them as an equation.

Solve the equation.

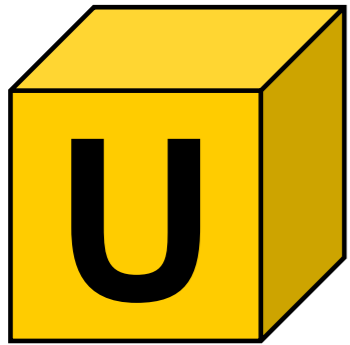
51. When the half of a certain number is added to the number, the sum is as much more than 60 as the number is less than 65. What is the number? *50 ans*

52. The difference between two numbers is 8, and the quotient arising from dividing the greater by the less is 3. What are the numbers?

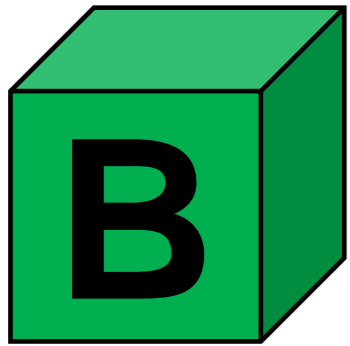
53. A man left one-half of his property to his wife, one-sixth to his children, a twelfth to his brother, and the rest, which was \$600, to charitable purposes. How much property had he?



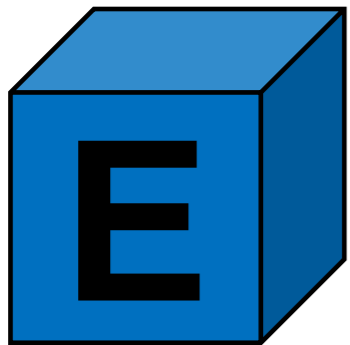
CIRCLE the numbers



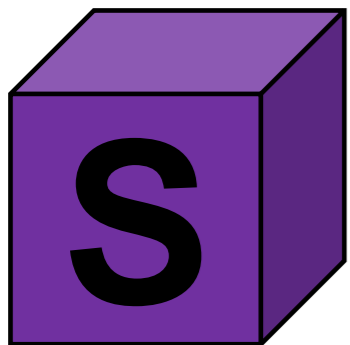
UNDERLINE the question



BOX the key words



~~ELIMINATE~~ info not needed



SOLVE and check ✓

In a class of 30 children, there are 3 girls for every 2 boys. How many girls are there altogether?

Source: Marilyn Burns

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

Making sense: 8

Not making sense: 24

$$\begin{array}{r} 5 \sqrt{125} \\ \underline{10} \\ 25 \\ \underline{25} \\ 0 \end{array}$$



Real-World Link



Common Core
State Standards

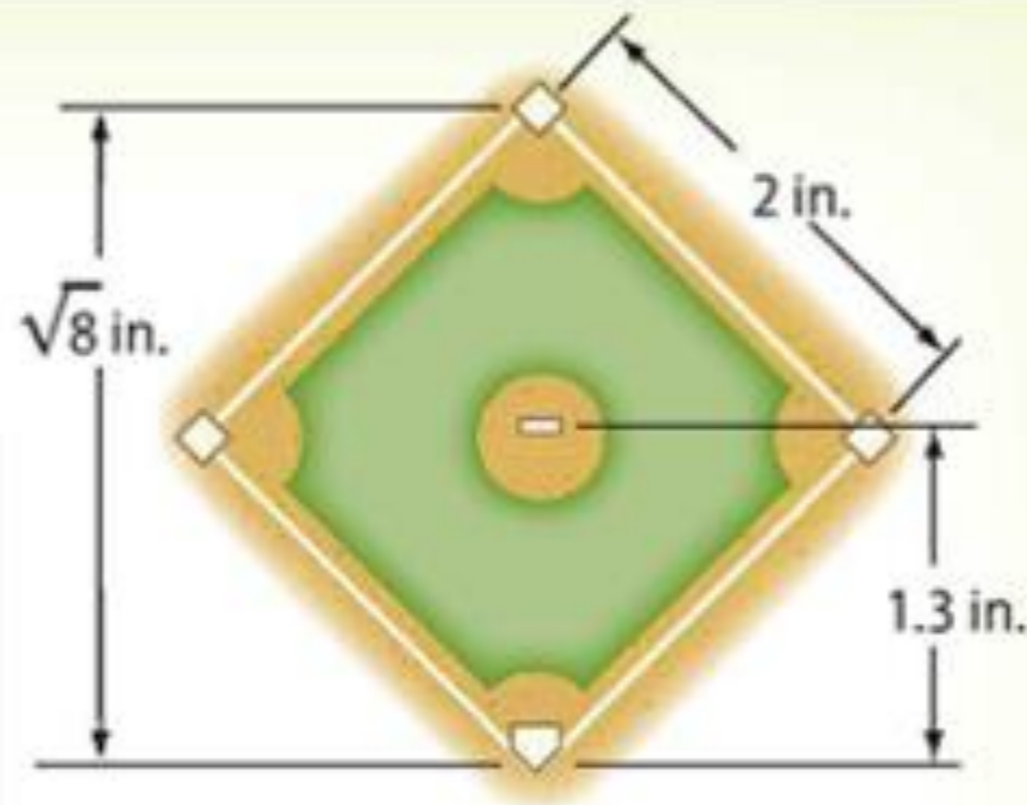
Content Standards

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

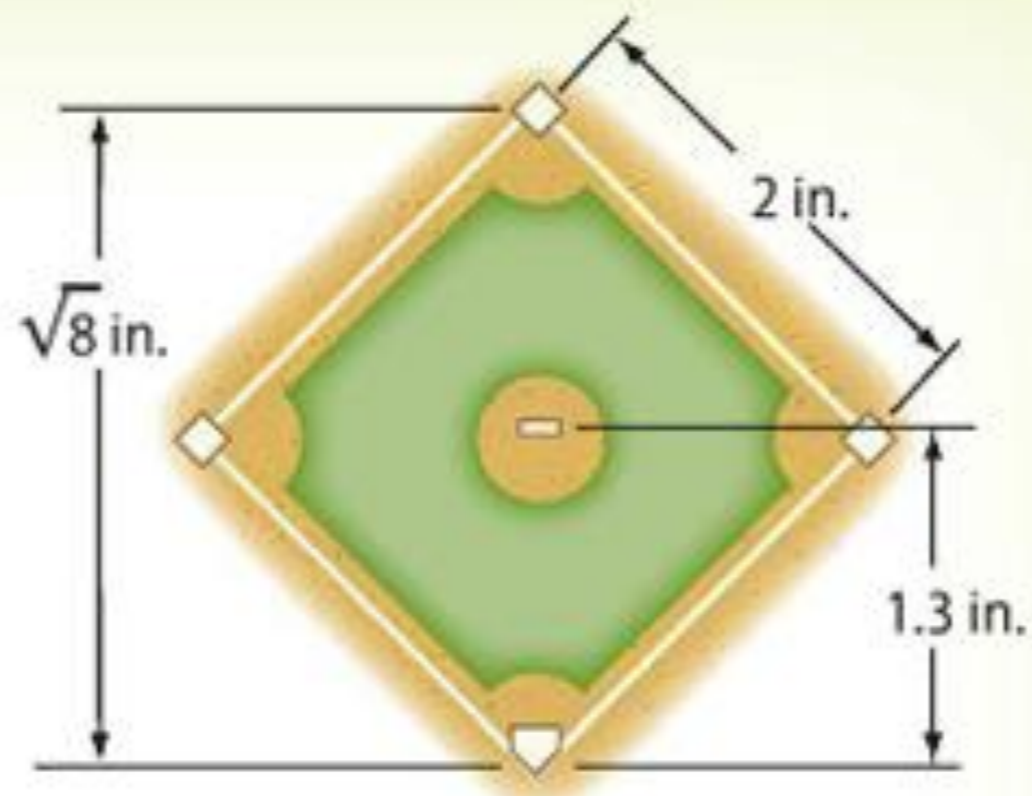
Content Standards

8.NS.1, 8.NS.2, 8.EE.2

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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 7/8 OZ. EA. CHEETOS® Crunchy Cheese Flavored Snacks 1 OZ. EA.

20 INDIVIDUAL BAGS: 7/8 OZ. EACH, 1 OZ. EACH, TOTAL NET WT. 19 5/8 OZ. (1 LB. 3 5/8 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 IS MATH MODELING USED IN REAL LIFE?

HOW DO WE HELP OUR STUDENTS IMPROVE?





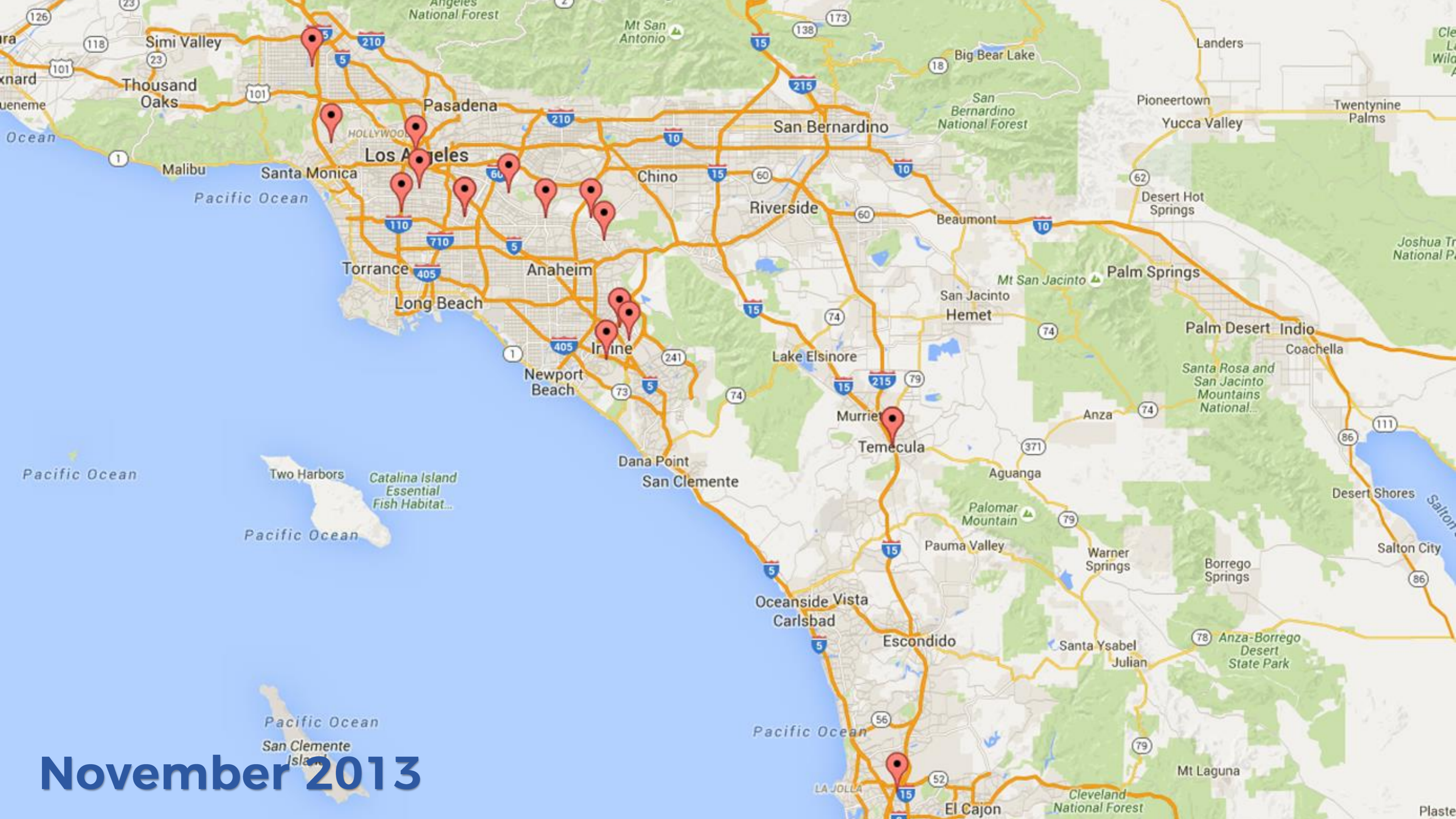


```
graph TD; Spies --> Analysts; Analysts --> Model; Model --> Spies;
```

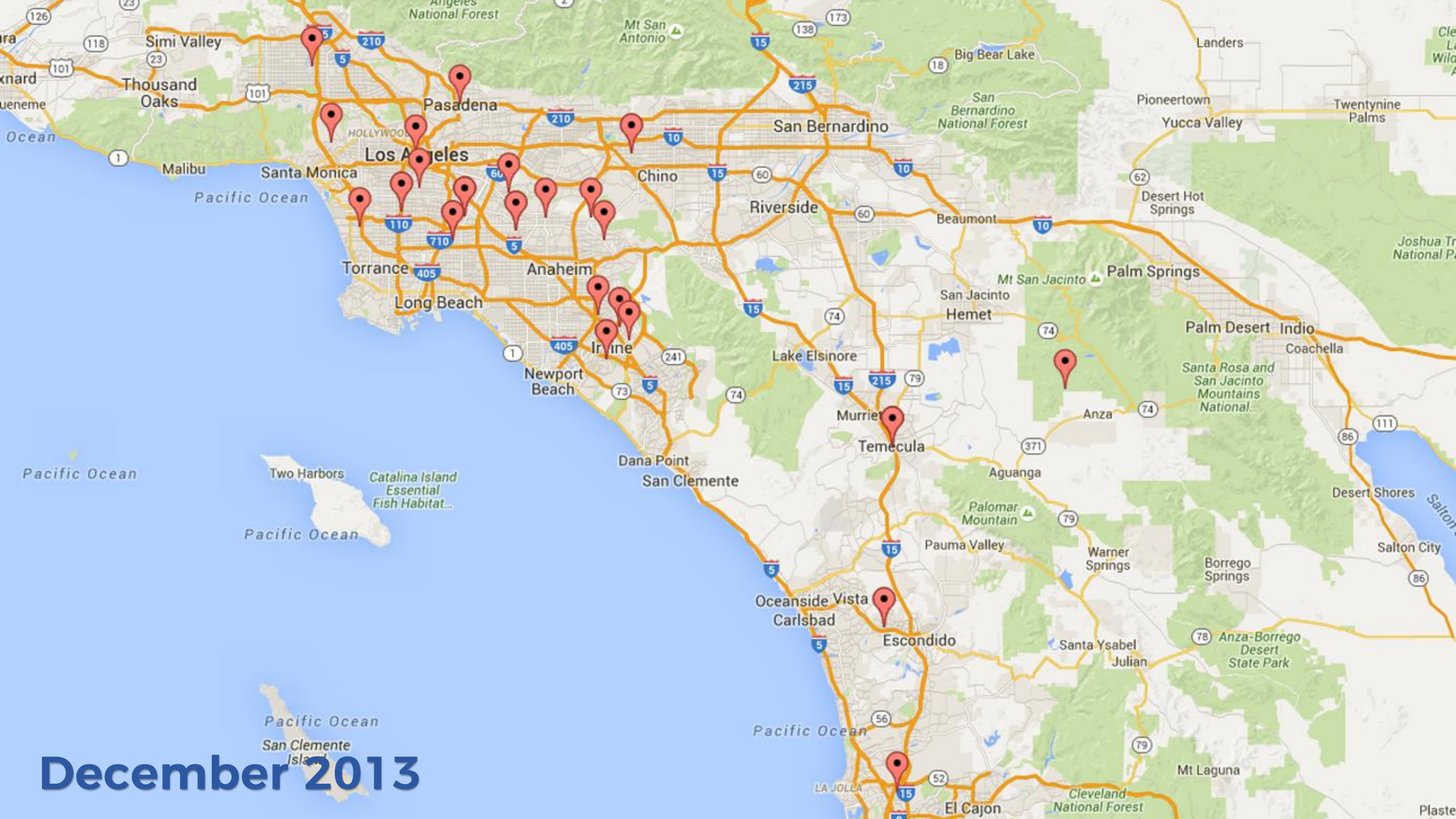
Spies

Analysts

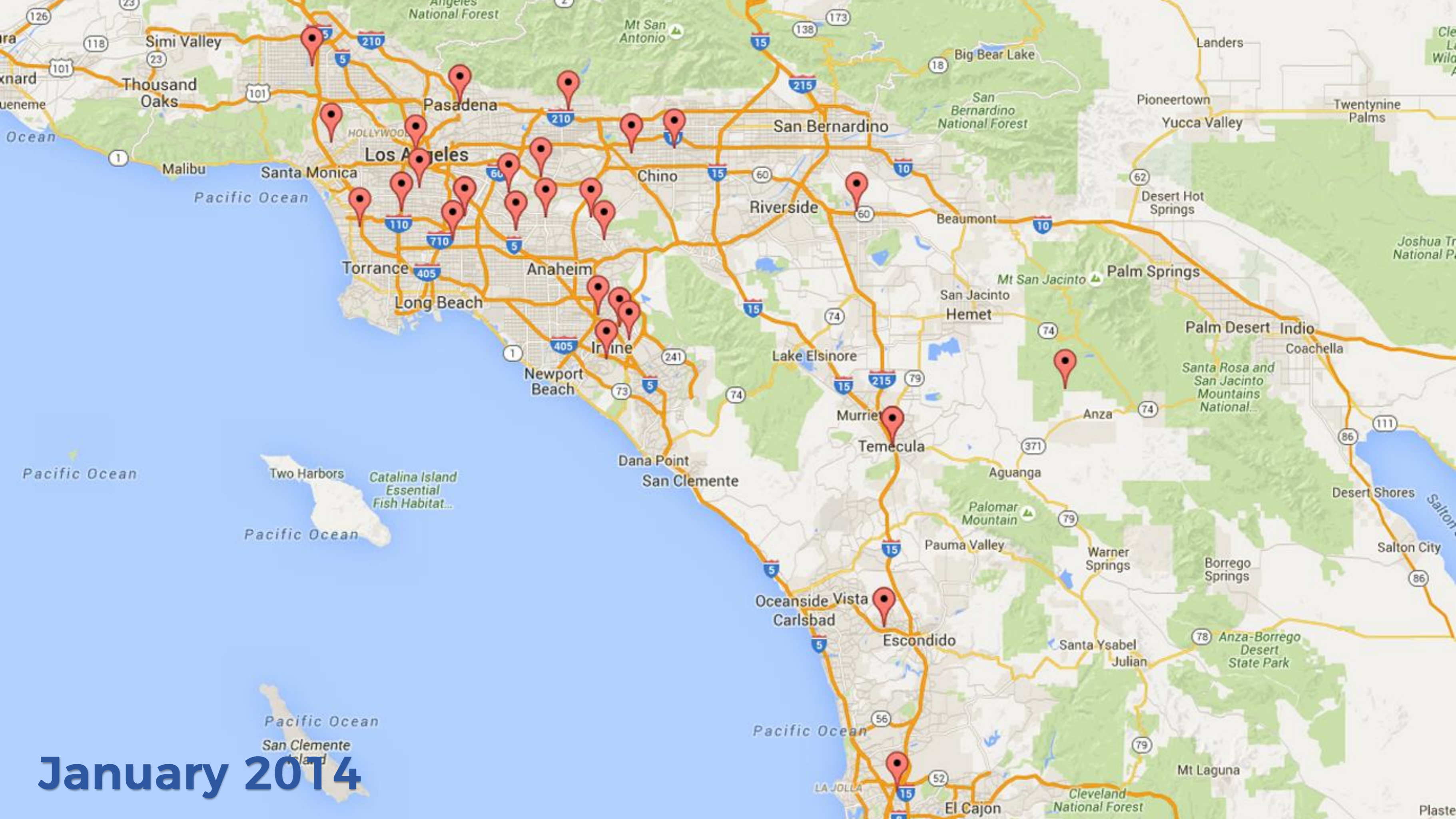
Model



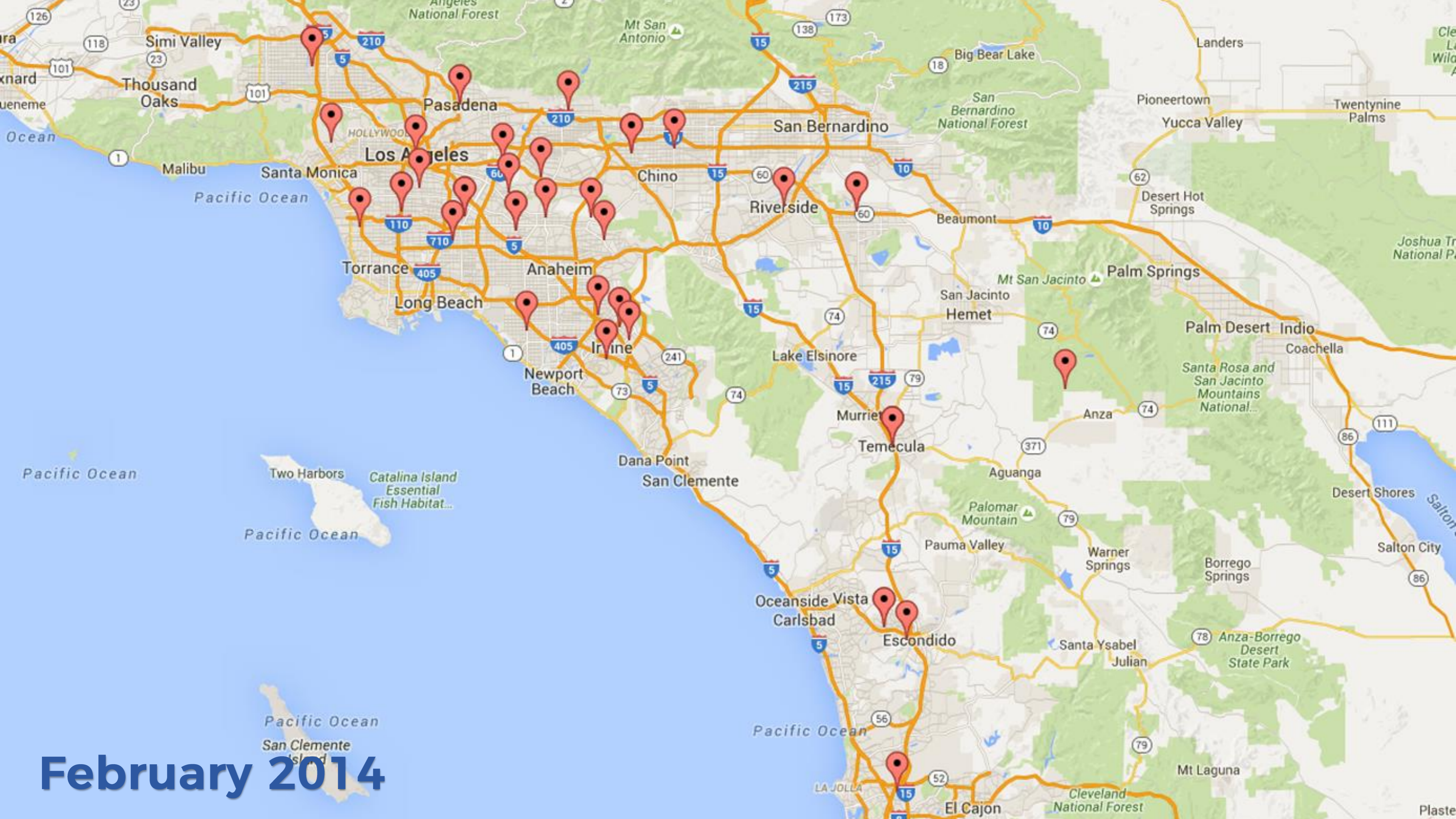
November 2013



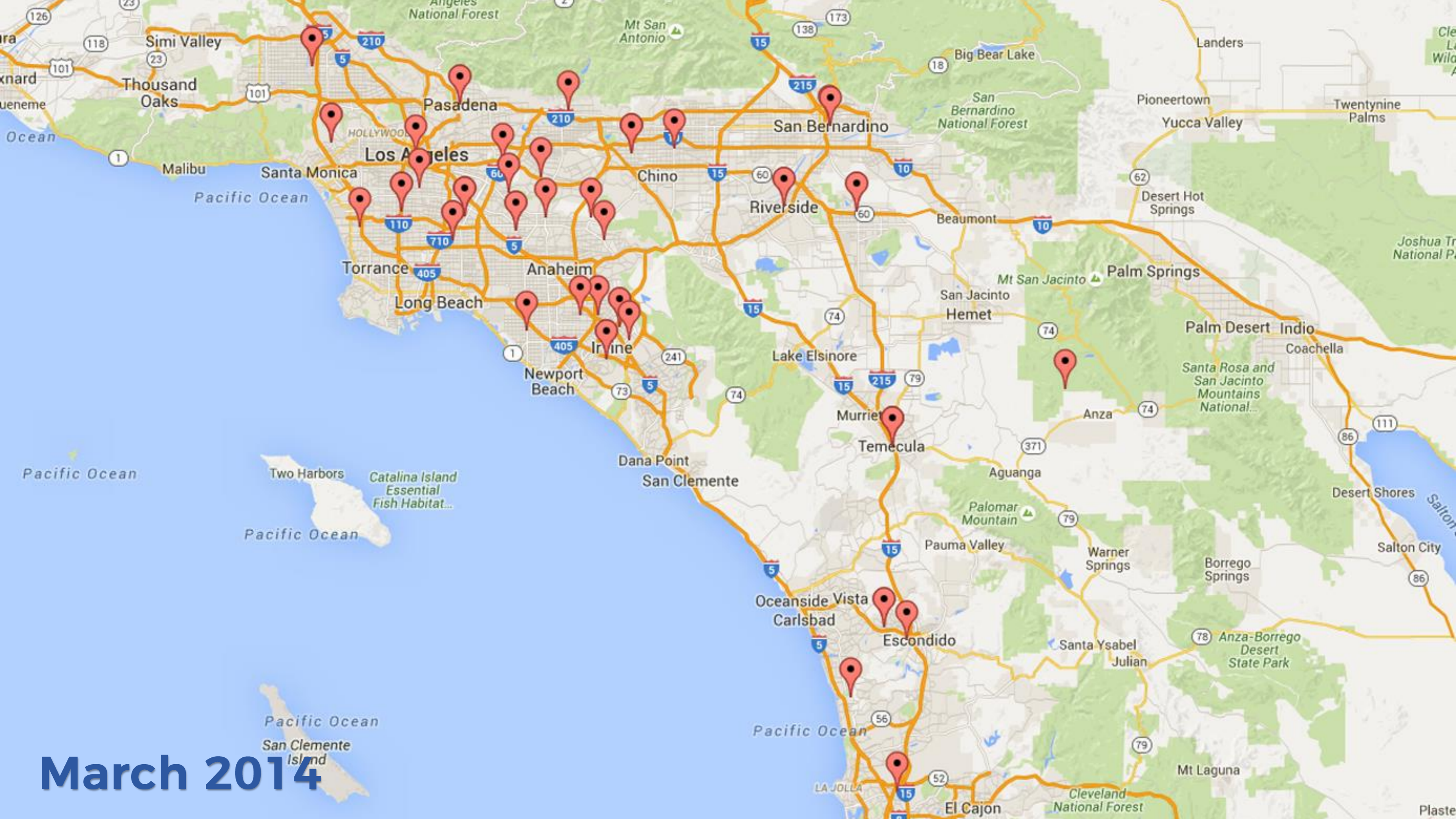
December 2013



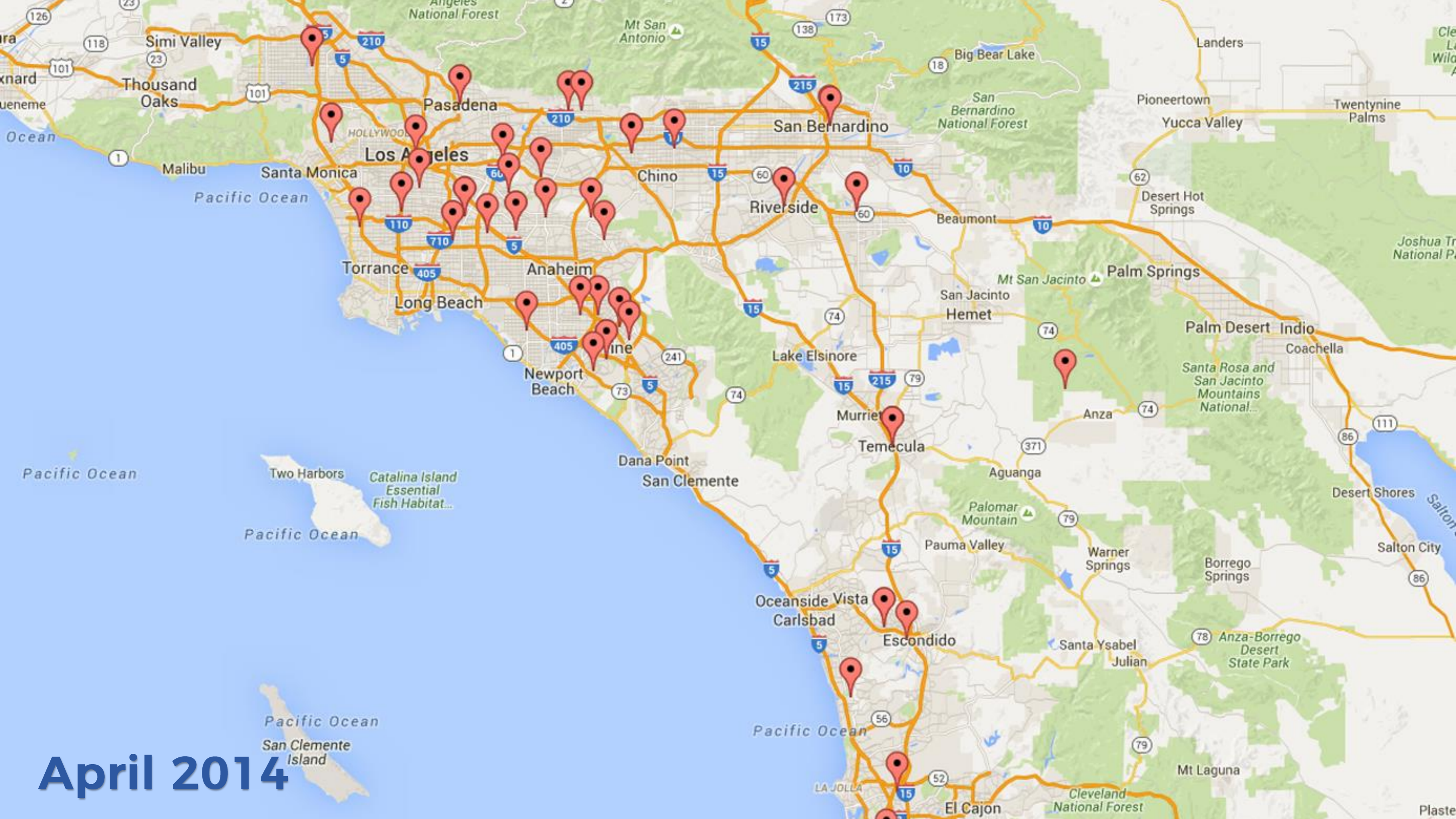
January 2014



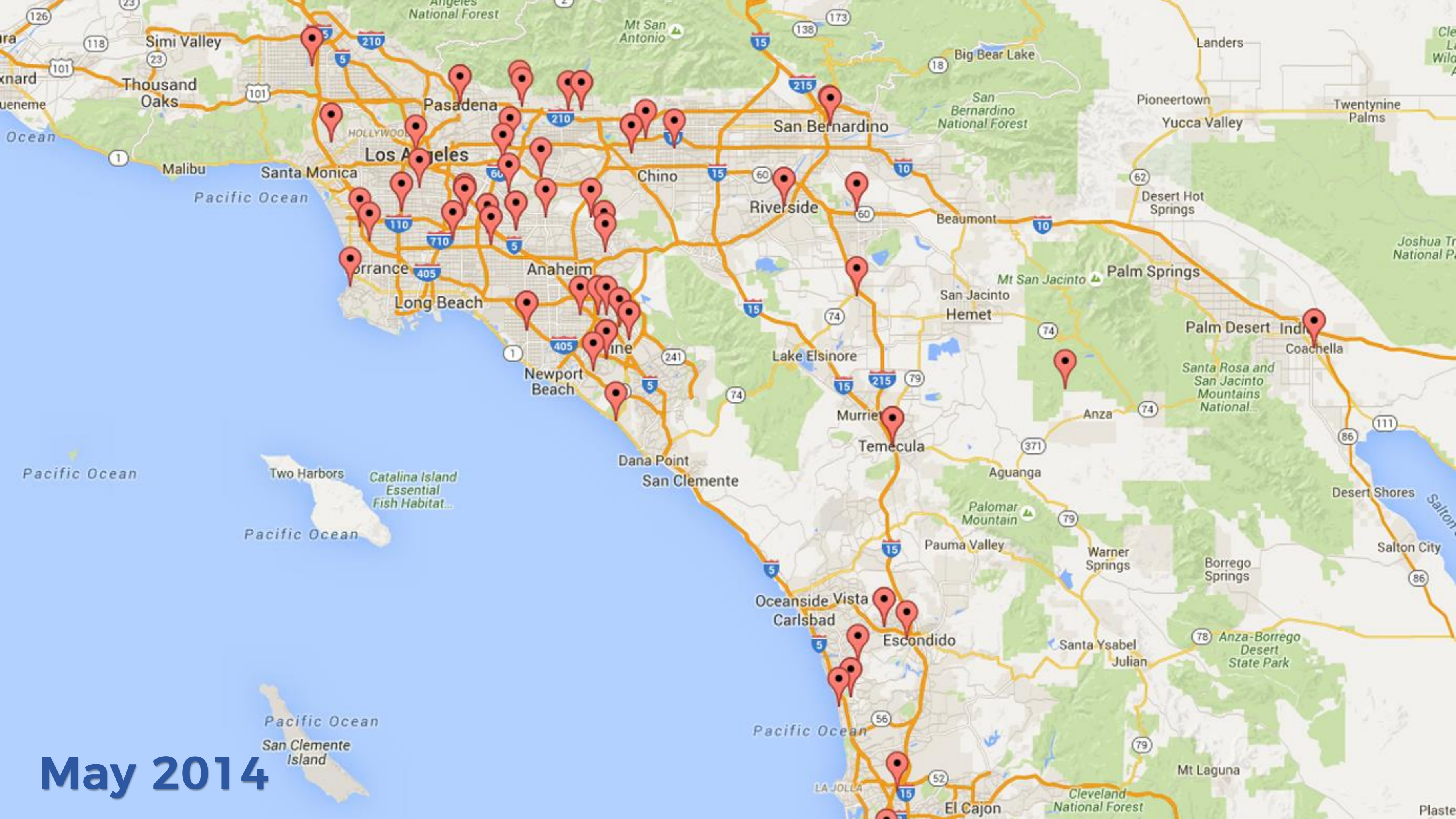
February 2014



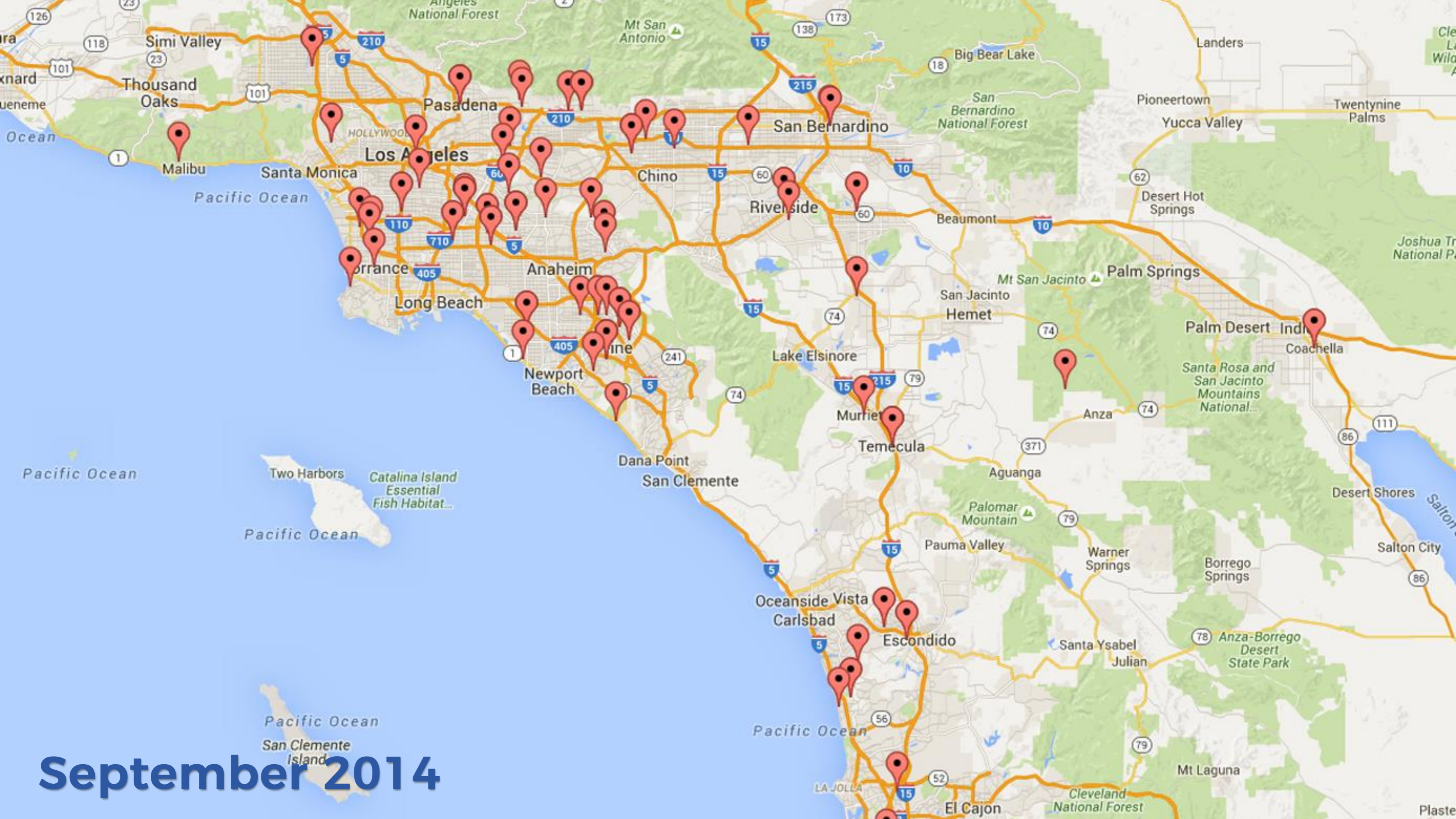
March 2014



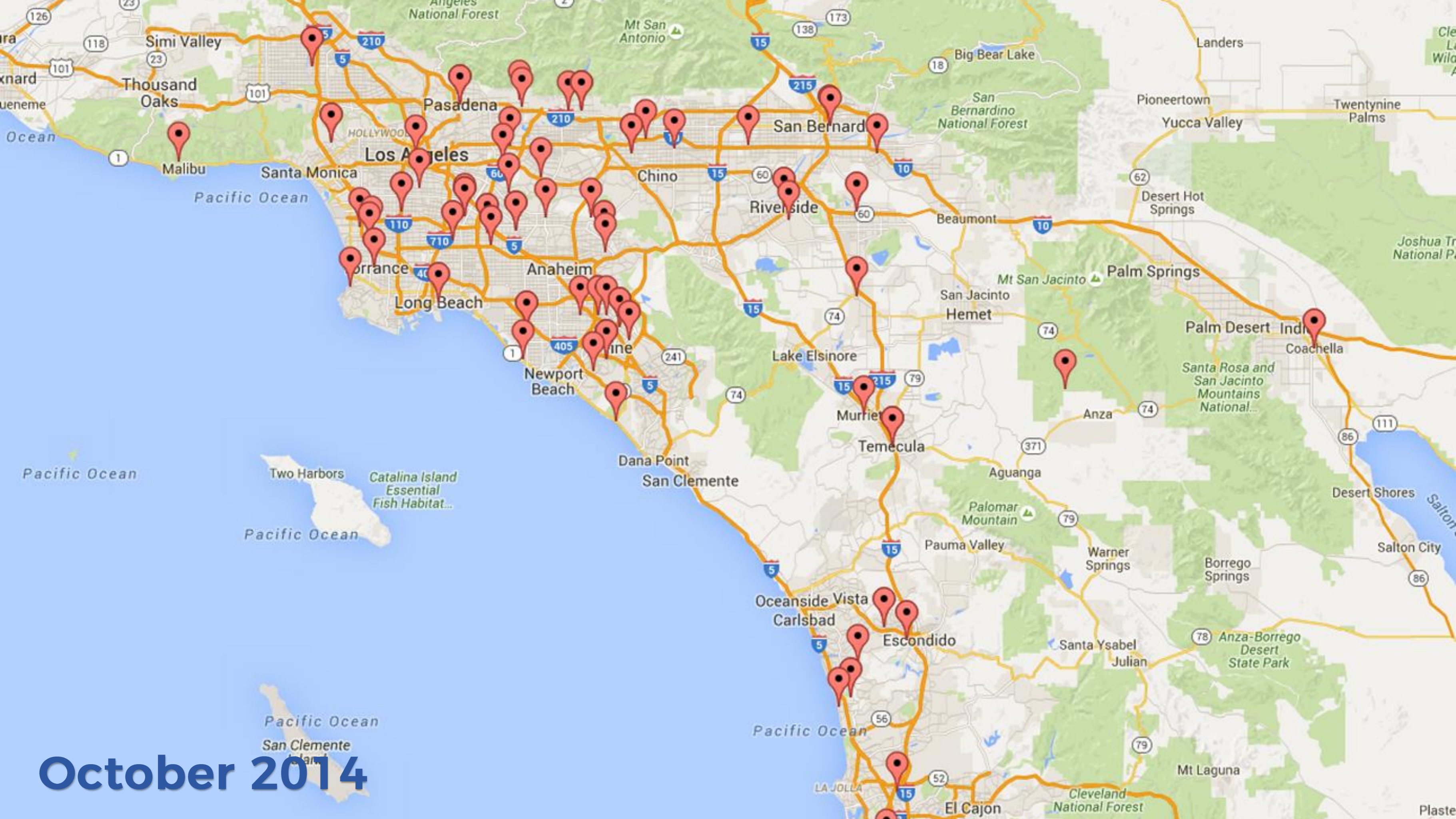
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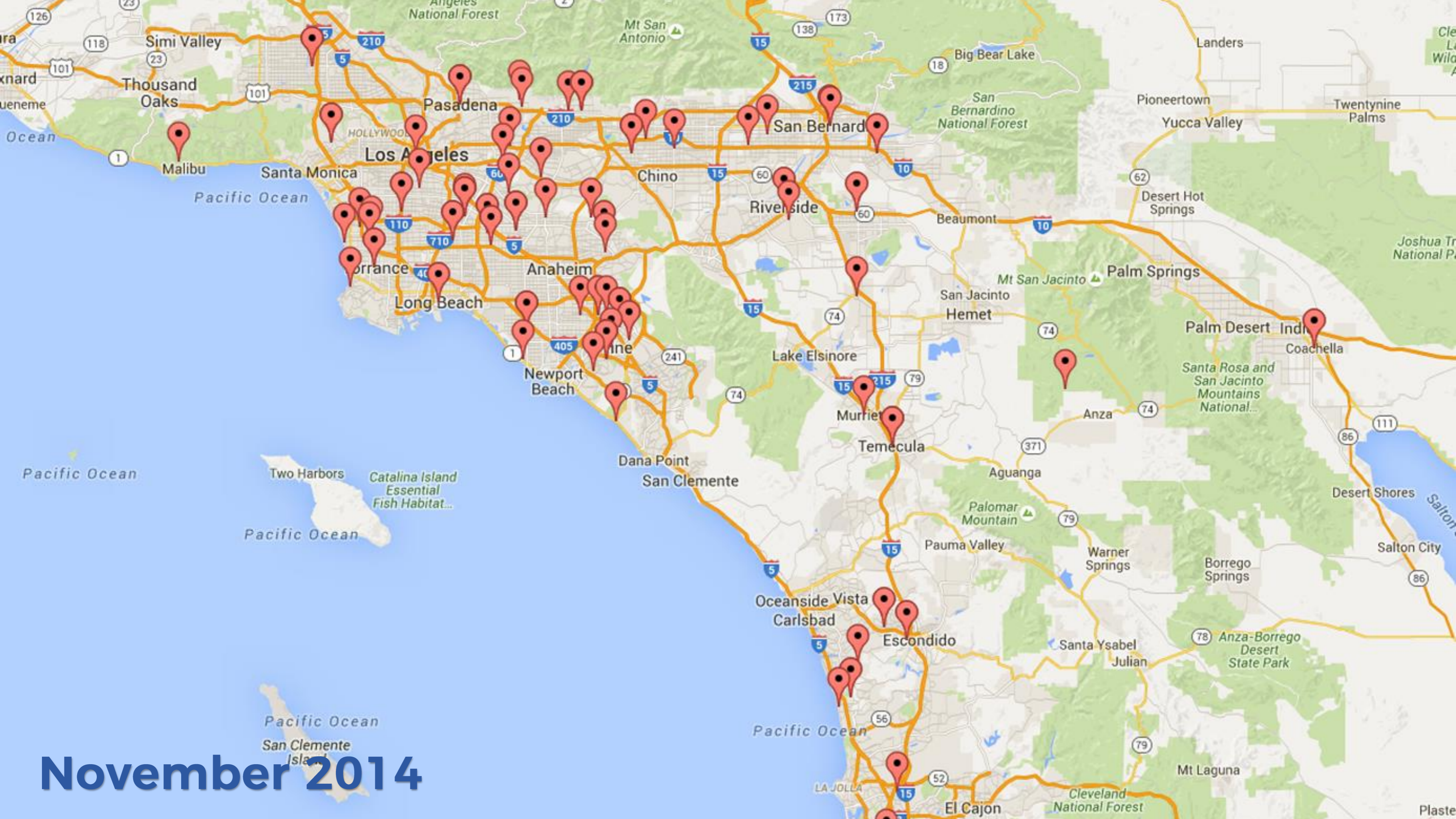
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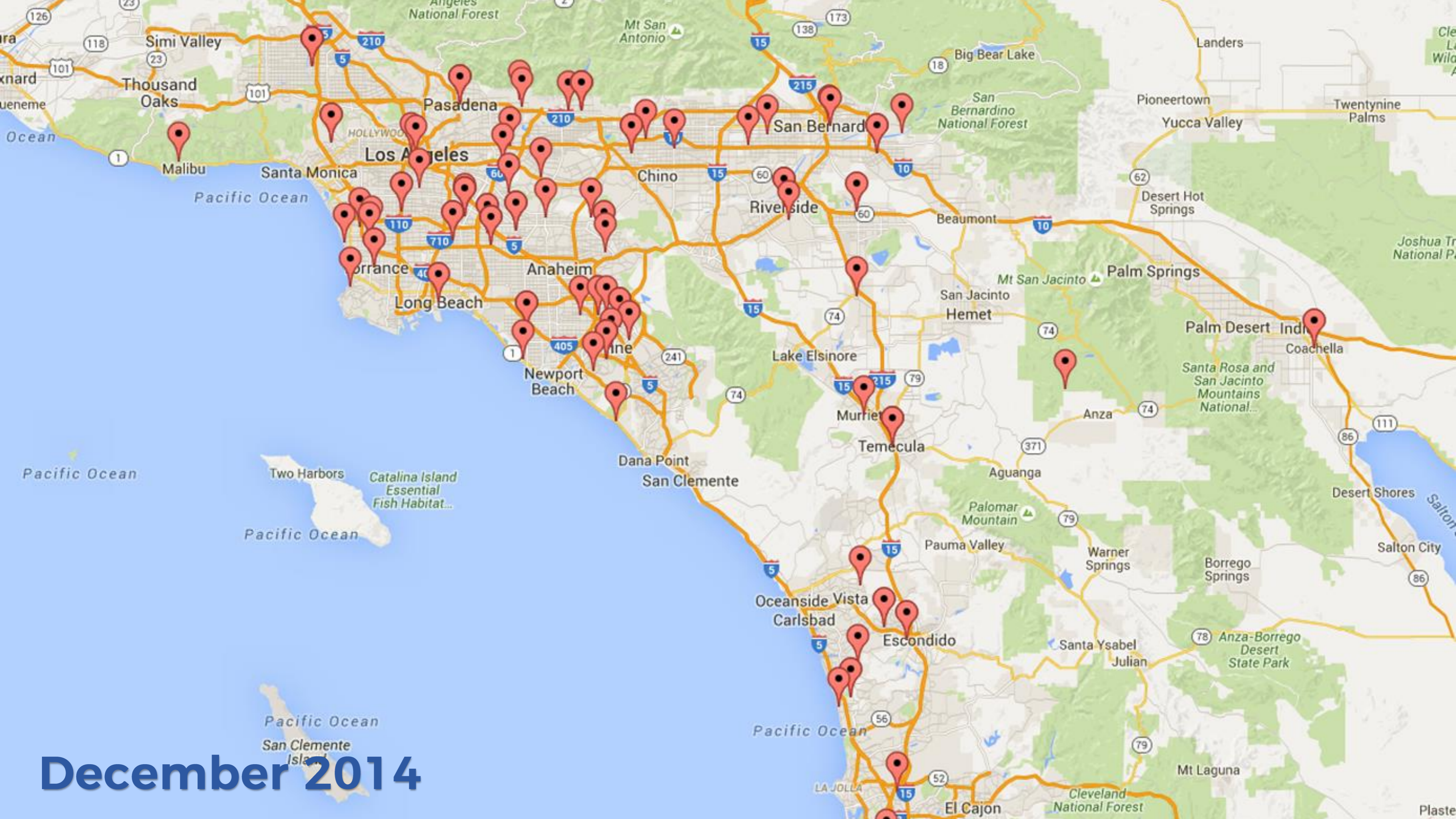
September 2014



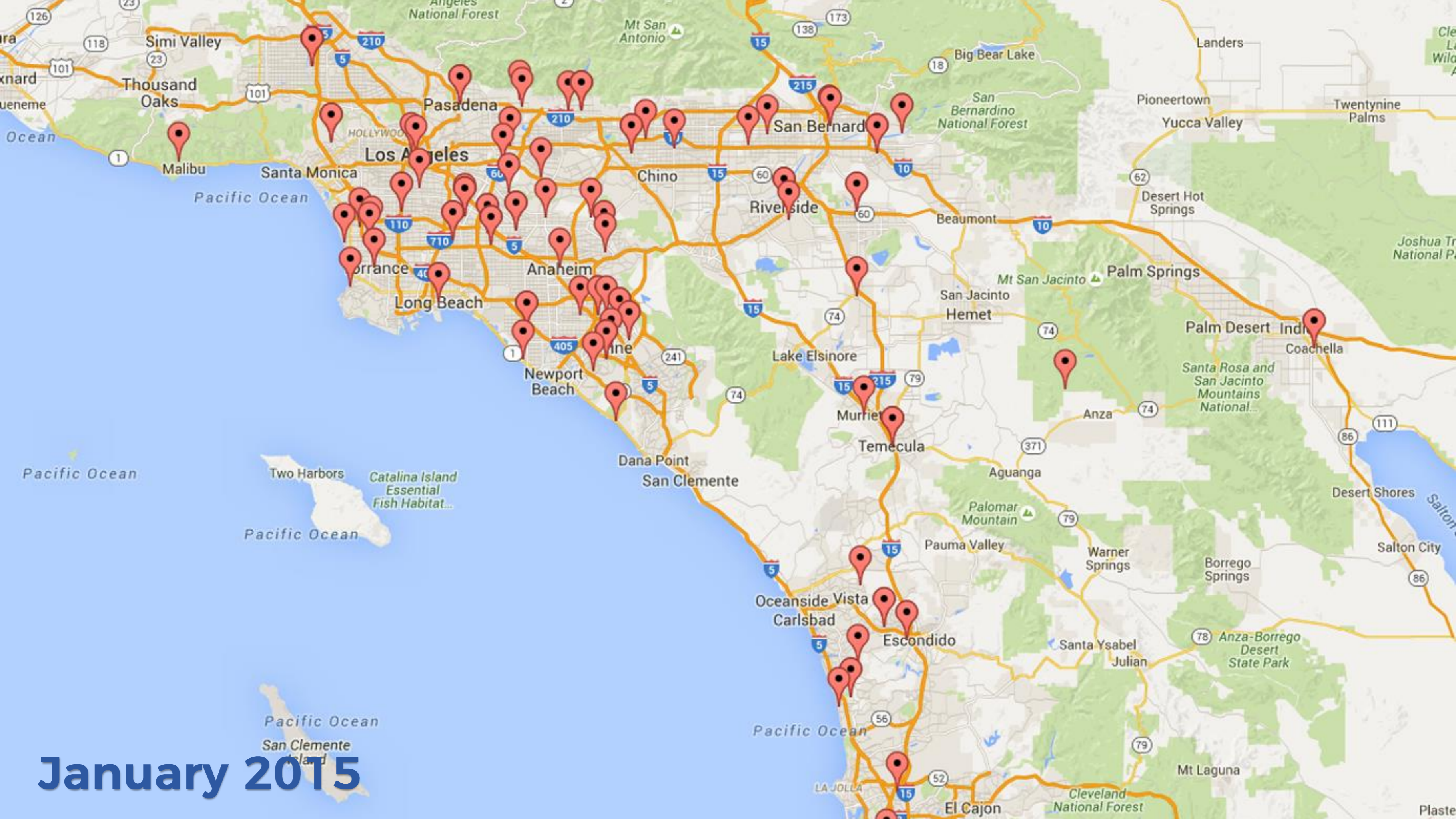
October 2014



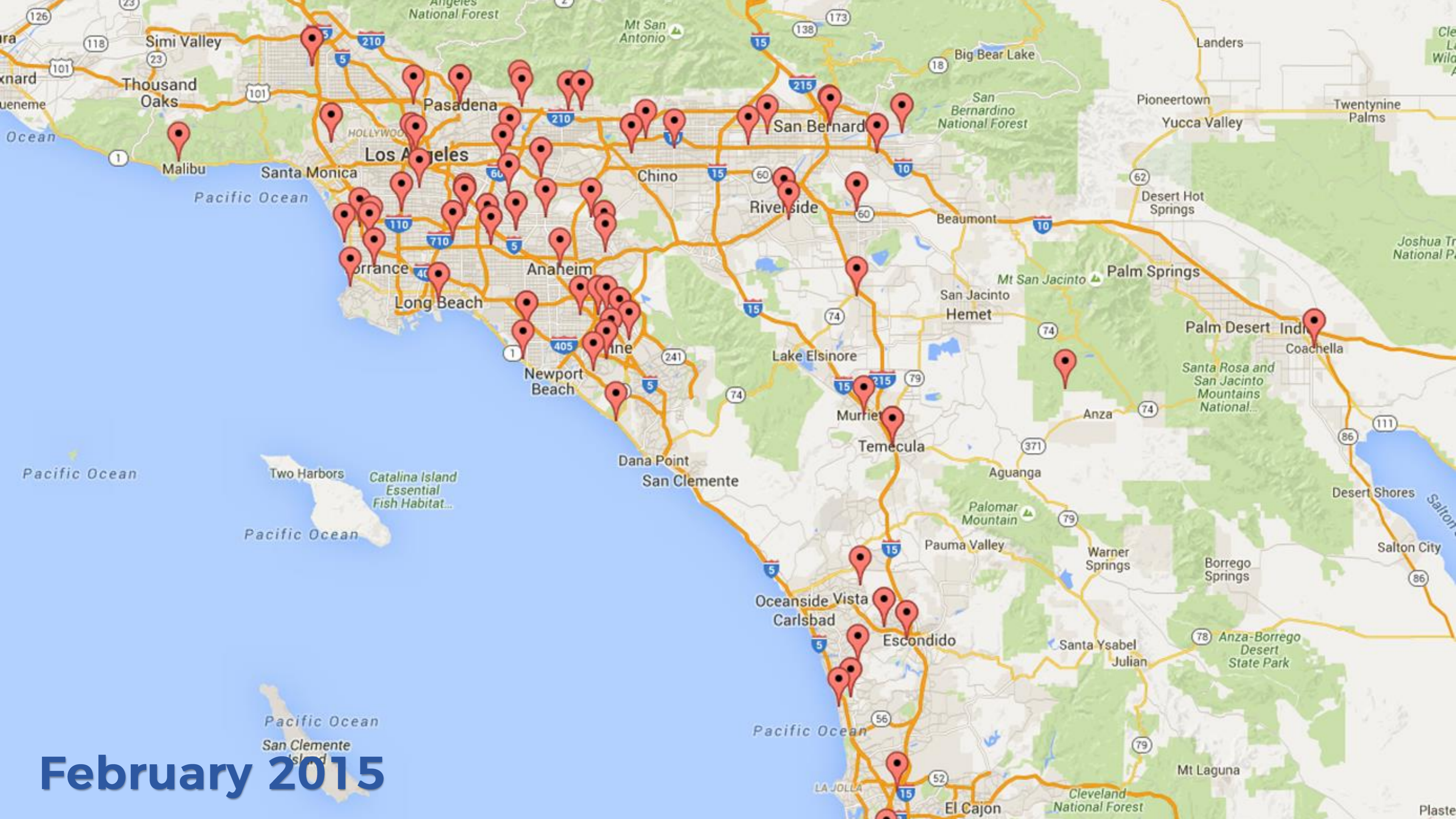
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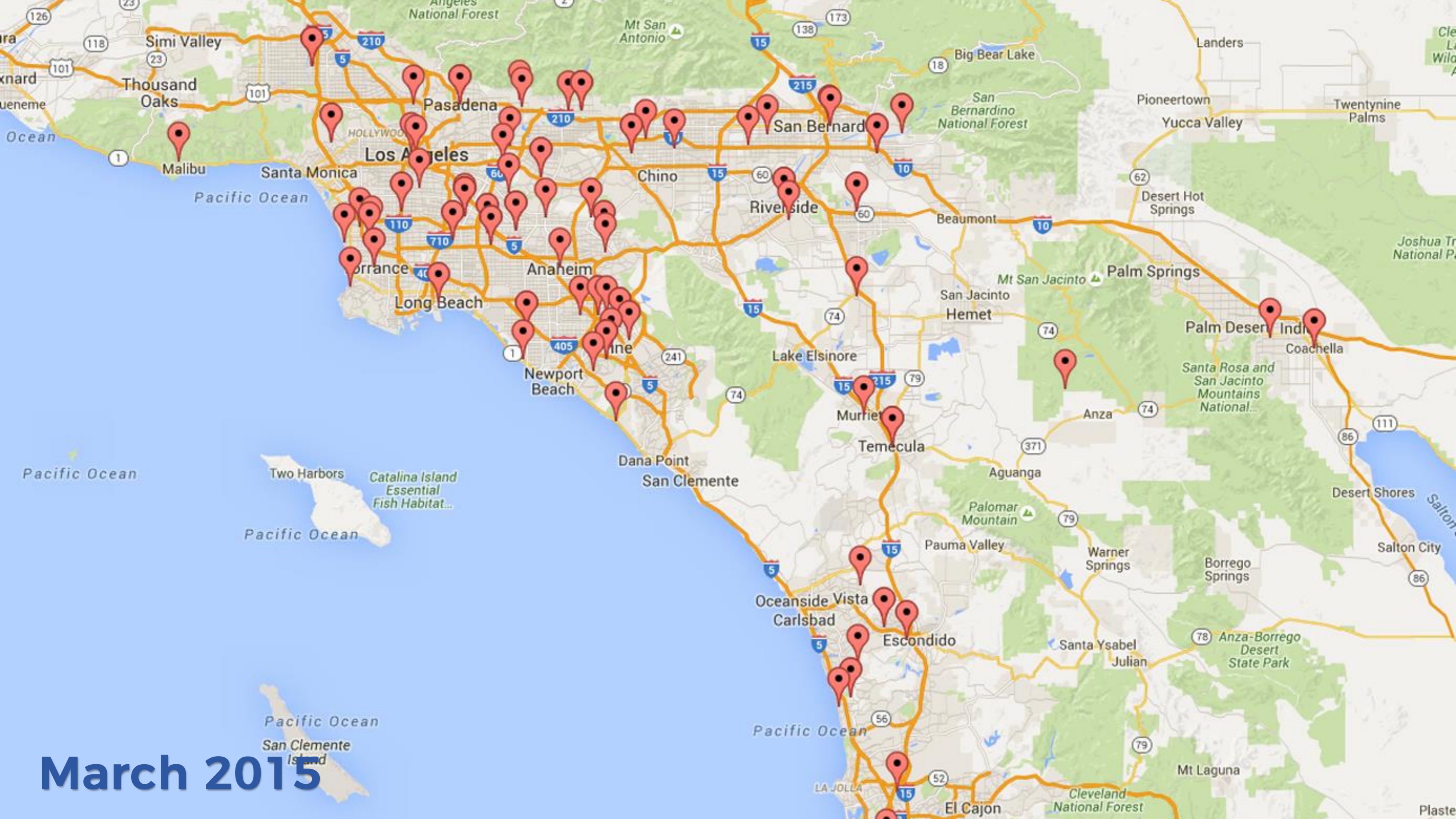
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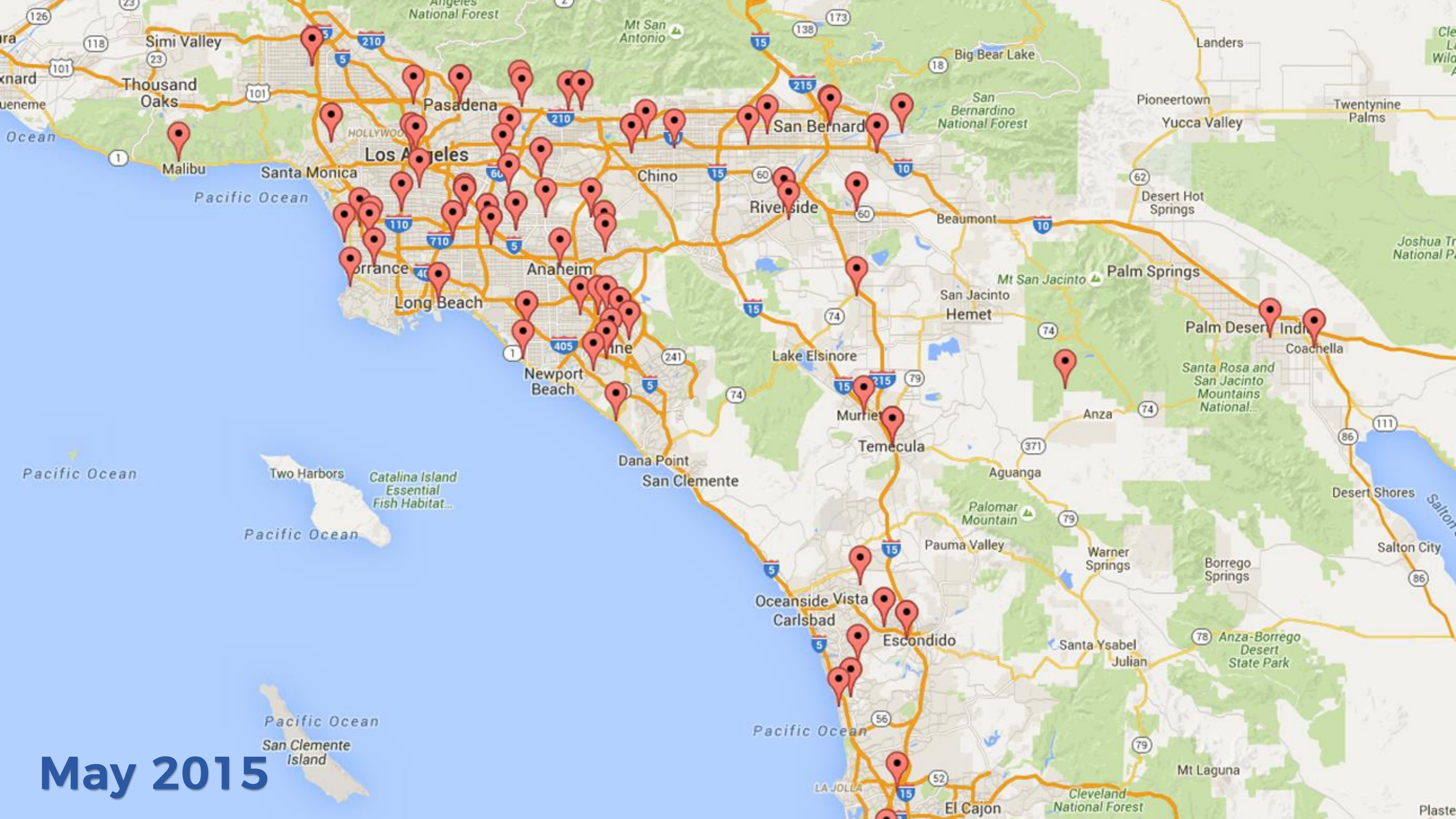
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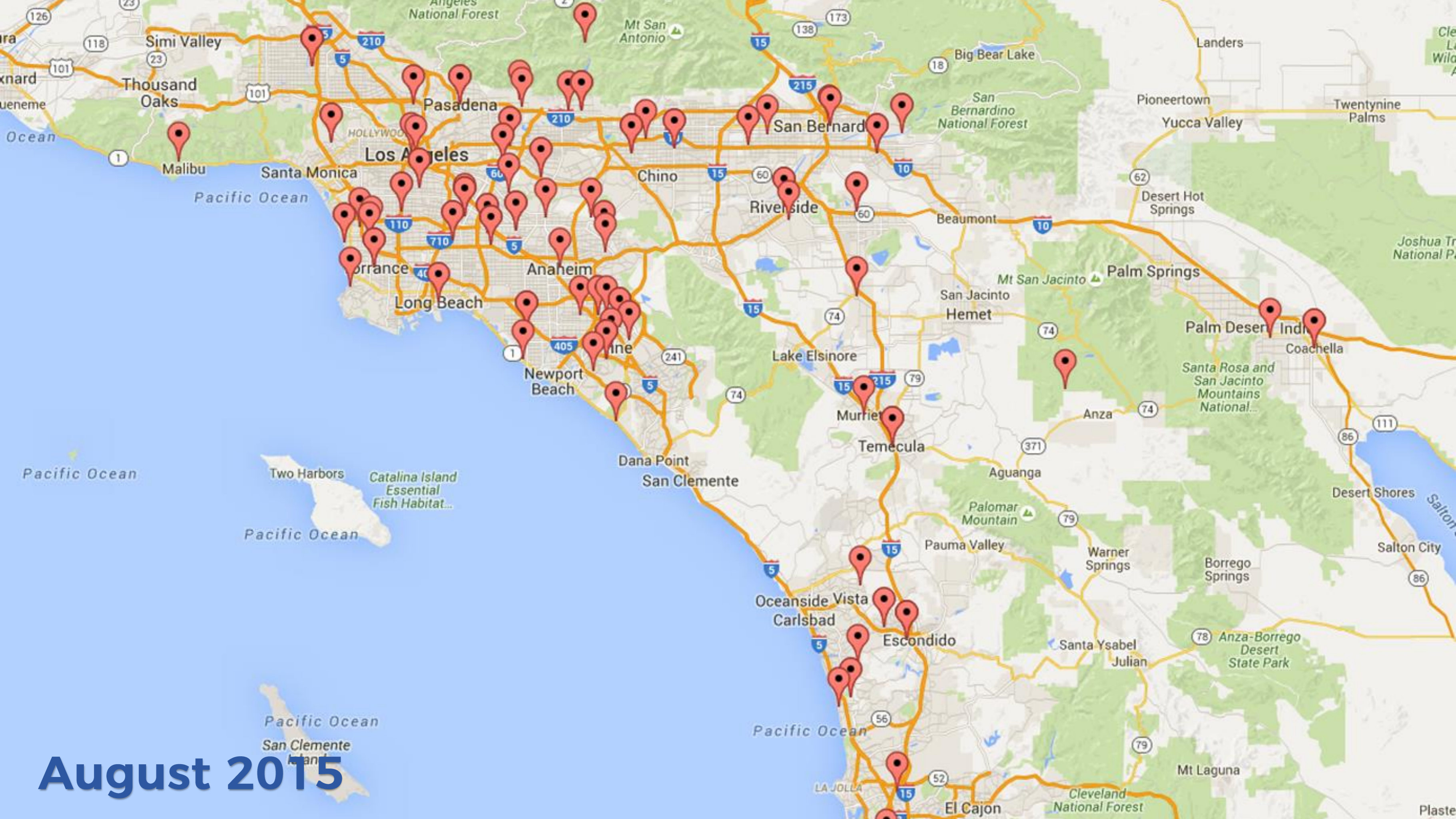
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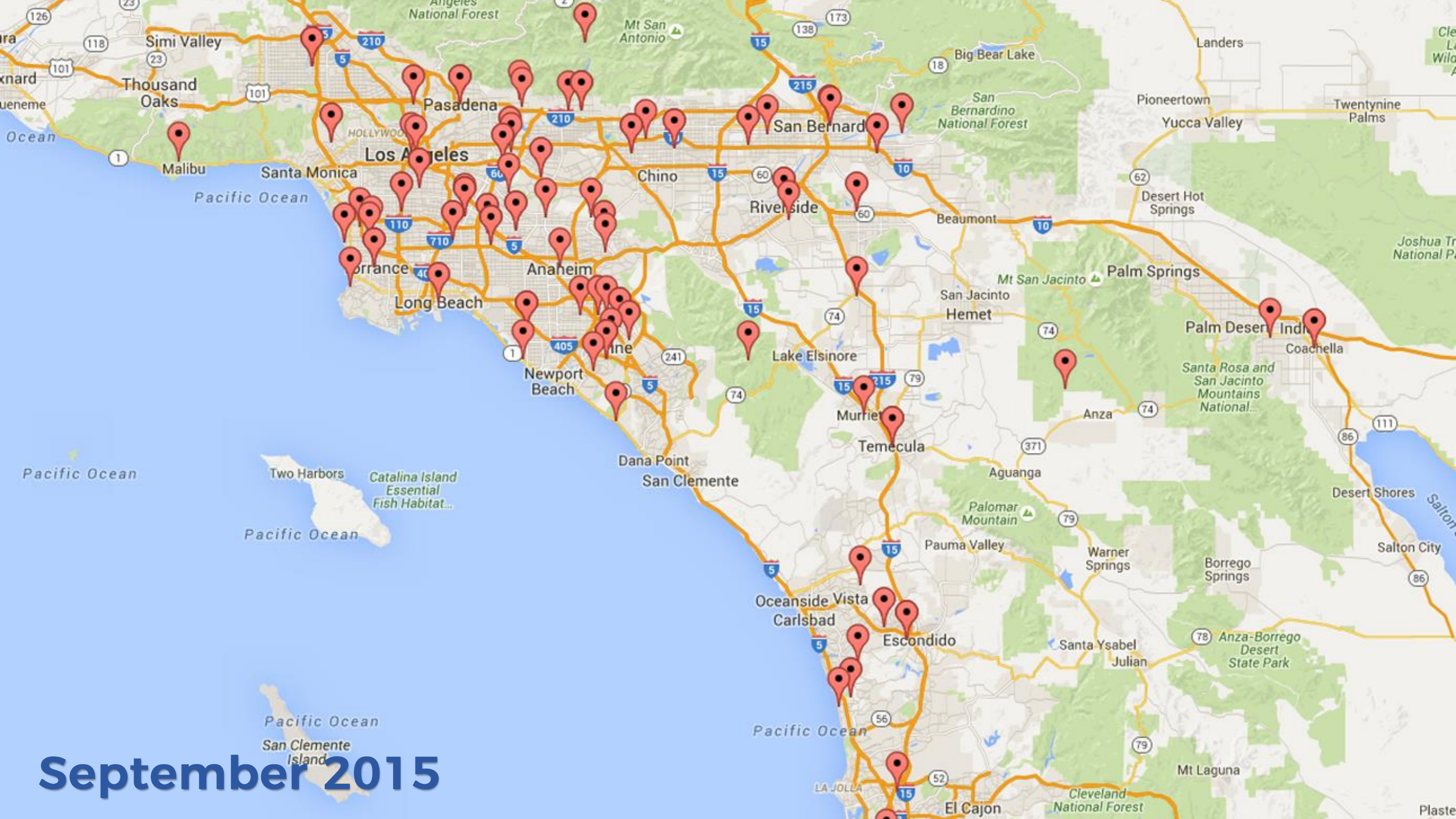
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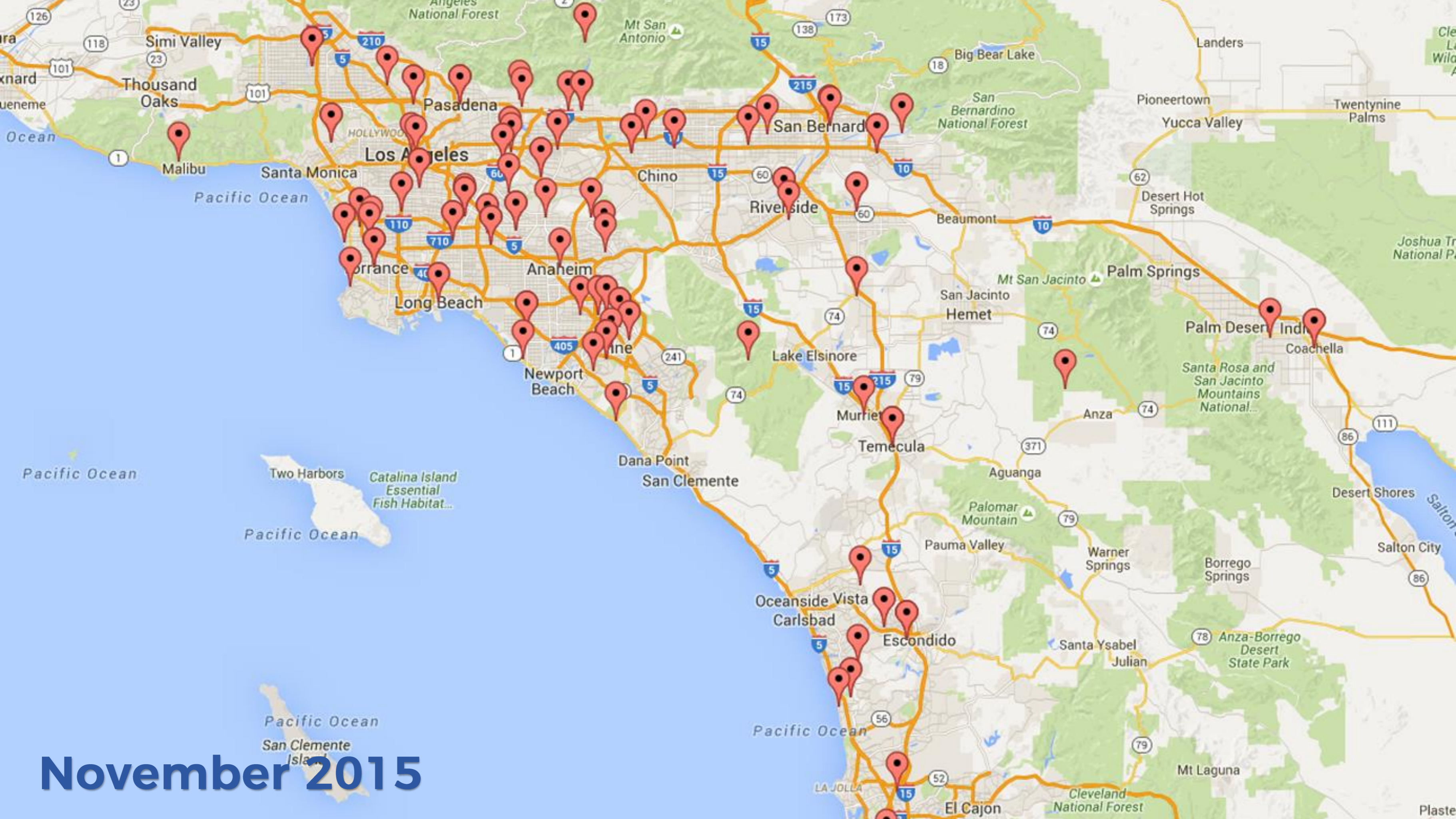
May 2015



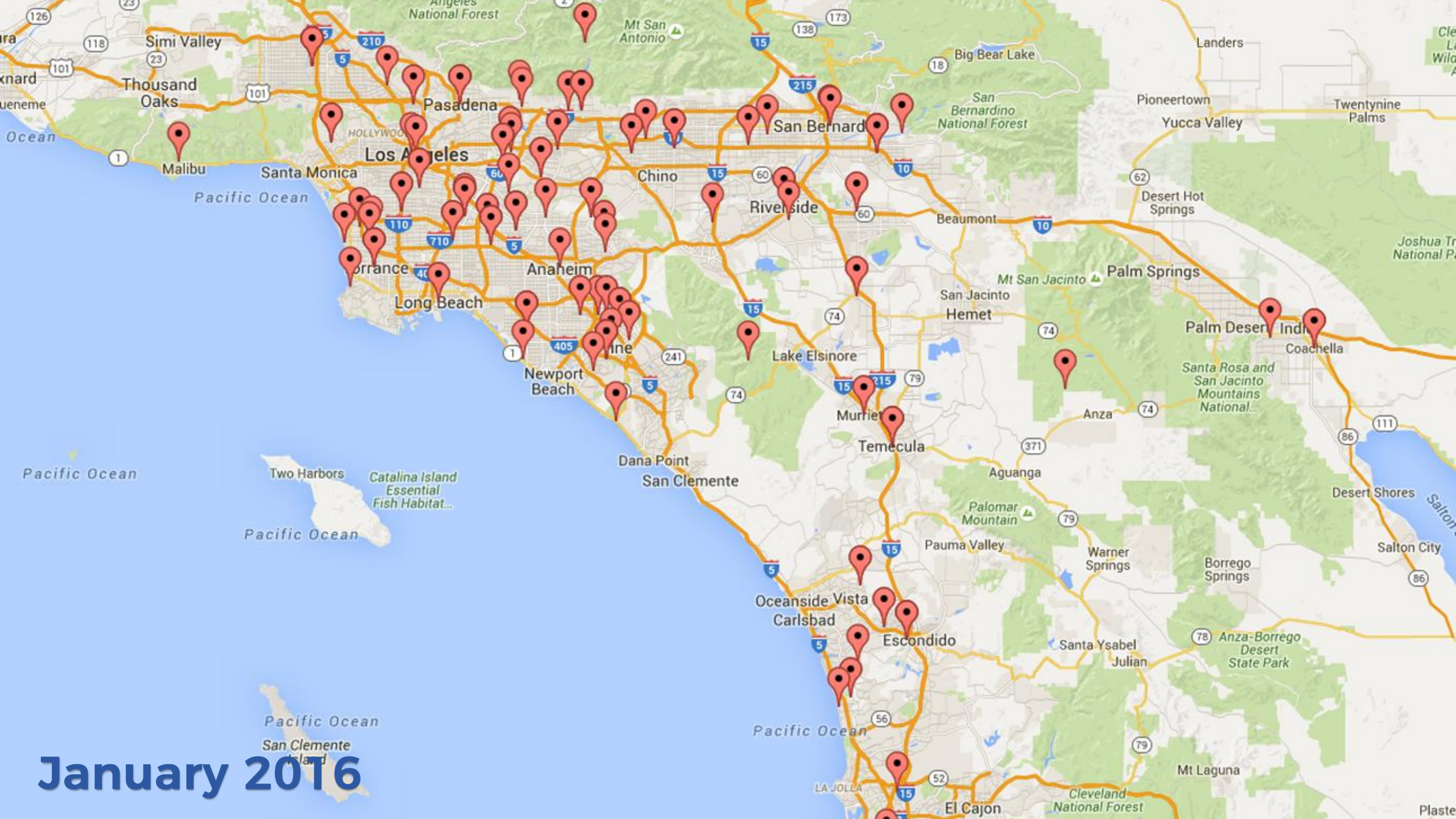
August 2015



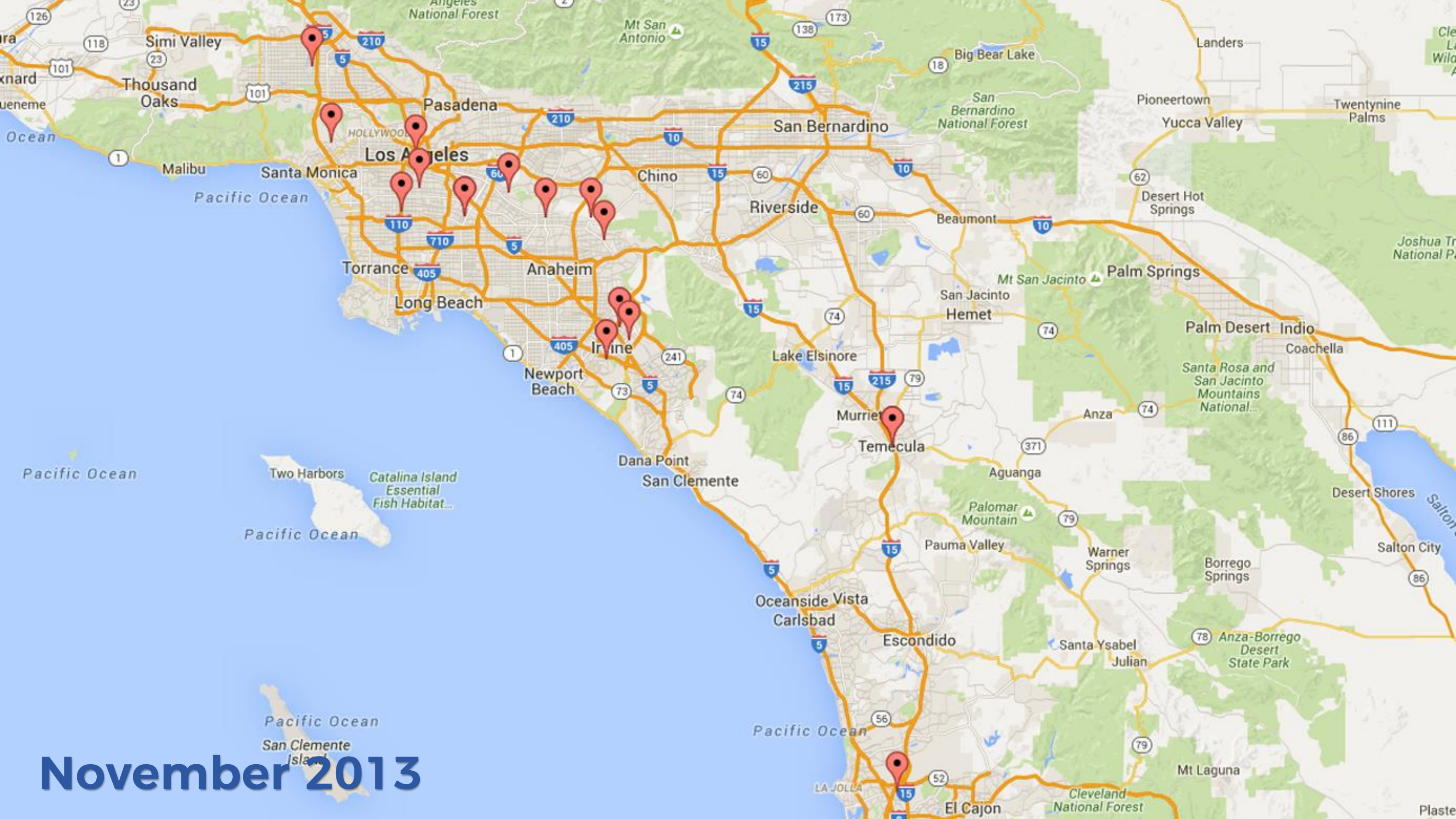
September 2015



November 2015



January 2016



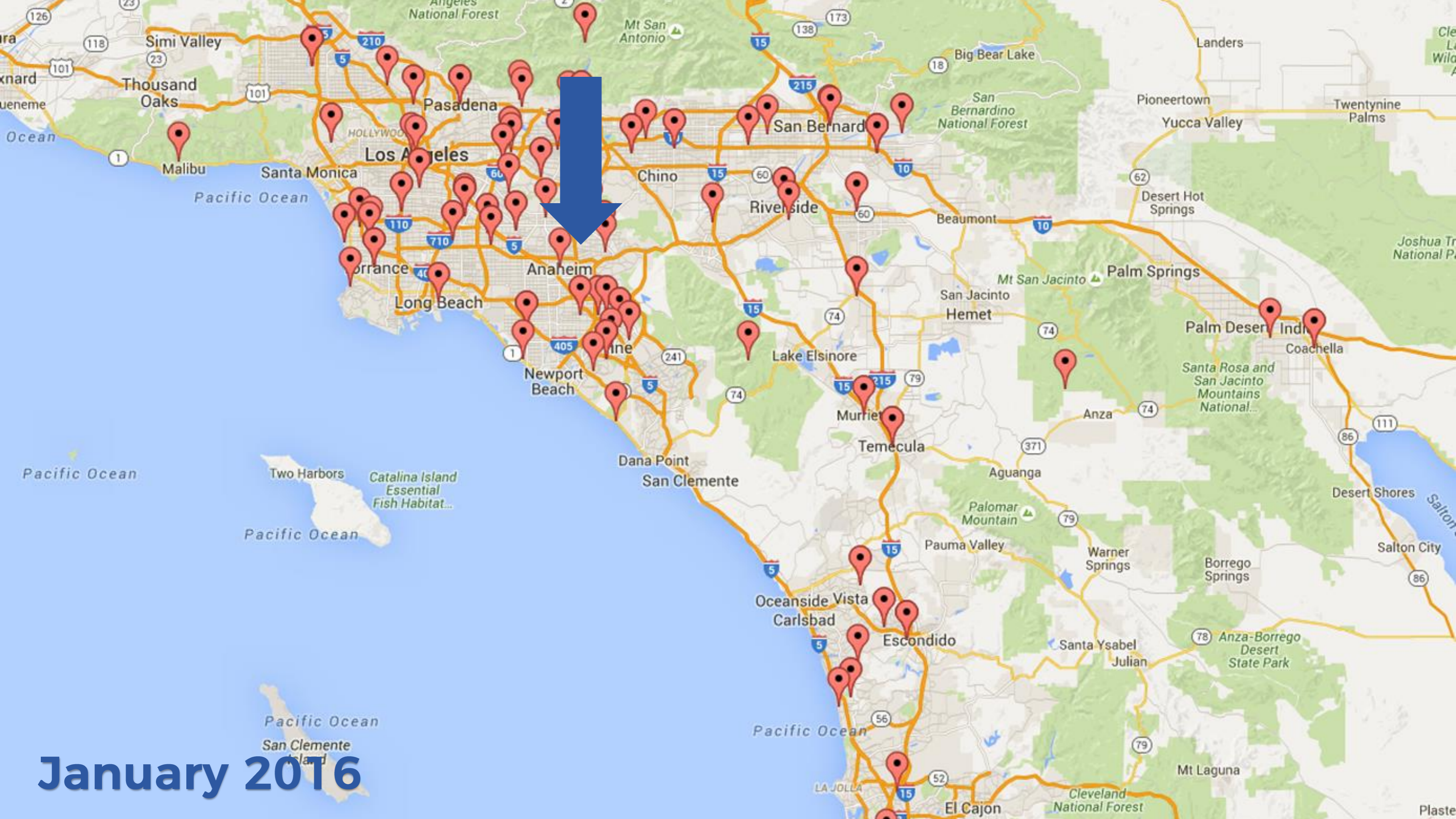
November 2013



Spies

Analysts

Model

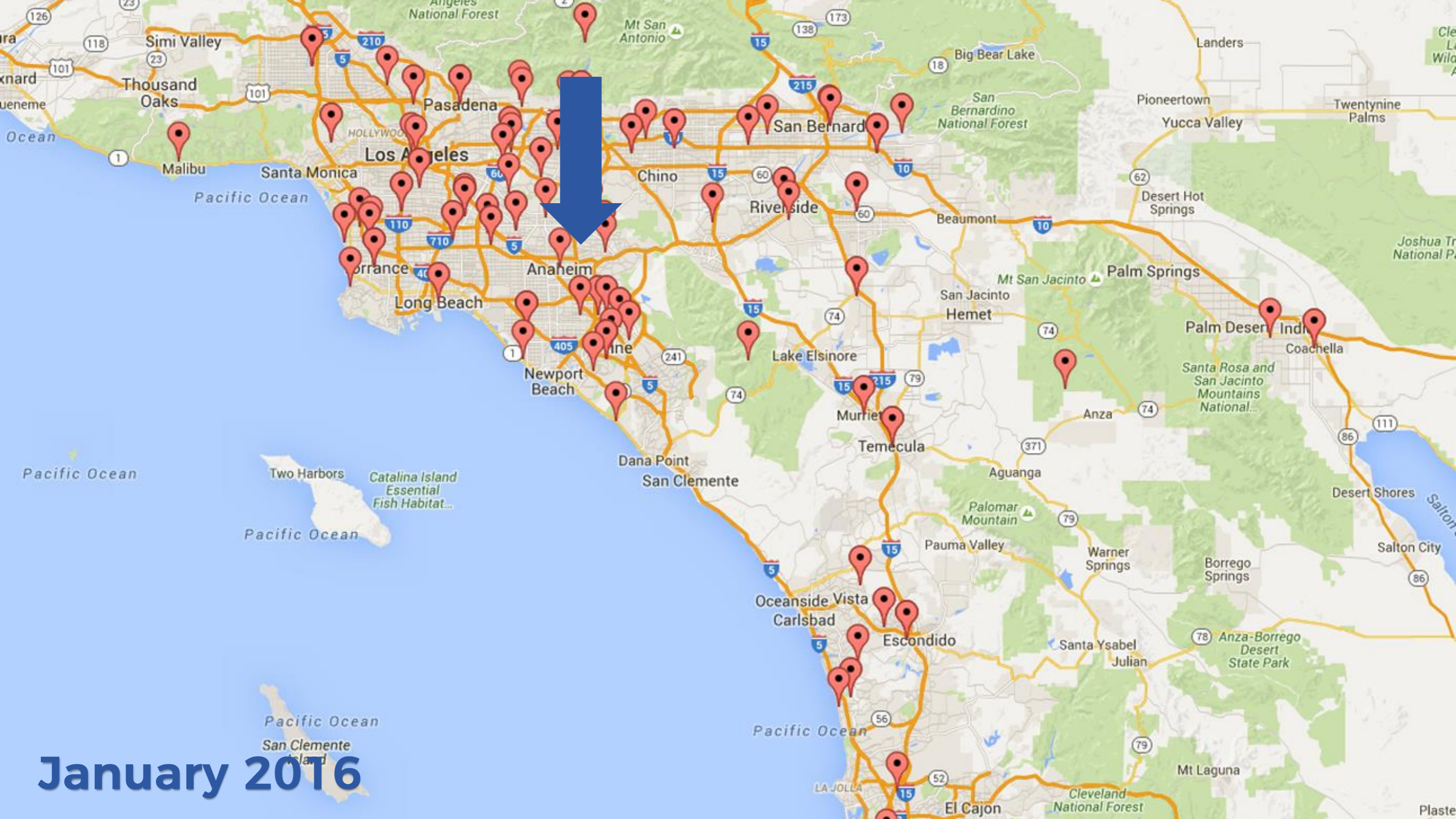


January 2016

Spies

Analysts

Model



January 2016

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.

```
graph TD; Spies --> Analysts; Analysts --> Model; Model --> Spies;
```

Spies

Analysts

Model

THINKING TIME

EASY TO STORE.



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.



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/etPtujll... #iteachmath



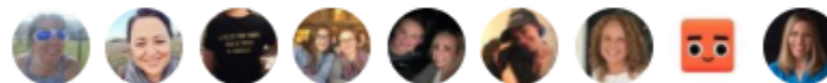
Favorite Chips

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





Favorite Chips (Responses)



File Edit View Insert Format Data Tools Form Add-ons Help

Comments

Share

100%
 \$ % .0 .00 123
Arial
10
B *I* ~~U~~ A

...
^

fx Timestamp

	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

+ Sheet3

Explore

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

CHIP BAG RESULTS

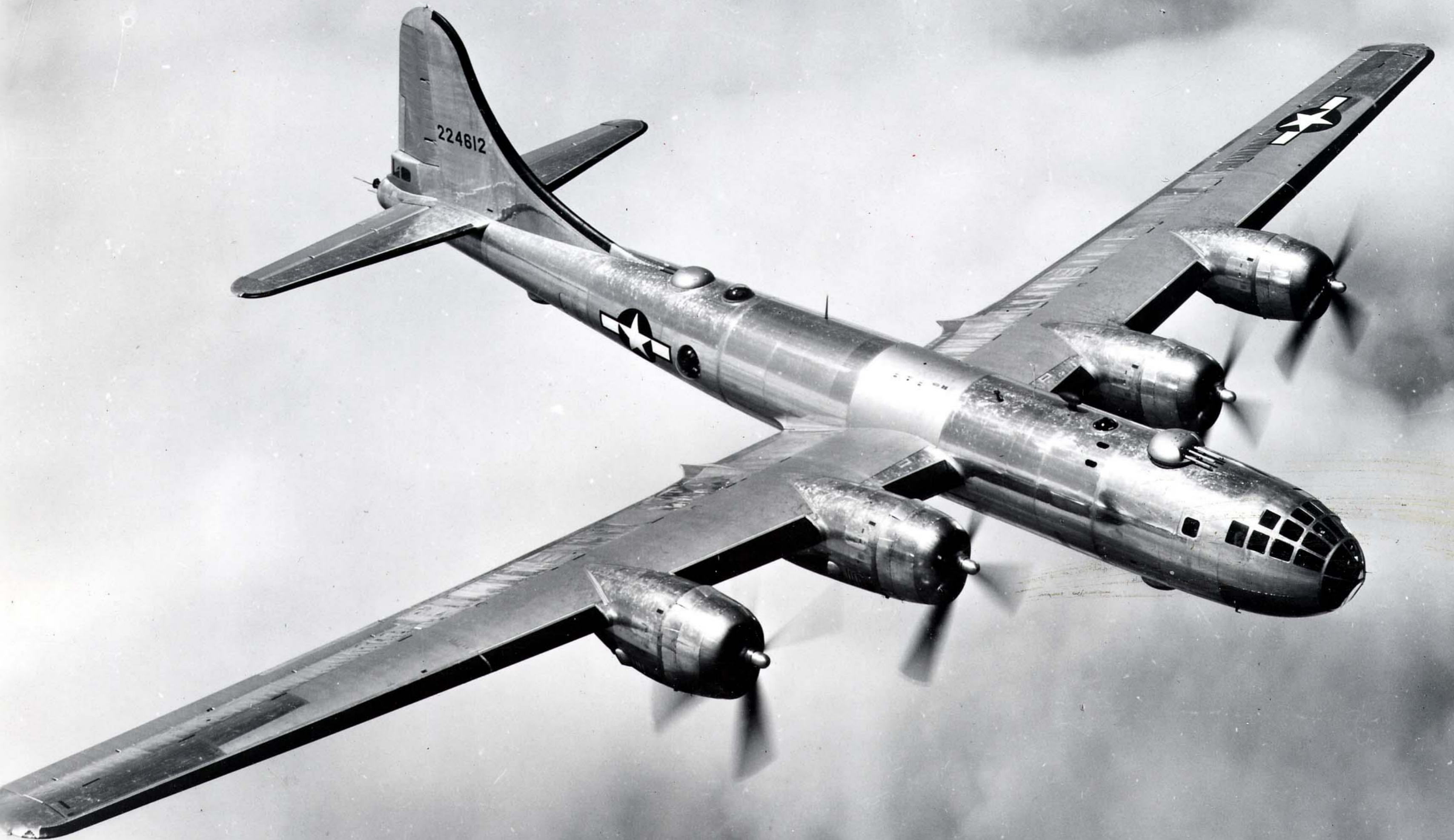
MATH MODELING

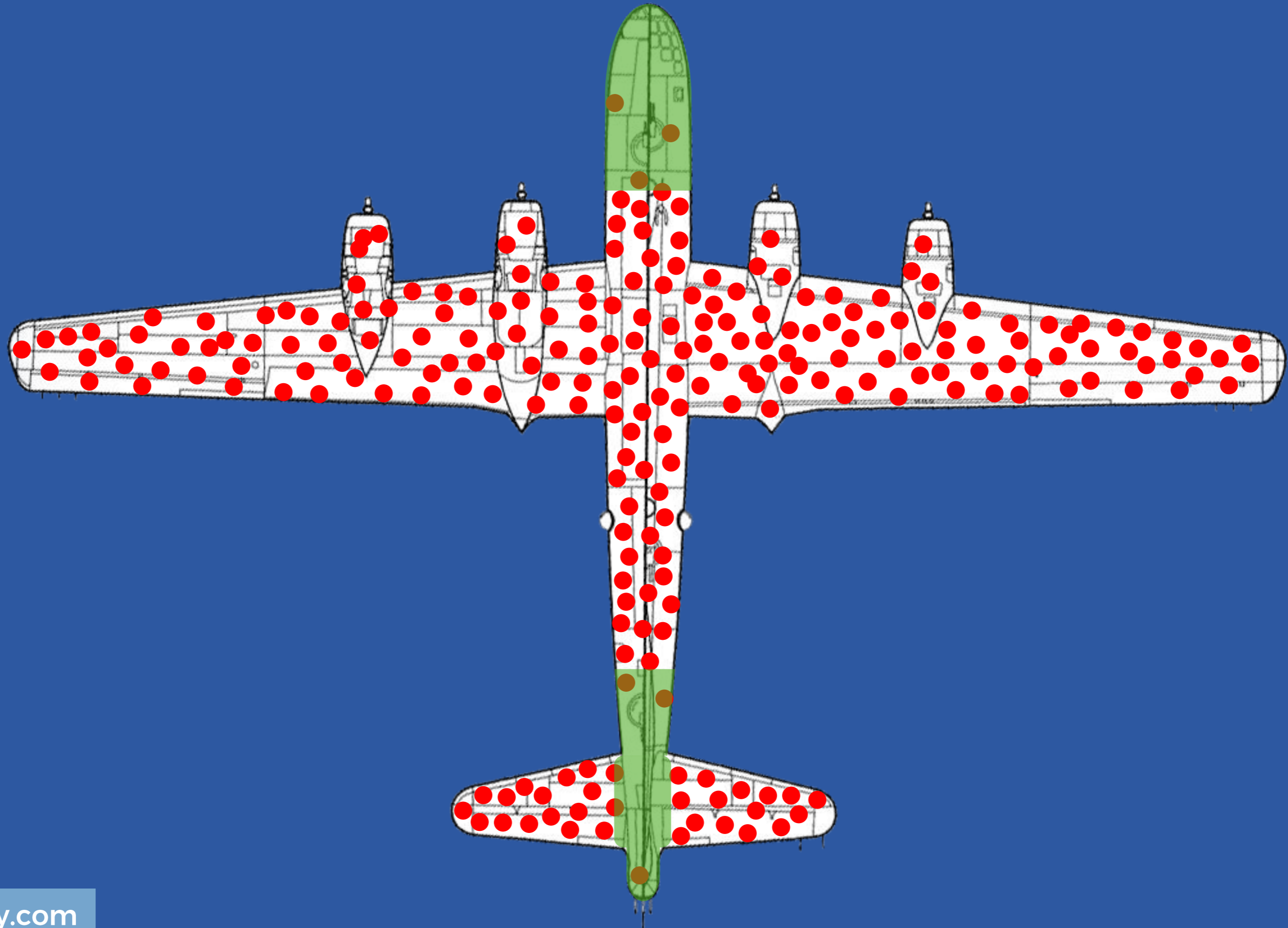
HOW DO WE MAKE SENSE OF MATH MODELING?

IS IT JUST ANSWERING QUESTIONS?

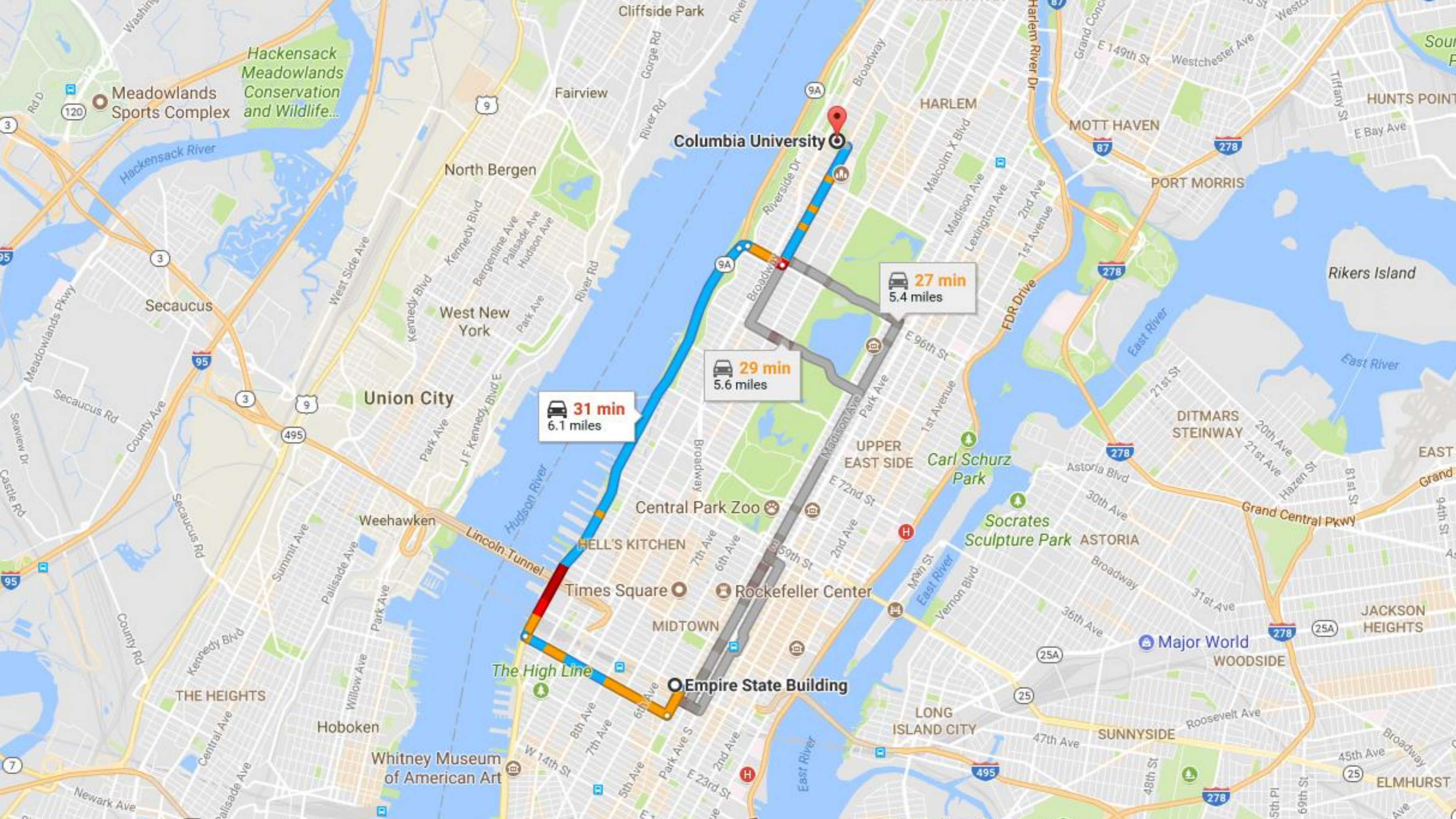
HOW IS MATH MODELING USED IN REAL LIFE?

HOW DO WE HELP OUR STUDENTS IMPROVE?





- ~~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

The High Line

Times Square

Rockefeller Center

Central Park Zoo

Carl Schurz Park

Socrates Sculpture Park

Hackensack Meadowlands Conservation and Wildlife...

Meadowlands Sports Complex

Rikers Island

JACKSON HEIGHTS

WOODSIDE

SUNNYSIDE

LONG ISLAND CITY

MIDTOWN

UPPER EAST SIDE

Union City

West New York

North Bergen

HARLEM

MOTT HAVEN

PORT MORRIS

HUNTS POINT

THE HEIGHTS

Hoboken

Whitney Museum of American Art

Weehawken

Secaucus

Cliffside Park

Fairview

ASTORIA

DITMARS STEINWAY

EAST

ELMHURST

- ~~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

HOW DO WE MAKE SENSE OF MATH MODELING?

IS IT JUST ANSWERING QUESTIONS?

HOW IS MATH MODELING USED IN REAL LIFE?

HOW DO WE HELP OUR STUDENTS IMPROVE?




TARGET PARKING



Spies

Analysts

Model



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

- **unscented lotion**
- **mineral supplements**
- **cotton balls**

Source: New York Times



UNITED



N4047

B G →

B →

← G A

A319
4047


```
graph TD; Spies --> Analysts; Analysts --> Model; Model --> Spies;
```

Spies

Analysts

Model

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

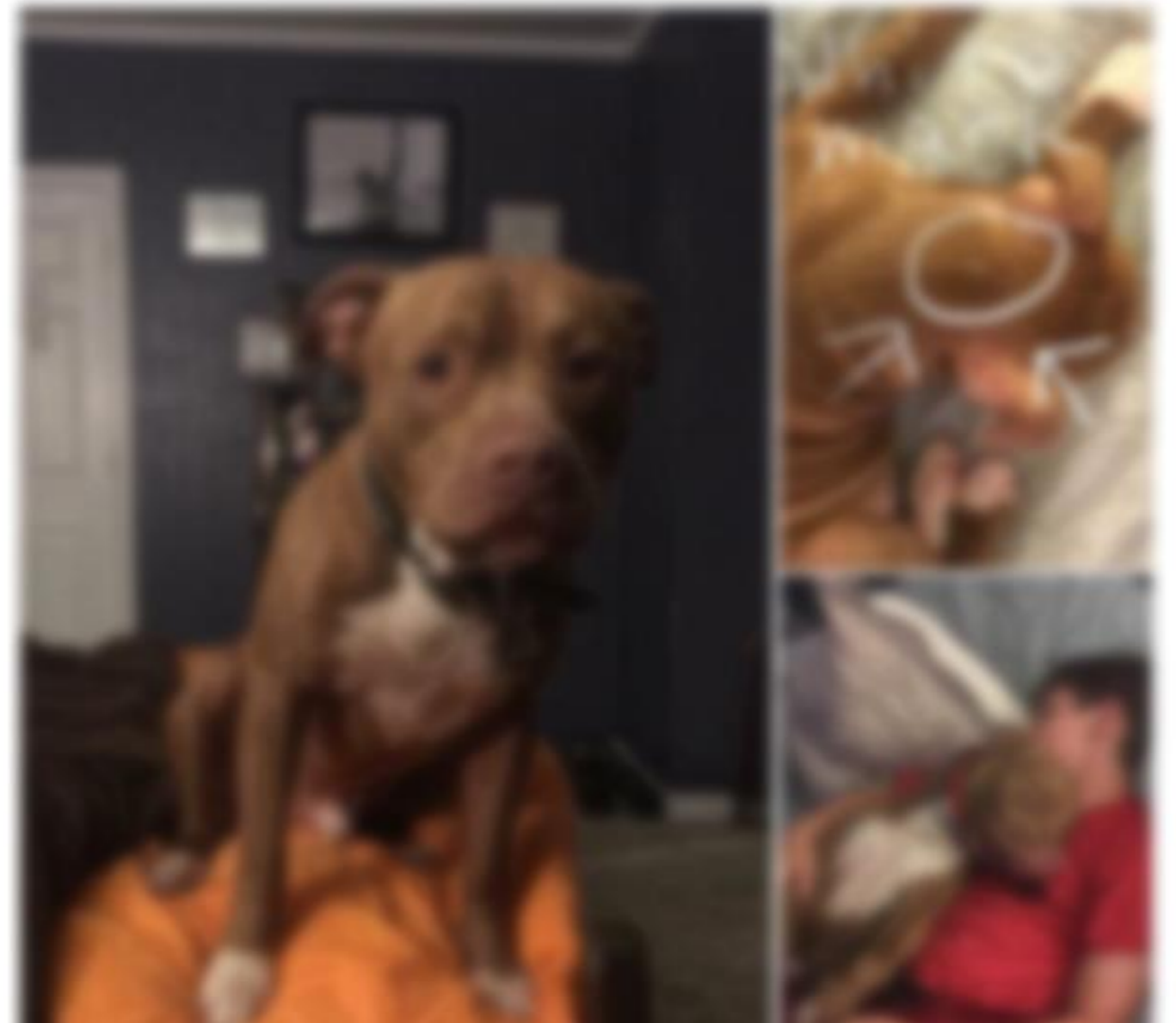
Ad · Page · Group · Event · Fundraiser

Make Post | Photo/Video Album | Live Video

What's on your mind, Robert?

Photo/Video | Feeling/Activity | ...

Ad: Add Schedule...
Missing this boy gets back to his family



News: New Father... activities to enjoy

Trending

- James Madison: The Dissolution of James and Isabella's Personal Email Server
- Fredericksburg, Virginia: Mother recovering from copperhead snake bite at Virginia... hospital
- Anthony Weiner: Anthony Weiner Sentenced to 21 Months in Prison

Watchlist: Latest Episodes

- Episode: The Making of a...
Fall in the Family
- Episode: The Making of a...
Fall in the Family

See All

Sponsored

Create Ad



```
graph TD; Spies --> Analysts; Analysts --> Model; Model --> Spies; Analysts --> Model;
```

Spies

Analysts

Model

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

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 Amazon know what products to recommend?
- How does Zillow estimate home prices?
- How does Pandora know what music to play?
- How does eHarmony know which people to show you?
- How do they figure out who should speak at a conference?

MATH MODELING

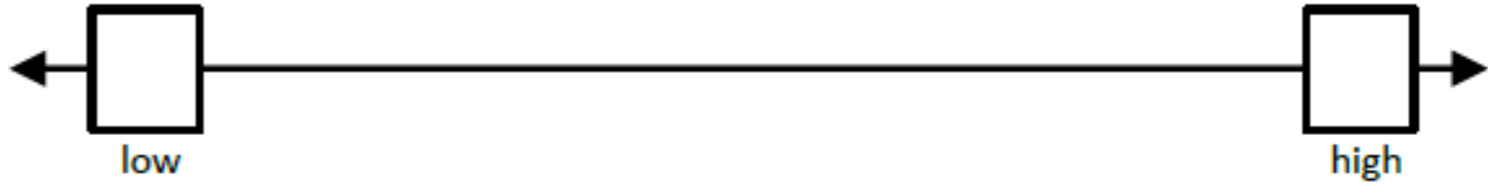
HOW DO WE MAKE SENSE OF MATH MODELING?

IS IT JUST ANSWERING QUESTIONS?

HOW IS MATH MODELING USED IN REAL LIFE?

HOW DO WE HELP OUR STUDENTS IMPROVE?

Name: _____ Period: _____ Date: _____

What problem are you trying to figure out?	What estimates do you have?
	 <p data-bbox="2059 714 2768 752">Place your estimate on the number line.</p>
What info do you already know about the problem?	What info do you need about the problem?
<p data-bbox="736 1001 1685 1365">TOP SECRET!</p>	<p data-bbox="1725 767 2558 1103">SPIES ONLY</p>
What is your conclusion? How did you reach that conclusion?	

Your work

DANGER

**ANALYSTS
AT WORK**

MODELING EXAMPLES

□ ELEMENTARY SCHOOL

□ MIDDLE SCHOOL

□ HIGH SCHOOL



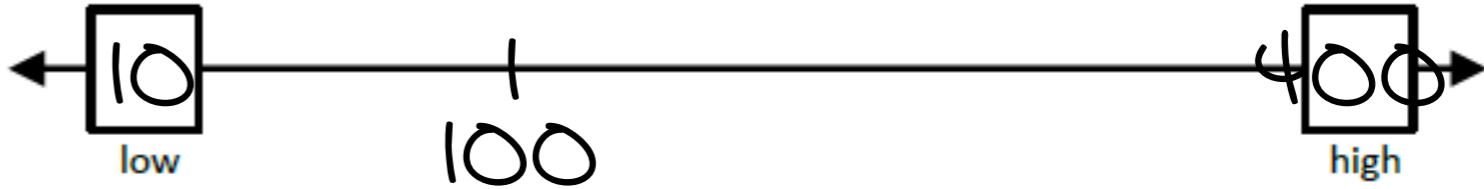
```
graph TD; Spies --> Analysts; Analysts --> Model; Model --> Spies;
```

Spies

Analysts

Model

THINKING TIME

What problem are you trying to figure out?	What estimates do you have?
<p>How many beverage choices are there?</p>	 <p style="text-align: center;">Place your estimate on the number line.</p>
What info do you already know about the problem?	What info do you need about the problem?
<ul style="list-style-type: none"> • There are main flavors and added flavors. • Lemonade is yummy. 	<ul style="list-style-type: none"> • 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 GROUPS



7

Coca-Cola

8

Sprite

no caffeine

8

Fanta

Orange

no caffeine

1

Pibb

no caffeine

2

Bany's

no caffeine

5

YALT

8

WIC

Orange

no caffeine

6

Minute Maid

LEMONADE

no caffeine

8

Powerade

Orange

no caffeine

low/no calories

Coca-Cola zero

8

Diet Coke

7

Diet Coke

no caffeine

7

Sprite zero

no caffeine

8

Fanta zero

Orange

no caffeine

8

Pibb

no caffeine

1

Bany's

no caffeine

2

DASANI

Lemon

no caffeine

8

DASANI sensations

Lemon

no caffeine

8

Minute Maid

LEMONADE

no caffeine

6

Powerade ZERO

Orange

no caffeine

8

Seagram's

LEMON LIME

no caffeine

1

INVENTED STRATEGY



8

8

no caffeine

8

no caffeine

7

7

no caffeine

7

no caffeine

8

no caffeine

low/no calories

8

8

no caffeine

8

no caffeine

8

no caffeine

8

8

no caffeine

8

no caffeine

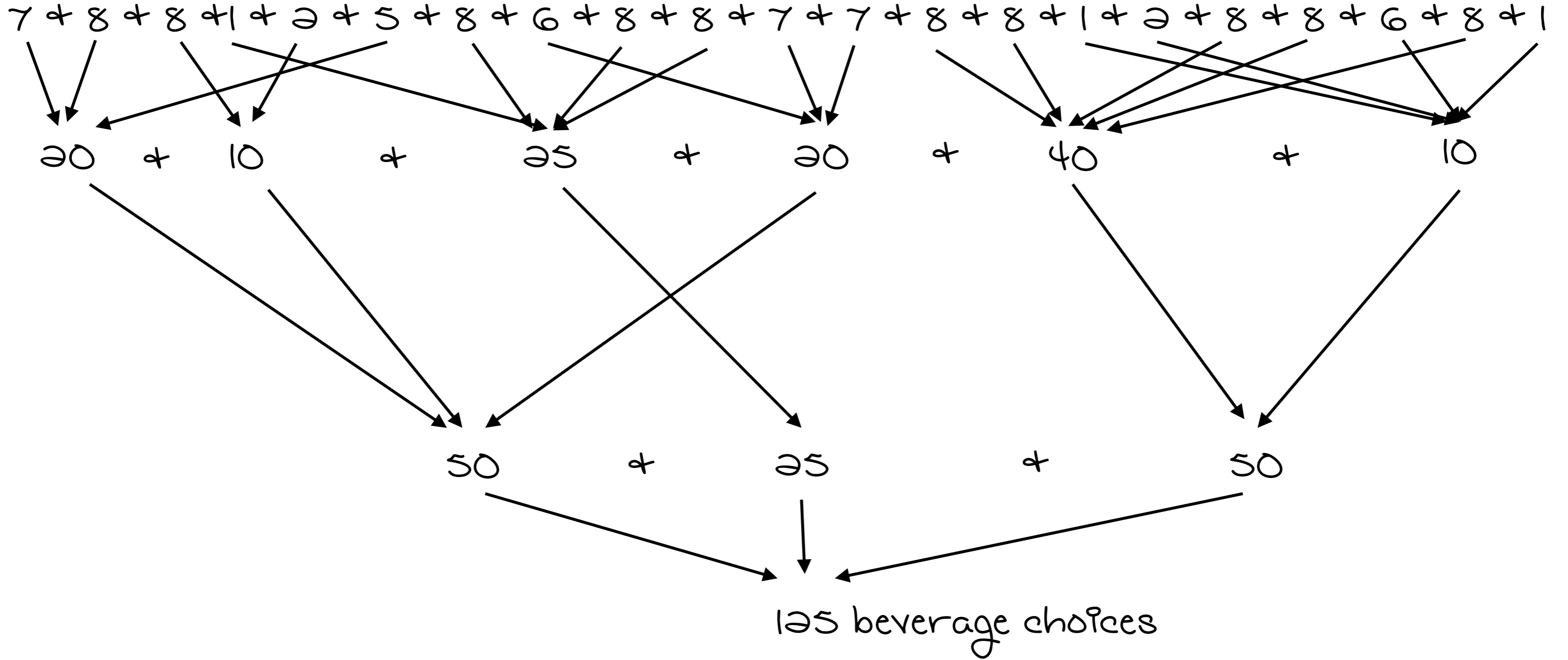
8

no caffeine

8

no caffeine

8



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

ELEMENTARY SCHOOL

MIDDLE SCHOOL

HIGH SCHOOL



Stacks

LIVE



FOX NEWS

Junction

```
graph TD; Spies --> Analysts; Analysts --> Model; Model --> Spies; Analysts --> Model;
```

Spies

Analysts

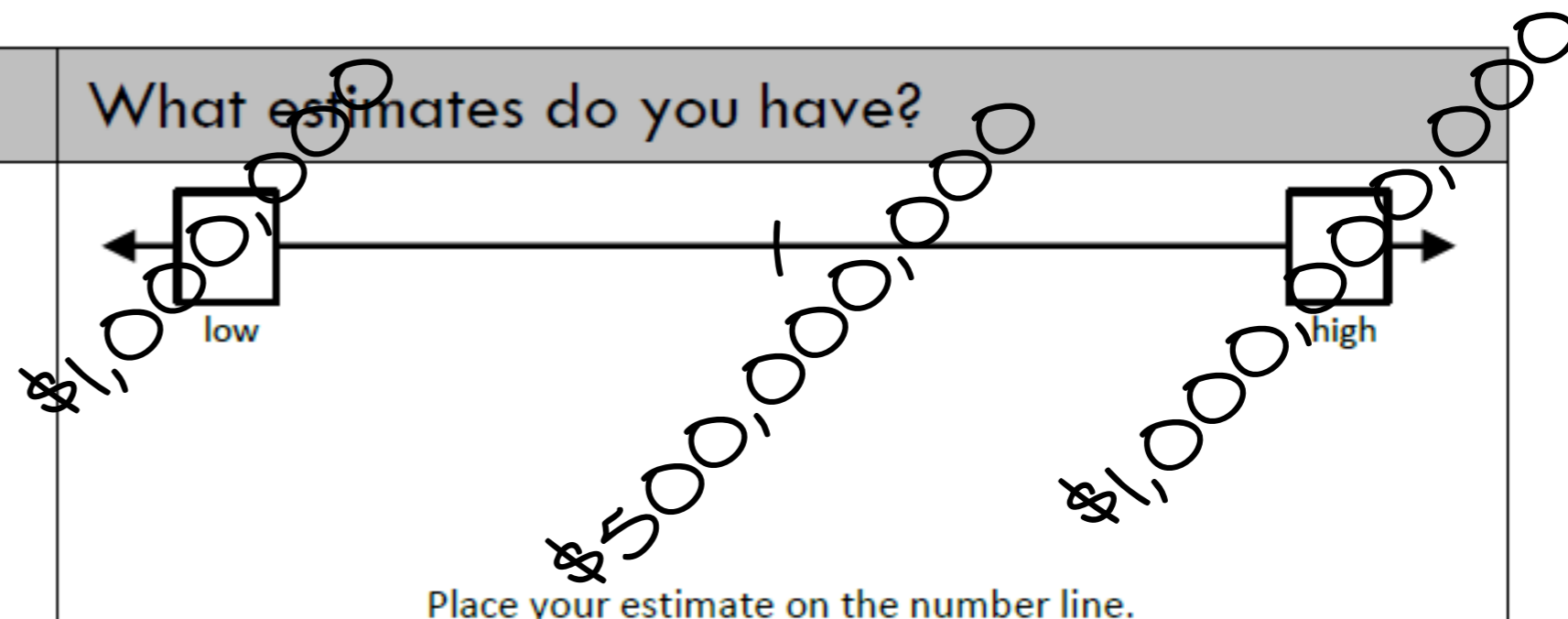
Model

THINKING TIME

What problem are you trying to figure out?

How much money was that?

What estimates do you have?



What info do you already know about the problem?

- There is a lot of money.
- It is in a pile.
- It is in bundles.

What info do you need about the problem?

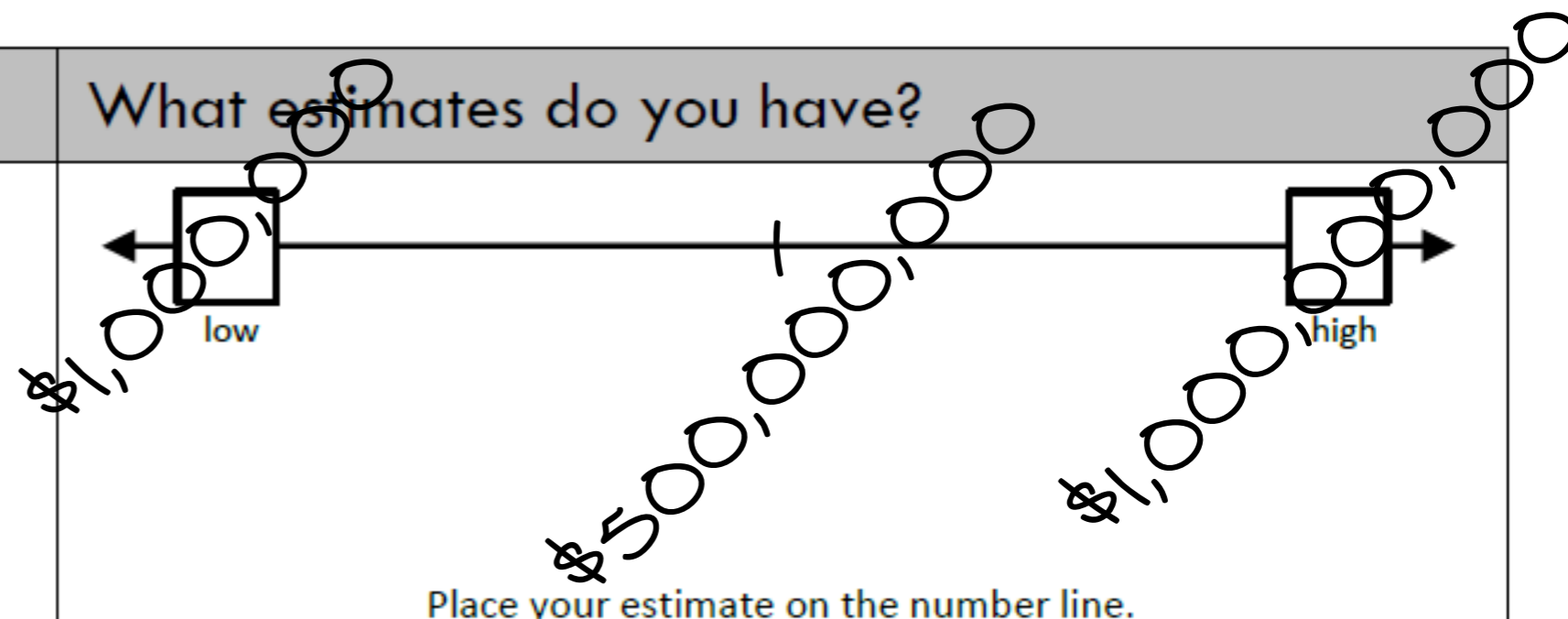
- Is it all the same denomination?
- ~~How much does one bill weigh?~~
- ~~How much does all the money weigh?~~

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

What problem are you trying to figure out?

How much money was that?

What estimates do you have?



What info do you already know about the problem?

- There is a lot of money.
- It is in a pile.
- It is in bundles.

What info do you need about the problem?

- 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?



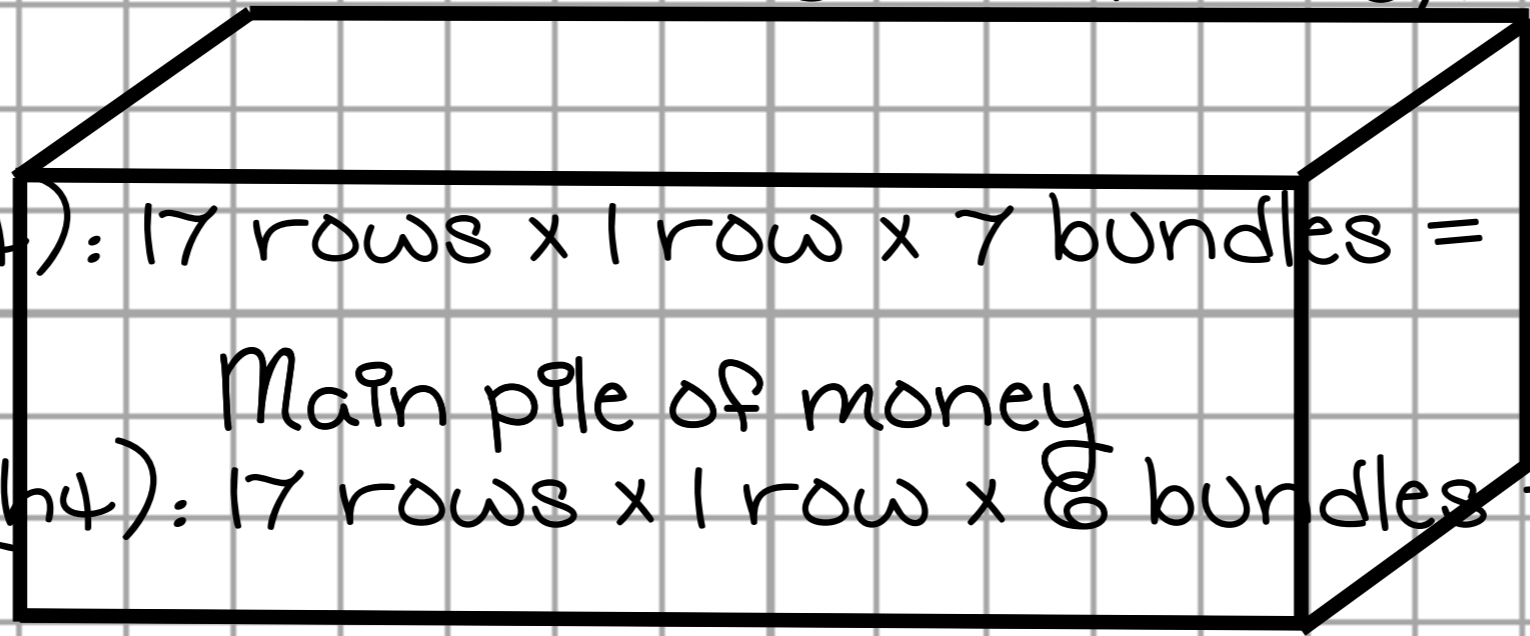


Your work

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

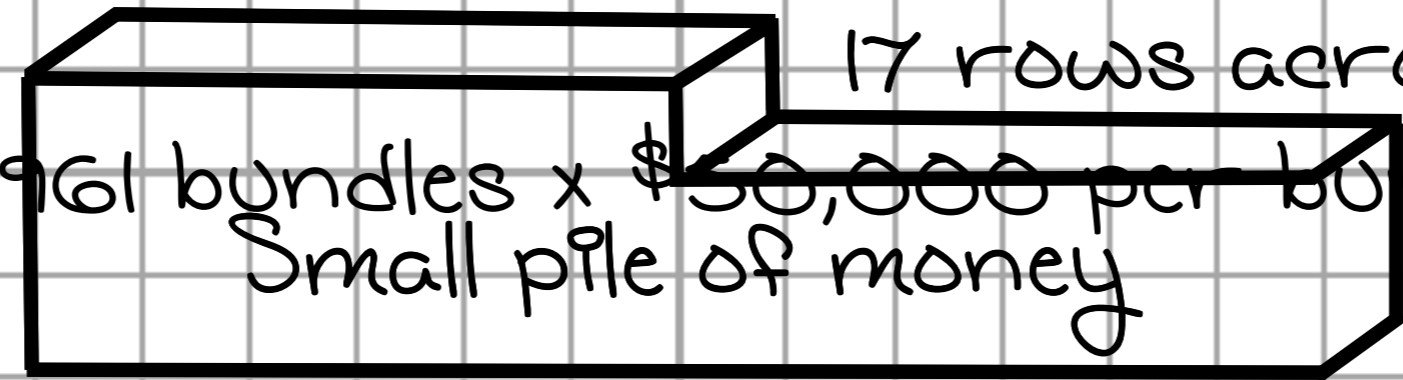
Small pile (left): 17 rows x 1 row x 7 bundles = 19 bundles
10 bundles

Small ^{high} pile (right): 17 rows x 1 row x 8 bundles = 102 bundles
11 rows deep



Total bundles: 3,740 + 19 + 102 = 3,961 bundles
17 rows across

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



8 bundles
high

7 bundles
high

FOX



So you

MODELING EXAMPLES

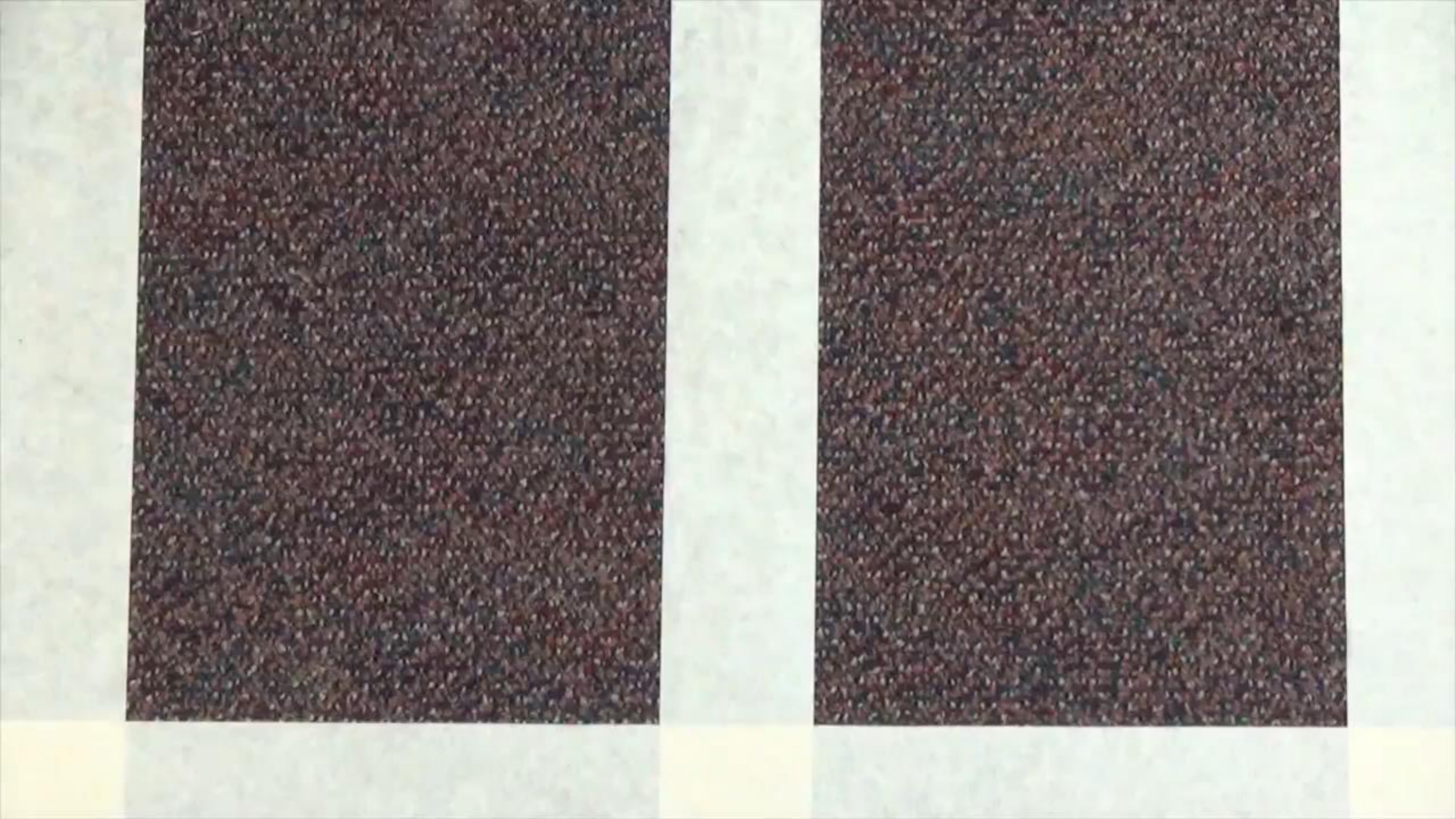
ELEMENTARY SCHOOL

MIDDLE SCHOOL

HIGH SCHOOL

NON-STAGGERED

STAGGERED



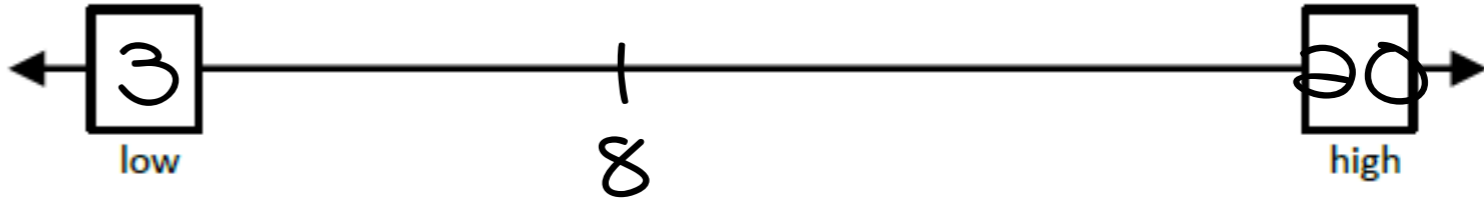
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graph TD; Spies --> Analysts; Analysts --> Model; Model --> Spies;
```

Spies

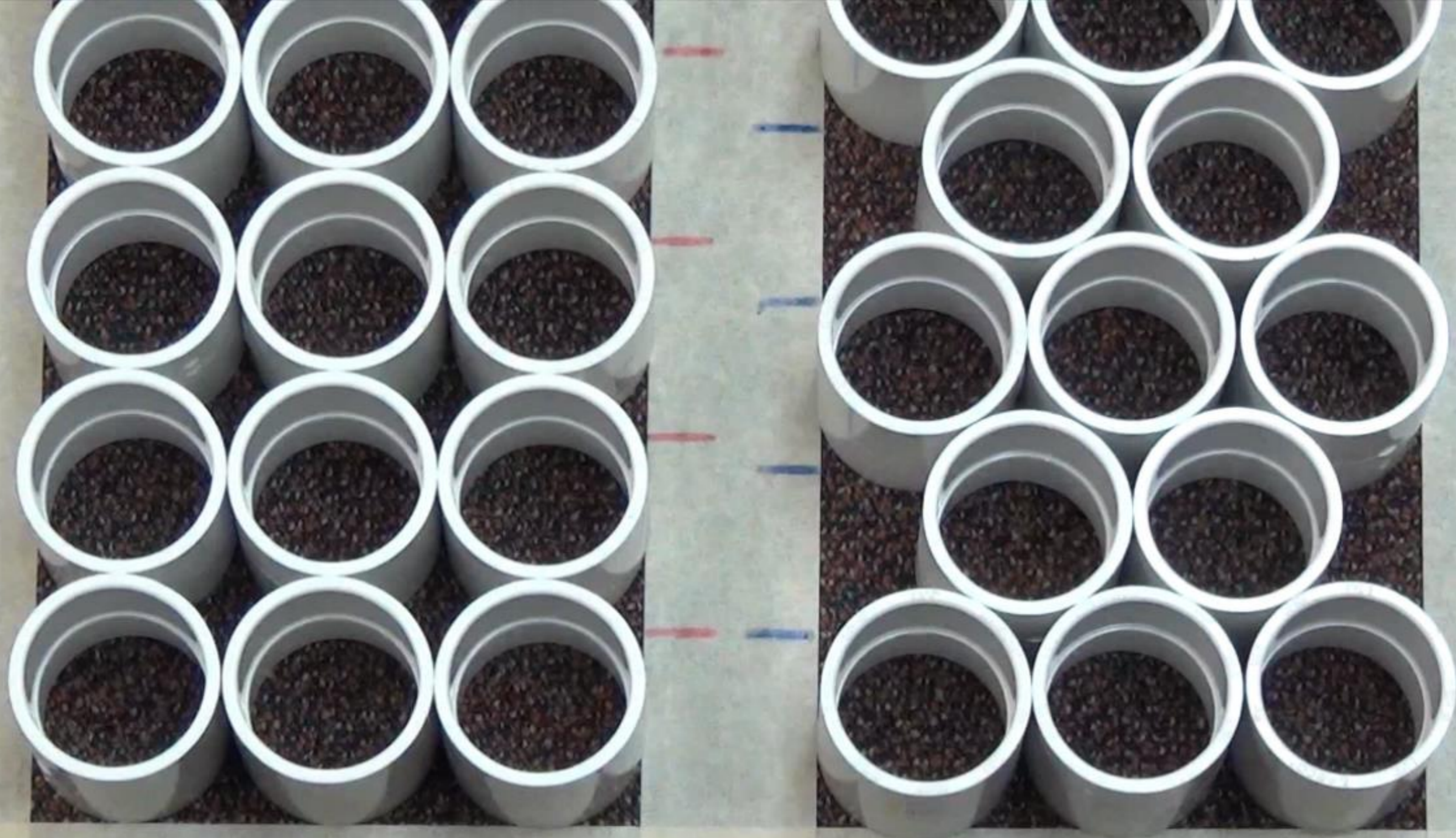
Analysts

Model

THINKING TIME

What problem are you trying to figure out?	What estimates do you have?
<p>How much shorter are 20 layers of non-staggered pipes?</p>	 <p>(in inches)</p> <p>Place your estimate on the number line.</p>
What info do you already know about the problem?	What info do you need about the problem?
<ul style="list-style-type: none"> • One pile of pipes is staggered. • One pile of pipes is not staggered. • We have to compare 20 layers of each. 	<ul style="list-style-type: none"> • What are the dimensions of a pipe? • What units are we using to measure?
What is your conclusion? How did you reach that conclusion?	

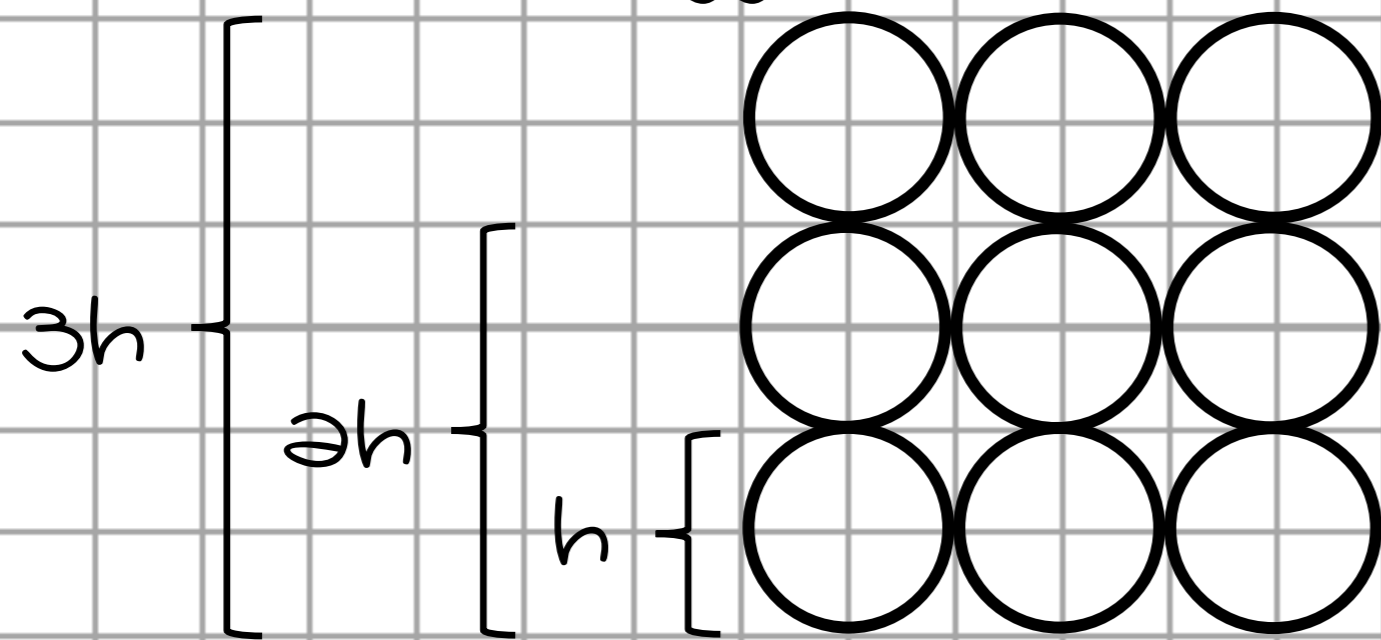




THINKING TIME

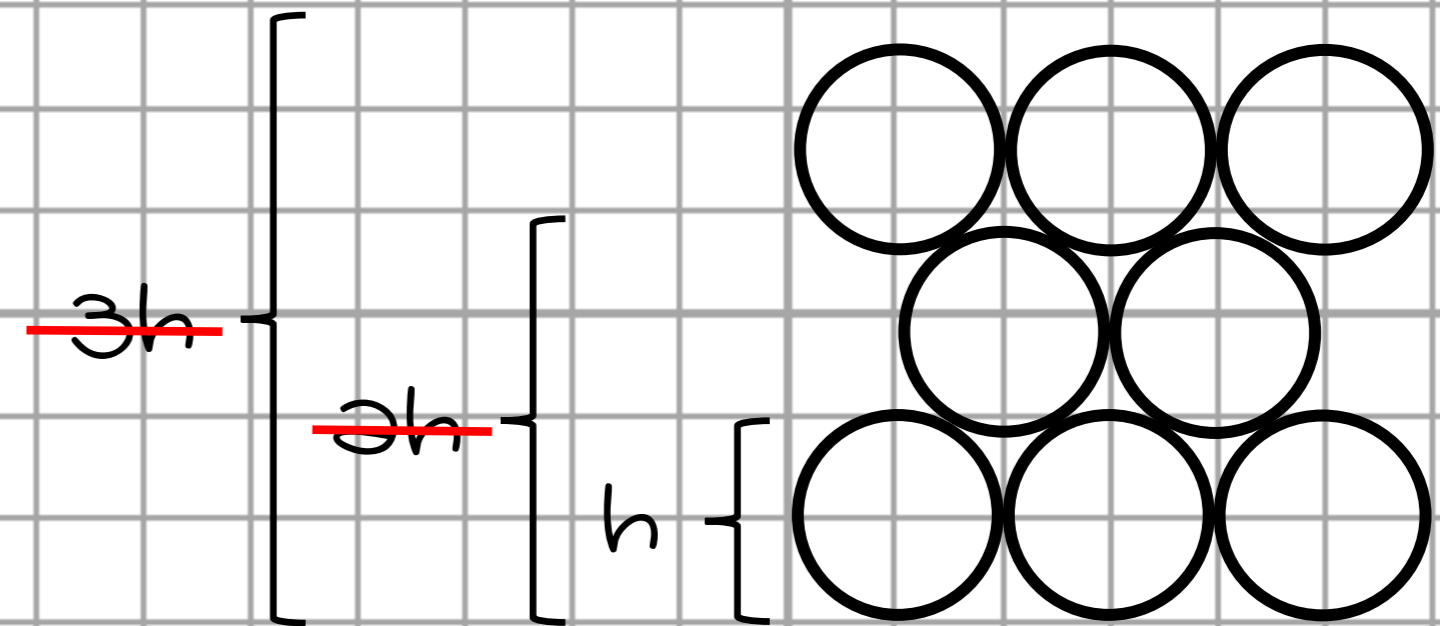


Non-staggered pipes



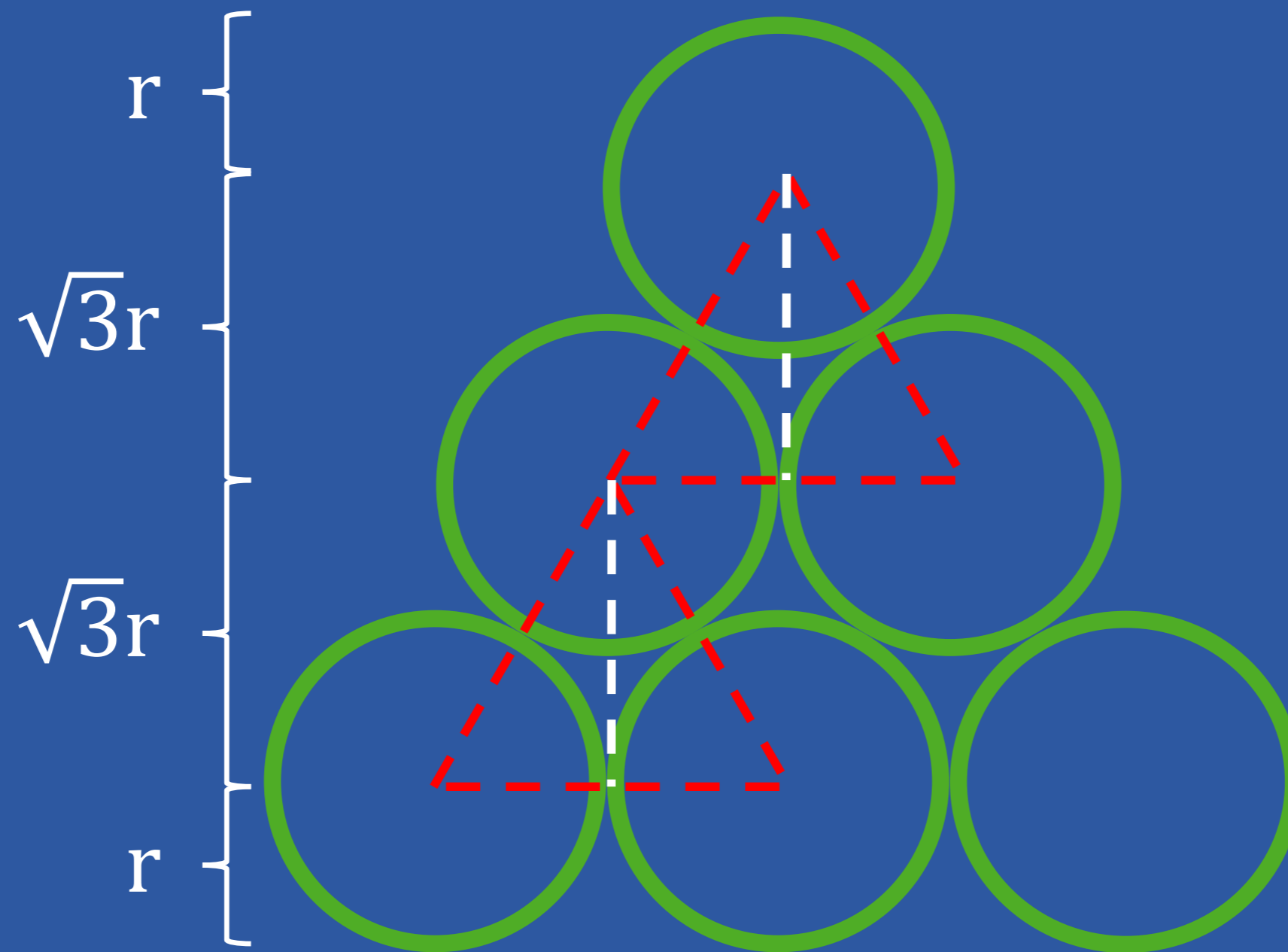
- 1 pipe = h cm
- 2 pipes = $2h$ cm
- 3 pipes = $3h$ cm
- ⋮
- 20 pipes = $20h$ cm

Staggered pipes



- 1 pipe = h cm
- 2 pipes = $2\sqrt{3}$ cm
- 3 pipes = $3\sqrt{3}$ cm
- ⋮
- 20 pipes = $20\sqrt{3}$ cm

STAGGERED PIPES



MODELING EXAMPLES

ELEMENTARY SCHOOL

MIDDLE SCHOOL

HIGH SCHOOL

MATH MODELING

HOW DO WE MAKE SENSE OF MATH MODELING?

IS IT JUST ANSWERING QUESTIONS?

HOW IS MATH MODELING USED IN REAL LIFE?

HOW DO WE HELP OUR STUDENTS IMPROVE?



Real-World Link



Common Core
State Standards

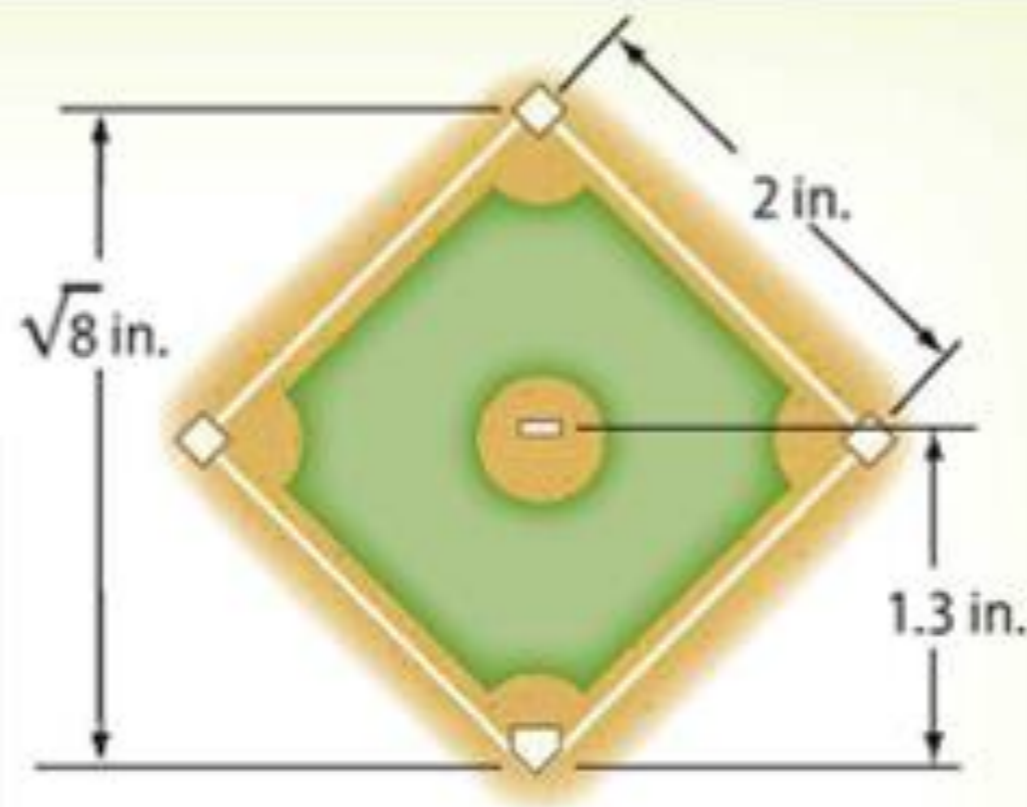
Content Standards

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

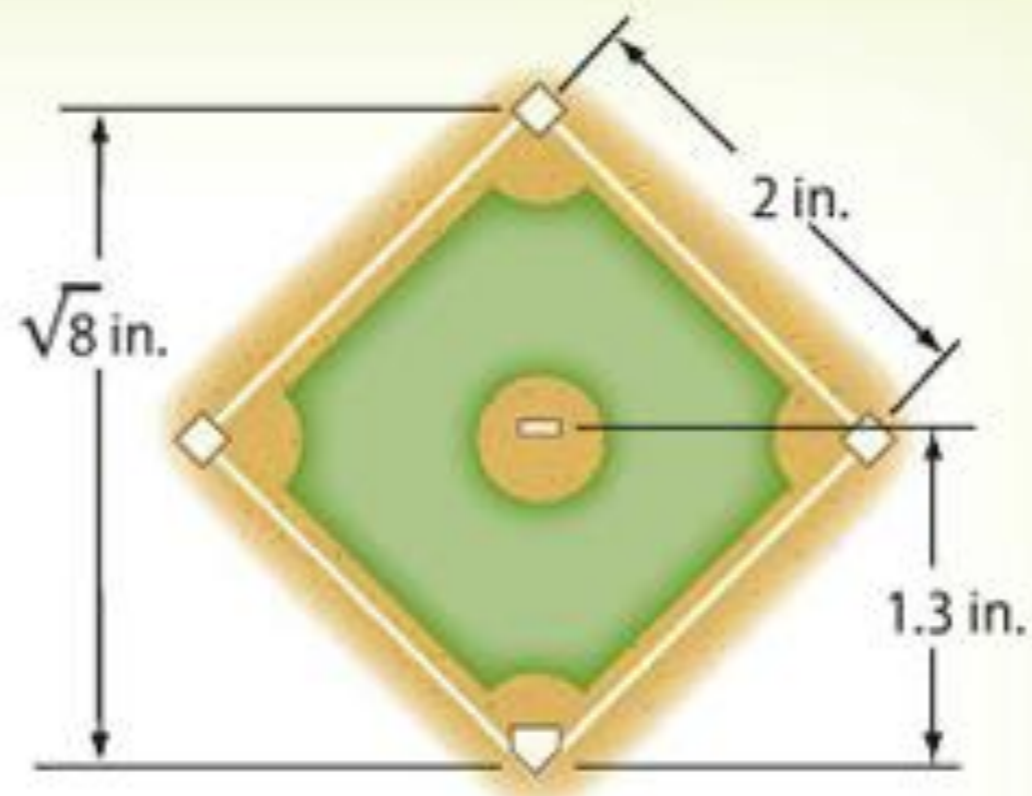
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2. On the model, the distance from first base to second base is 2 inches. Is 2 a rational number? Explain.

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?





NETFLIX

2009

DATE: 09-21-09

PAY TO THE ORDER OF: BellKor's Pragmatic Chaos

\$1,000,000⁰⁰

AMOUNT: ONE MILLION

00/100

FOR: The Netflix Prize

Reed Hastings

DISCUSSION TIME

- Why should we reconsider using word problems?
- What should we be doing instead of word problems?

GOALS

CORRECT ANSWERS = UNDERSTANDING?

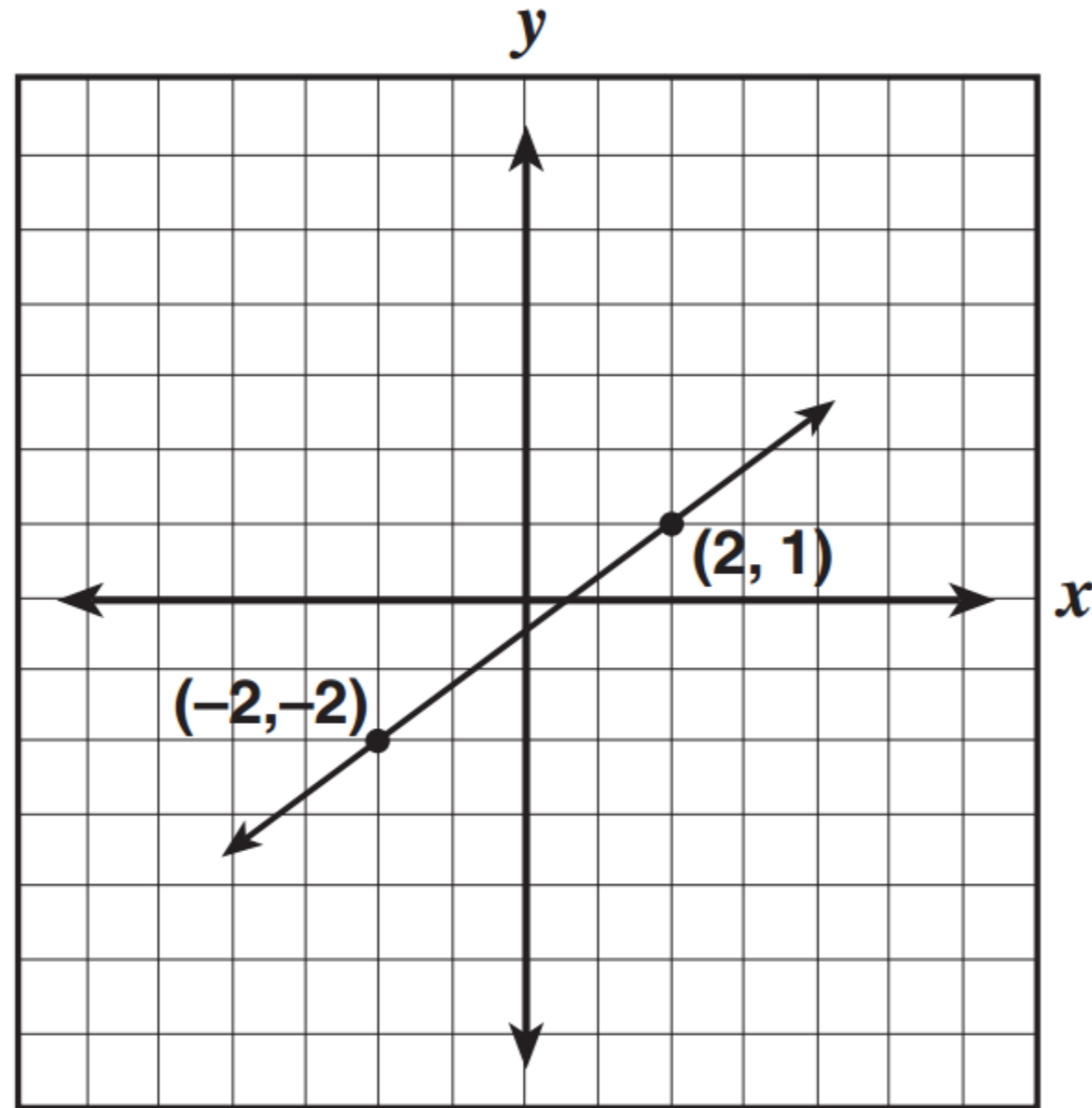
MAKE OUR LESSONS UNFORGETTABLE

RECONSIDER USING WORD PROBLEMS

MAKE MATH CHALLENGING + ACCESSIBLE

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	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%
[REDACTED]	[REDACTED]	ADV	427	13	93%	7	88%	6	60%	13	87%	11	85%	5	100%
[REDACTED]	[REDACTED]	ADV	427	14	100%	5	63%	7	70%	14	93%	10	77%	5	100%
[REDACTED]	[REDACTED]	ADV	421	13	93%	6	75%	6	60%	14	93%	10	77%	5	100%
[REDACTED]	[REDACTED]	ADV	421	11	79%	5	63%	9	90%	13	87%	11	85%	5	100%
[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%
[REDACTED]	[REDACTED]	PRO	402	13	93%	7	88%	9	90%	10	67%	7	54%	5	100%
[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 $\frac{4}{3}$



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	Number Correct	Percent Correct		
...	...	ADV	476	13	93%	8	100%	8	80%	14	93%	12	92%	5	100%
...	...	ADV	464	13	93%	7	88%	8	80%	15	100%	11	85%	5	100%
...	...	ADV	453	10	71%	8	100%	10	100%	14	93%	11	85%	5	100%
...	8	100%	...	...	...	...	11	85%	5	100%
...	10	77%	5	100%
...	10	77%	4	80%
...	9	69%	5	100%
...	12	...	...	75%	...	...	...	...	10	77%	5	100%
...	12	...	...	75%	...	...	...	...	11	85%	5	100%
...	88%	...	...	...	...	10	77%	5	100%
...	6	75%	...	...	...	...	10	77%	5	100%
...	7	88%	...	...	...	...	11	85%	5	100%
...	5	63%	...	...	...	...	10	77%	5	100%
...	421	...	93%	6	75%	6	...	...	...	10	77%	5	100%
...	421	11	79%	5	63%	9	90%	13	87%	11	85%	5	100%
...	414	12	86%	6	75%	8	80%	11	73%	11	85%	5	100%
...	414	12	86%	8	100%	8	80%	13	87%	8	62%	4	80%
...	408	11	79%	6	75%	9	90%	11	73%	10	77%	5	100%
...	402	12	86%	8	100%	9	90%	8	53%	11	85%	3	60%
...	402	8	57%	7	88%	8	80%	13	87%	10	77%	5	100%
...	402	13	93%	6	75%	7	70%	13	87%	8	62%	4	80%
...	402	11	79%	5	63%	7	70%	11	73%	12	92%	5	100%
...	402	13	93%	7	88%	9	90%	10	67%	7	54%	5	100%
...	402	13	93%	7	88%	7	70%	11	73%	8	62%	5	100%
...	396	10	71%	6	75%	9	90%	14	93%	7	54%	4	80%
...	396	12	86%	8	100%	6	60%	9	60%	11	85%	4	80%

X-RAY VISION PROBLEMS

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.

$$\boxed{} + x = \boxed{}$$

PROBLEM THREE

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

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



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.

PROBLEM ONE
Solve for x.
 $21 + x = 7$

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.
[][] + x = [][]

PROBLEM THREE
Using the digits 1 to 9, at most one time each, create an equation where x has the greatest possible value.
[][] + x = [][]

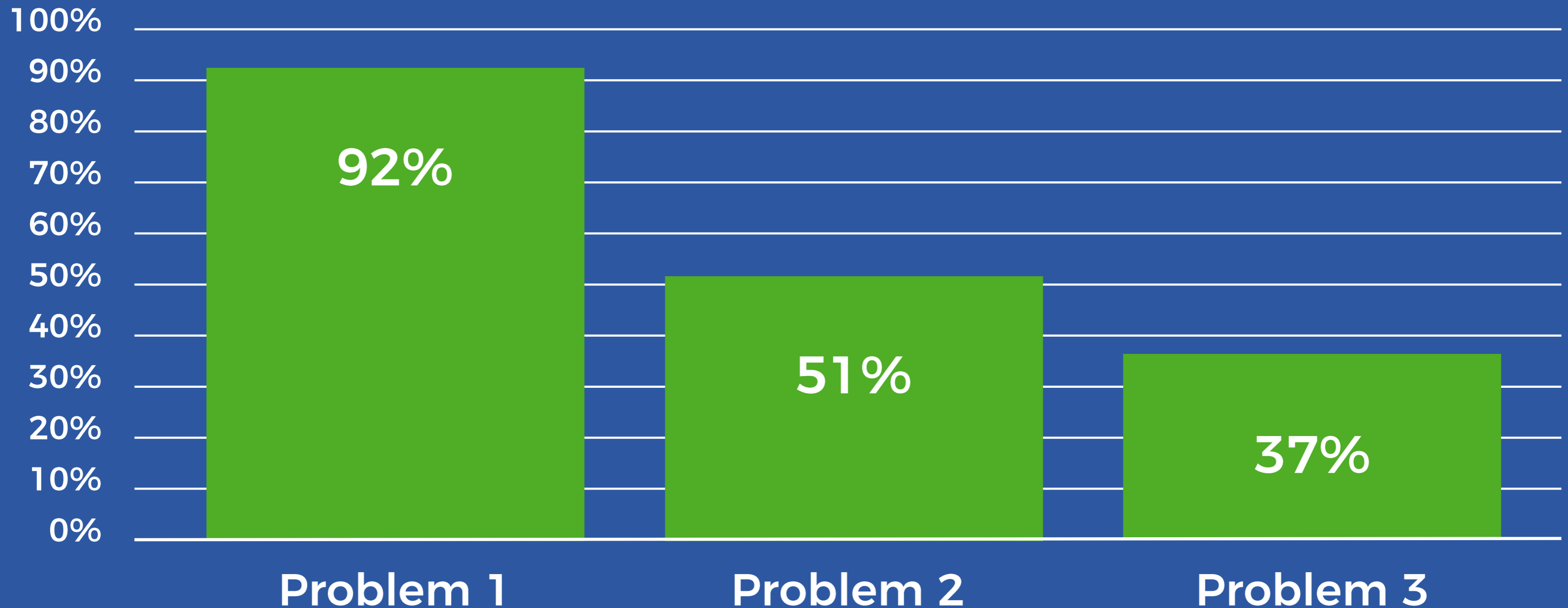
RobertKaplinsky.com

RETWEETS
36

LIKES
54



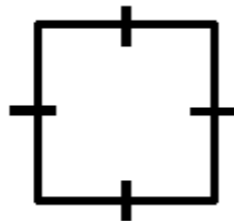
PROBLEM RESULTS



Depth of Knowledge Matrix - Secondary Math

Topic	Dividing Fractions	Solving Two-Step Equations	Exponents	Solving Equations with Variables on Both Sides
CCSS Standard(s)	<ul style="list-style-type: none"> 6.NS.1 	<ul style="list-style-type: none"> 7.EE.4a 	<ul style="list-style-type: none"> 8.EE.1 	<ul style="list-style-type: none"> 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. $\square x + \square = \square x + \square$

Depth of Knowledge Matrix - Secondary Math

Topic	Geometric Proofs	Complex Numbers	Trigonometric Functions	Definite Integral
CCSS Standard(s)	<ul style="list-style-type: none"> G-CO.11 	<ul style="list-style-type: none"> N-CN.2 	<ul style="list-style-type: none"> F-TF.3 	<ul style="list-style-type: none"> 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

WHY DO WE NEED THEM?

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.

$$\square + a = \square$$

$$\square - \square = \square$$

SOLVING EQUATIONS EXTENSION MENU

You must earn at least 12 points 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

WHY DO WE NEED THEM?

WHY ARE THEY DIFFERENT?

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

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.

$$\boxed{} \boxed{} + \boxed{} \boxed{} = 71$$

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 $\frac{2}{3}$.

$$\frac{\boxed{}}{\boxed{}} \times \frac{\boxed{}}{\boxed{}} = \frac{2}{3}$$

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.

$$\boxed{1} \boxed{8} + \boxed{3} \boxed{5} = \boxed{4} \boxed{9}$$

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 $\frac{4}{11}$ as possible.

$$\frac{\boxed{}}{\boxed{}} \times \frac{\boxed{}}{\boxed{}}$$

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.

$$41 + 36 = \underline{\quad}$$

Multiplying Fractions

Solve.

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

Trigonometry

Solve.

$$\sin \frac{\pi}{3} = \underline{\quad}$$

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



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Hey @openmiddle fans, we want to hear from you. Why you use our problems



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

7

LIKES

6



2:10 PM - 11 Jan 2017



8



7



6



1



2



DISCUSSION TIME

- How can x-ray vision problems like the kinds on Open Middle spot misconceptions that may often go unnoticed?
- How do Open Middle problems make mathematics accessible yet appropriately challenging for every student?

GOALS

- ✓ **CORRECT ANSWERS = UNDERSTANDING?**
- ✓ **MAKE OUR LESSONS UNFORGETTABLE**
- ✓ **RECONSIDER USING WORD PROBLEMS**
- ✓ **MAKE MATH CHALLENGING + ACCESSIBLE**

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

THE TOP 10 MOST POPULAR PROBLEMS OF 2017

1. Order of Operations by Robert Kaplinsky with answer from Michael Fenton and his students
2. Two-Step Equations by Robert Kaplinsky, Daniel Luevanos, and Robert Kaplinsky
3. Dot Card Counting by Robert Kaplinsky
4. Two-Step Equations 3 by Erick Lee
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. Rational and Irrational Numbers by Bryan Anderson
9. Converting Between Fractions and Decimals by Robert Kaplinsky
10. Interpreting Percentages by Robert Kaplinsky

WHAT ARE PEOPLE SAYING ABOUT OPEN MIDDLE?



Brian Marks
@Yummymath



Have you checked out openmiddle.com @openmiddle Should be on your short list of math ed resources #MTBoS #mathchat #maths #elemchat



OPEN MIDDLE WORKSHEET

- English (student version)
- English (document camera version)
- Spanish (student version)
- Spanish (document camera version)

BROWSE BY COMMON CORE STATE STANDARDS

- Kindergarten (12)
 - Counting & Cardinality (3)
 - Geometry (3)
 - Number & Operations in Base Ten (1)
 - Operations & Algebraic Thinking (5)
- Grade 1 (17)
 - Geometry (3)
 - Measurement & Data (4)
 - Number & Operations in Base Ten (3)
 - Operations & Algebraic Thinking (7)

[Home](#) > [High School: Geometry](#) > [Expressing Geometric Properties with Equations](#) > [Equidistant Points](#)

EQUIDISTANT POINTS

Directions: How many points with integer coordinates are 5 units away from $(-2, 3)$?

Hint

Which methods are available to determine the answer to this problem? What shape is defined by all of the points that are 5 units away $(-2, 3)$?

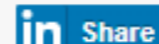
Answer

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](#)



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Tags

8.G.8

DOK 2: SKILL / CONCEPT

DYLAN KANE

G-GPE.1

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[Counting & Cardinality \(3\)](#)

[Geometry \(3\)](#)

[Number & Operations in Base Ten \(1\)](#)

[Operations & Algebraic Thinking \(5\)](#)

[Grade 1 \(17\)](#)

[Geometry \(3\)](#)

[Measurement & Data \(4\)](#)

[Number & Operations in Base Ten \(3\)](#)

[Operations & Algebraic Thinking \(7\)](#)

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- [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?



Search

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First Name

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Email address

Zip Code (optional)

Job Role(s)

- Elementary School
- Middle School
- High School
- Higher Education

Resources

Depth of Knowledge

- ▶ [Open Middle](#)
- ▶ [Open Middle Worksheet - English \(student version\)](#)
- ▶ [Open Middle Worksheet - English \(document camera version\)](#)
- ▶ [Open Middle Worksheet - Spanish \(student version\)](#)
- ▶ [Open Middle Worksheet - Spanish \(document camera version\)](#)
- ▶ [Robert's blog posts on Depth of Knowledge](#)
- ▶ [Tool to Distinguish Between Depth of Knowledge Levels](#)

Problem-Based Lesson Tools

- ▶ [Problem-Based Lesson Search Engine](#)
- ▶ [Problem Solving Framework v8.1](#)
- ▶ [Robert's blog posts on Problem-Based Learning](#)

Problem-Based Lesson Sources

- ▶ [101 Questions](#)
- ▶ [Andrew Gael](#)
- ▶ [Andrew Stadel](#)
- ▶ [Catherine Castillo](#)
- ▶ [Christina Tondevold](#)
- ▶ [Dan Meyer](#)
- ▶ [Dane Ehlert](#)
- ▶ [Emergent Math's Problem Based Curriculum Maps](#)

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sent to you via email!

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Zip Code (optional)

Job Role(s)

- Elementary School
- Middle School
- High School
- Higher Education

Robert Kaplinsky's Problem-Based Lessons

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	A	B	C	D	E	F	G	H	I
1	Lesson	Concept / Skill	Standard 1	Standard 2	Standard 3	Standard 4	Standard 5	Standard 6	Standard 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.NB.1
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.1
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.3b
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.3b
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.4
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.1c
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 100x100 In-N-Out Cheeseburger Cost?	Building and Interpreting 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.5
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				



Scary & Dangerous





THE FOUR STEPS TO CREATE A CLASSROOM WHERE STUDENTS ARE EXCITED TO LEARN MATHEMATICS

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