

# Noticing and Wondering in the Secondary Grades

**Annie Fetter**

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2020 SD STEM Ed Conference, #SDSTEMEd

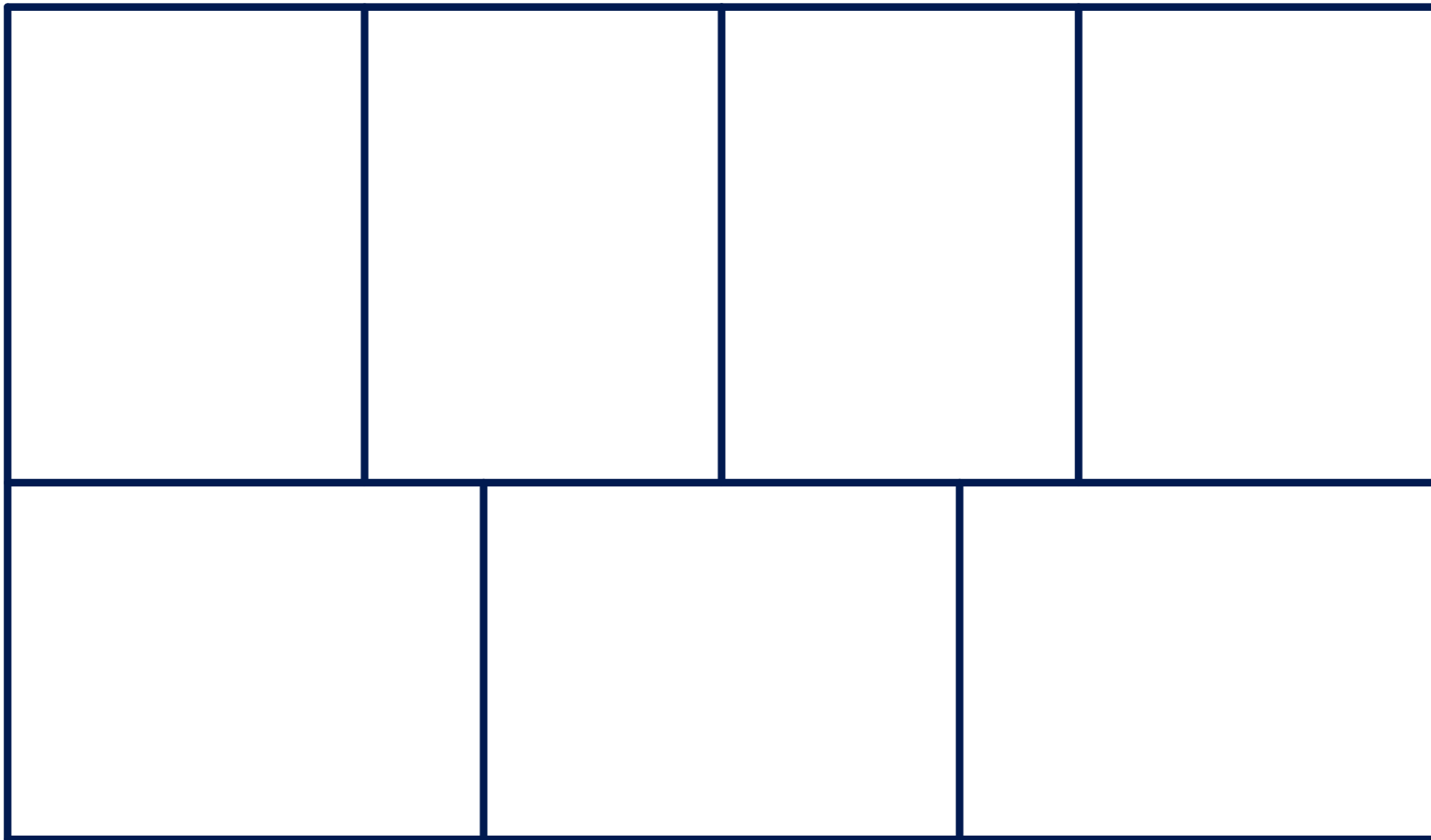
Slides and links to related resources will be available on my blog after the talk:

[annie.mathematicalthinking.org](http://annie.mathematicalthinking.org)

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@MFAnnie  
#NoticeWonder

# Congruent Rectangles Scenario I

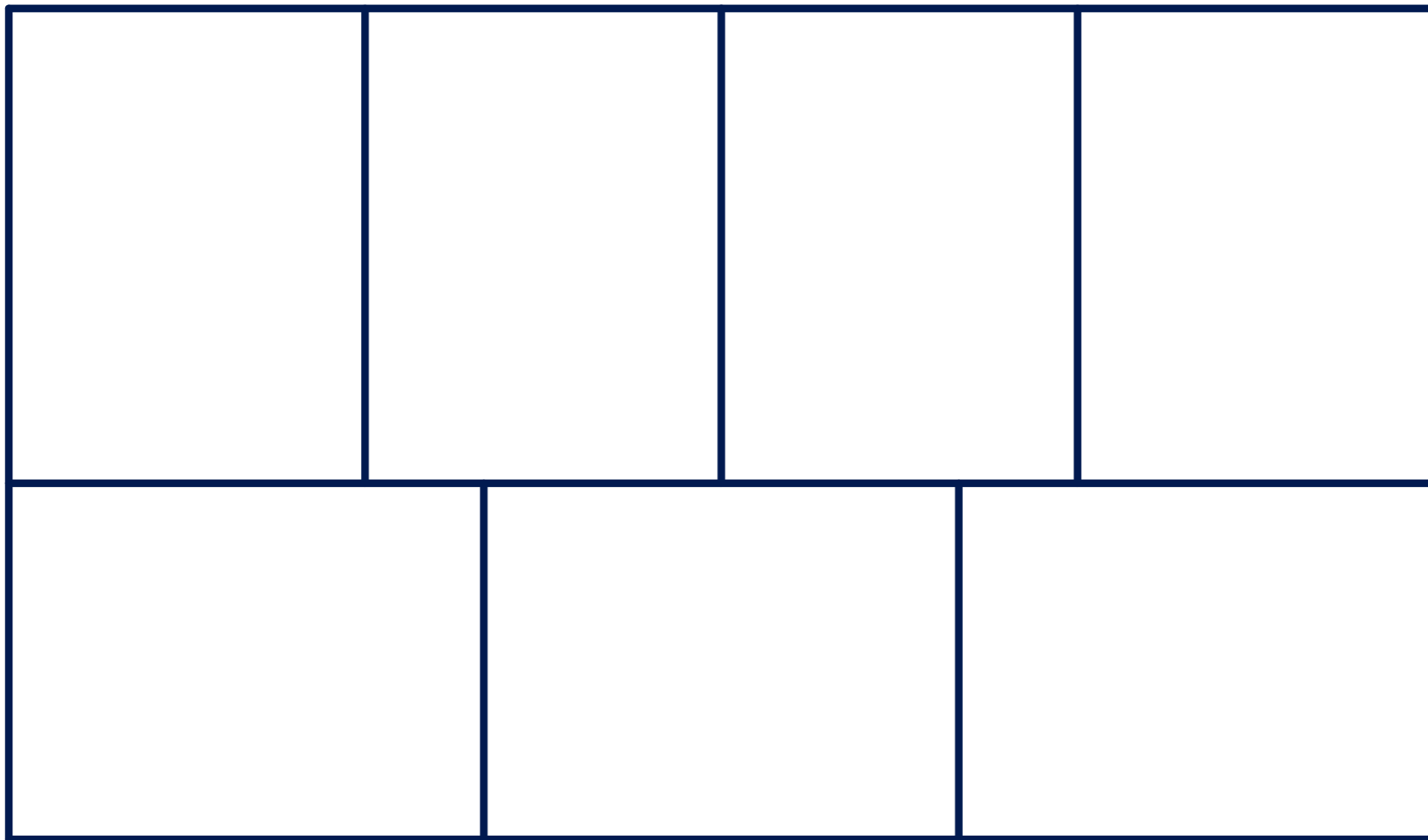
The seven small rectangles in this picture are congruent.



# Congruent Rectangles Scenario II

The seven rectangles in this picture are congruent.

The area of the large rectangle is 756 square centimeters.



# CCSS Mathematical Practice 1



**Jessica Strom**

@strom\_win

Following



"We" dont give students enough credit! I had my Ss graph points for  $\sin x$  &  $\cos x$ , then **#noticewonder** about their graphs. They noticed EVERYTHING I wanted to teach them and the discussion was amazing! Thanks **@saravdwerf** & **@MFAnnie** for inspiring me! **#MTBoS** **#iteachmath** **#NWMNmath**

8:13 PM - 15 Feb 2019

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# CCSS Mathematical Practice 1

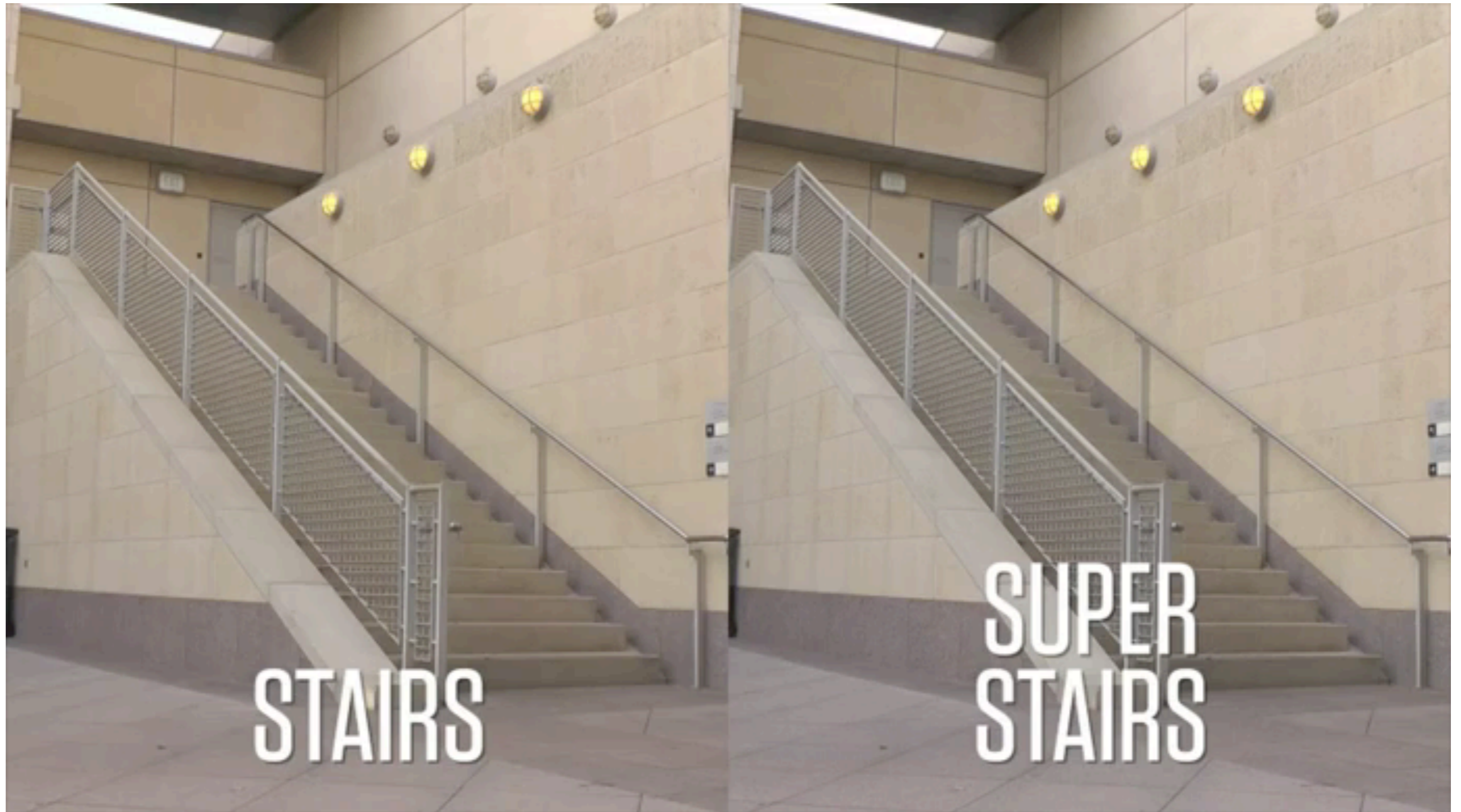
**Make sense of problems and persevere in solving them.**

Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry points to its solution.

They analyze givens, constraints, relationships, and goals.

They make conjectures about the form and meaning of the solution and plan a solution pathway **rather than simply jumping into a solution attempt.**

# 3-Act Tasks - Act 1



More info about Super Stairs: <https://www.101qs.com/2714>

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# 3-Act Tasks - Act 2

What do you notice? What do you wonder?

What do you want to know? What information do you think you need?

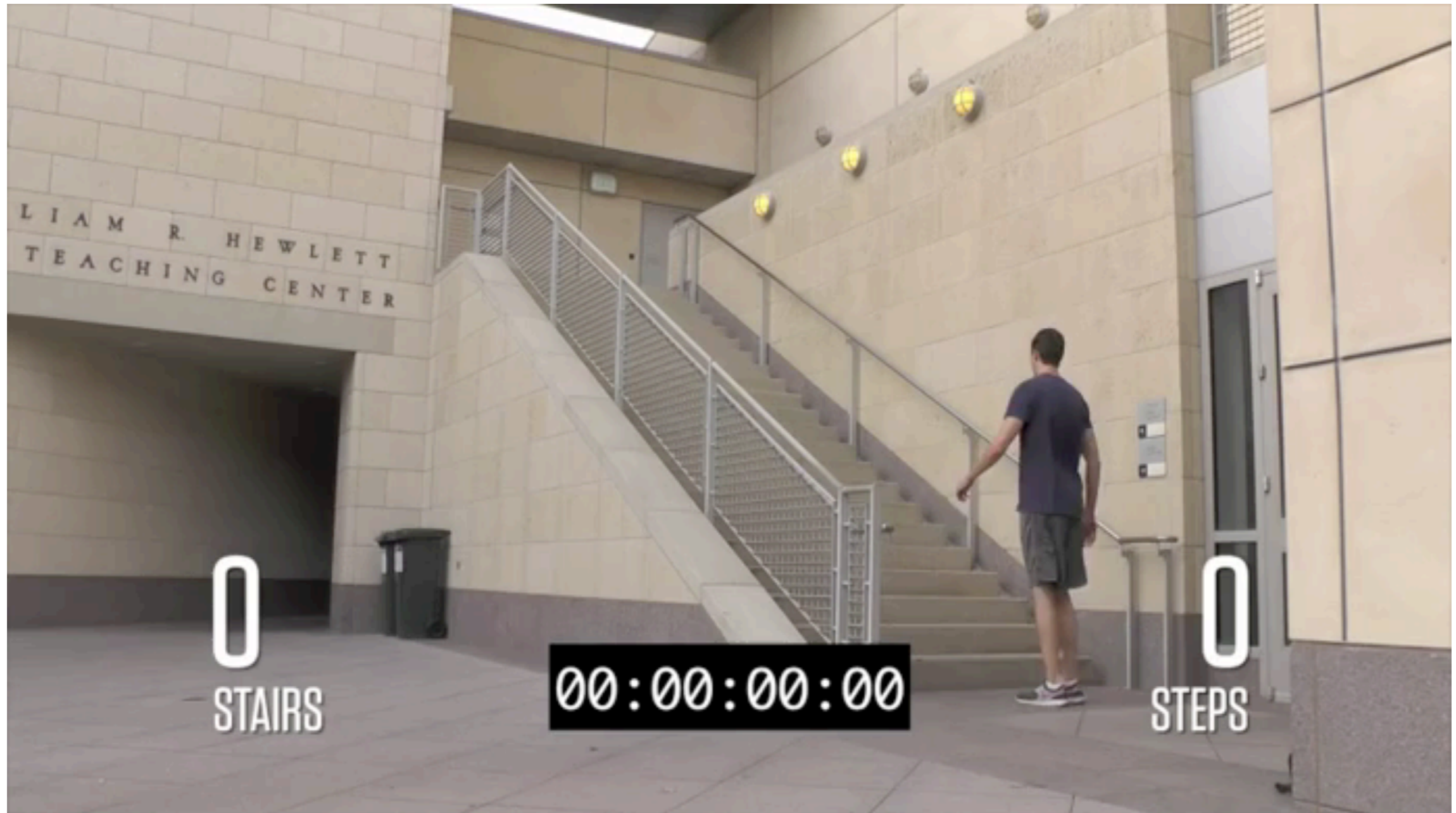
What's a guess that you know is too high?

What's a guess that you know is too low?

What's your best guess?

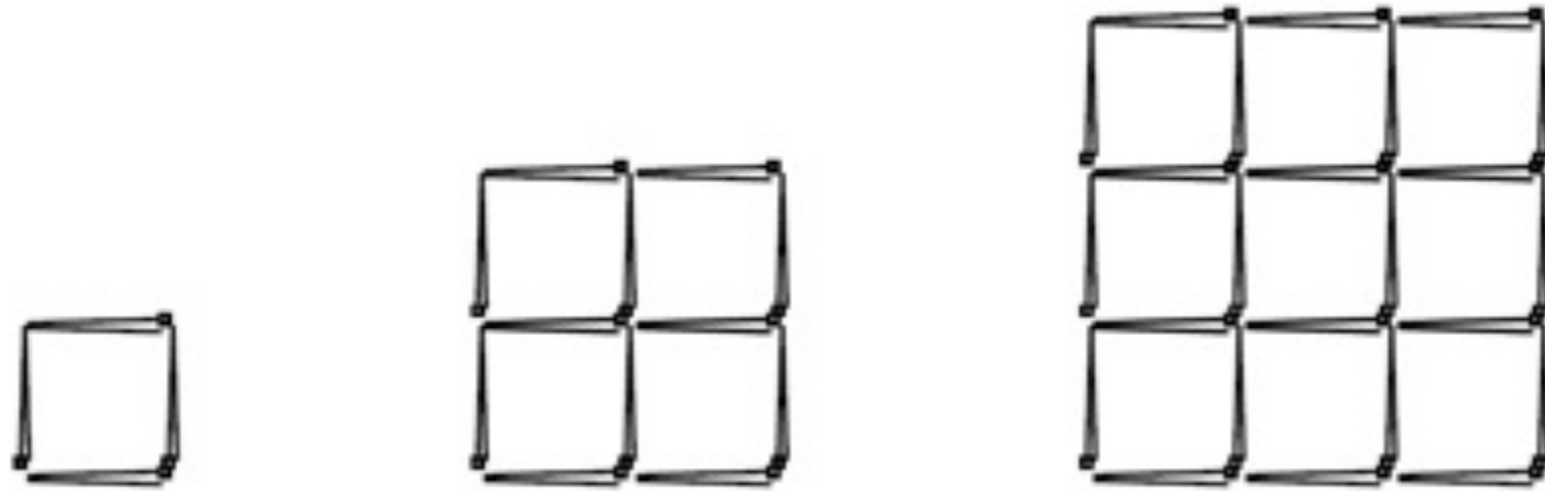


# 3-Act Tasks

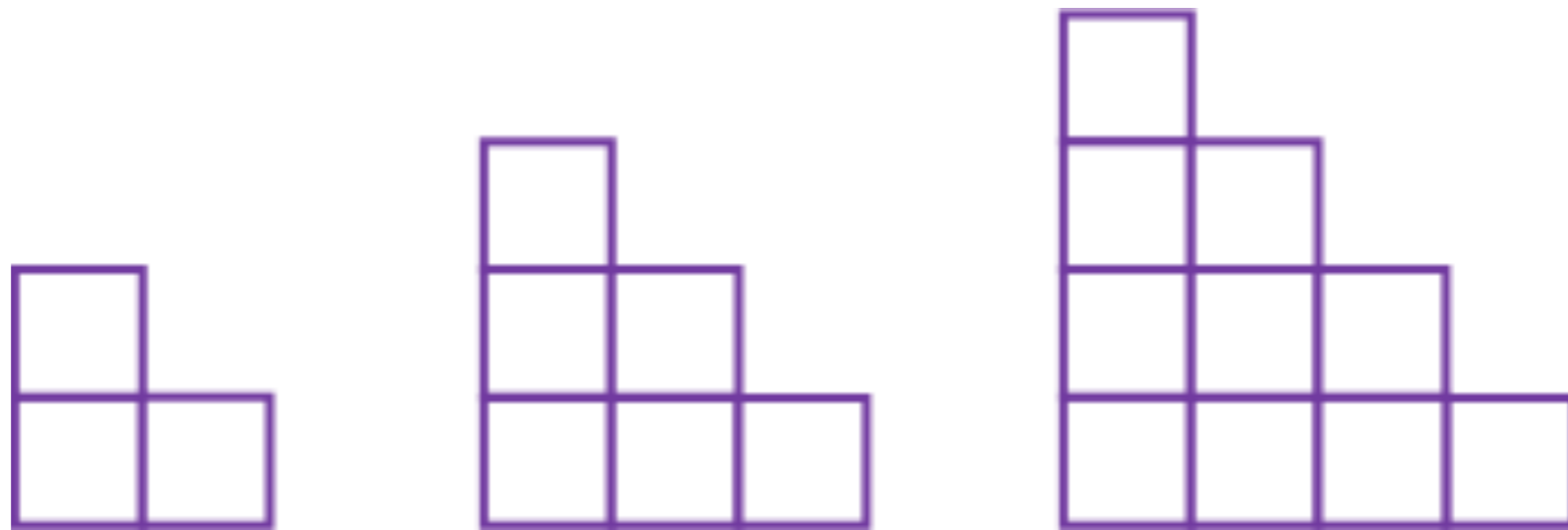




# Visual Patterns



Pattern #1, Squares in step 43 = 1849, Toothpicks in step 43 = 3784

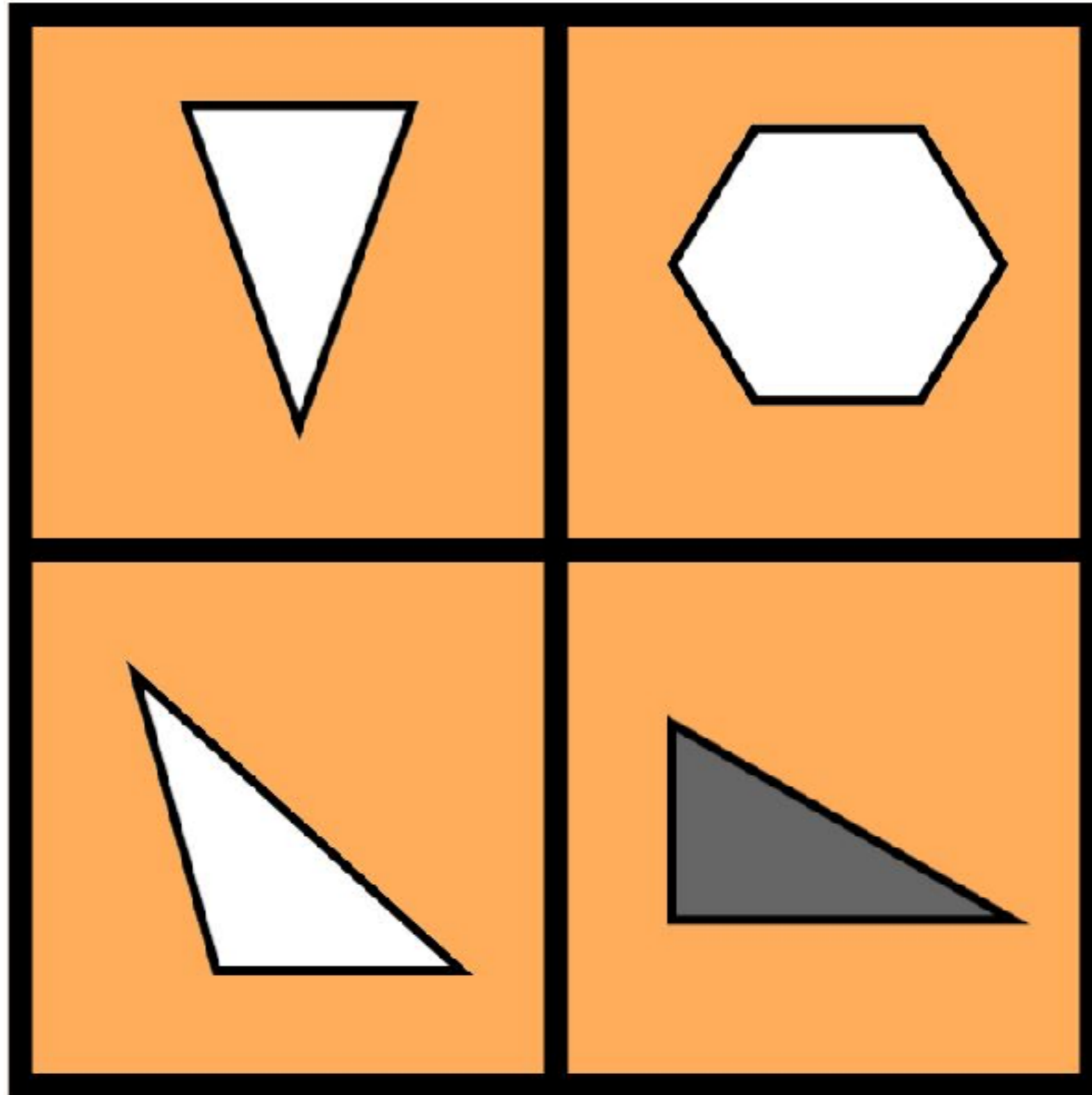


Pattern #3, Squares in step 43 = 990

# Visual Patterns



# Which One Doesn't Belong?



# Which One Doesn't Belong?

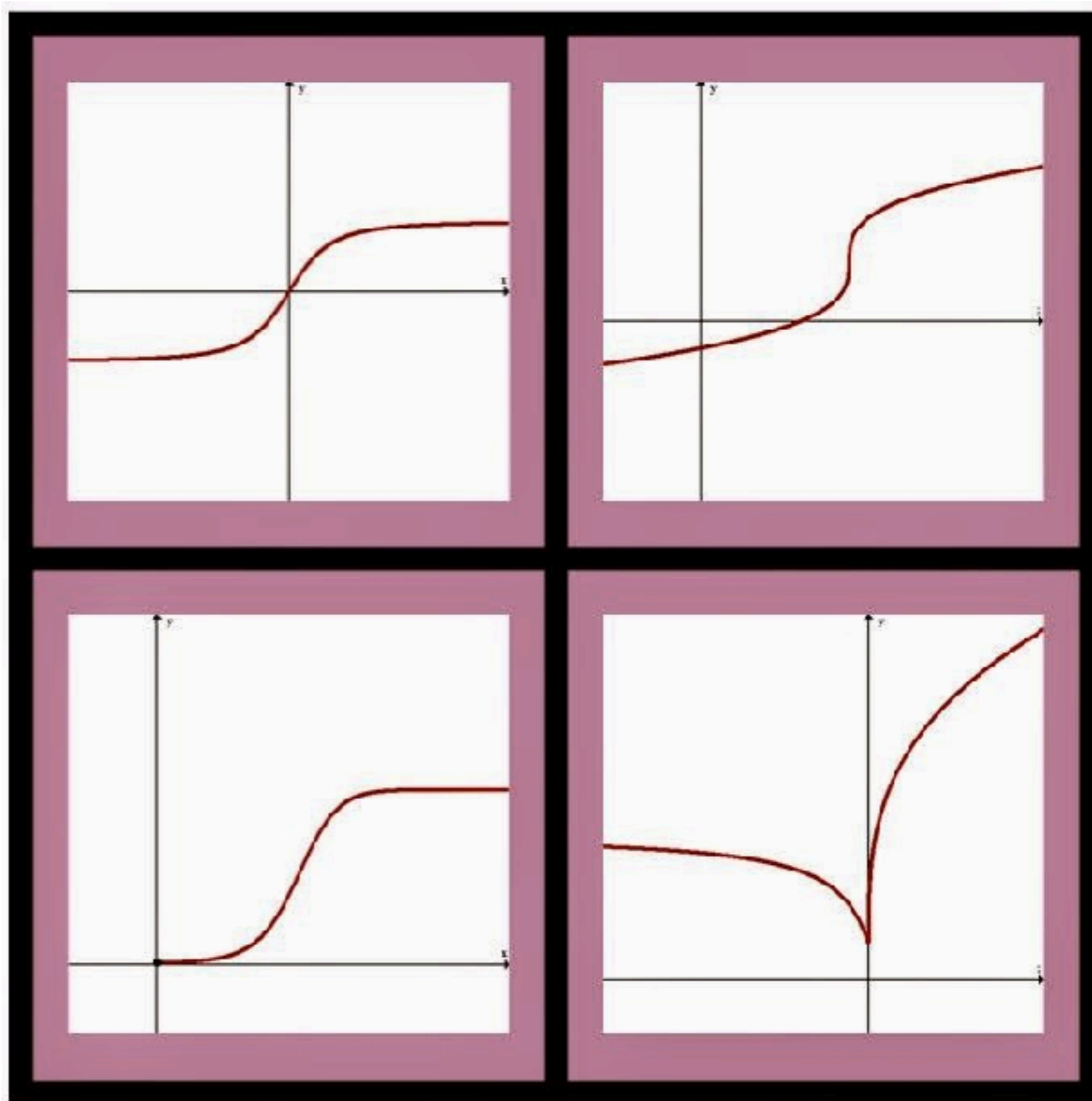
$$y = 4x$$

$$y = x + 7$$

$$y = -2x + 4$$

$$y = 3x - 1$$

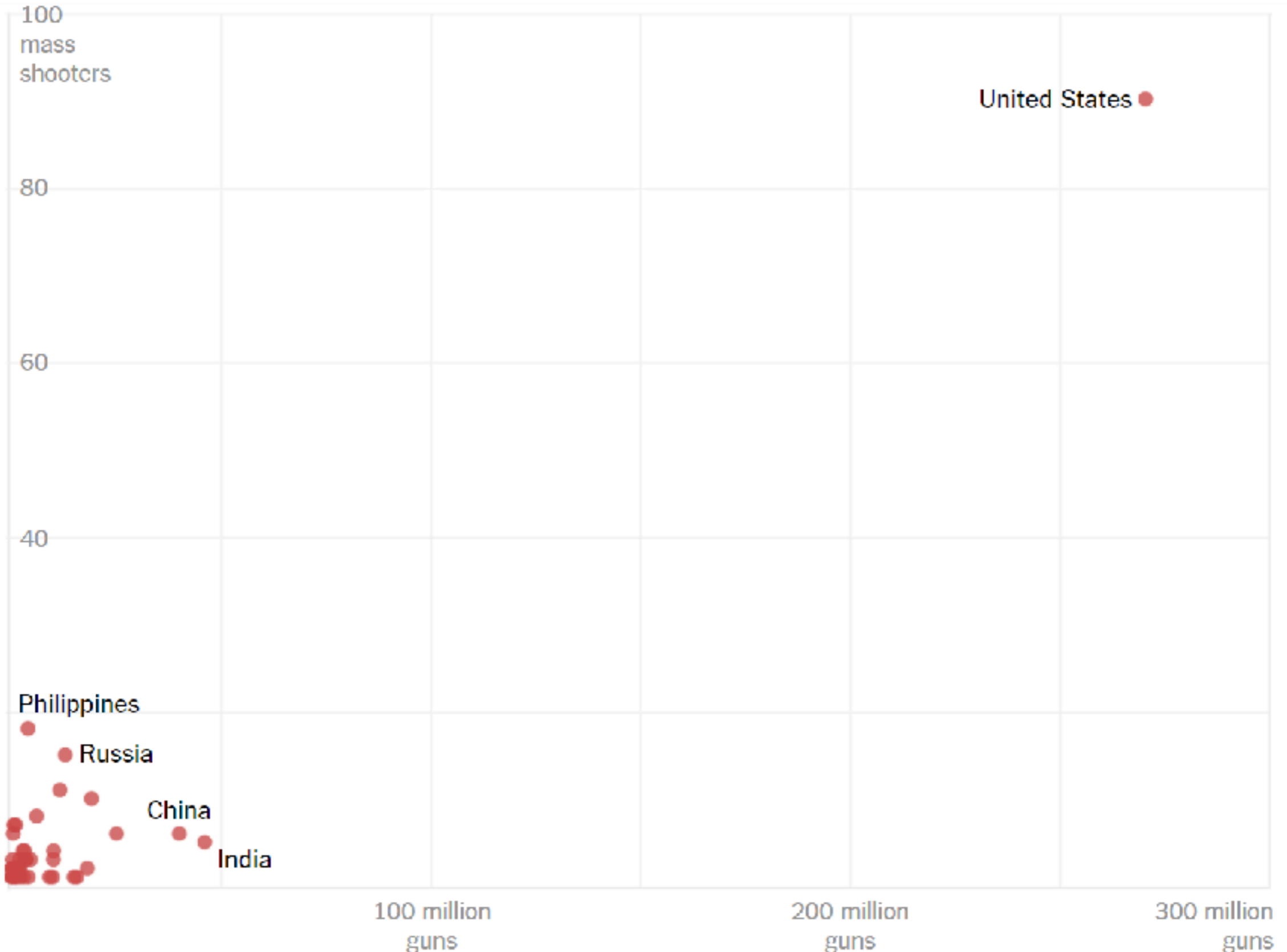
# Which One Doesn't Belong?





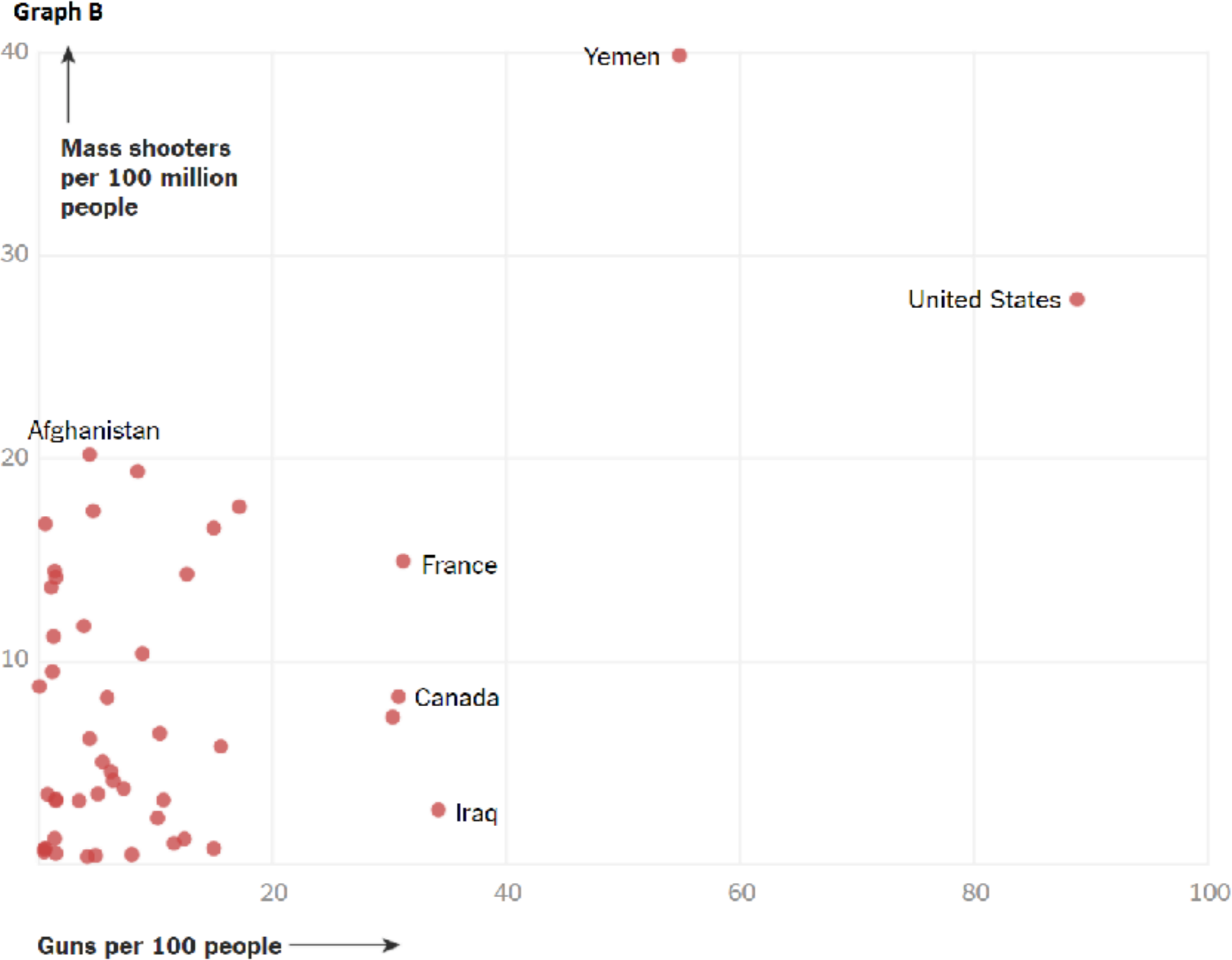
# What's Going On With This Graph?

Graph A





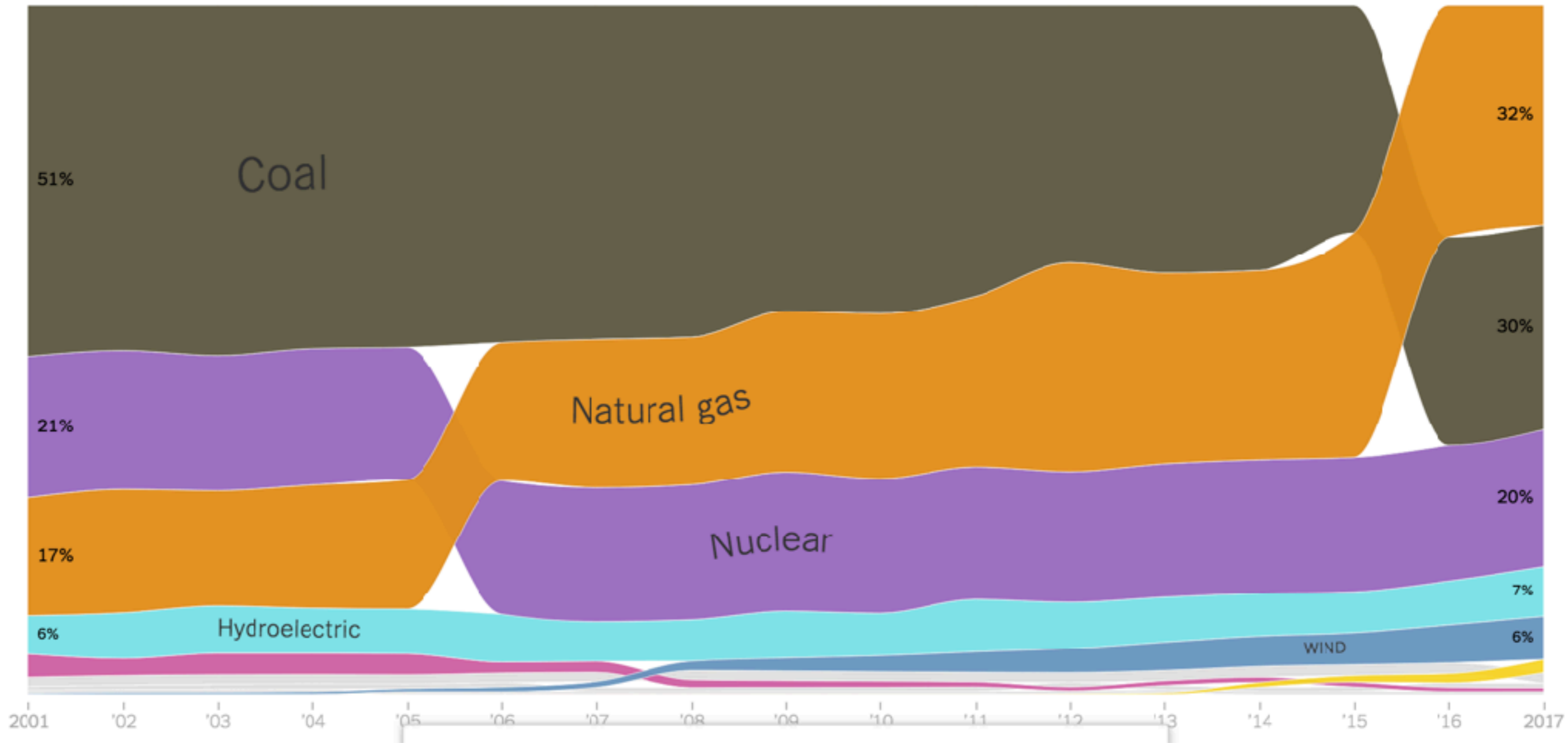
# What's Going On With This Graph?



# What's Going On With This Graph?

How **the United States** generated electricity from 2001 to 2017

Percentage of power produced from each energy source



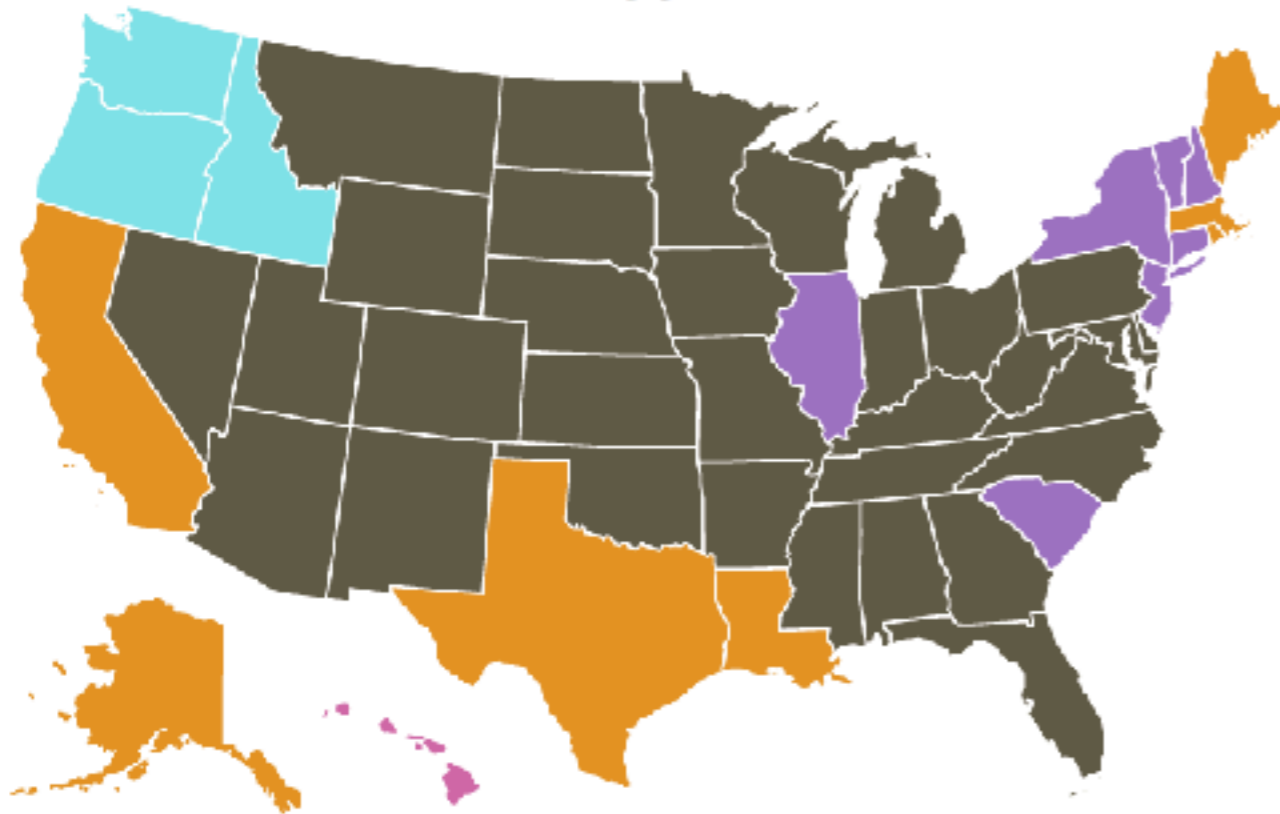
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# What's Going On With This Graph?

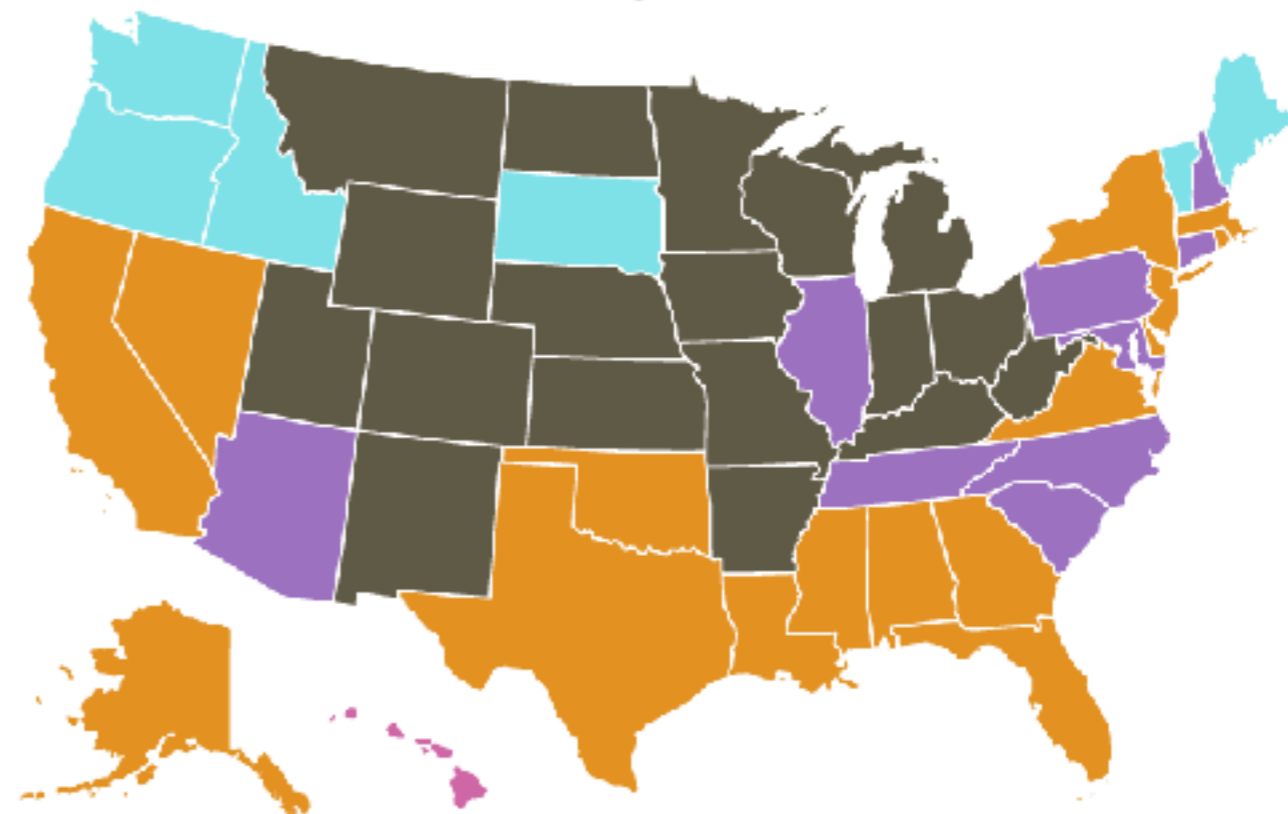
## Top Source of Electricity Generation In Every State

■ Coal ■ Natural gas ■ Nuclear ■ Hydroelectric ■ Petroleum

2001



2017

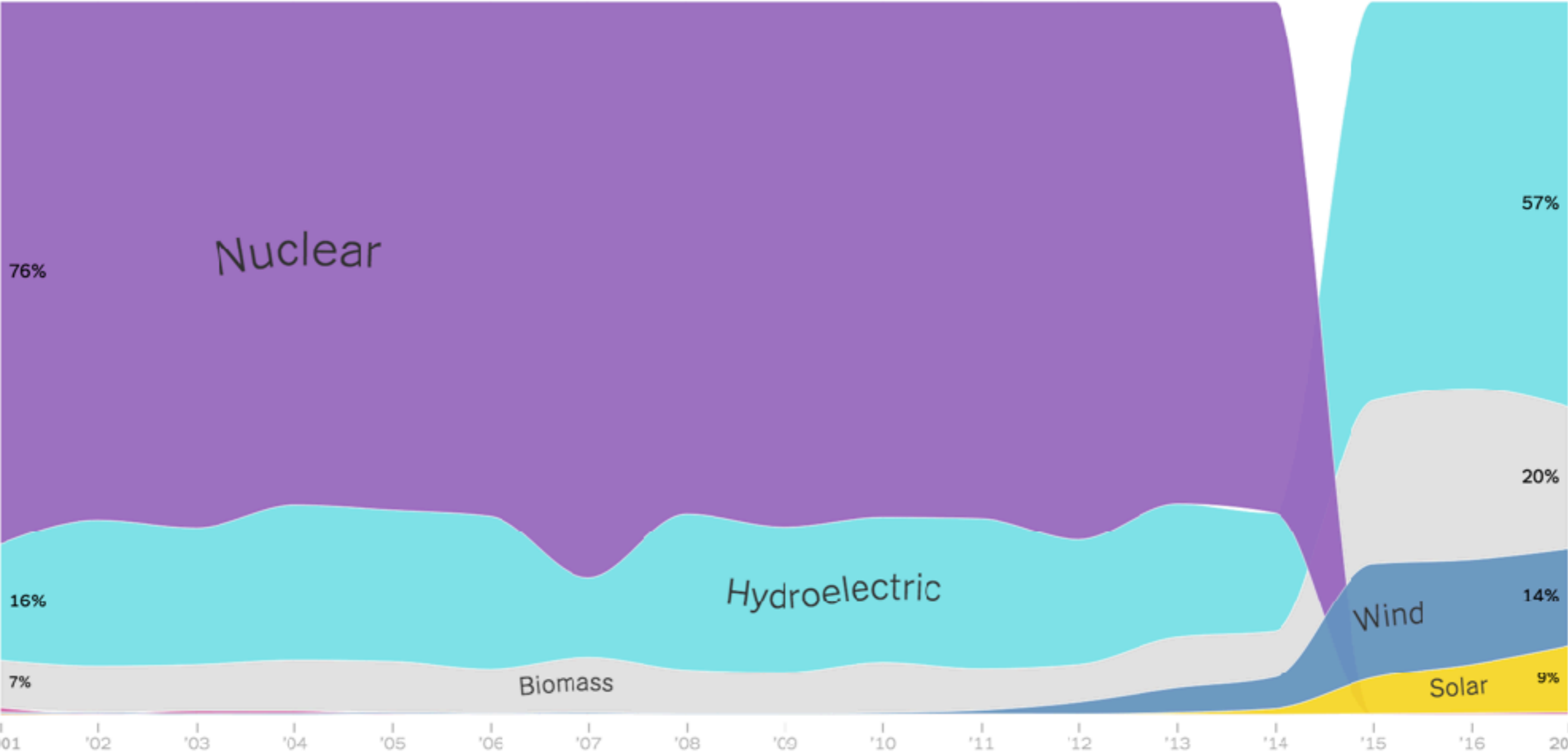


# What's Going On With This Graph?

How **Vermont** generated electricity from 2001 to 2017



Percentage of power produced from each energy source



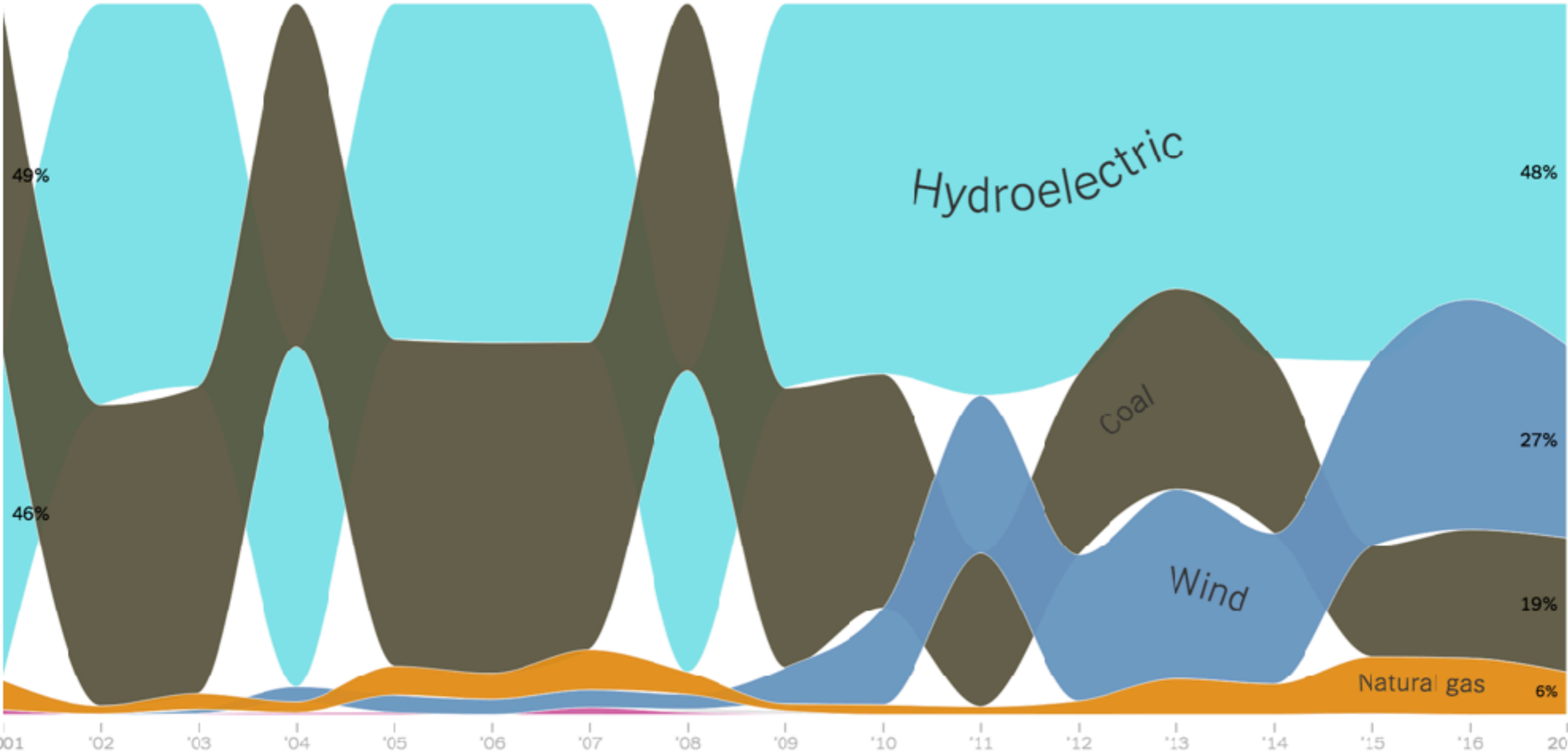
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# What's Going On With This Graph?

How **South Dakota** generated electricity from 2001 to 2017



Percentage of power produced from each energy source

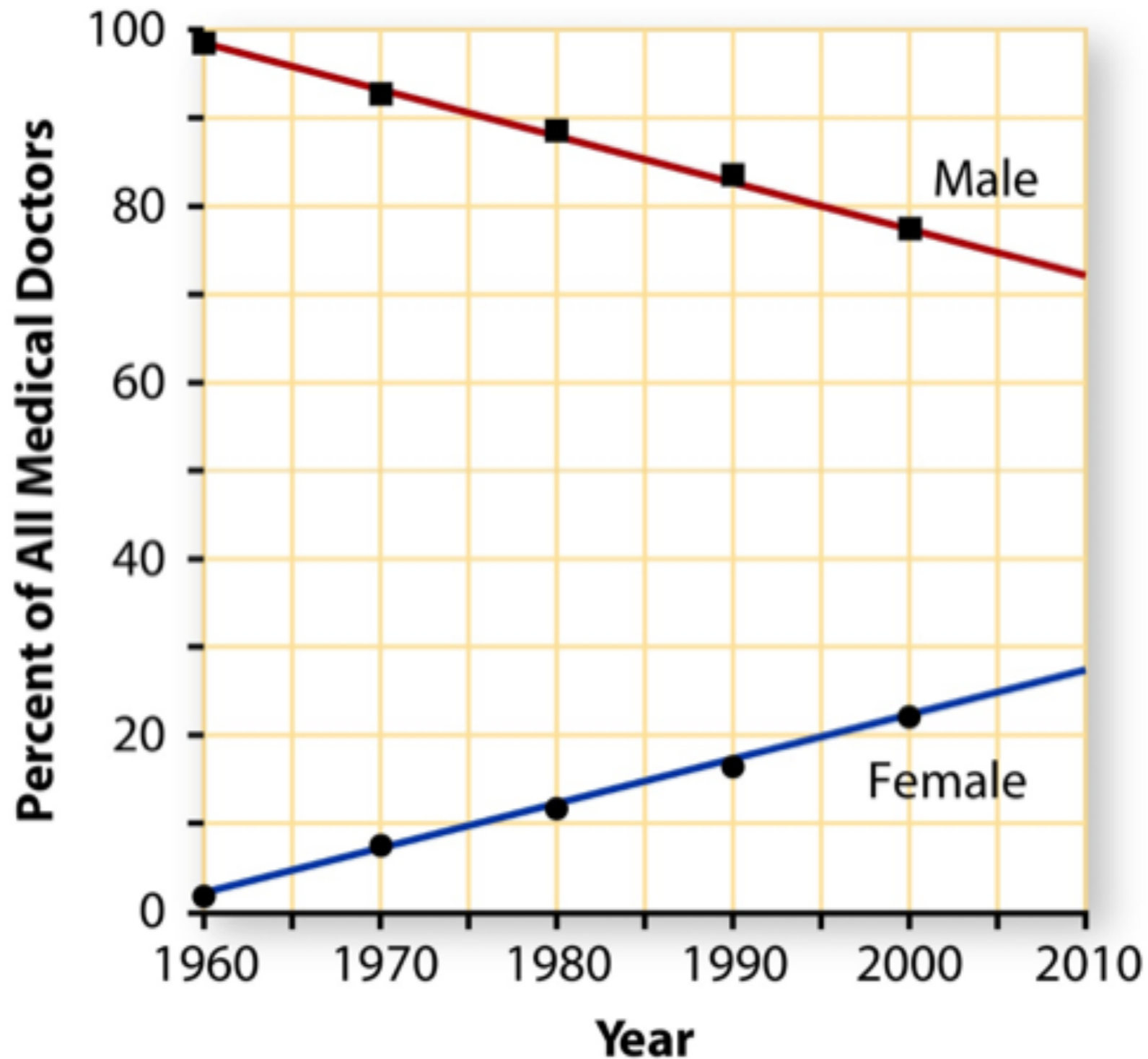


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# #NoticeWonder with Textbooks

## Male and Female Medical Doctors

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# #NoticeWonder with Textbooks

## Think About This Situation

Study the trends in the percentage of male and female medical doctors in the United States between 1960 and 2000.

- a** How would you describe the trends shown in the data plots and the linear models that have been drawn to match patterns in those points?
- b** Why do you suppose the percentage of women doctors has been increasing over the past 40 years?
- c** Would you expect the trend in the graph to continue 10 or 20 years beyond 2000?
- d** How would you go about finding function rules to model the data trends?
- e** If you were asked to make a report on future prospects for the percentages of male and female doctors, what kinds of questions could you answer using the linear models?

# #NoticeWonder with Textbooks

- 4) 50 cars and one locomotive weigh 4825 tons.  
the locomotive weighs 225 tons
- 5) A car's tank holds 16 gallons of gas. At 1 gallon, you stop at the gas station to refuel. the car uses 3 gallons per hour,
- 6) A farmer has \$755. One cow costs \$500 and a flock of chicks costs \$20.

# Using NW with Naked Problems

Write down everything you NOTICE and WONDER

**23)** about these two pairs of equations.

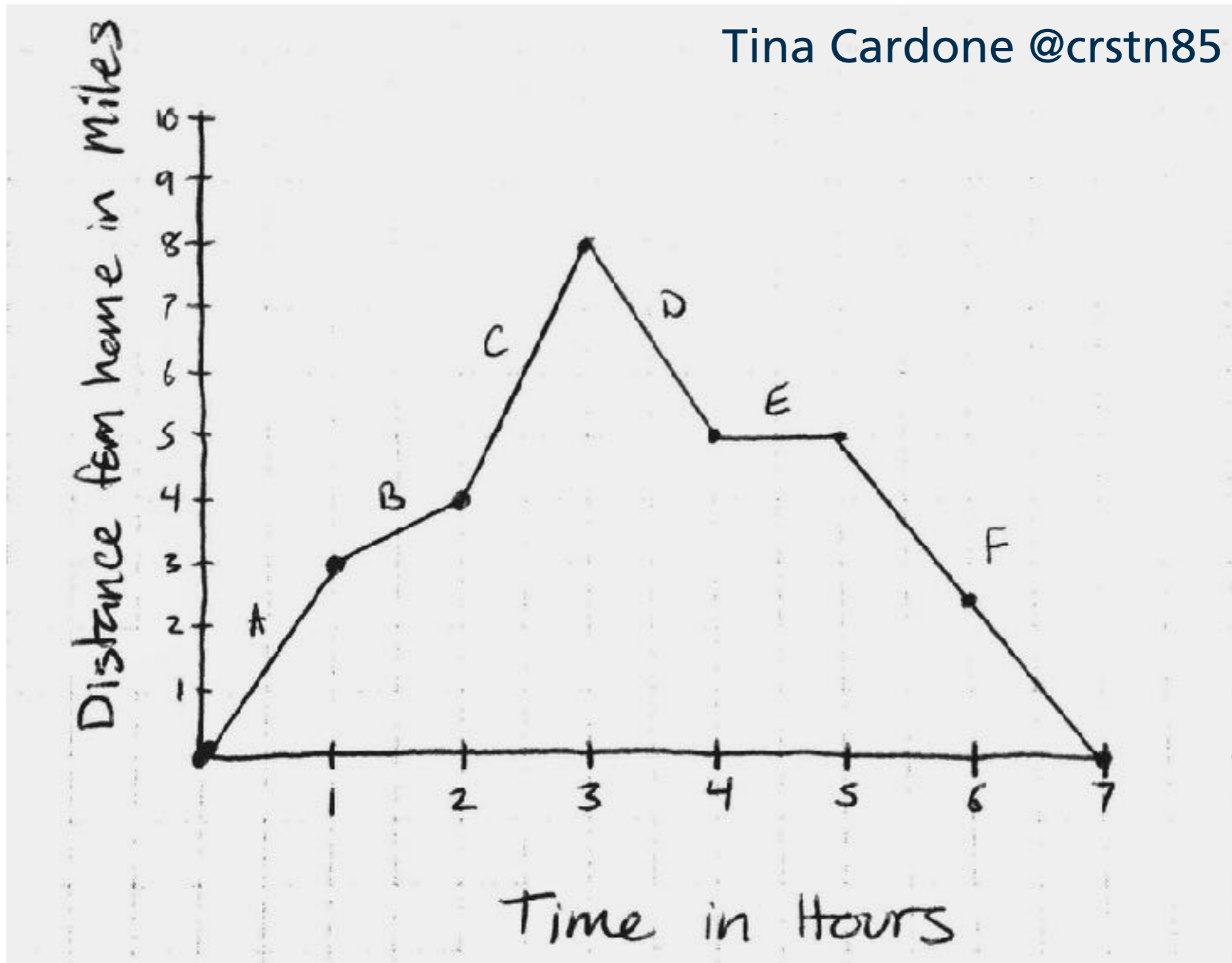
$$\mathbf{a)} \quad \left. \begin{array}{l} x + 3y = 20 \\ x^2 + y^2 + 5y = 70 \end{array} \right\}$$

$$\mathbf{b)} \quad \left. \begin{array}{l} x - 4y = -1 \\ 3y^2 - 2x = -3 \end{array} \right\}$$

**I don't have time for  
one more thing.**

# #NoticeWonder as a Launch

Tina Cardone @crstn85







**Tina Cardone** @crstn85 · Nov 24

@MFAnnie when I gave the graph and did notice/wonder first I didn't have to answer nearly so many questions when they did the handout



**Tina Cardone** @crstn85 · Nov 24

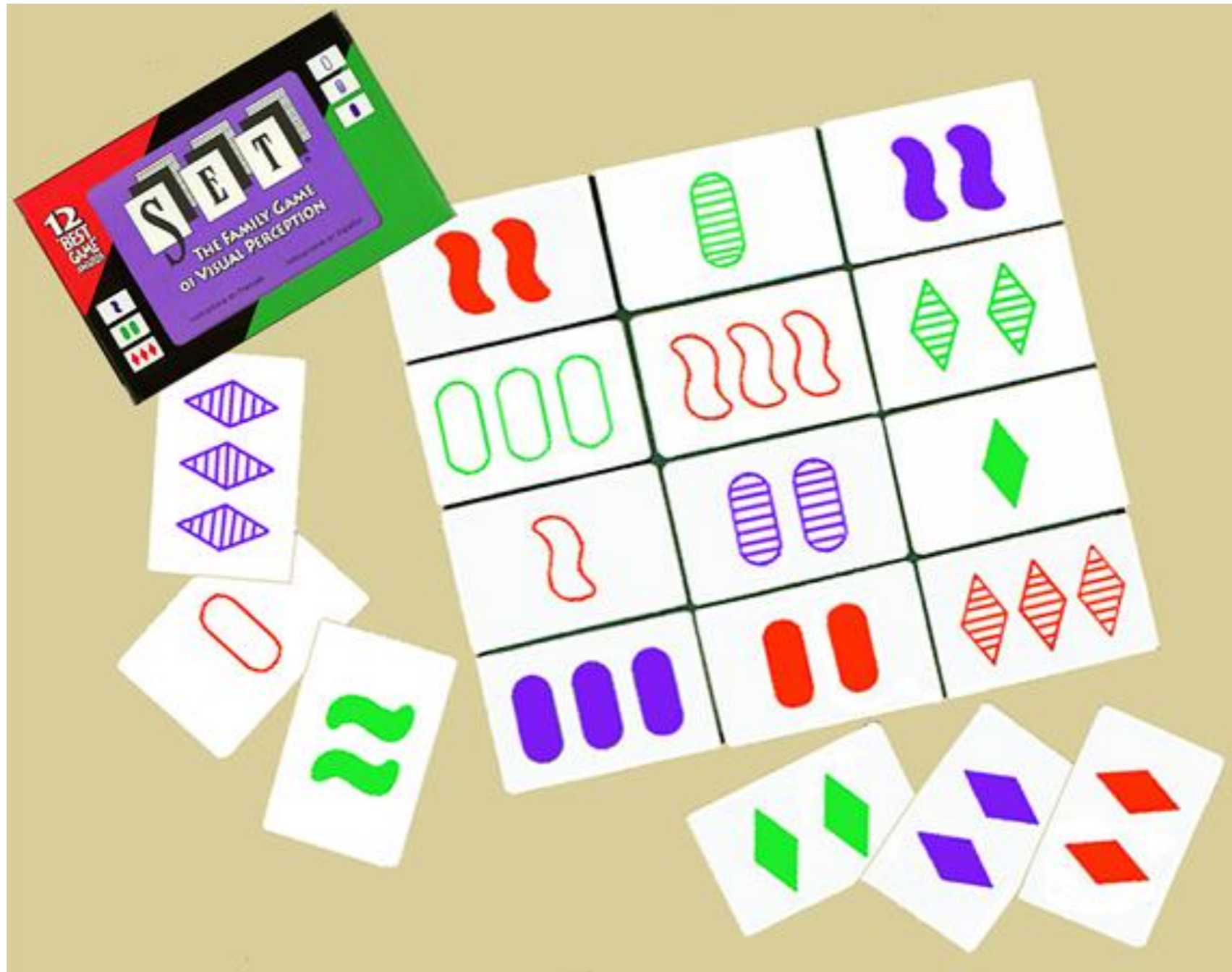
@MFAnnie worth the few minutes it took and meant we skipped wrap up discussion (they already had it)  
[drawingonmath.blogspot.com/2014/11/distan...](http://drawingonmath.blogspot.com/2014/11/distan...)



<http://drawingonmath.blogspot.com/2014/11/distance-graph.html>



# Using NW to Figure Out Rules



# How Long Does it Take?

# What If It Doesn't Work?

(meaning they don't wonder the thing you want them to)

# I Asked Twitter for Advice



**Annie Fetter**

@MFAnnie

Talking **#NoticeWonder** at **#NCSM17** + **#NCTMannual**. What's something thing you'd want me to be sure to tell/show/share with folks? **#mtbos**

# Other Tips from Twitter



**Melynee Naegele**

@MNMmath

Replying to @MFAnnie @bkdidact and 2 others

**#NoticeWonder** is for everyone! Given real think time ALL can & do think critically It is life changing for everyone involved. **POWERFULSTUFF!**

10:22am · 1 Apr 2017 · Twitter for Android

📍 Verdigris, OK, United States



**Andrew Gael**

@bkdidact

Replying to @MFAnnie @MNMmath and 2 others

**#noticewonder** creates access for all Ss by focusing on sense-making and not answer-getting. Levels the playing field. Creates ownership!

11:05am · 1 Apr 2017 · Twitter for iPhone



**Joe Schwartz**

@JSchwartz10a

Replying to @MFAnnie @MNMmath and 2 others

I'd say: Be sure to read Max's book. N/W isn't just an end in itself, it's a means to an end: problem solving/mathematizing **@maxmathforum**

5:56pm · 1 Apr 2017 · Twitter Web Client



**Beth Brandenburg**

@Brandeli1974

Replying to @MFAnnie @MNMmath and 2 others

**#noticewonder** also levels the playing field so that ALL students have an entry point into problems.



# Other Tips from Twitter



**Amie Albrecht**  
@nomad\_penguin

Replying to @MFAnnie

Non-mathematical #NoticeWonder are part of the process and shouldn't be dismissed.

10:10am · 1 Apr 2017 · Tweetbot for iOS



**Christine Newell**  
@MrsNewell22

Replying to @MFAnnie @MNmMath and 3 others

Honor all noticings/wonderings but discuss mathematical vs. "Other"

2:26am · 2 Apr 2017 · Twitter for Android



**Debster**  
@hartmann12

Replying to @MFAnnie @HCDSB

Ts are loving #noticewonder and we present again on April 5 to another group. @HCDSB loves #noticewonder for math as well as other subjects!

2:44pm · 1 Apr 2017 · Twitter Web Client



# Time for Reflection

Write down

- two upcoming moments where you could use a “scenario” (no question, maybe no numbers) in the very near future
- two things you’re wondering

# Mingle Instructions

- Stand up and move around.
- Find someone and introduce yourself.
- Ask them one question from the list.
- Listen to their answer.
- Move on to find another person.
- No back and forth, just ask one question and listen to the answer.
- When I raise my hand, finish your conversation and raise your hand.

# Thank you!

## Annie Fetter

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Slides and links to related resources will be available on my blog after the talk:

<https://mathematicalthinking.org/annie/>