

VCTM Virtual
Fall Conference

MAKING CONNECTIONS

**Sense Making: Is It at the
Core of Your Classroom?**

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21st Century Partnership for STEM Education



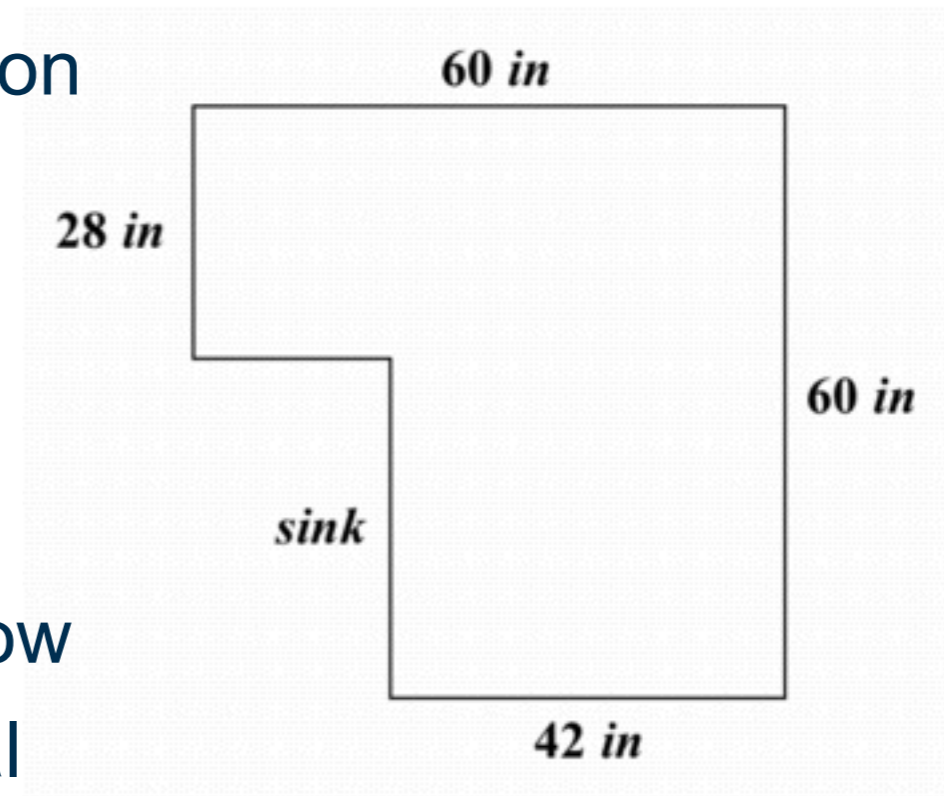


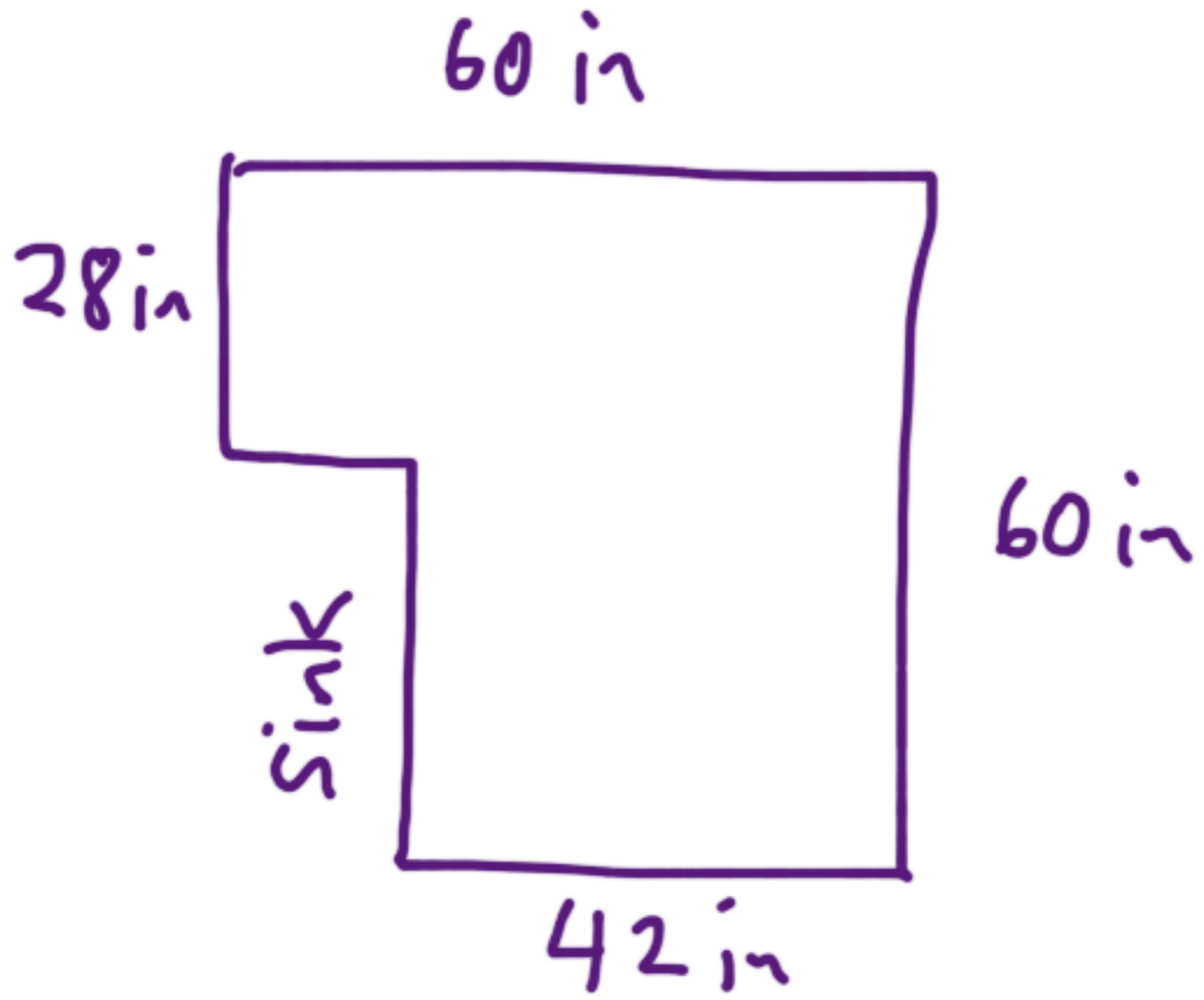
Teresa's Tiles

Teresa is going to put down new ceramic tiles on her bathroom floor. She has selected square tiles that are 4 inches on each side. These are the kind of tiles that can be placed right next to each other without leaving additional space for grout. At The Home Station, she learned how to cut the tiles in case she needs any fractional pieces to cover her floor completely.

This diagram of the bathroom floor shows the dimensions of the floor space she needs to cover. The sink area does not get tiled.

Questions: How many tiles will she need to buy to cover her floor? How many tiles will she have to cut in order to cover the entire space?





Teresa's Tiles "Scenario"

Things that some "low-performing" 8th graders noticed about the picture:

- two sides are equal
- two sides are 60 inches
- one side is 28 inches
- they are longest
- one side is 42 inches
- it used to be a square
- your lines aren't very straight
- the short side of the sink is 18"
- the sink is a rectangle
- the long side of the sink is 32"
- can find the area of the whole thing by making it two pieces

Sample Grade 3 Test Question

The corner deli sells roses in bunches of 6. If Dylan buys 3 bunches of roses, how many roses does he have?

A.6 18%

B.9 46%

C.18 31%

D.24 4%

Combined scores of the 160 third graders in a group of four low-performing schools I used to support.

Sample Test Question Revised

The corner deli sells roses in bunches of 6. Dylan bought 3 bunches. Draw a picture of the story.



CCSS Math 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.**

They consider analogous problems, and try special cases and simpler forms of the original problem in order to gain insight into its solution.

They monitor and evaluate their progress and change course if necessary.

Integrated Math 2 (Grade 10)

	Boy	Girl	Total
Wear Sunscreen	84	133	217
Do Not Wear Sunscreen	170	118	288
Total	254	251	505

$P(\text{wears sunscreen})$

$P(\text{is a boy})$

$P(\text{wears sunscreen} \mid \text{is a boy})$

$P(\text{wears sunscreen and is a boy})$

$P(\text{wears sunscreen or is a boy})$

$P(\text{is a boy} \mid \text{wears sunscreen})$

$P(\text{is a boy or a girl})$

“Doing Math” or Sense Making?

$$12 - p = 5$$

$$12 - ? = 5$$

[Michelle's son] was struggling to “remember” $28/4$. When [she] asked him, “How do you think about $28/4$?” He replied, “Mom, you aren’t supposed to think about it, you are just supposed to do it!!”

The Five Strands of Mathematical Proficiency

National Research Council, 2001, *Adding it up: Helping children learn mathematics*.

1. Conceptual understanding
2. Procedural fluency
3. Strategic competence
4. Adaptive reasoning
5. Productive disposition

“Productive disposition is the inclination to see mathematics as sensible, useful, and worthwhile, coupled with a belief in diligence and one’s own efficacy.”

Your Most Important Job: Monitor for Sense-Making

Encouraging Sense Making

Q: What's one way to cultivate a classroom focused on *sense making* rather than *answer-getting*?

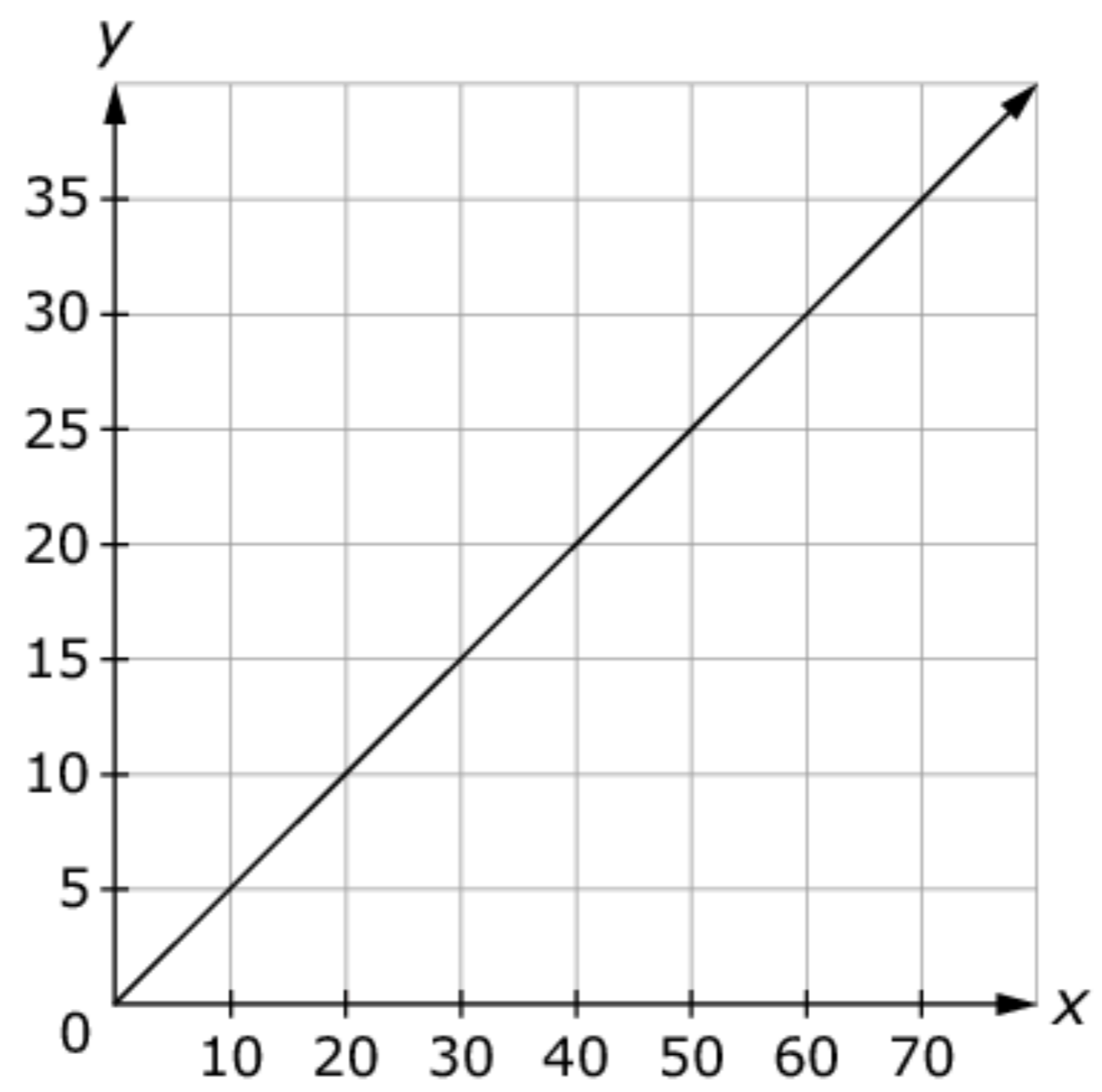
A: Get rid of the question. Literally.

Get Rid of the Question

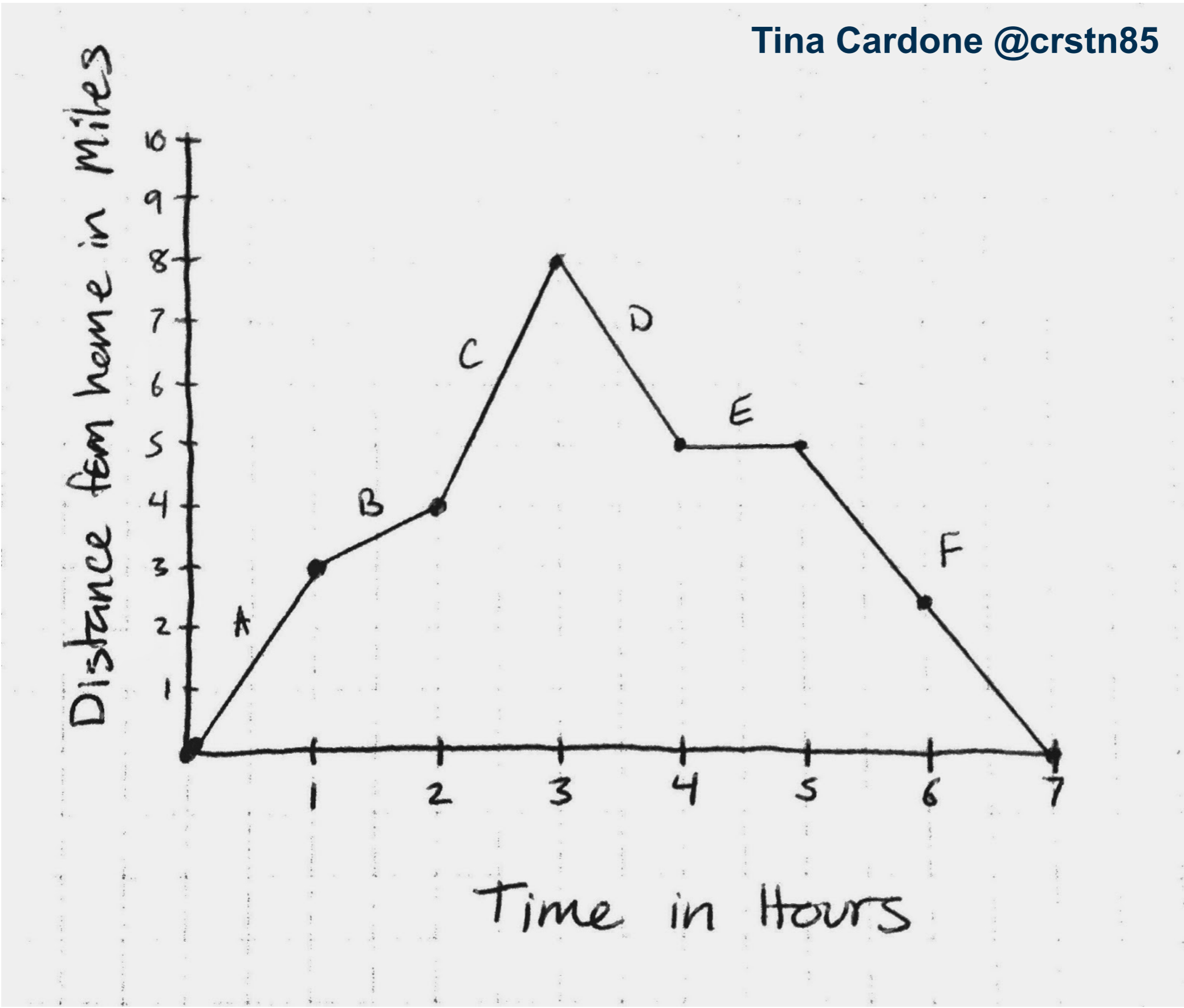
Apple juice costs 50¢. The juice machine accepts quarters, dimes, and nickels.

I Notice	I Wonder

Get Rid of the Question



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/distance-graph.html>

Encouraging Sense-Making

Q: What's another way to cultivate a classroom focused on *sense making* rather than *answer-getting*?

A: Get rid of the question *and* the numbers.

Get Rid of the Question and the Numbers

Allison is saving to buy a bicycle by working during summer vacation.

- The job pays her some money for every 1 hour worked.
- She works the same number of hours every week.

Get Rid of the Question and the Numbers

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If she works for 4 weeks and buys the bicycle, how much money will she have left over?

Get Rid of the Question and the Numbers

Allison is saving to buy a \$500 bicycle by working during summer vacation.

- The job pays her some money for every 1 hour worked.
- She works the same number of hours every week.

If she works for 4 weeks and buys the bicycle, how much money will she have left over?

Get Rid of the Question and the Numbers

Allison is saving to buy a \$500 bicycle by working during summer vacation.

- The job pays her \$8 for every 1 hour worked.
- She works the same number of hours every week.

If she works for 4 weeks and buys the bicycle, how much money will she have left over?

Get Rid of the Question and the Numbers

Allison is saving to buy a \$500 bicycle by working during summer vacation.

- The job pays her \$8 for every 1 hour worked.
- She works 20 hours every week.

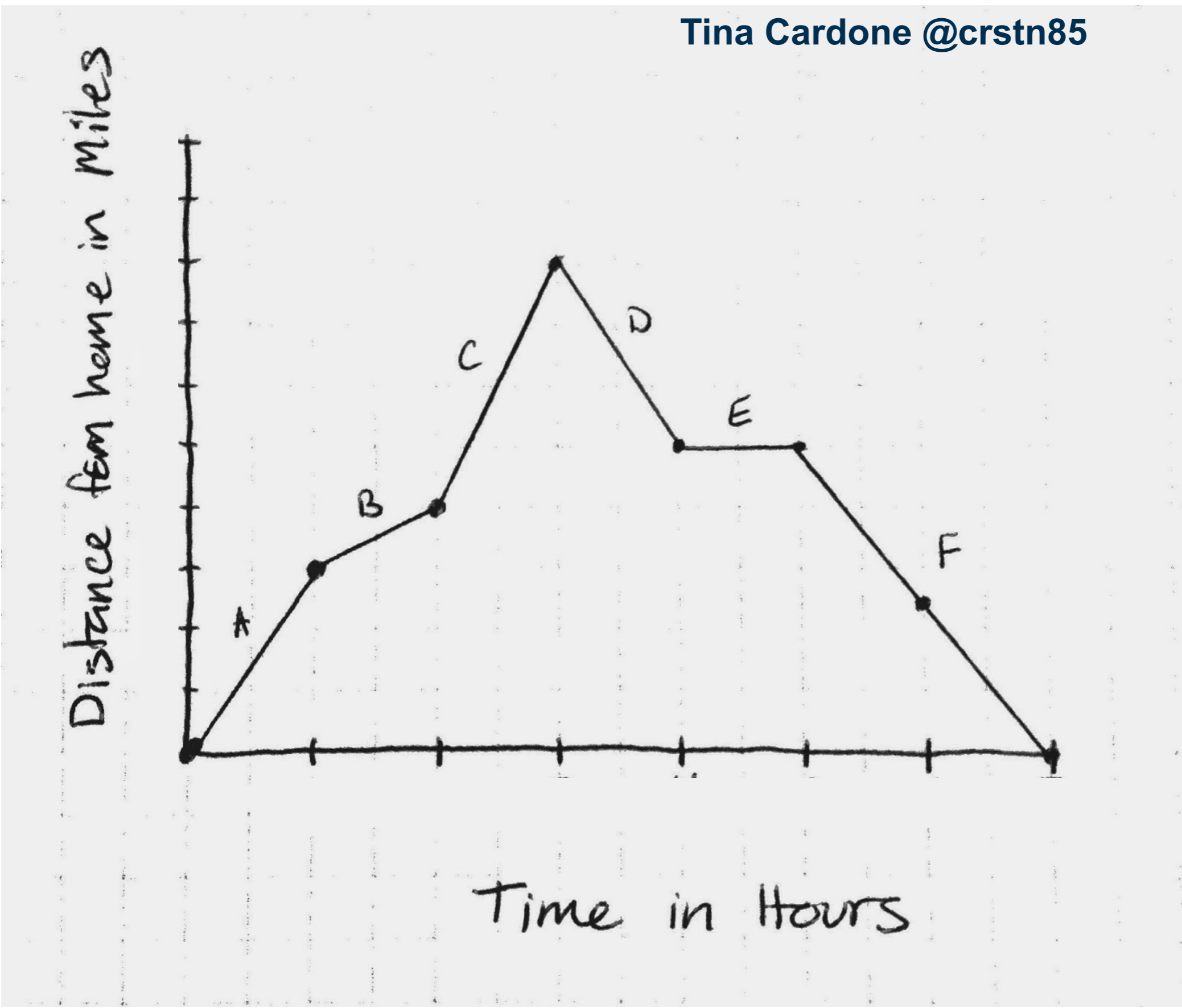
If she works for 4 weeks and buys the bicycle, how much money will she have left over?

Get Rid of the Question and the Numbers

A store has the floor plan shown. The area of the women's department is



Tina Cardone @crstn85



Encouraging Sense Making

Q: What's another way to cultivate a classroom focused on *sense making* rather than *answer-getting*?

A: Give the answer.

Give the Answer

◆ Math Message Follow-Up

WHOLE-CLASS ACTIVITY

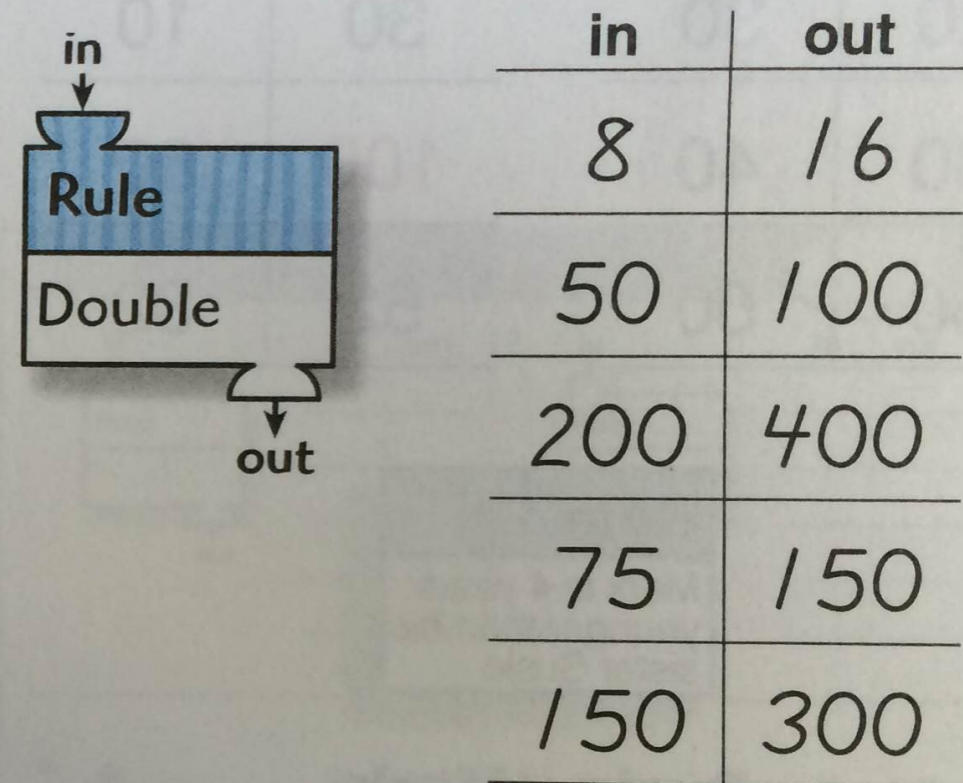
Draw or display a function machine and “What’s My Rule?” table. (See Advance Preparation.)

Ask children to imagine that the **function machine** works like this:

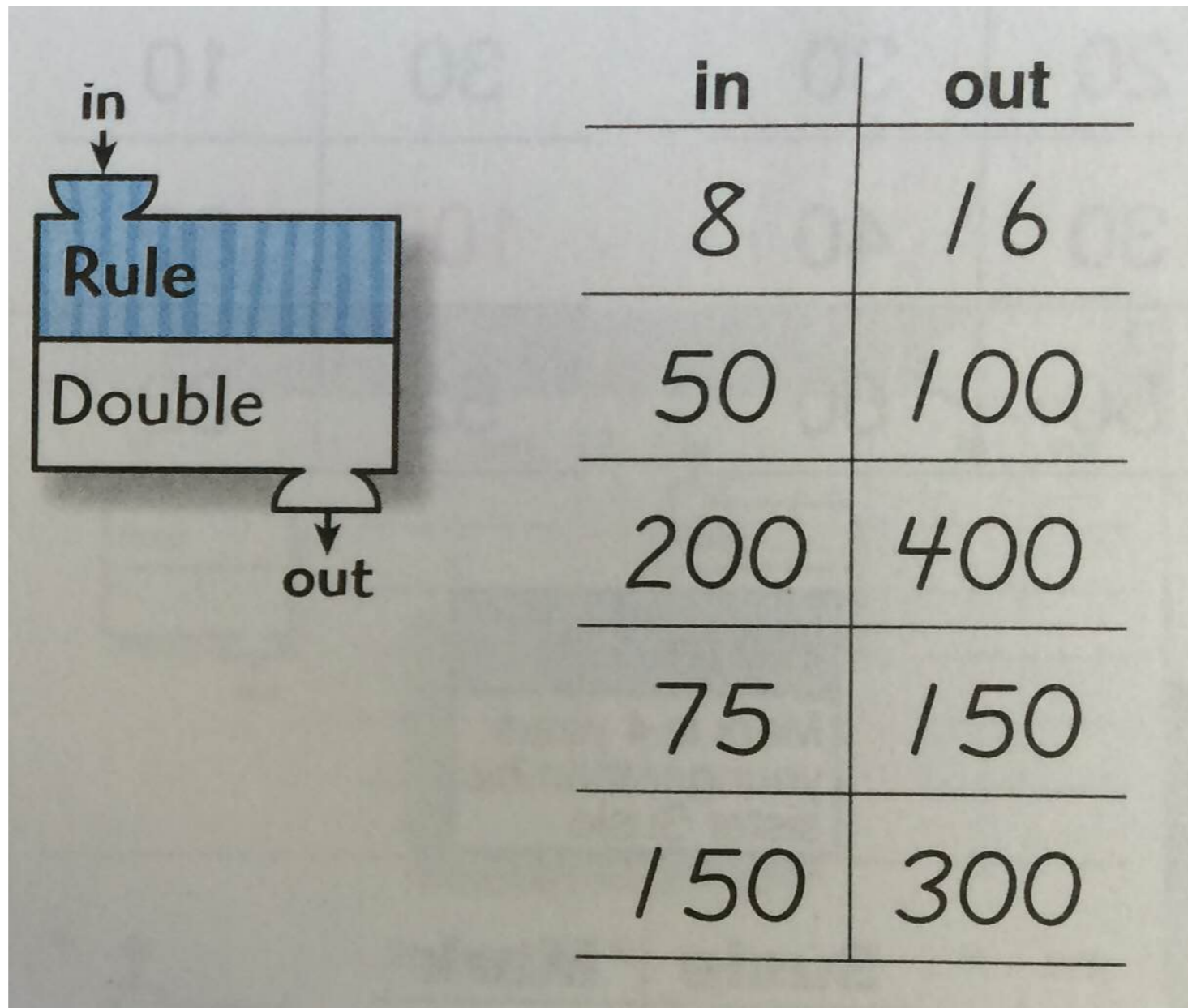
- A number (the **input**) is dropped into the machine,
- the machine changes the number according to a rule,
- and a new number (the **output**) comes out the other end.

The **rule** for the Math Message problem is “Double the number.” Write the word *Double* in the function machine.

Point out the “**What’s My Rule?**” table. Discuss the 8 in the *in* column and the 16 in the *out* column. Explain to children that numbers in the *in* column represent the numbers of bacteria now. Corresponding numbers in the *out* column represent the numbers of bacteria 20 minutes from now.



Give the Answer



in	out
8	16
50	100
200	400
75	150
150	300

Give the Answer (or Several!)

Rachel bakes cookies and delivers them to her friends.

- It takes 8 minutes to mix the batter.
- The cookies bake for 9 minutes.
- For 6 minutes they cool.

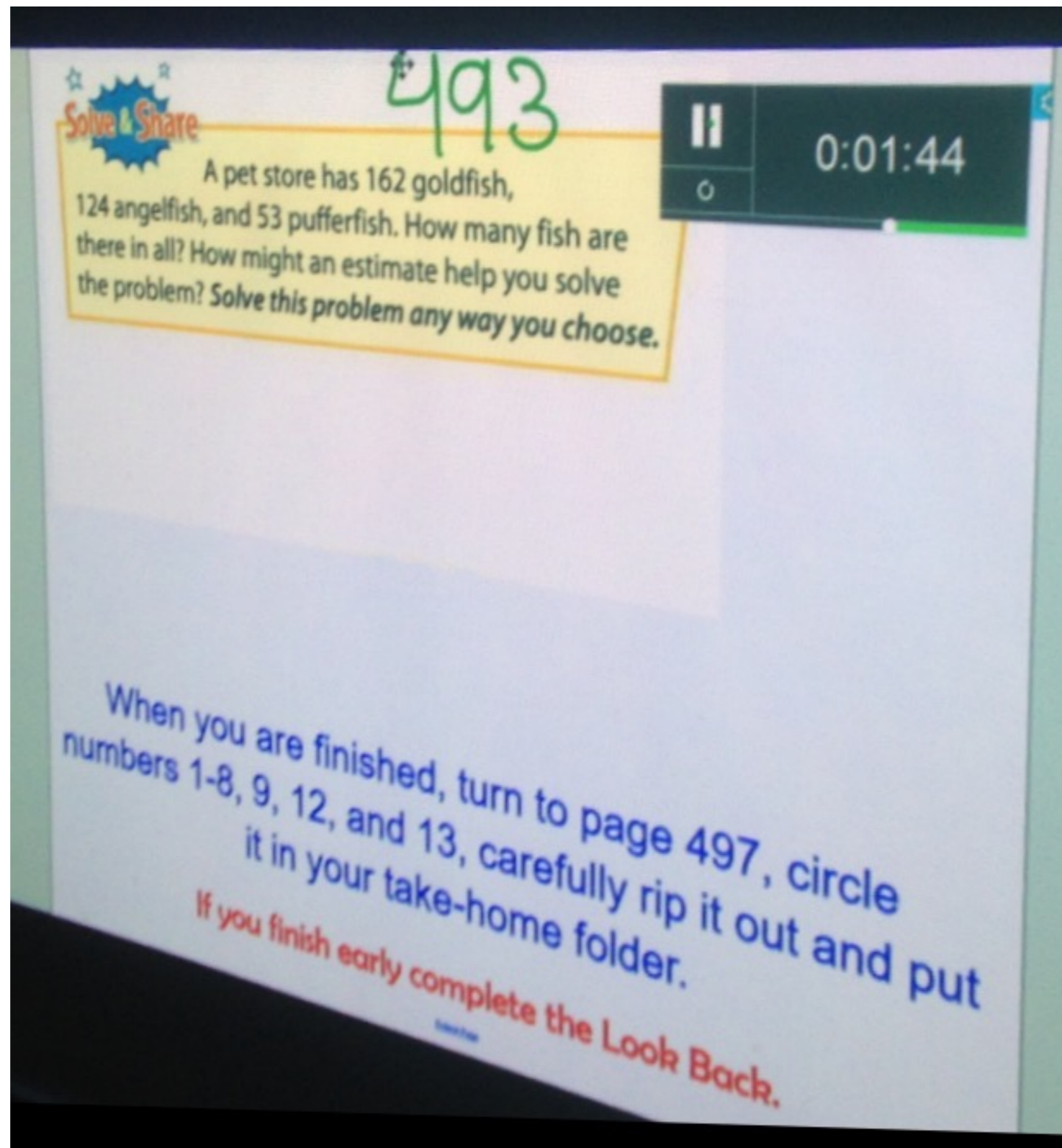
If the answer is 23 minutes, what is the question?

If the answer is 3 minutes, what is the question?

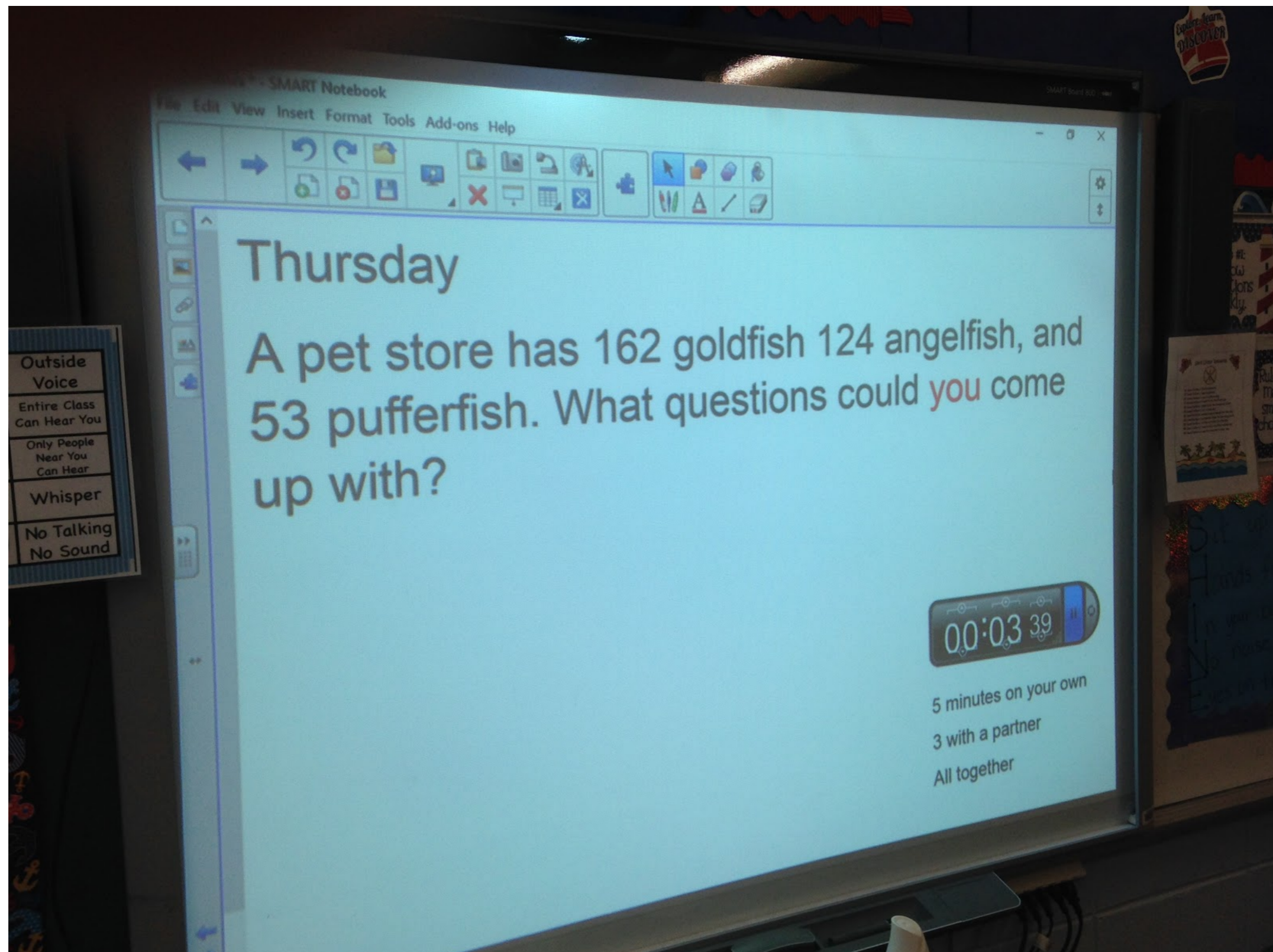
If the answer is bake, what is the question?

from Joe Schwartz, @JSchwartz10a

Ask for Questions (and slow down!)



Ask for Questions



Ask for Questions

pufferfish. What questions could you come up with?

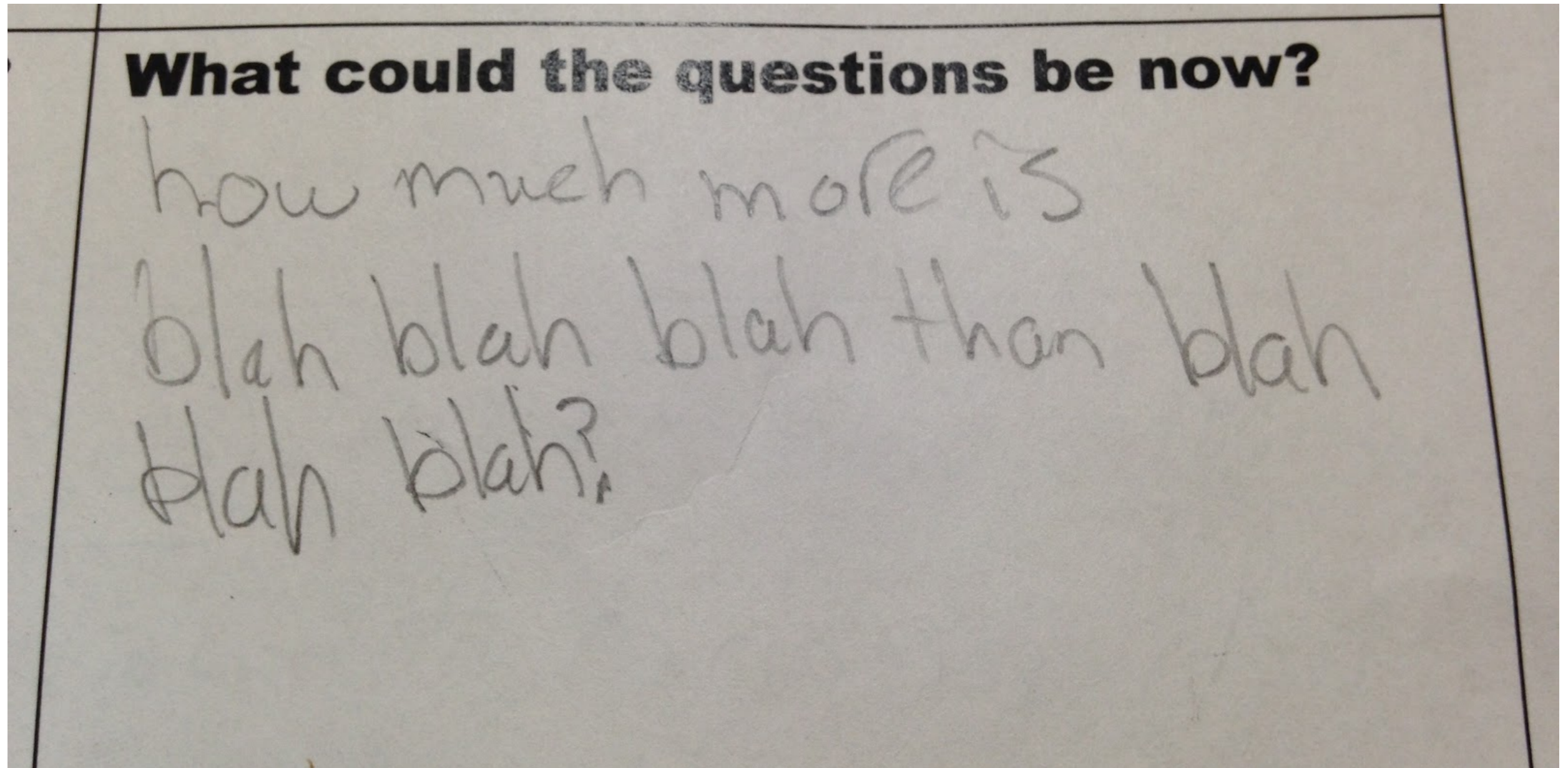
How much more does the goldfish's has more than the angelfish?

What is the total of all fishes?

How much does the pufferfish and the goldfish have altogether?

How much does the angelfish and

Ask for Questions



Encouraging Sense Making

Q: What's another way to cultivate a classroom focused on *sense making* rather than *answer-getting*?

A: Ask about ideas, not answers.

This can be really simple:

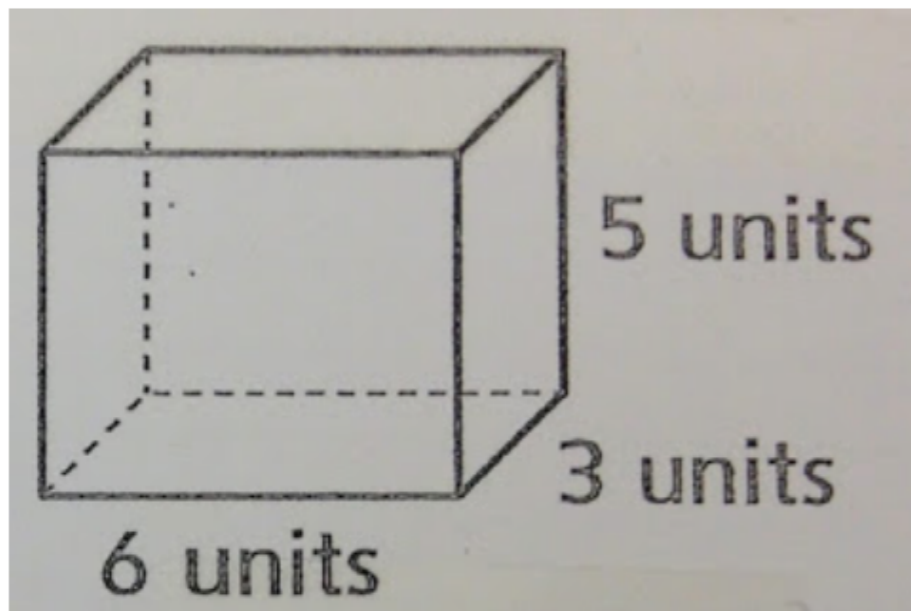
“Tell me something about number 7.”

instead of

“What's the answer to number 7?”

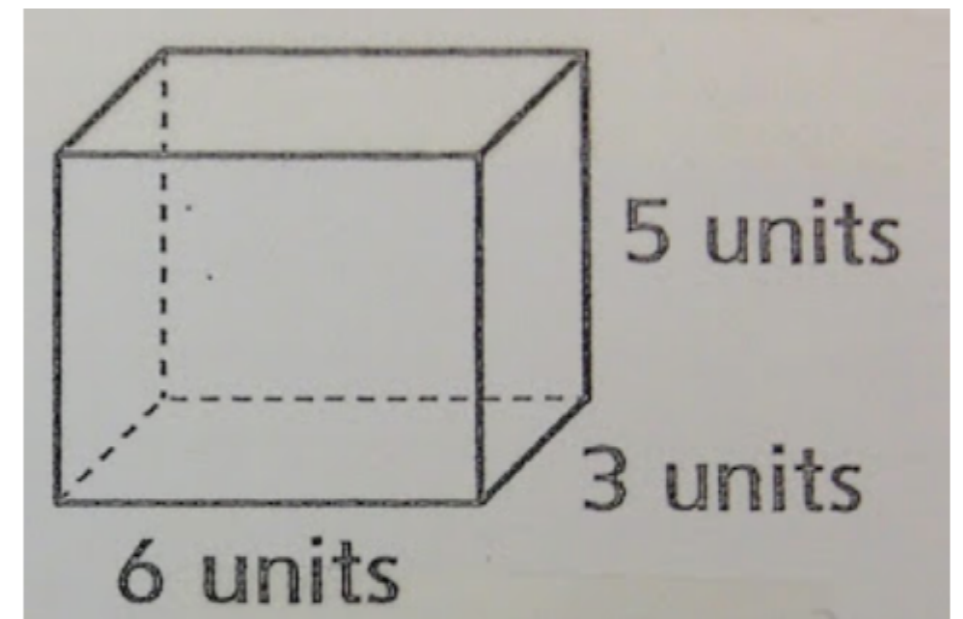
Ask About Ideas, Not Answers

It can be a little more complex:



Tell me everything you can about this figure.

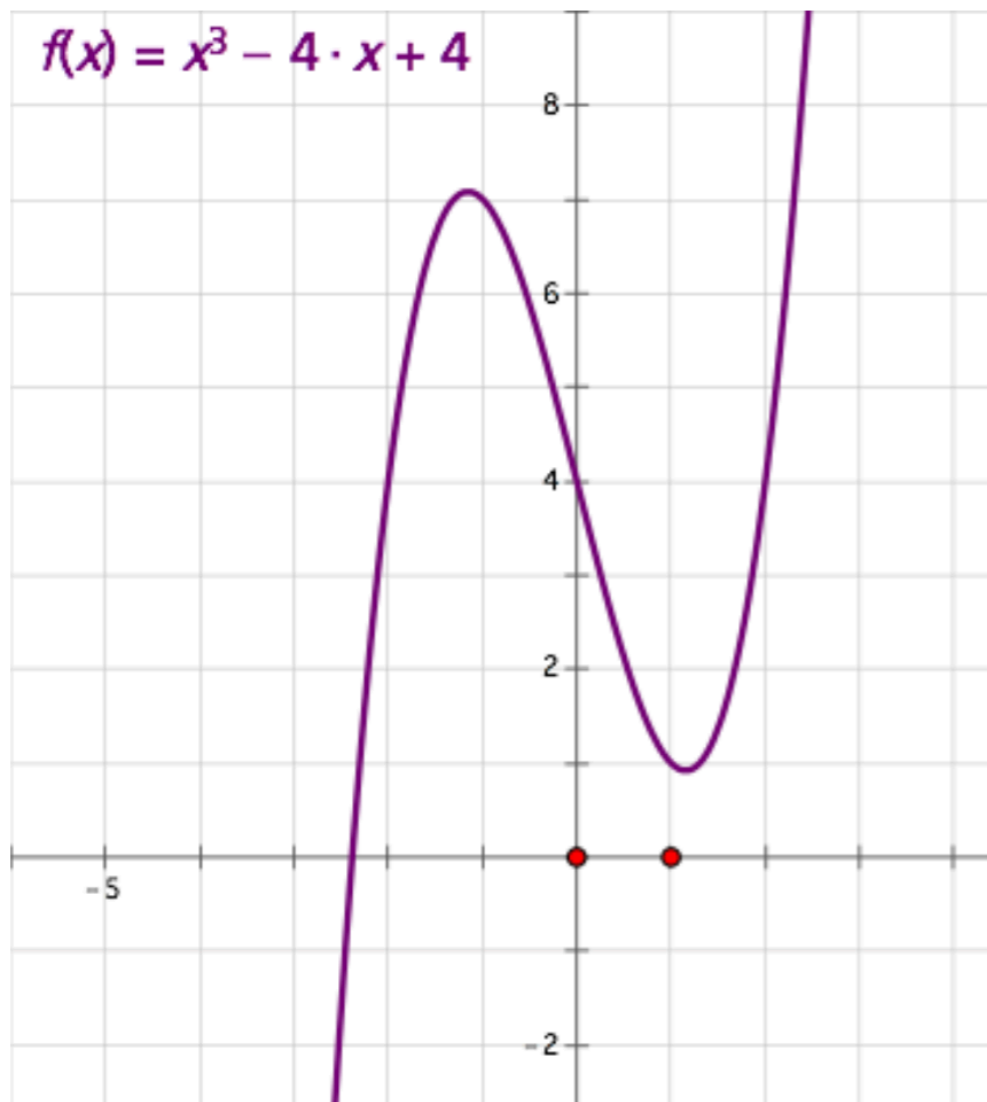
instead of



Find the volume of the rectangular prism.

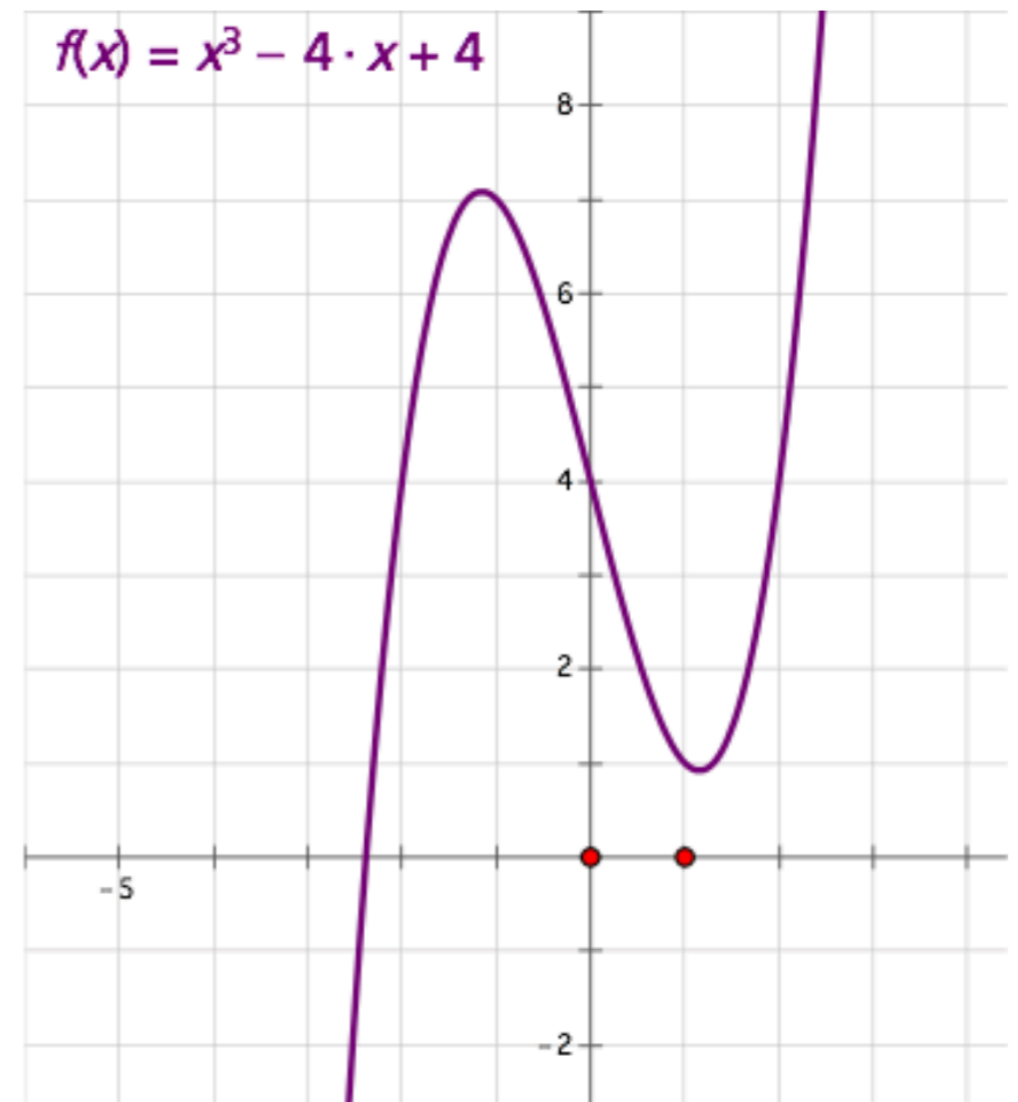
(from Joe Schwartz's blog, exit10a.blogspot.com, October 10, 2016)

Ask About Ideas, Not Answers



Tell me everything you can about the derivative of this function.

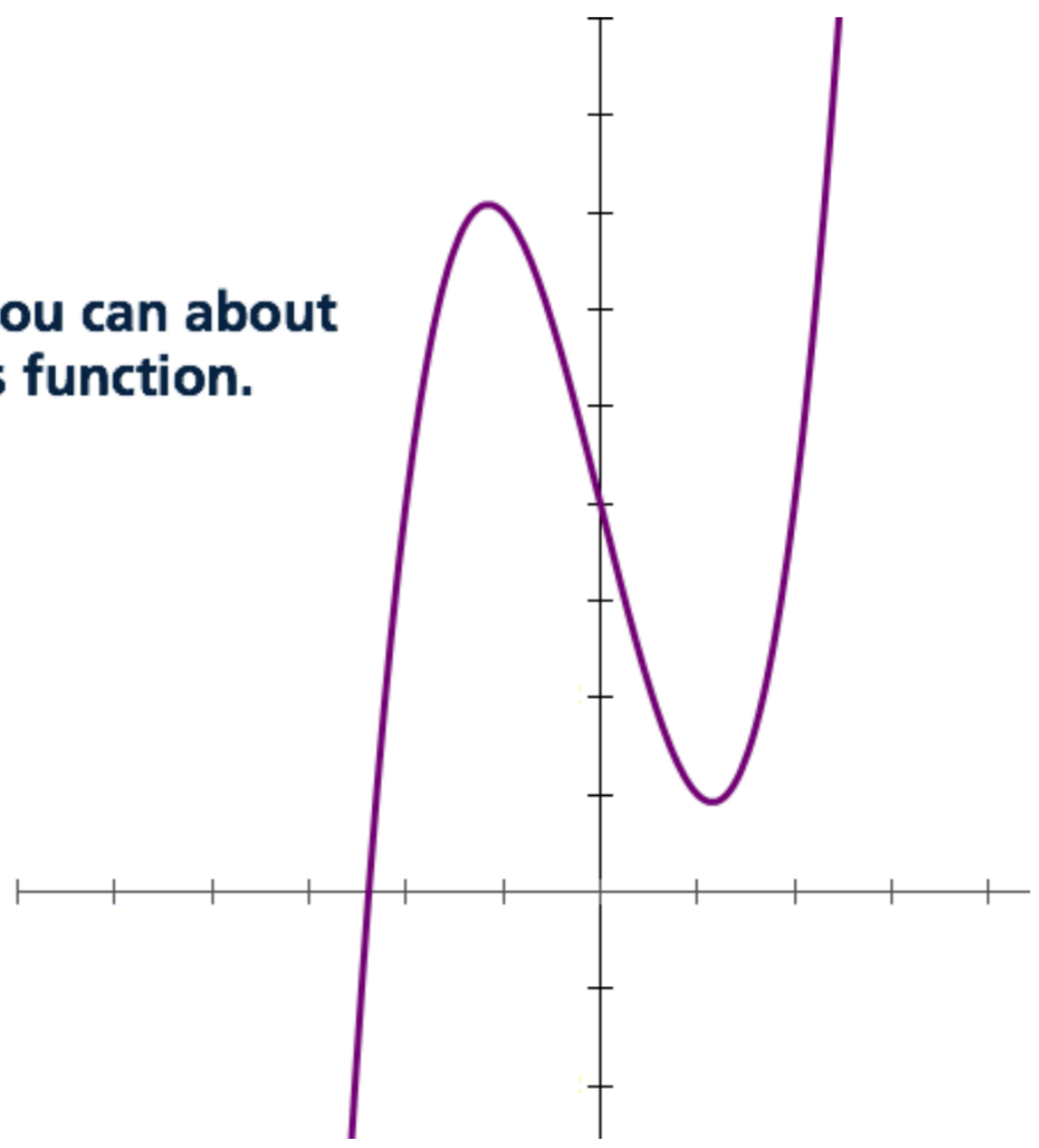
instead of



Find the derivative of this function.

Ask About Ideas, Not Answers

Explain everything you can about the derivative of this function.



Teacher Questions

“Why?”

“How do you know?”

“How did you decide?”

“Tell me more about that.”

Ways to Encourage Sense Making Rather Than Answer Getting

- Get rid of the question.
- Get rid of the question *and* the numbers.
- Give the answer.
- Ask about ideas, not answers.

Also, launch by asking for students' ideas, not telling them something.

**My Goal 1:
That Students Believe They Have
Ideas About Every Problem/
Situation/Story**

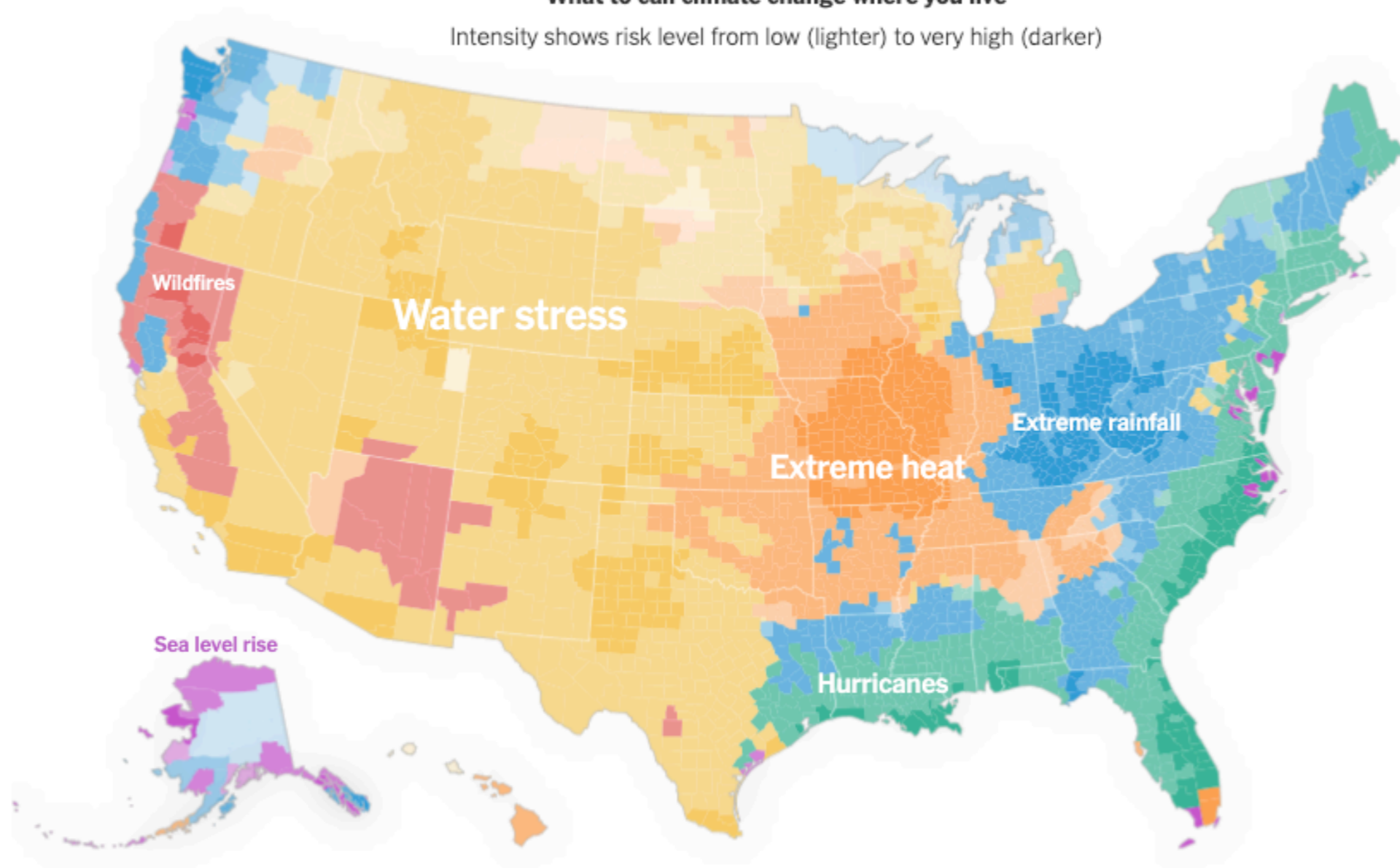
**My Goal 2:
That Students Believe
Mathematics Makes Sense**

What's Going On in This Graph? | Climate Threats

Every place has its own climate risk. What is it where you live?
How may climate change affect your community?

What to call climate change where you live

Intensity shows risk level from low (lighter) to very high (darker)

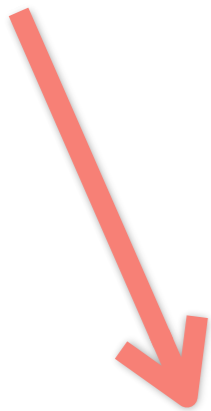


After looking closely at the interactive map above (or at [this full-size image](#)), discuss with someone what each of you notice in the graph. Then, answer these four questions:

- What do you notice?
- What do you wonder?
- What impact does this have on you and your community?
- What's going on in this graph? Write a catchy headline that captures the map's main idea.

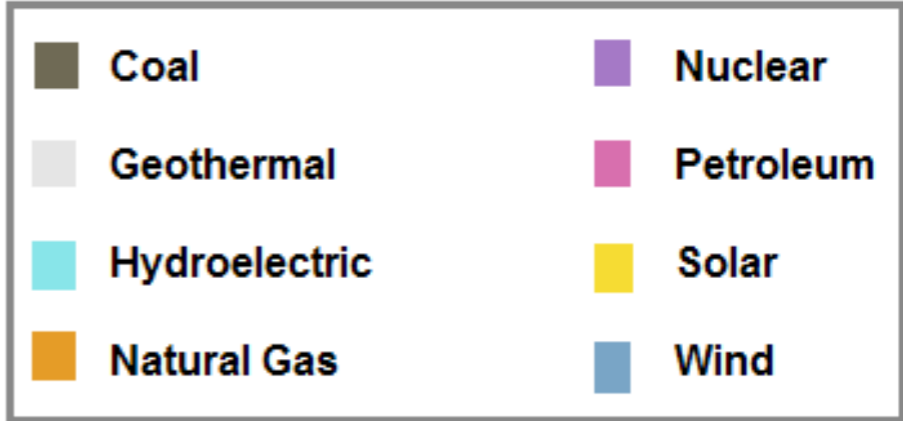
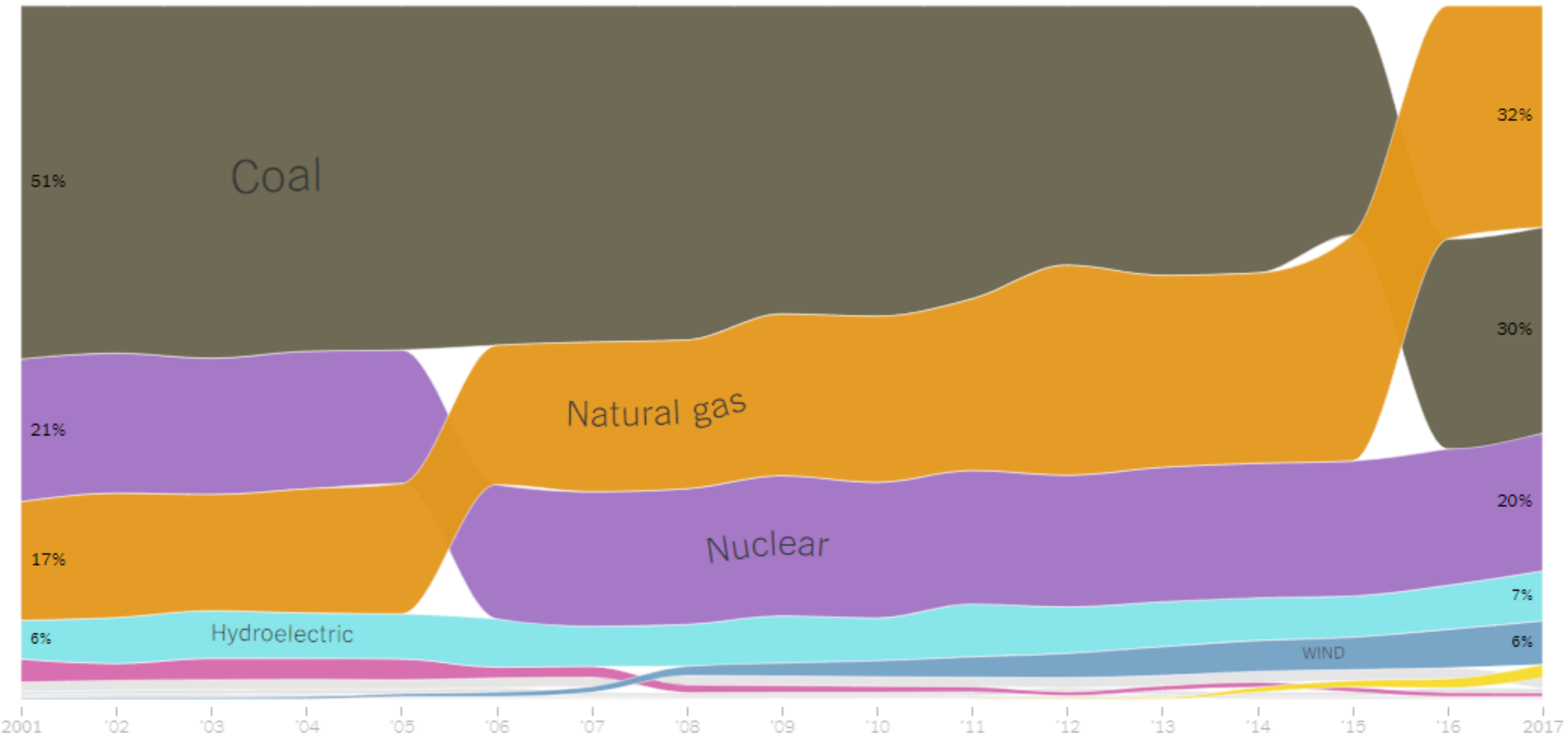
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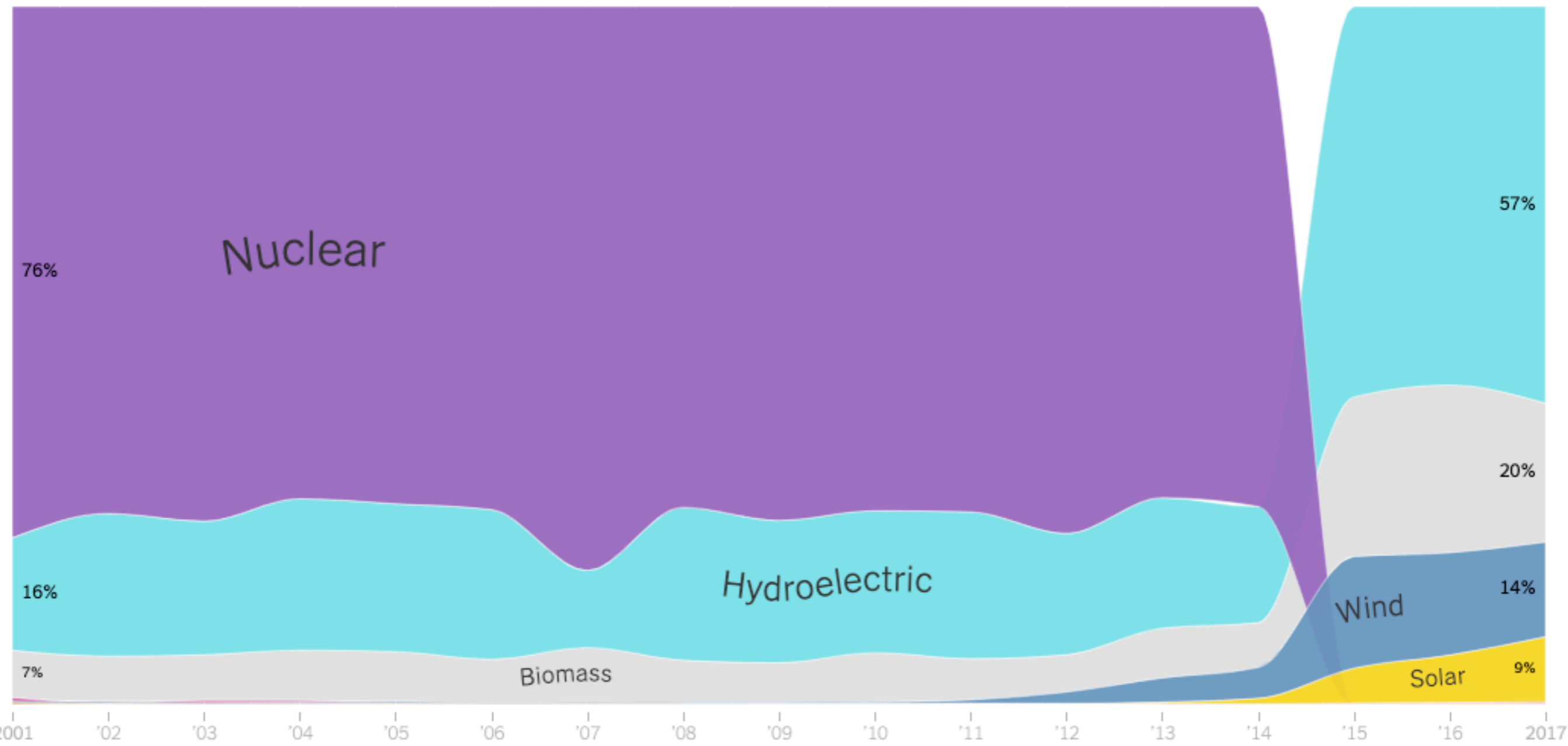
Students in U.S. high schools can get [free digital access to The New York Times](#) until Sept. 2021.

Sources of electricity generation in the United States



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

Percentage of power produced from each energy source



Moment for Reflection and Personal (Possibly Public) Commitments

What's one thing you might try next week?

What's one thing you're wondering?

Thank you!

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Slides and links to related resources will be available on my blog later today:

annie.mathematicalthinking.org