Sense Making: Aren't We Already Doing That in Literacy?

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

annie.mathematicalthinking.org

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.

Sample Grade 3 Test Question

Hot dog buns come in packages of 8. Michael buys 6 packages of hot dog buns. How many hot dog buns does Michael have in all?

A. 14 43%

B. 36 8%

C. 48 40%

D. 56 5%

"Cracking the Math Code"

ADDITION	SUBTRACTION	MULTIPLICATION	DIVISION
Add	are not	By (dimension)	as much
Altogether	change	Double	cut up
And	decreased by	Each group	divided by
Both	difference	Multiplied by	each group has
How many	fewer	Of	half (or other fractions)
How much	have left	Product of	how many in each
In all	how many did not have	Times	parts
Increased by	how many more	Triple	quotient of
Plus	less than		Separated
Sum	remain		Share something equally
Together	subtract		split
Total	take away		
	Taller/shorter		

(document from the web site of a large Eastern US metropolitan school district)

Sample Grade 3 Test Question

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A. 14 43%

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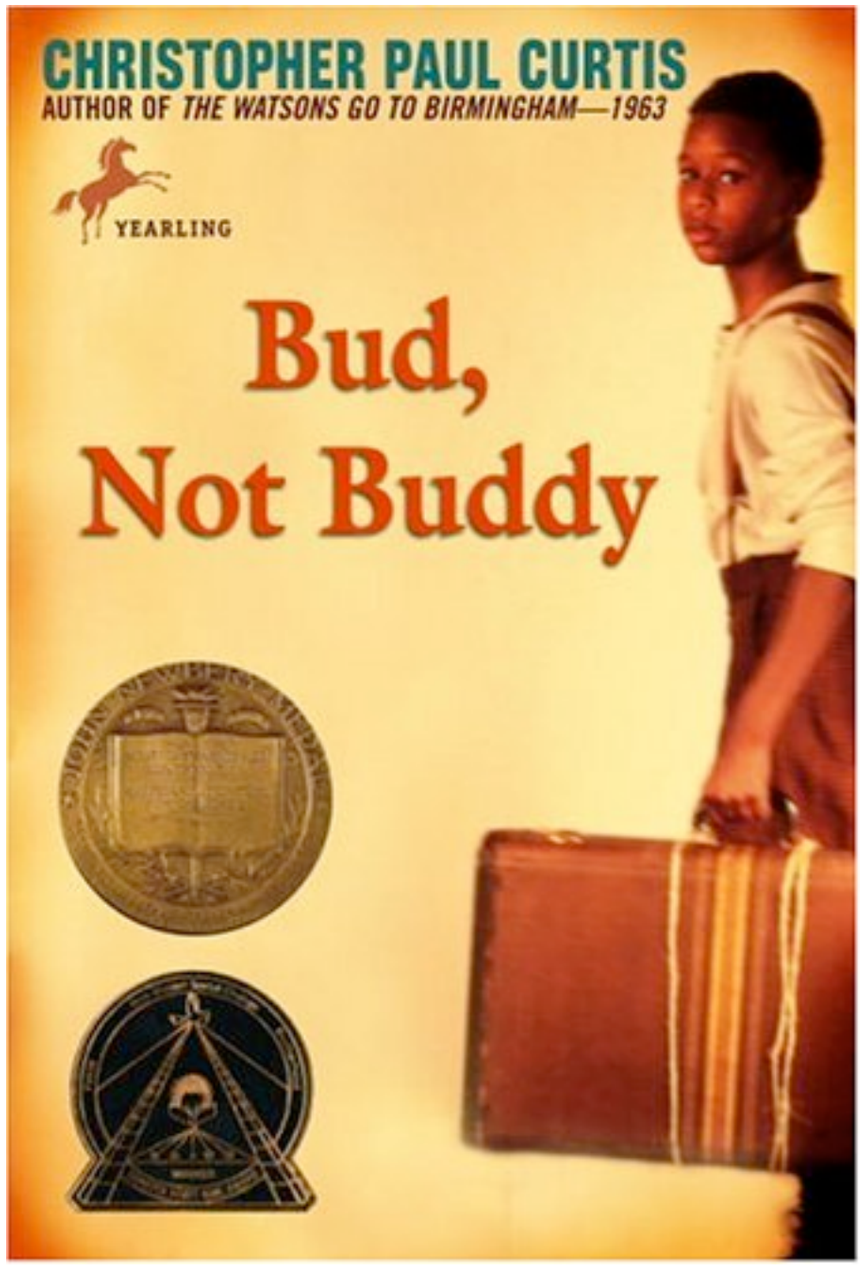
Dr. Jekyll and Mr. Hyde



Reading Strategies

What are some reading strategies that you've taught or seen taught so far this year?

Strategies - Unfamiliar Words

- Sound it out
- Context clues
- Apply known patterns to a new situations

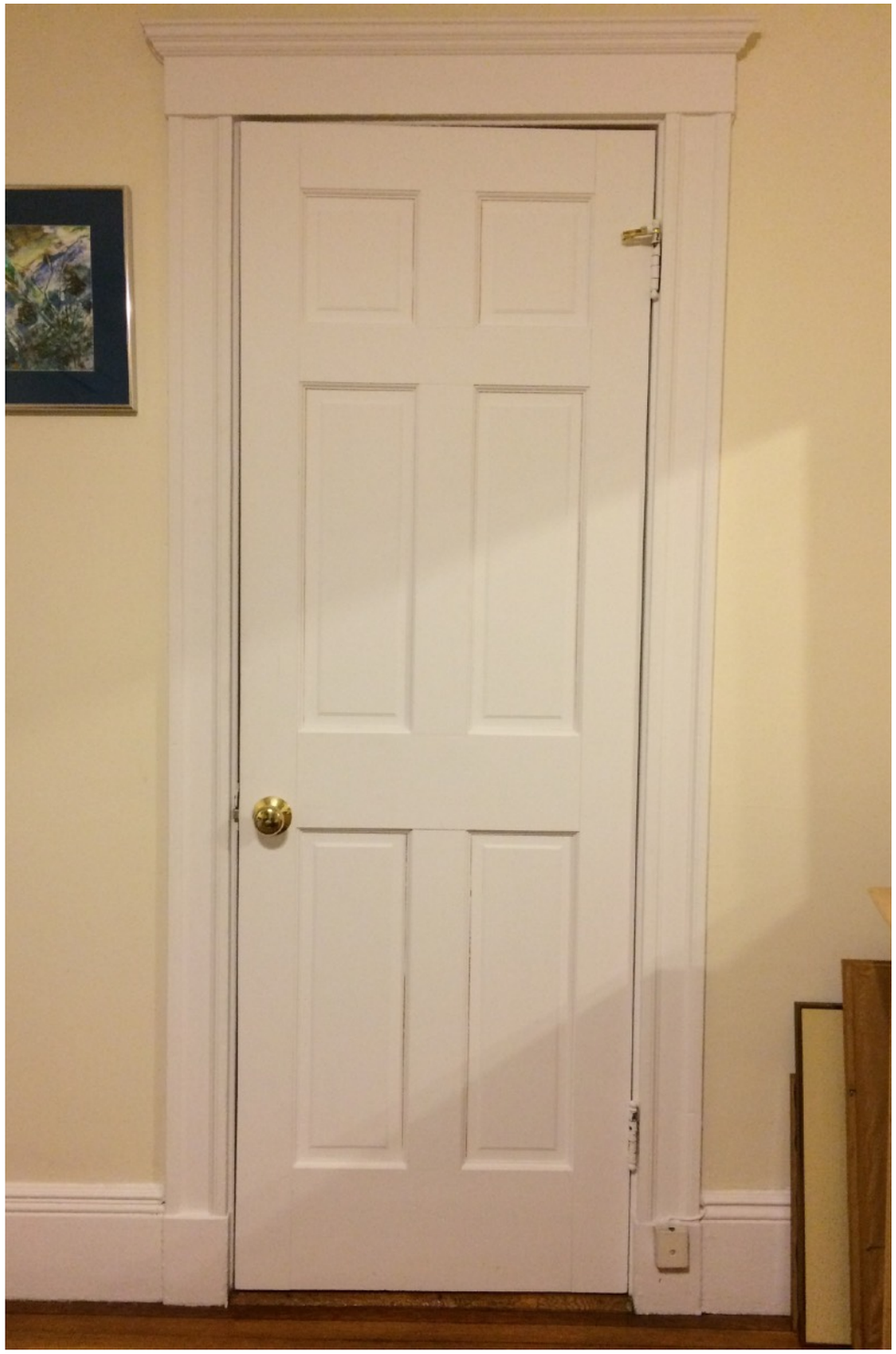
Strategies - Comprehension

- Predicting
- Estimating
- Hypothesizing
- Make a movie in your mind
- Storyboarding (beginning, middle, end)
- Story elements (character, setting, problem, solution)

What Are We Really Teaching?

Most *reading* skills and strategies are really *thinking* skills and strategies.

Making a Movie in Your Mind



Does the Room Look Different?

"Oh, I can't use small group work during math."

Defining Our Role(s)

What is your/the teacher's role during the literacy block?

What is your/the teacher's role during the math block?

Characteristics of Strong ~~Readers~~ Mathematicians

- They are motivated to ~~read~~. tackle problems
- They are able to ~~read words~~ accurately and automatically. recite facts
- They comprehend what they read.
- They are able to read with expression.
- They use a variety of strategies to tackle ~~words~~ problems they don't recognize.
- They use active problem solving strategies to search for information, to determine meaning, to make sense of words, to make connections.

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.

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 Main Job: Do Your Students Think Math Makes Sense?

Encouraging Sense Making

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

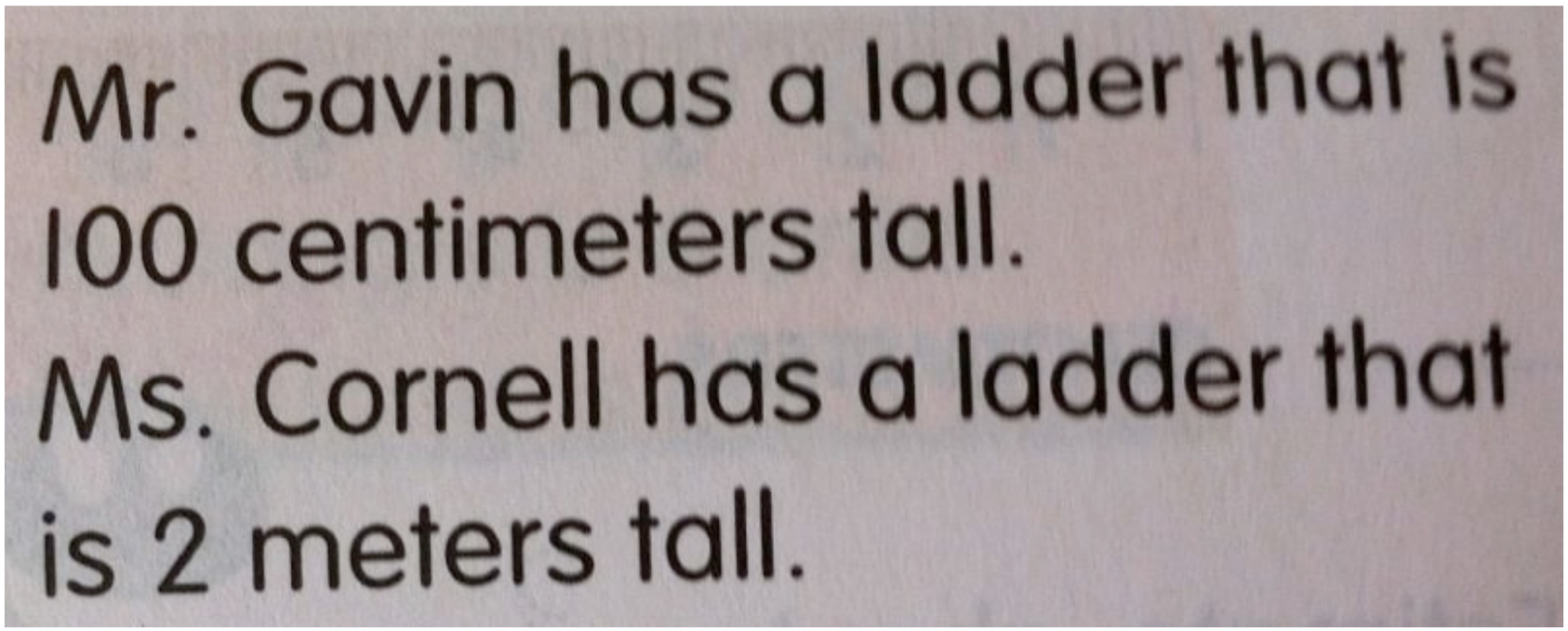
A: Get rid of the question. Literally.

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



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

Raul had some pet mice. Xavier gave him some more mice.

Raul had some pet mice. Xavier gave him 3 more mice.

Raul had some pet mice. Xavier gave him 3 more mice. Now Raul has 8 mice.

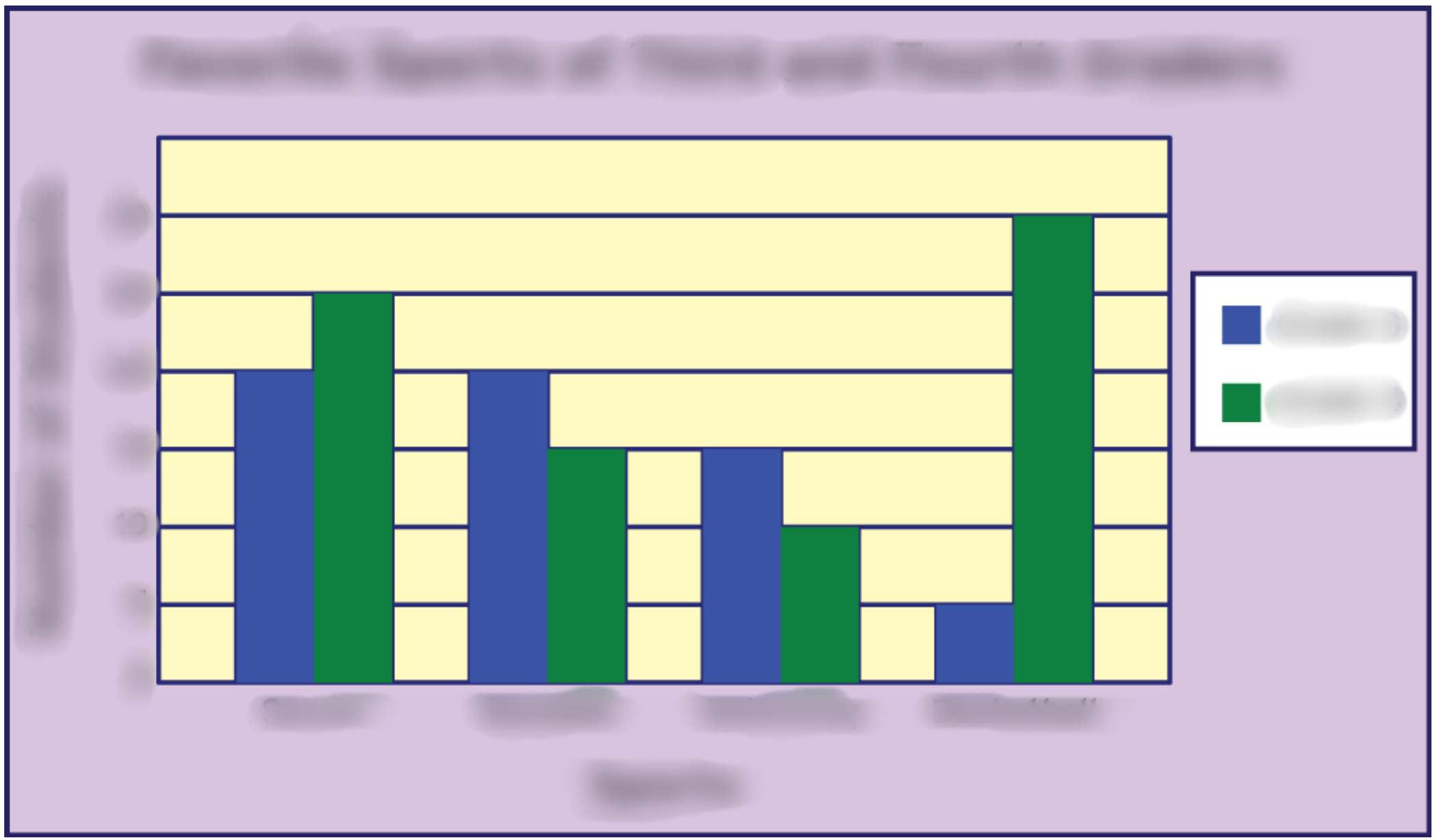
Raul had some pet mice. Xavier gave him 3 more mice. Now Raul has 8 mice. How many mice did Raul have to start with?

A Numberless Word Problem from Brian Bushart, bstockus.wordpress.com

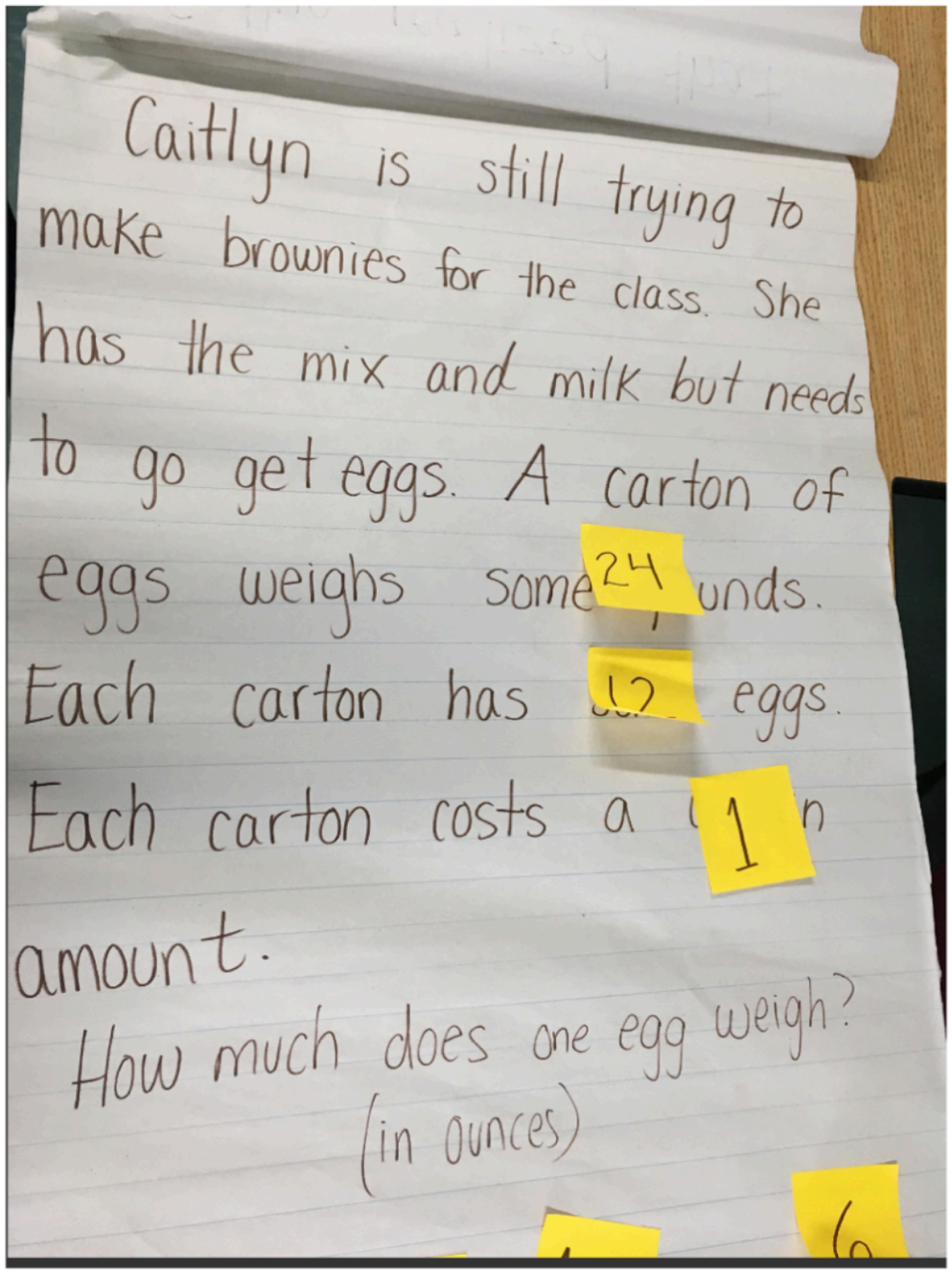
Get Rid of the Question and the Numbers

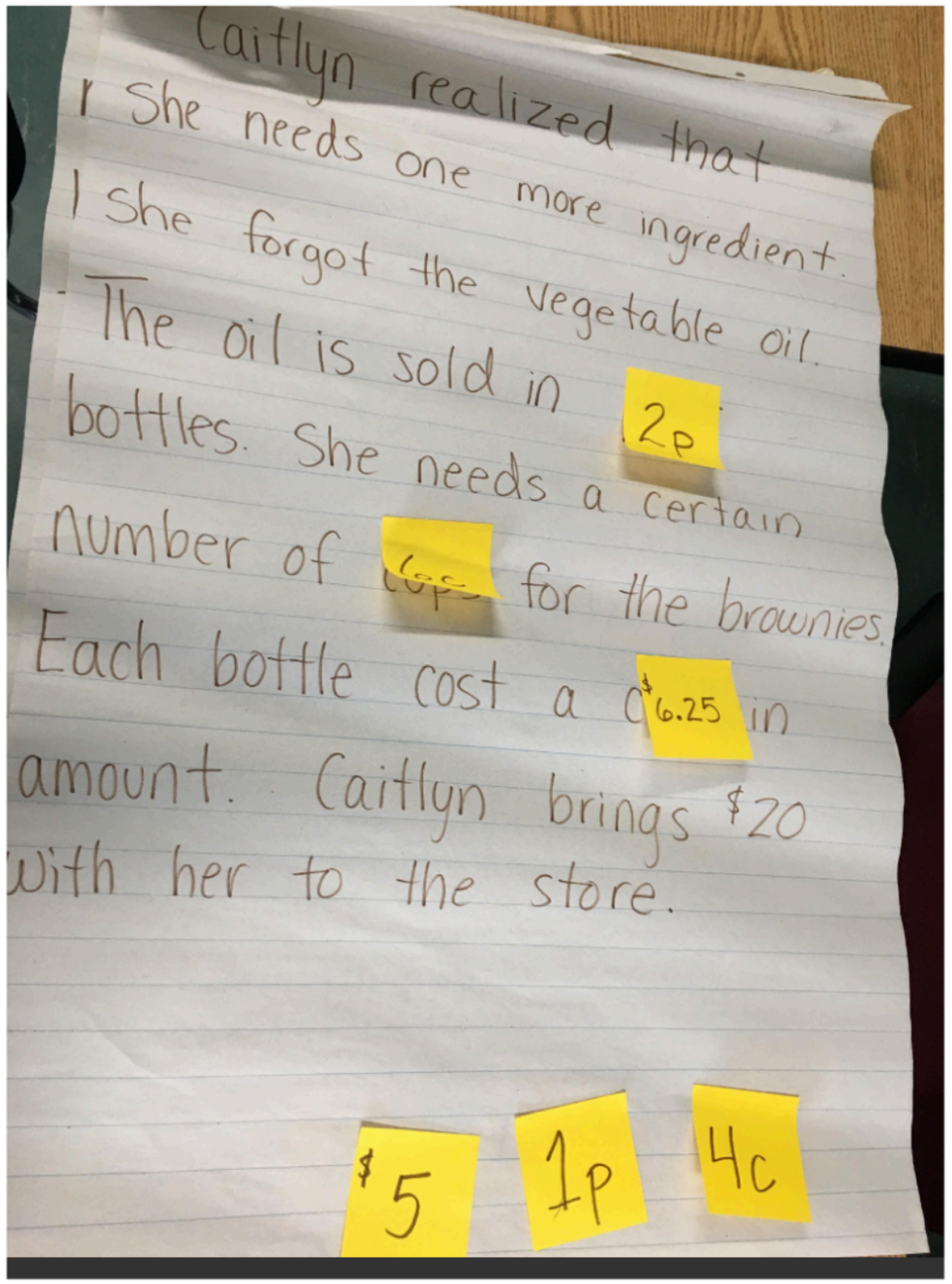
A store has the floor plan shown. The area of the women's department is [illegible]

Get Rid of the Question and the Numbers



Get Rid of the Numbers





From Kat Kulis, grade 5, Windham Center School, Windham, CT

Numbers vs. Relationships

$$A = L \times W$$

$$A = \pi r^2$$

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

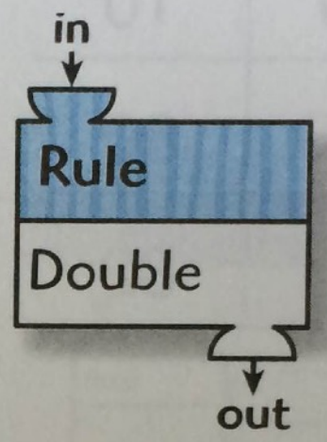
Draw or display a function machine and "What's My Rule?" table. (See Advance Preparation.)

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.

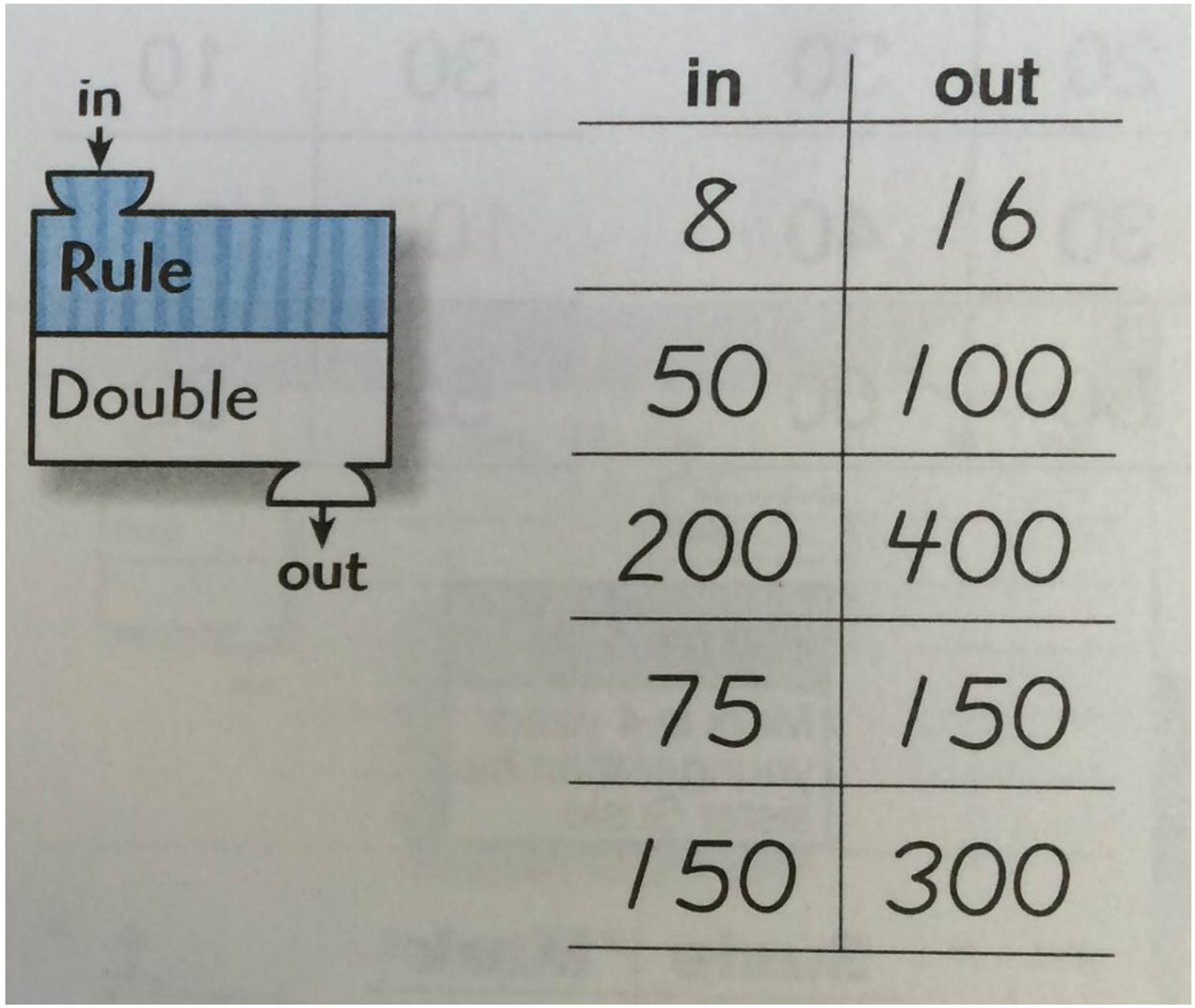
The **rule** for the Math Message problem is "Double the number." Write the word *Double* in the function machine.

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.



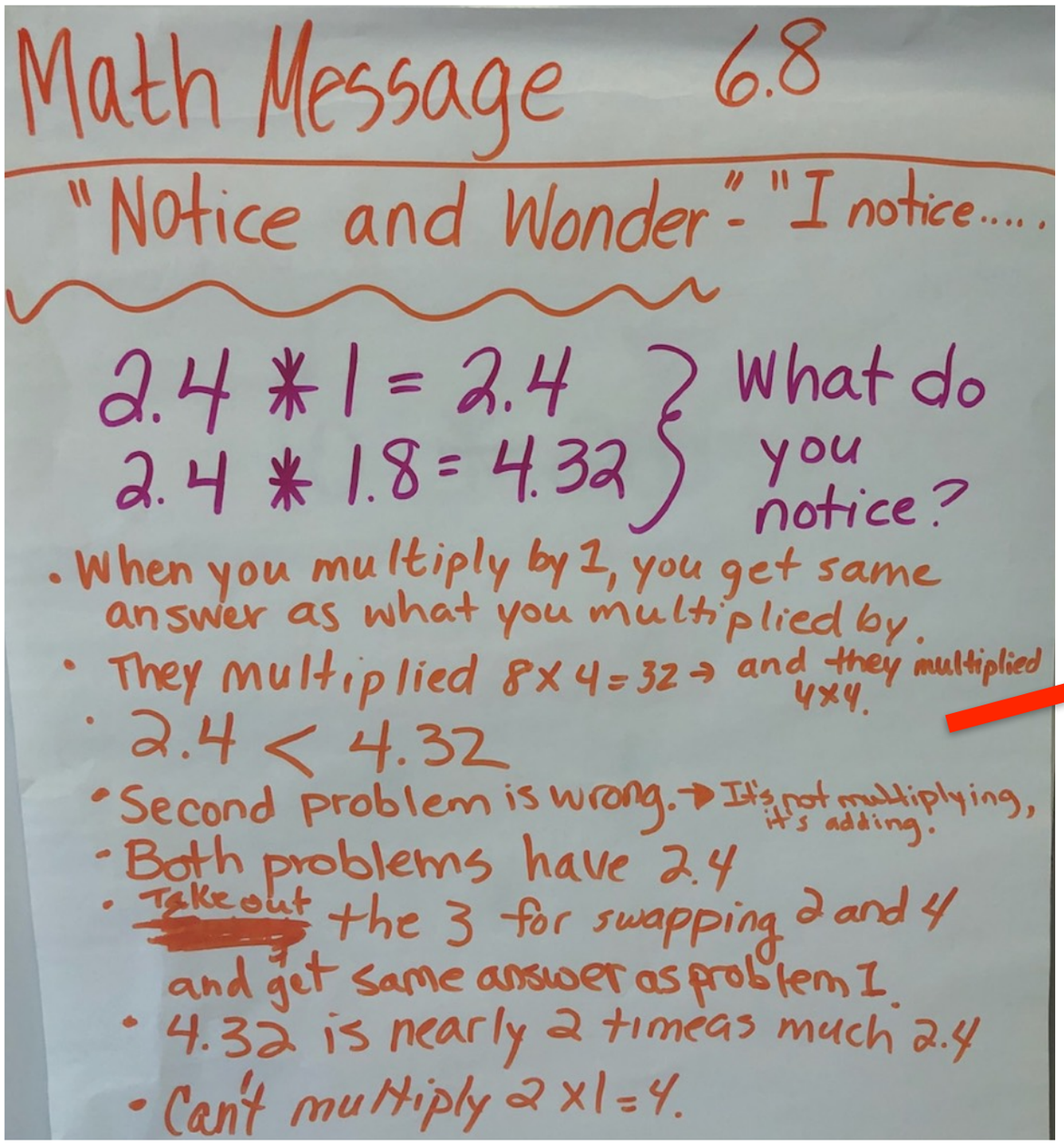
in	out
8	16
50	100
200	400
75	150
150	300

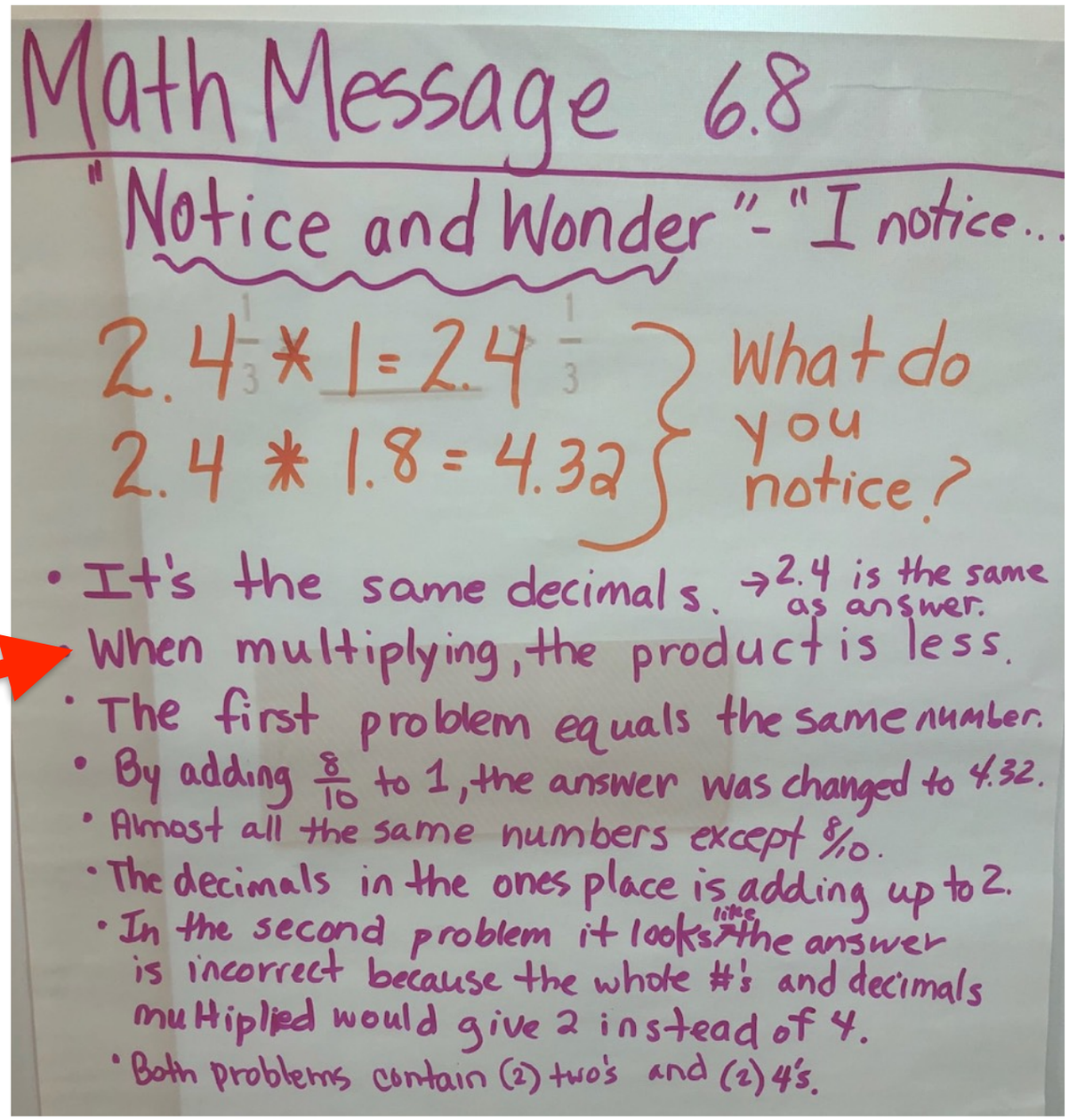
Give the Answer



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

You know 2.4 * 1 = 2.4. Will 2.4 * 1.8 be greater than or less than 2.4? How do you know?





Sally Nordyke, Grade 5, Daniel F. Ryan School 19, Passaic, NJ

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.

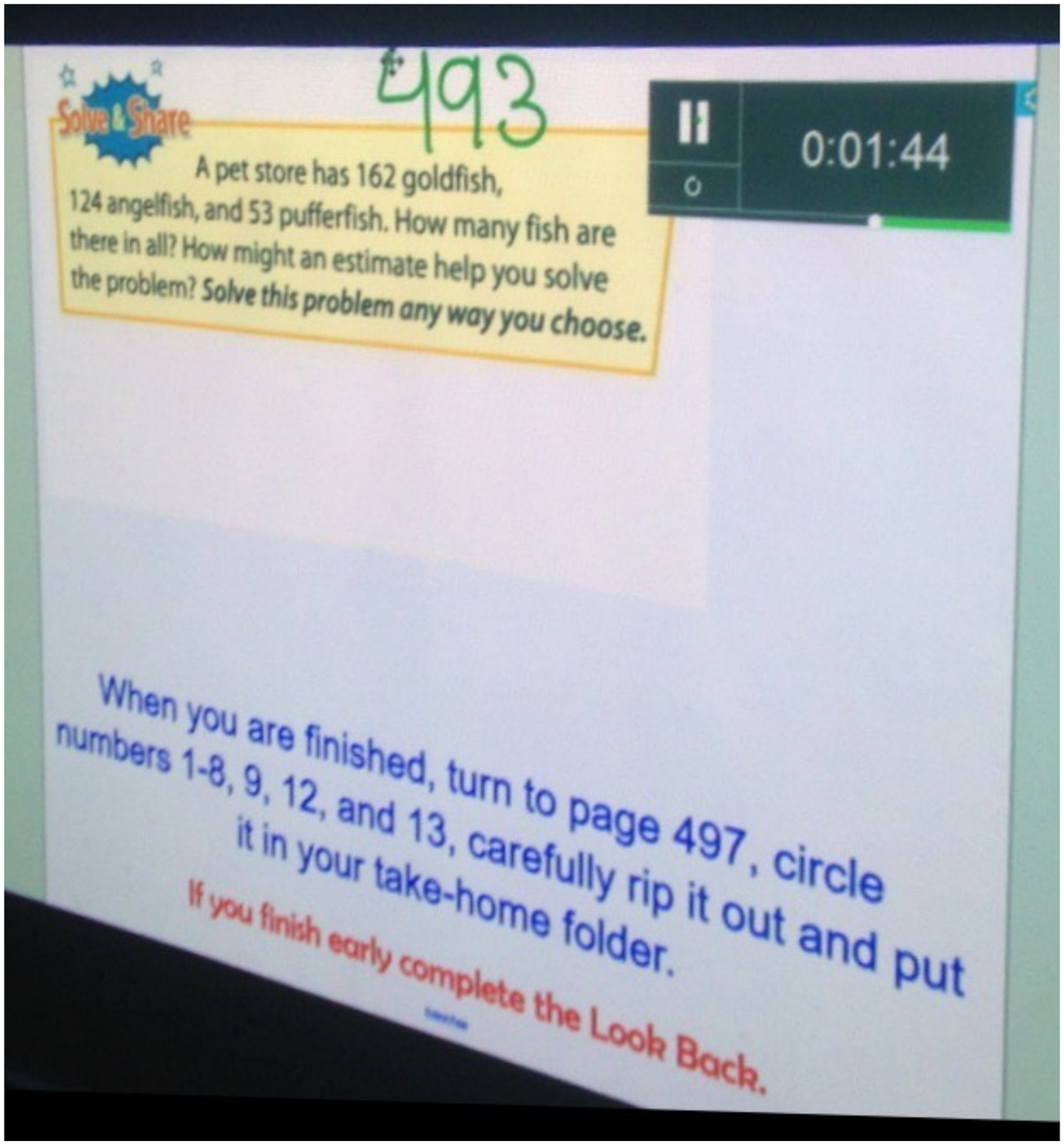
If the answer is 23 minutes, what is the question?

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

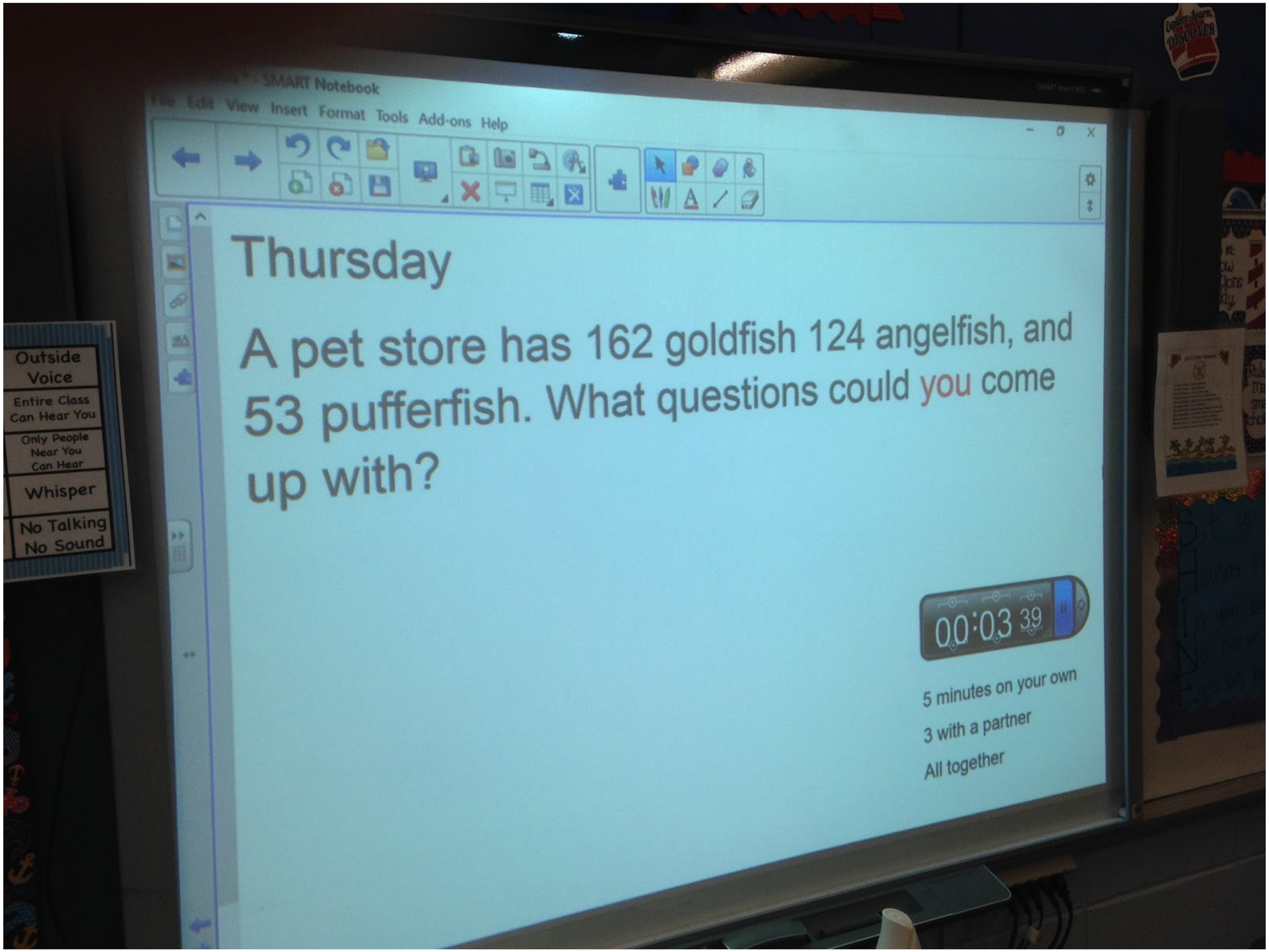
If the answer is bake, what is the question?

from Joe Schwartz, @JSchwartz10a

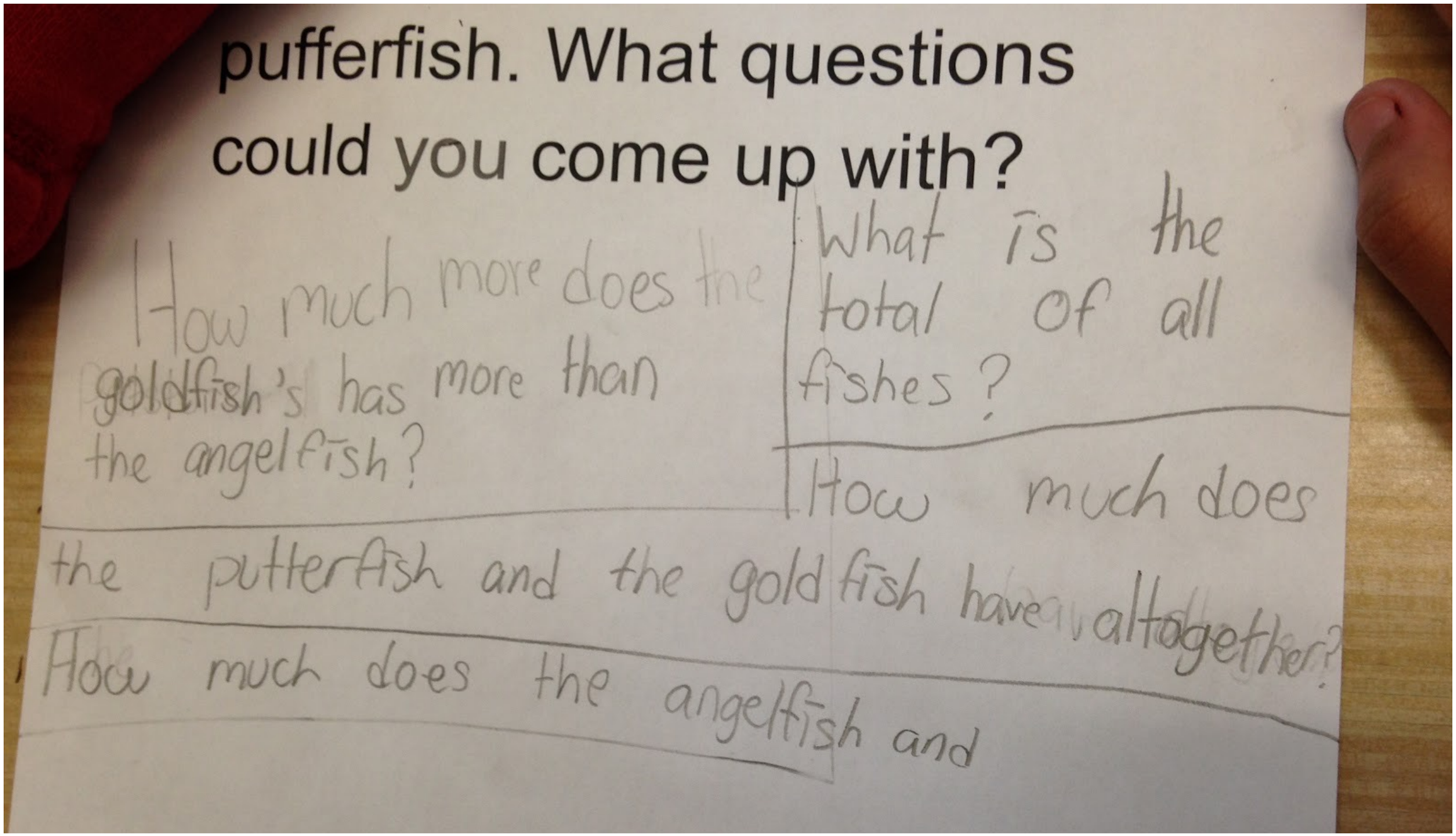
Ask for Questions



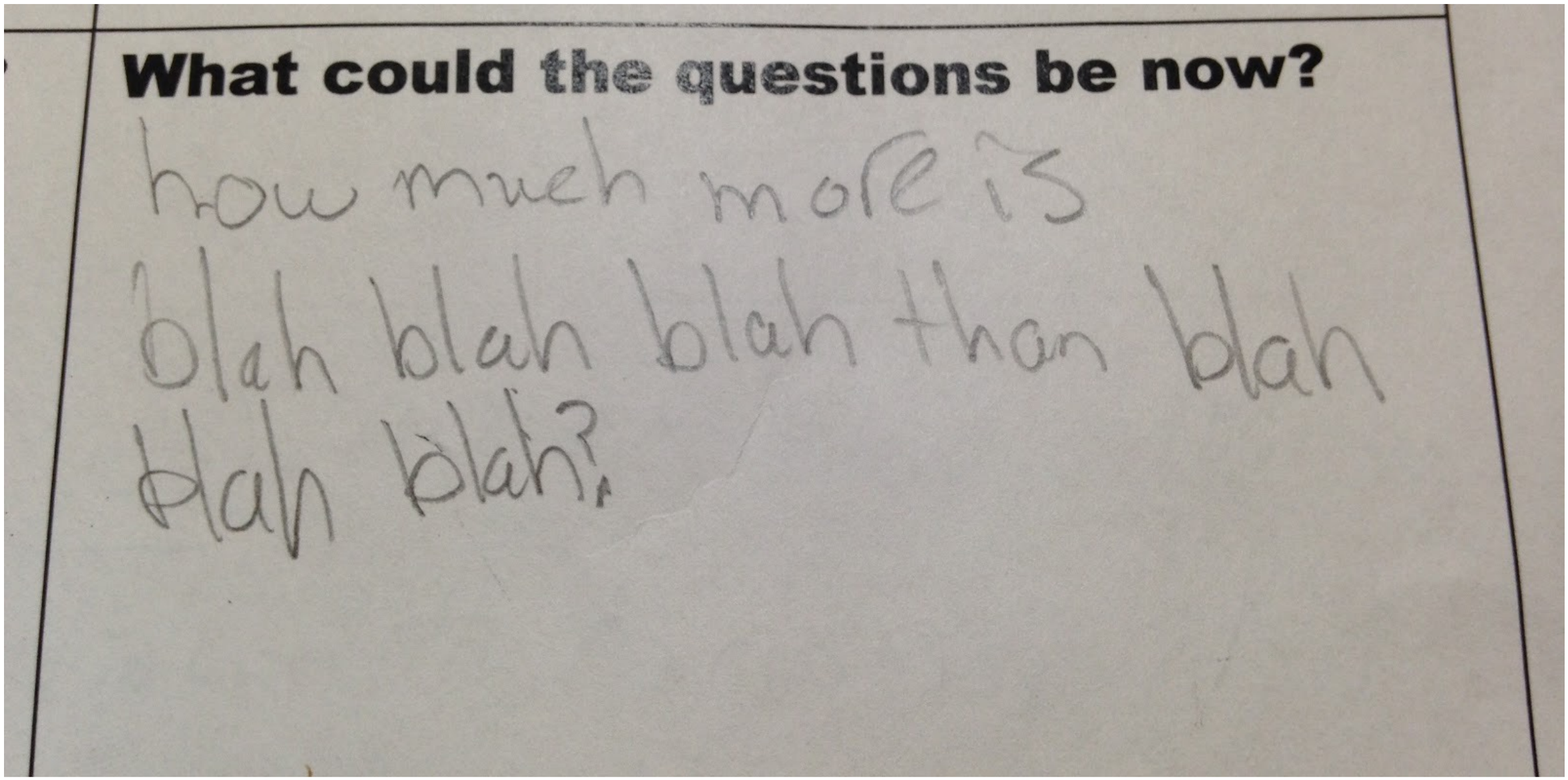
Ask for Questions



Ask for Questions



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:

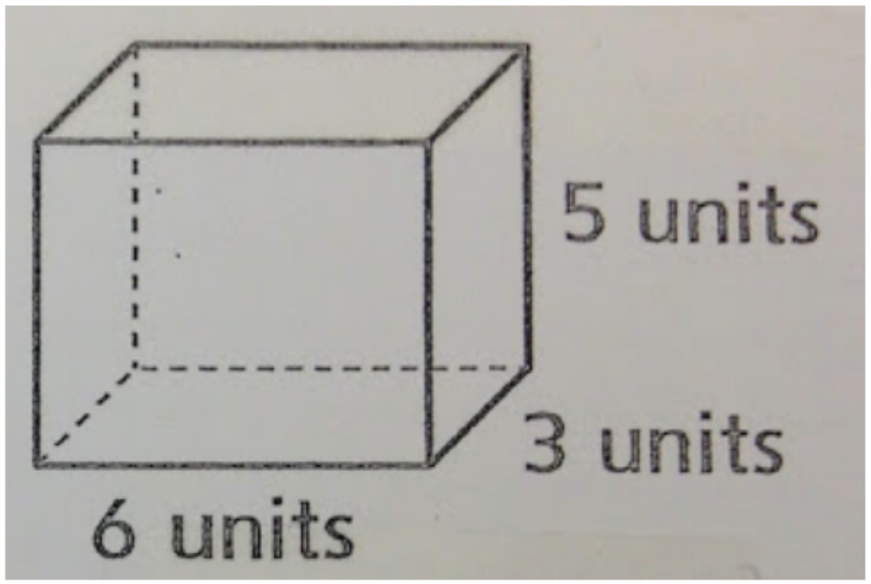
"Tell me something about number 7."

instead of

"What's the answer to number 7?"

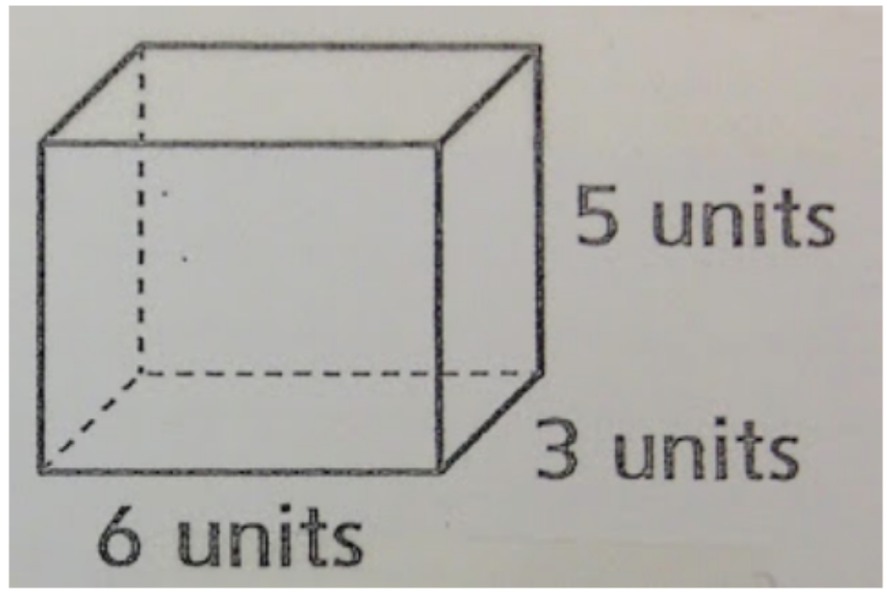
Ask About Ideas, Not Answers

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

1. Suppose 5 U.S. dollars (5 USD) can be exchanged for 64 Mexican pesos. What operation would be used to find the value of 1 USD in pesos?

division

Find the value of 1 USD in pesos.1 USD = 12.8 pesos

Tell everything you can about this statement: 5 U.S. dollars (5 USD) can be exchanged for 64 Mexican pesos.

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.

Reflection Questions

Write down and/or tell your neighbor

- two sense-making strategies you're going to try in your class, or shifts you want to make in your role during math block
- two things you're wondering

Thank you!

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