The Power of Ideas: Letting Students' Thinking Take Center Stage

Annie Fetter

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2020 NCSM Annual Conference ONLINE
#NCSM2020

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

annie.mathematicalthinking.org

Welcome!

- If you didn't already, introduce yourself in the chat - where are you? what's your role?
- Please reply to the POLL on the right side - what grade(s) students do you work with (as a teacher, or coach)? You CAN choose more than one.

Suggestions & Tips

- Be sure you're viewing the chat panel.
- Put questions in the chat, not the Q&A.
- Send chat messages to "All Participants".
- Under the megaphone icon, the "applause" icon is hereby renamed "hand washing" for this session. Feel free to use it frequently.

OMG! Quick! Take a screenshot!

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(They are NOT there right now, so you aren't missing anything if you looked.)

(Just kidding. We'll remind you later.)

Agenda-ish

- “Do” a few idea-focused routines.
- Talk a bit about kids and math and sense-making.
- Explore strategies for shifting from answer-getting to idea-honoring.

Agenda-ish

- "Do" a few idea-focused routines.
- Talk a bit about kids and math and sense-making.
- Rush through well-illustrated strategies for shifting from answer-getting to idea-honoring. that you can review on the slides later.

Let's Count!

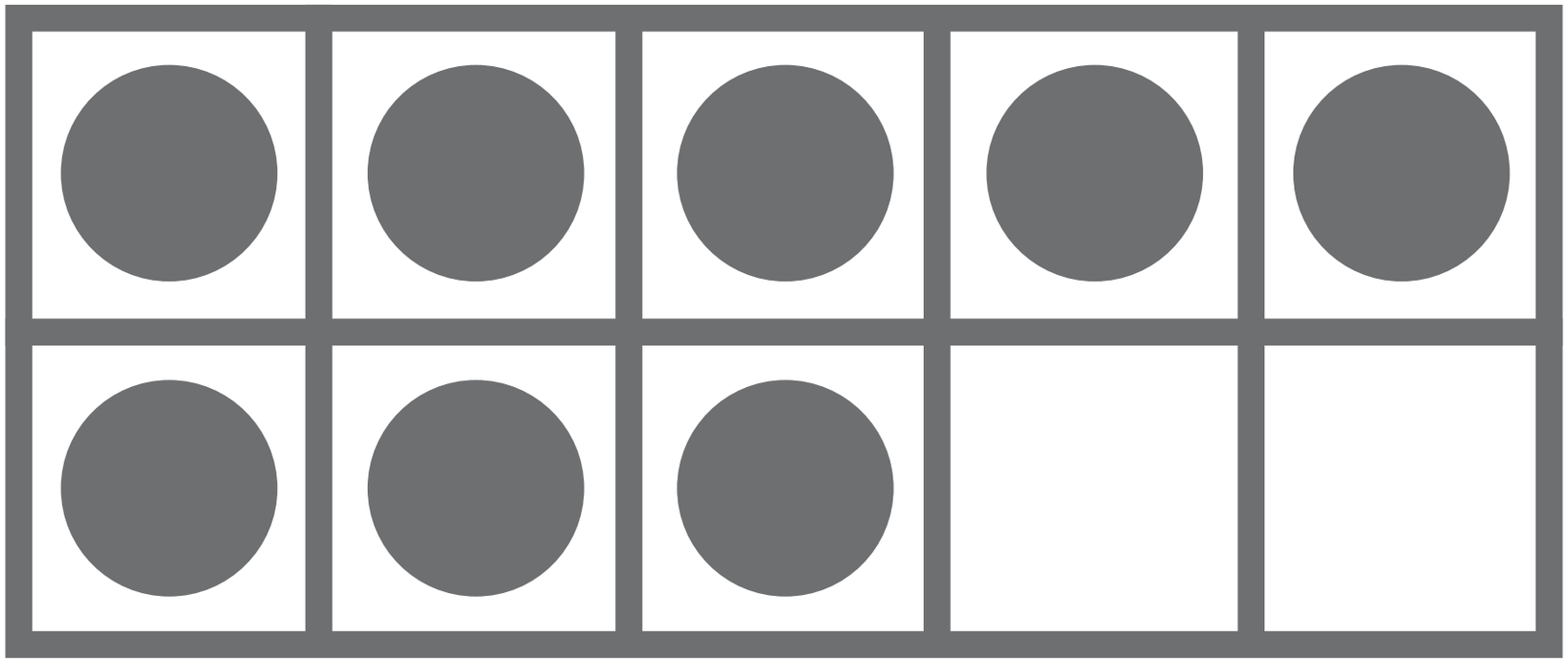
I'll show an image, then hide it.

You'll type your answer to "How many? How did you count?" in the chat.

Be as descriptive as possible!

Let's Count!

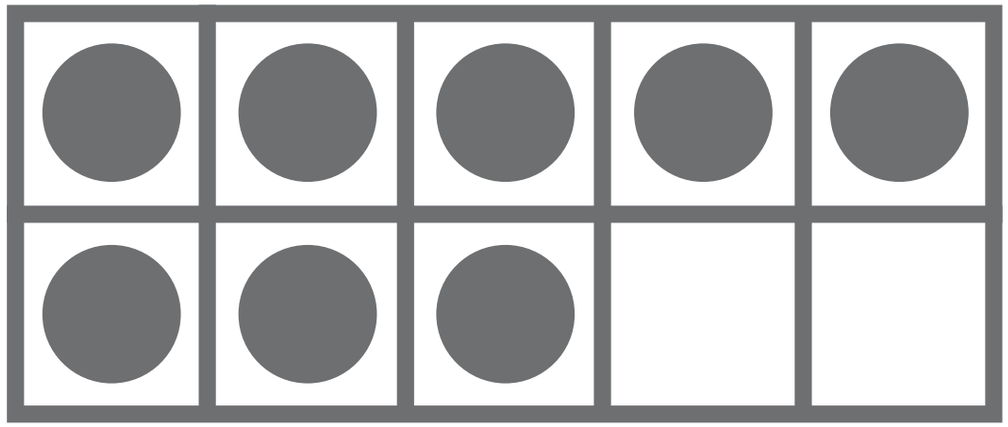
Watch this space….

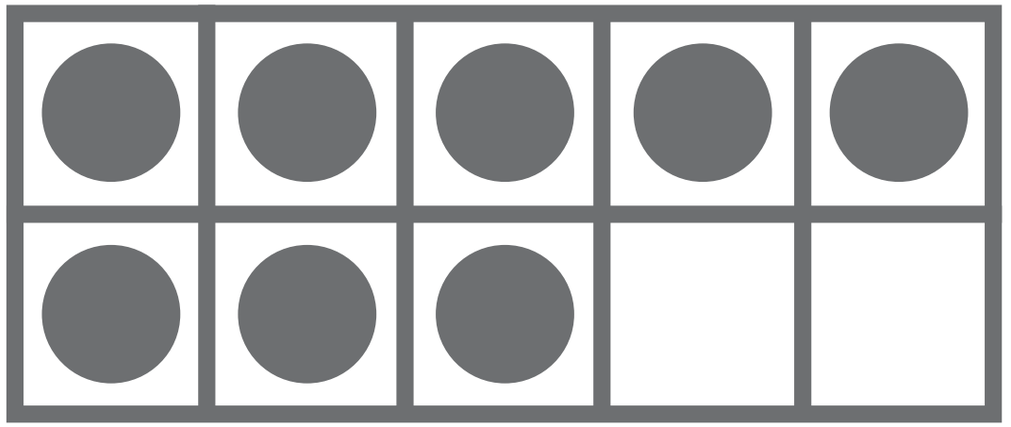


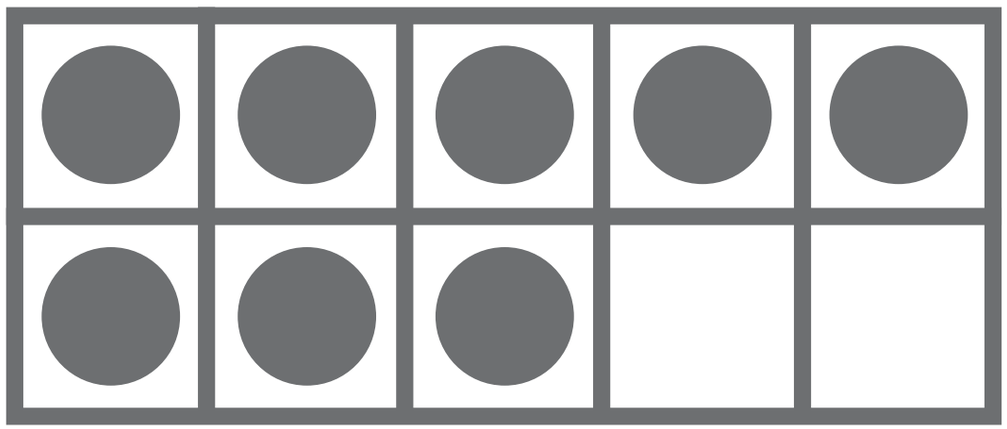
Let's Count!

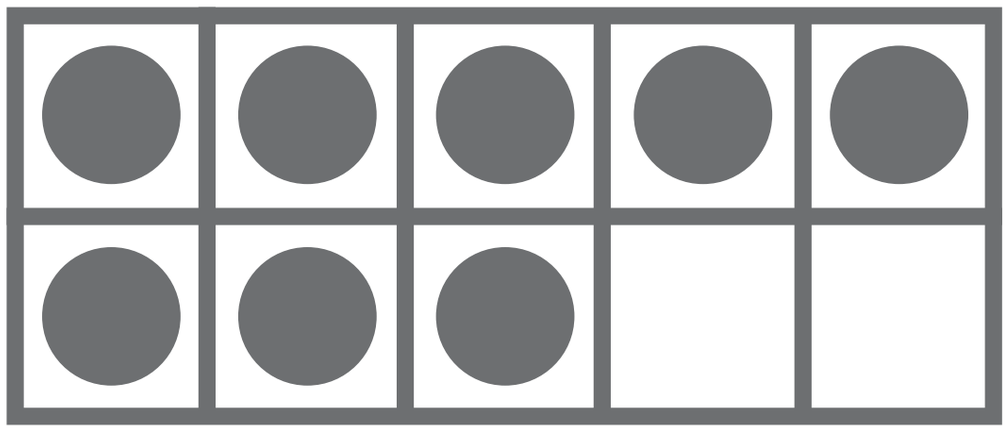
How many? How did you count?

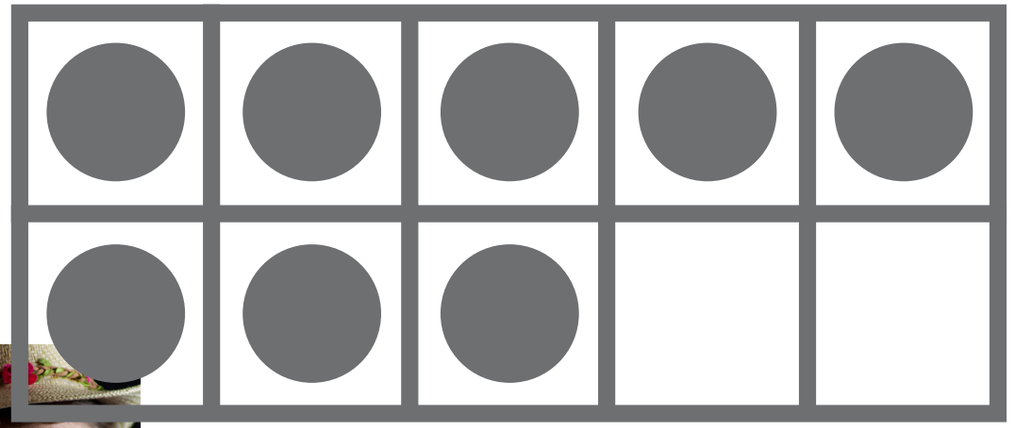
Type your answer in the chat box
and be as descriptive as possible.

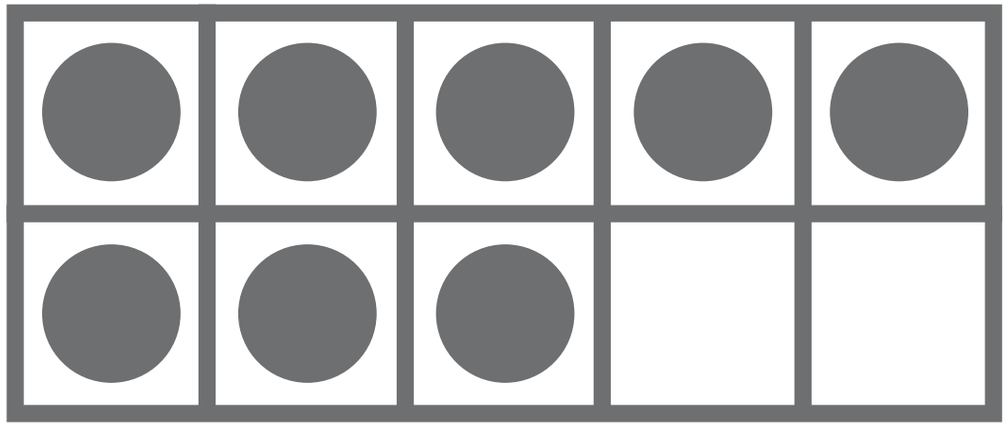












Let's Count!

Let's do another. Ready?

Let's Count!

How many? How did you count?

Type your answer in the chat box *(remember to be descriptive!)*.

We won’t do this today, but normally the next thing would be another round with new directions:

- Put your thumb up when you have an answer and are ready to describe how you figured it out.
- Add another finger for every other way you see that it could be figured out.

(Another dot figure.)

Who had to ask their partner to describe “their way” a second time?

Who had to ask their partner to describe “their way” a second time?

“Once I see it my way, it’s SOO hard to see it someone else’s way!”

—*past workshop participant*

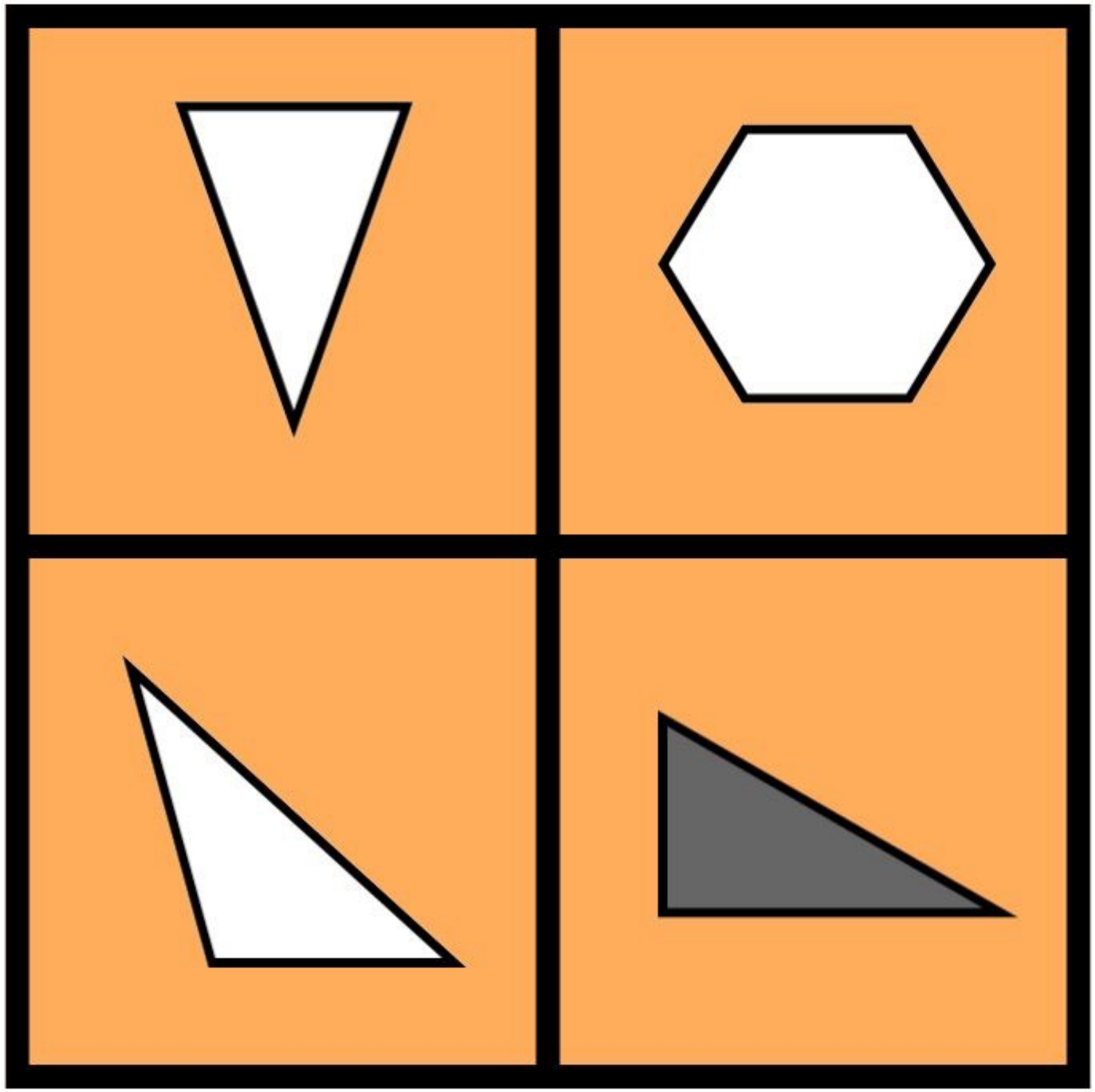
Dot Talks

26 + 49

26 + 49

Number Talks

9	16
25	43



Which One Doesn't Belong?

Check out http://wodb.ca

Routines That Focus on Ideas

- Dot Talks
- Number Talks
- Which One Doesn't Belong?

I used to think my job was to teach students to see what I see. I no longer believe this. My job is to teach students to see; and to recognize that no matter what the problem is, we don't all see things the same way. But when we examine our different ways of seeing, and look for the relationships involved, everyone sees more clearly; everyone understands more deeply.

—Ruth Parker

Do your students all think they have valid mathematical ideas about pretty much every problem or story?

Grade 3 State Test Problem

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

A. 6
B. 9
C. 18
D. 24

Grade 3 State Test Problem

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.

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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.**

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.

As young teachers, we believed our job was to carefully explain what we knew about mathematics to our students. We asked questions and listened to our students' answers but our listening was aimed at assessing whether our students got what we had explained rather than uncovering their understanding of the content.

We now see that we missed valuable opportunities to develop students' understanding because we did not elicit their ideas or relate their ideas to the content we were teaching.

—Susan B. Empson and Linda Levi

Extending Children's Mathematics: Fractions and Decimals

(In case you missed it earlier.)

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(Or just follow me on Twitter. My handle is on every page)

What Do We Do?

Honoring Students' Ideas

Q: What's one way to cultivate a classroom focused on *ideas* rather than *answers*?

A: Get rid of the question. Literally.

Get Rid of the Question

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

Get Rid of the Question

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

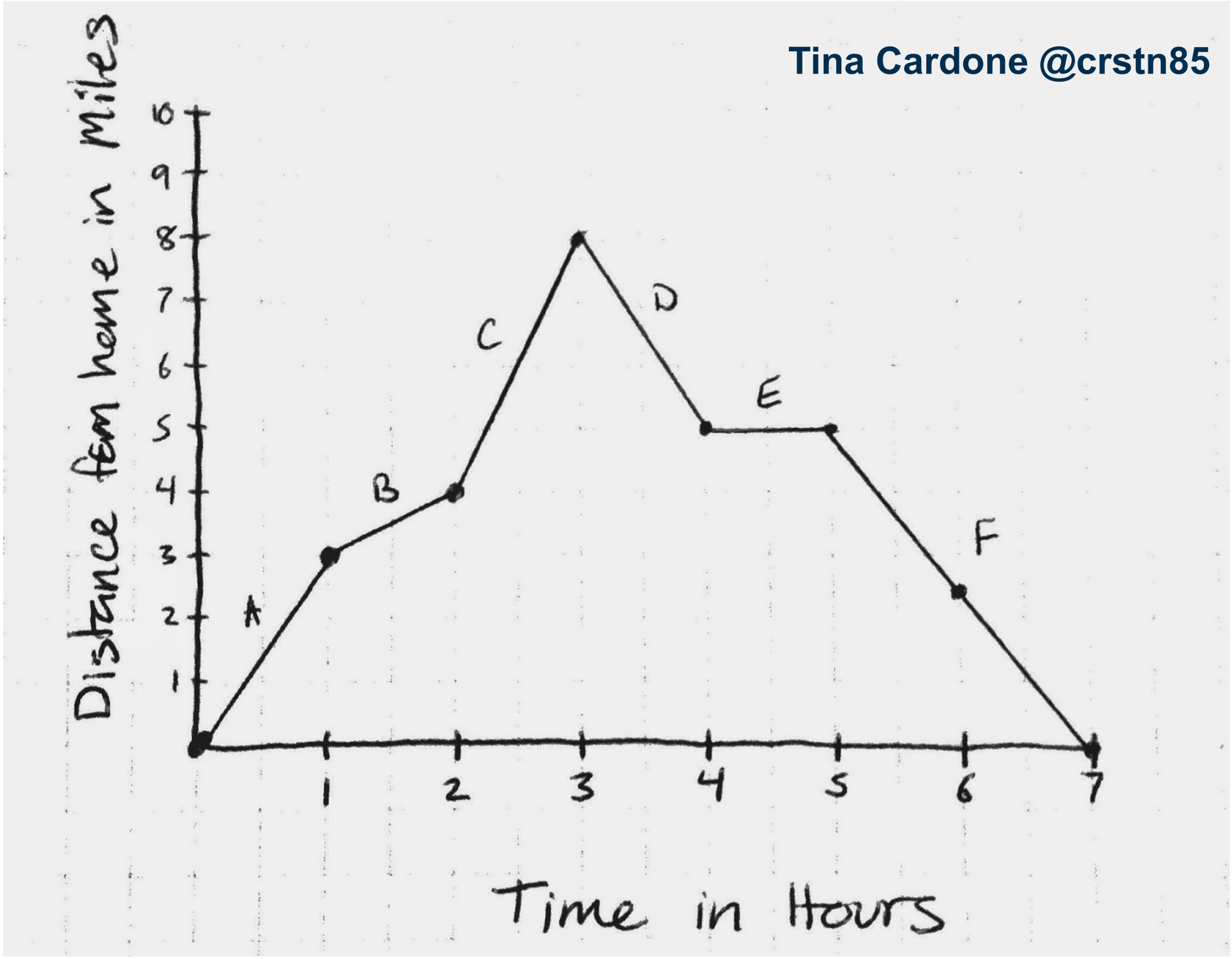
I Notice	I Wonder

Get Rid of the Question

You have 7 cups of dog food. You use two-thirds of a cup of food at each meal.

Get Rid of the Question

Tina Cardone @crstn85



Get Rid of the Question

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…

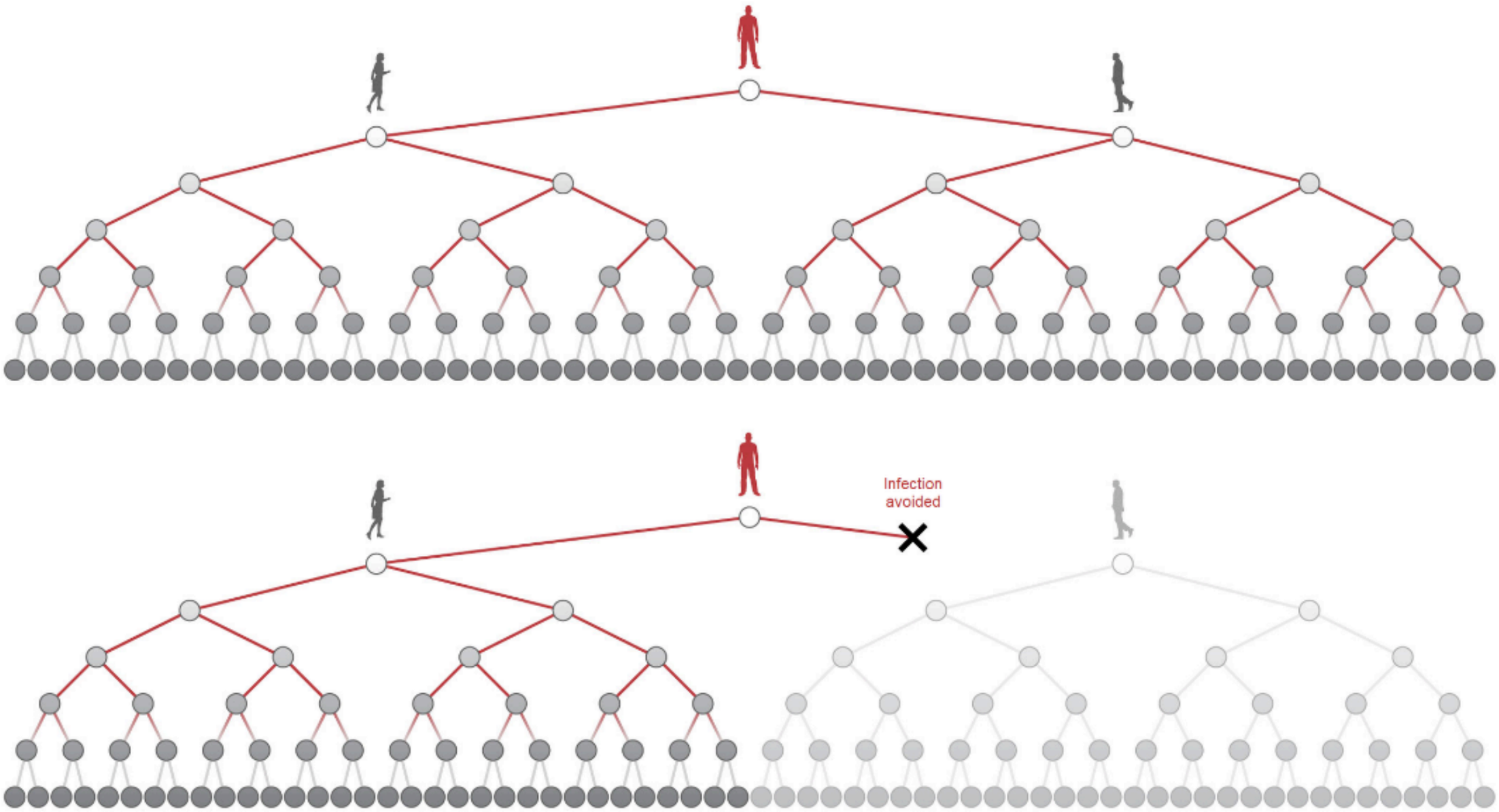
2

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

What's Going On in This Graph? | April 1, 2020

How can social distancing affect the chain of coronavirus transmission?

Coronavirus Chain of Transmission
Without and with limiting social contacts



What's Going On With This Graph?

By The Learning Network <— this part of the NYTimes is free, no $$ necessary

March 26, 2020

168

This graph appeared elsewhere in The New York Times.

By Friday morning, April 3, we will provide the "Reveal" — the graph's free online link, additional background and questions, shout outs highlighting student comments and headlines, and Stat Nuggets.

After looking closely at the graph above (or at this full-size image), think about these three questions:

- What do you notice? *If you make a claim, tell us what you noticed that supports your claim.*
- What do you wonder? *What are you curious about that comes from what you notice in the graphs?*
- What's going on in this graph? Write a catchy headline that captures the graph's main idea.

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Do your students all think they have valid mathematical ideas about pretty much every problem or story?

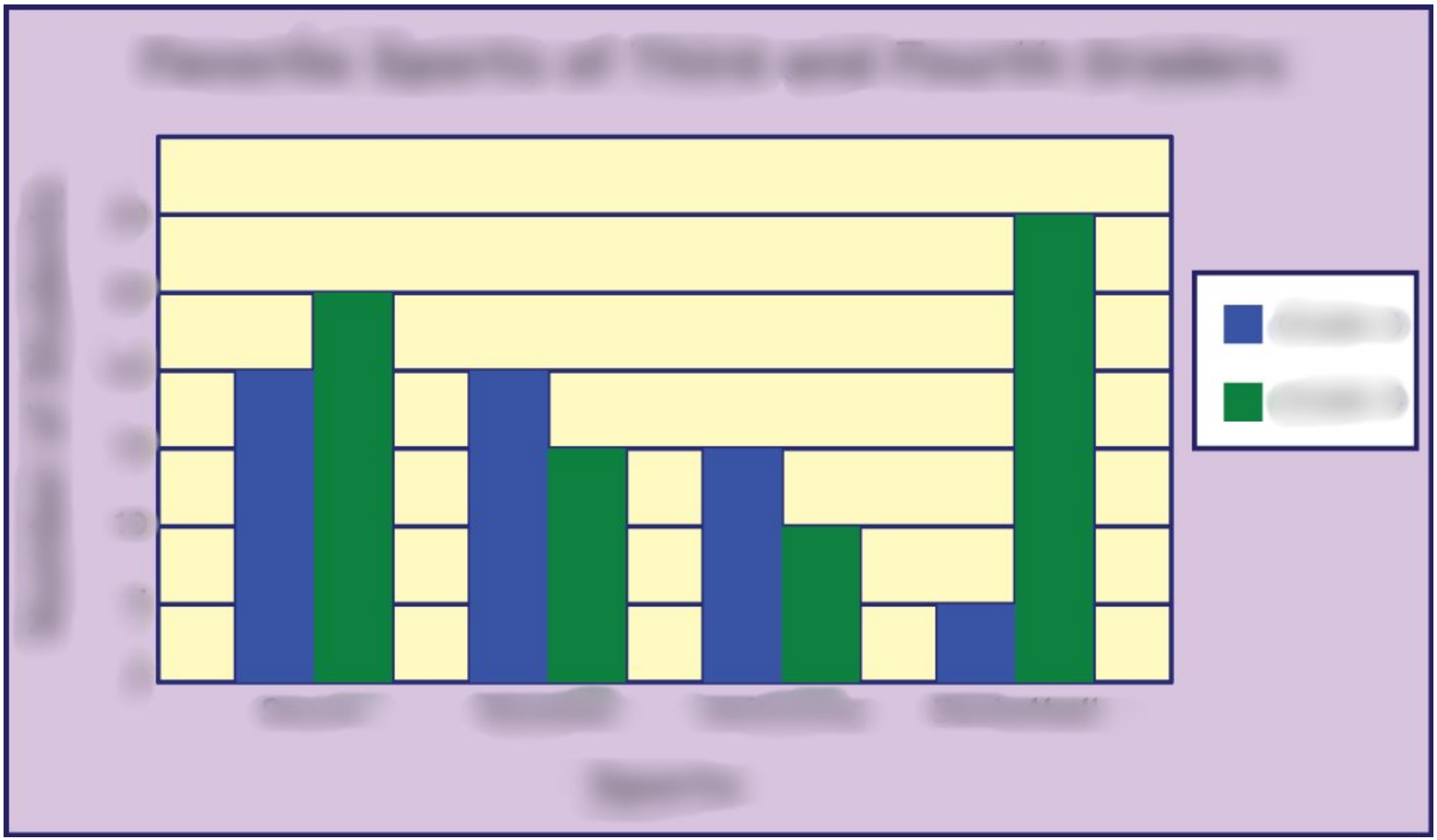
And do they think that you care about those ideas?

Honoring Students' Ideas

Q: What's another way to cultivate a classroom focused on *ideas* rather than *answers*?

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

Get Rid of the Question and the Numbers



Get Rid of the Numbers...

A city worker is painting a stripe down the center of Main Street. Main Street is [ ] mile long. The worker painted [ ] mile of the street. Explain how to find what part of a mile is left to paint.

...or Use Nicer Ones

A city worker is painting a stripe down the center of Main Street. Main Street is 10 mile long. The worker painted 3 mile of the street. Explain how to find what part of a mile is left to paint.

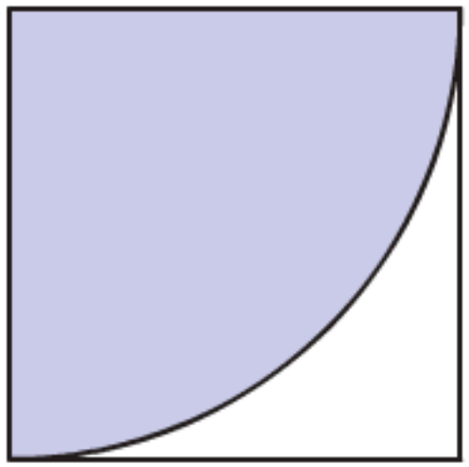
Get Rid of the Numbers, or Use Nicer Ones

A city worker is painting a stripe down the center of Main Street. Main Street is $\frac{8}{10}$ mile long. The worker painted $\frac{4}{10}$ mile of the street. Explain how to find what part of a mile is left to paint.

Get Rid of the Numbers

What is the probability a tiny drop of ink will land on the blue regions of the following square boards?

1.



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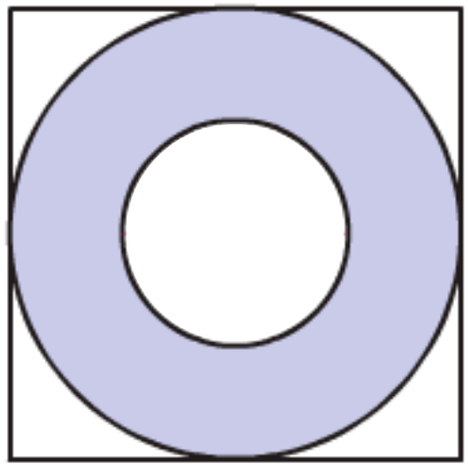

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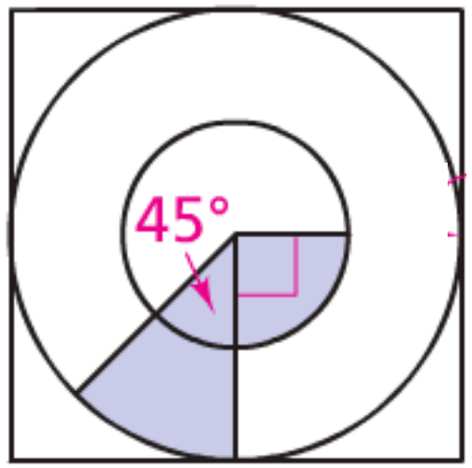
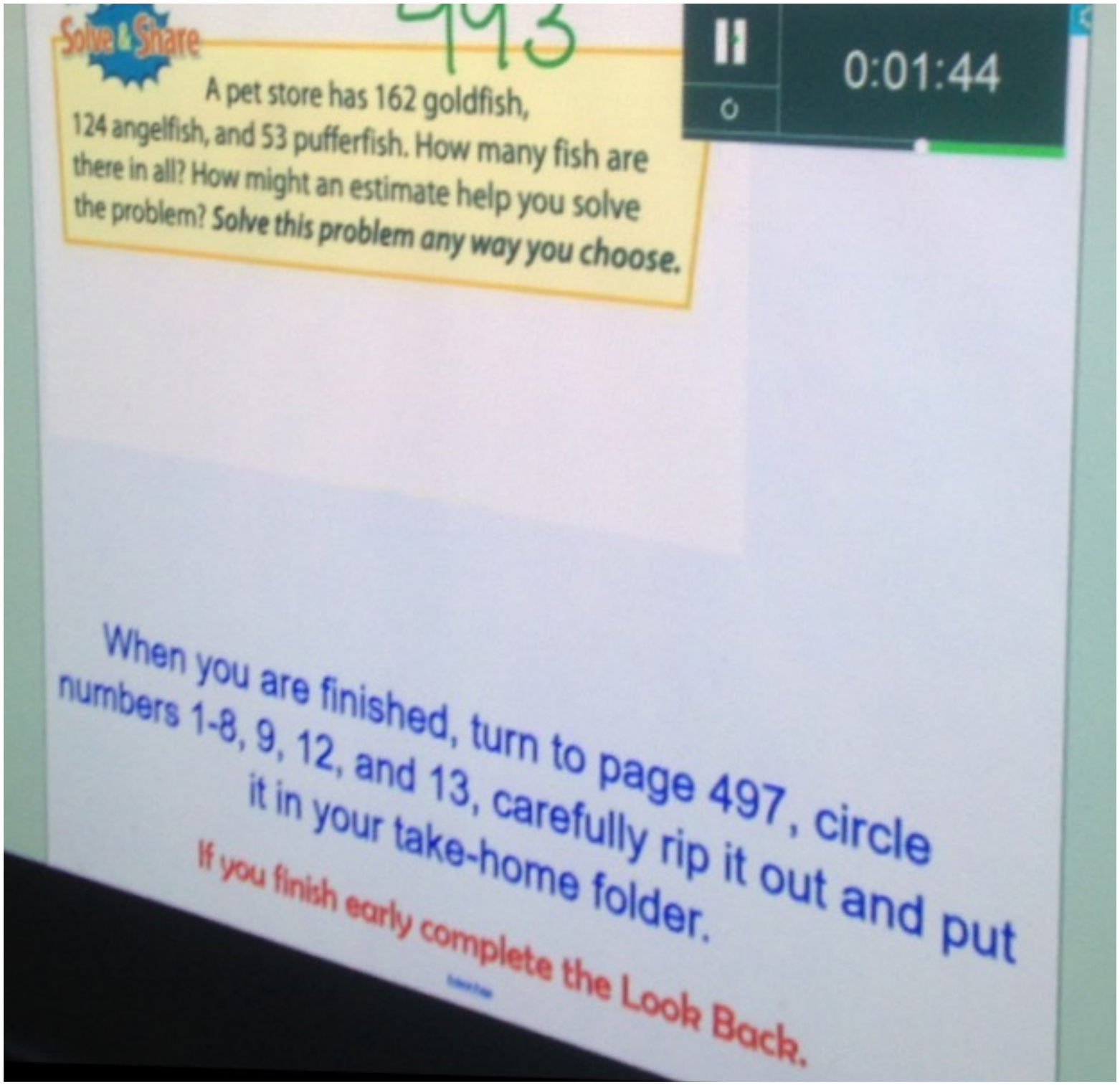


Honoring Students' Ideas

Q: What's another way to cultivate a classroom focused on *ideas* rather than *answers*?

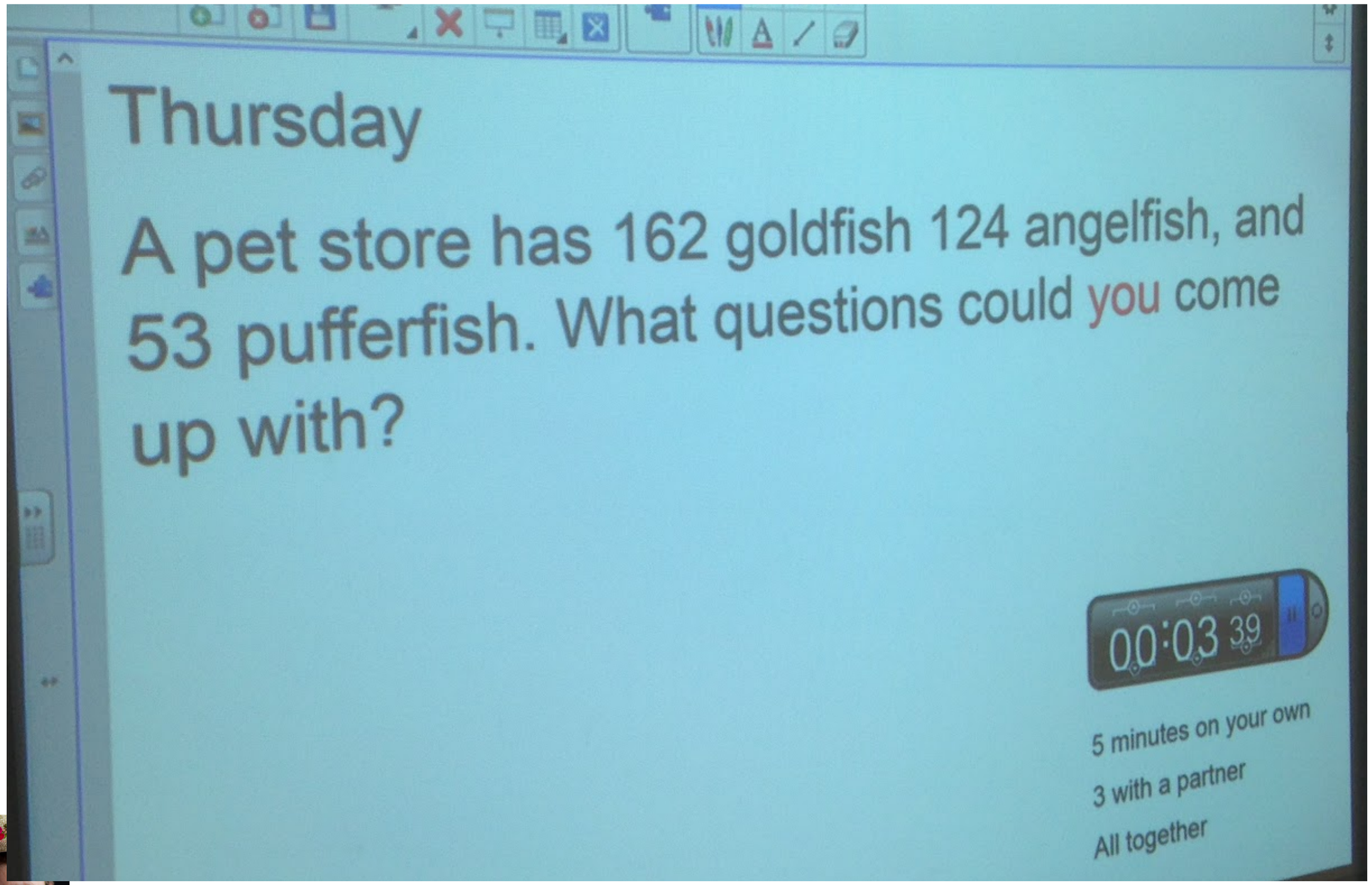
A: Ask for questions instead of answers.

Ask for Questions, Not Answers



via Joe Schwartz
@JSchwartz10a

Ask for Questions, Not Answers



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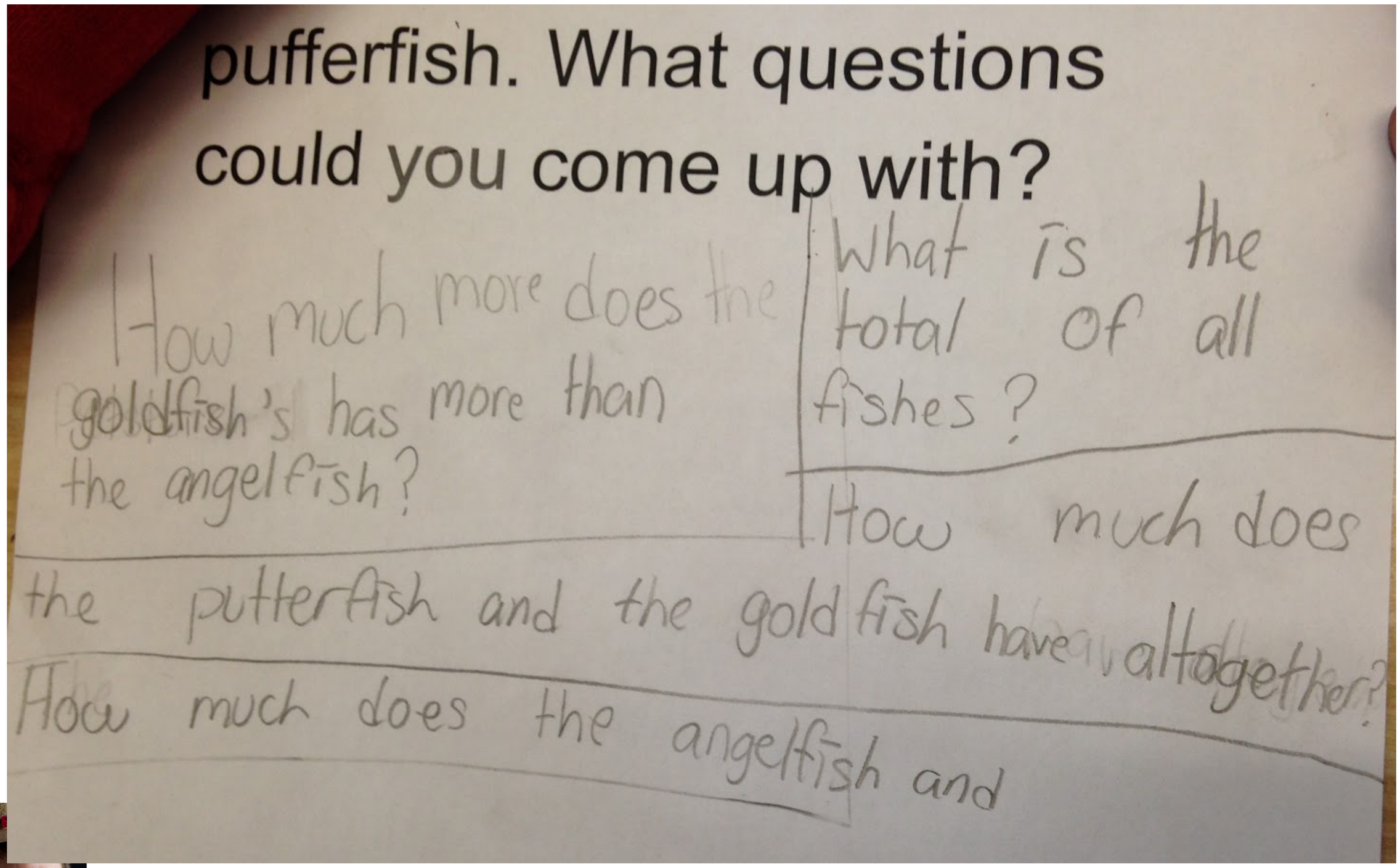

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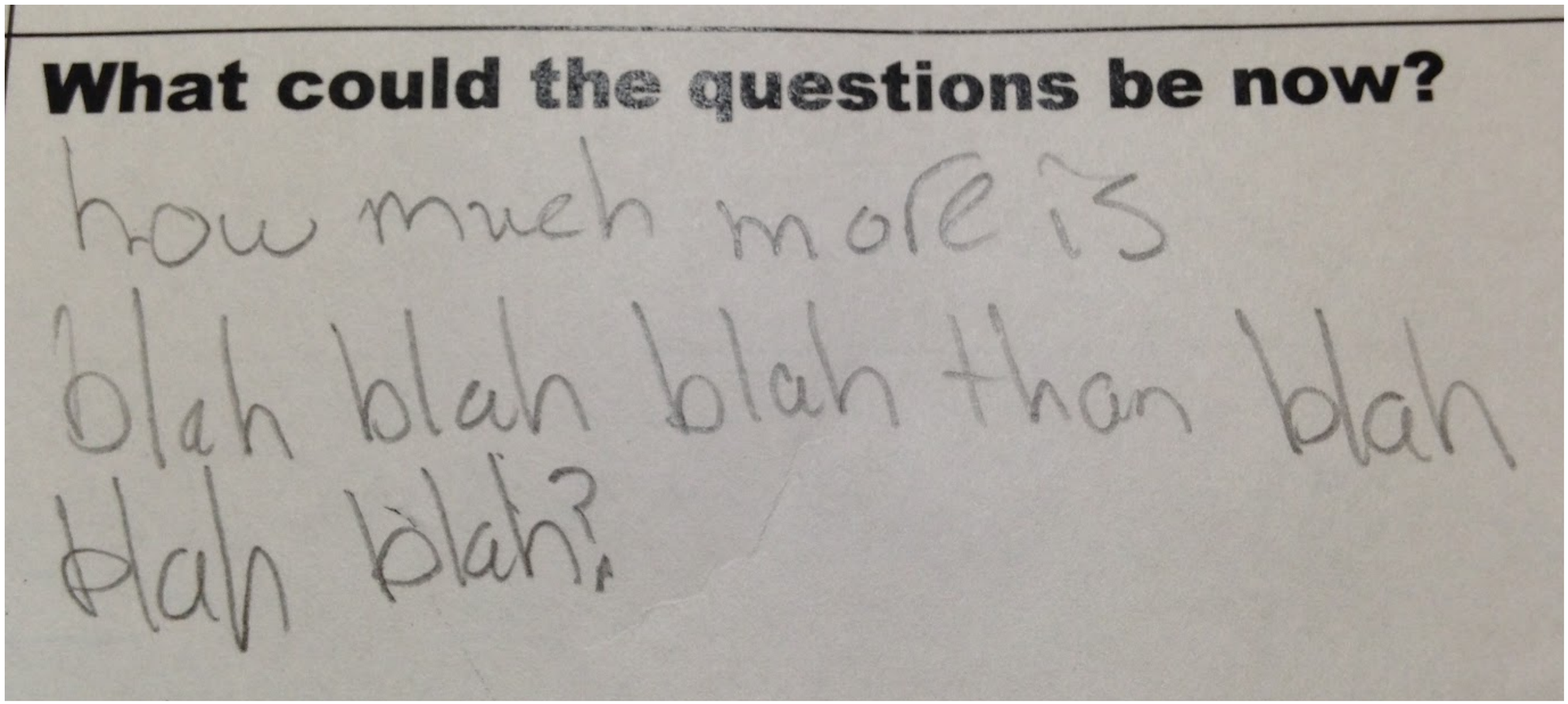
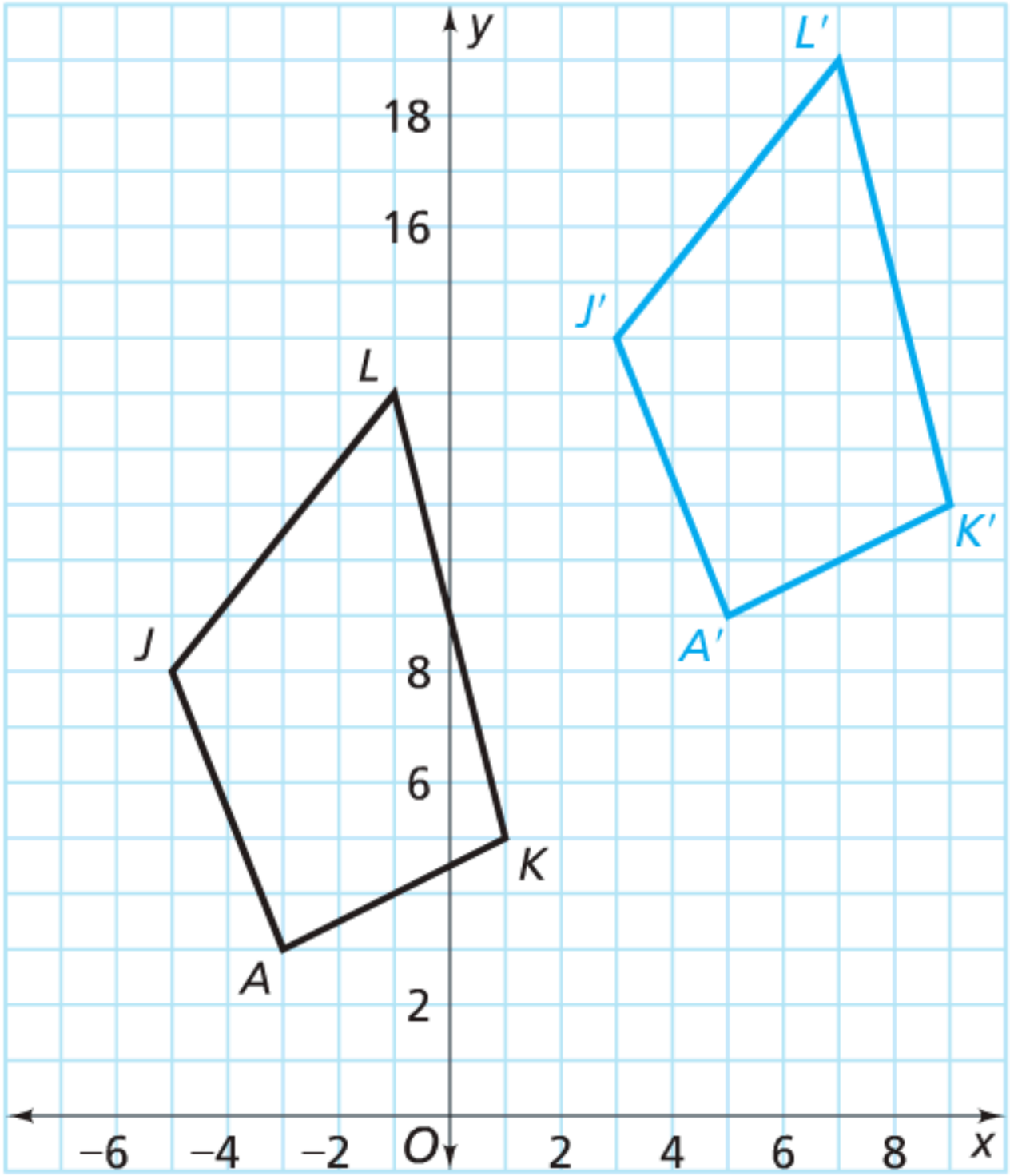
Ask for Questions, Not Answers



via Joe Schwartz @JSchwartz10a

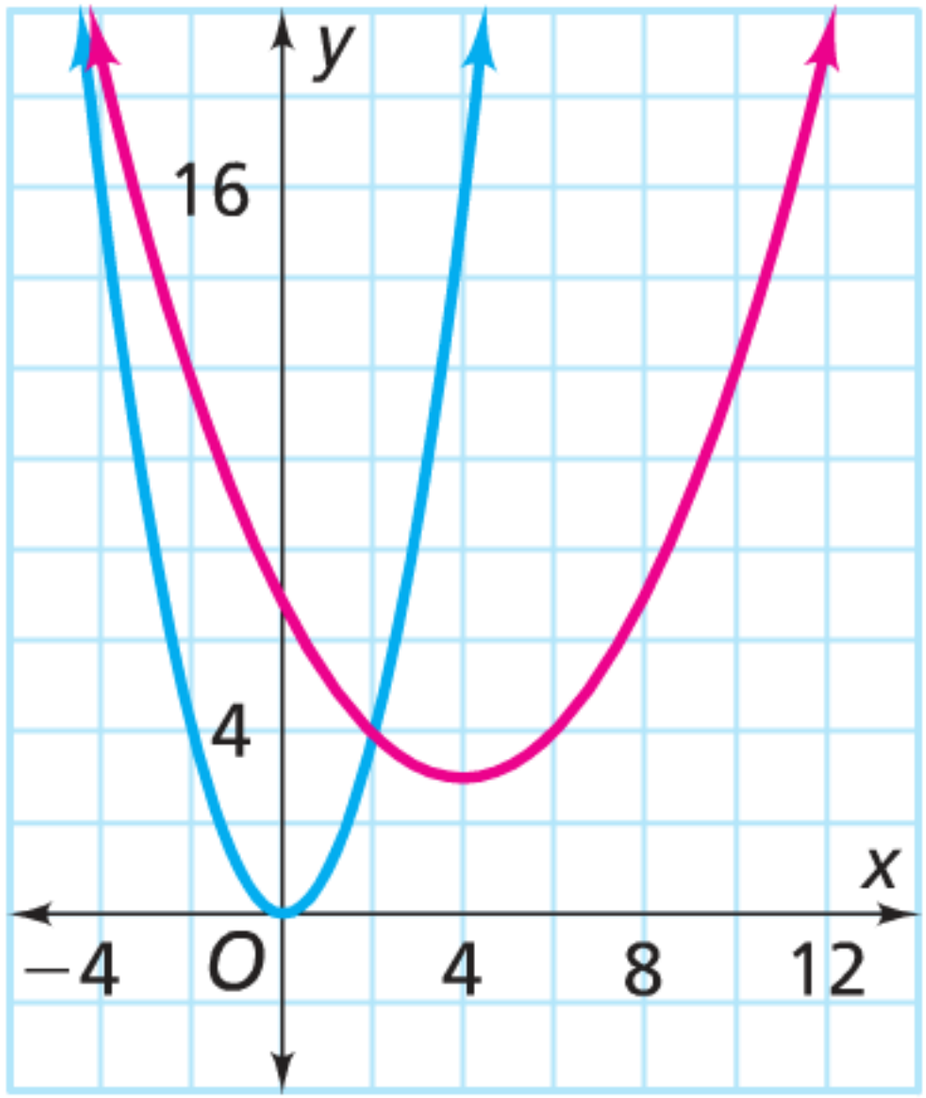
Ask for Questions, Not Answers

What questions could you ask about this picture?



Ask for Questions, Not Answers

What questions could you ask about this picture?



Honoring Students' Ideas

Q: What's another way to cultivate a classroom focused on *ideas* rather than *answers*?

A: Ask about ideas, not answers.

Honoring Students' Ideas

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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?"

Idea-Focused Questions

"Why?"

"How do you know?"

"How did you decide?"

"Tell me more about that."

Ways to Honor Students' Ideas

- Get rid of the question.
- Get rid of the question *and/or* the numbers.
- Ask for questions.
- Ask about ideas, not answers.

Wait! There's More!

Honoring Students' Ideas

Q: Another?

A: Launch by asking for their ideas instead of telling them things. (Just hush up for a bit!)

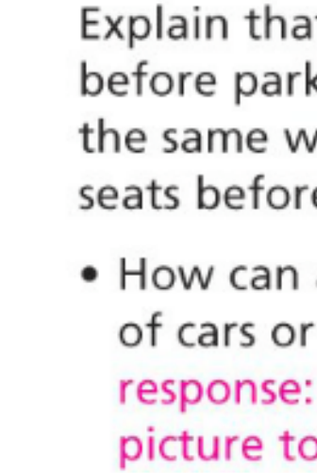
Gather Ideas as a Launch

Relate Pictures to Tens and Ones

MATH TALK

MP.1 Make Sense of Problems Analyze the Problem Discuss the pictures in Exercises 1 and 2. Count the number of cars in the first row. 10 cars Explain that drivers may be directed to fill a row before parking in the next row of a parking lot. In the same way, people may be asked to fill a row of seats before sitting in the next row at a theater.

- How can a filled row help you count the number of cars or the number of people? Possible response: A filled row shows ten, so I can use the picture to count tens and extras.
- How do the cars in Exercise 1 show tens and ones? 2 filled rows show tens and 3 extra cars show ones.
- How do the people in Exercise 2 show tens and ones? There are 4 rows of ten with 6 extra ones. This time the ones are at the top and the tens are shown below.



Math and the Community Theater

Linda and her family go to a show.

1. 10 cars can park in each row.

How many cars are there?

_____ tens _____ ones = _____ cars

2. 10 people can sit in each row.

How many people are there?

_____ tens _____ ones = _____ people

What Do You Notice? Wonder?

Gather Ideas as a Launch

Math Message Follow-Up

WHOLE-CLASS ACTIVITY

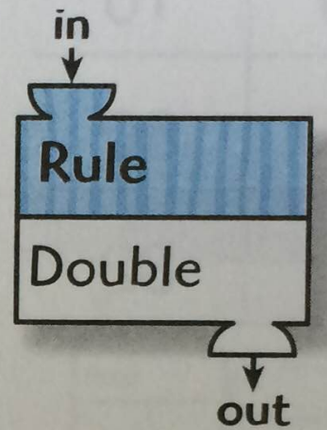
Draw or display a function machine and "What's My Rule?" table. (See Advance Preparation.)

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.

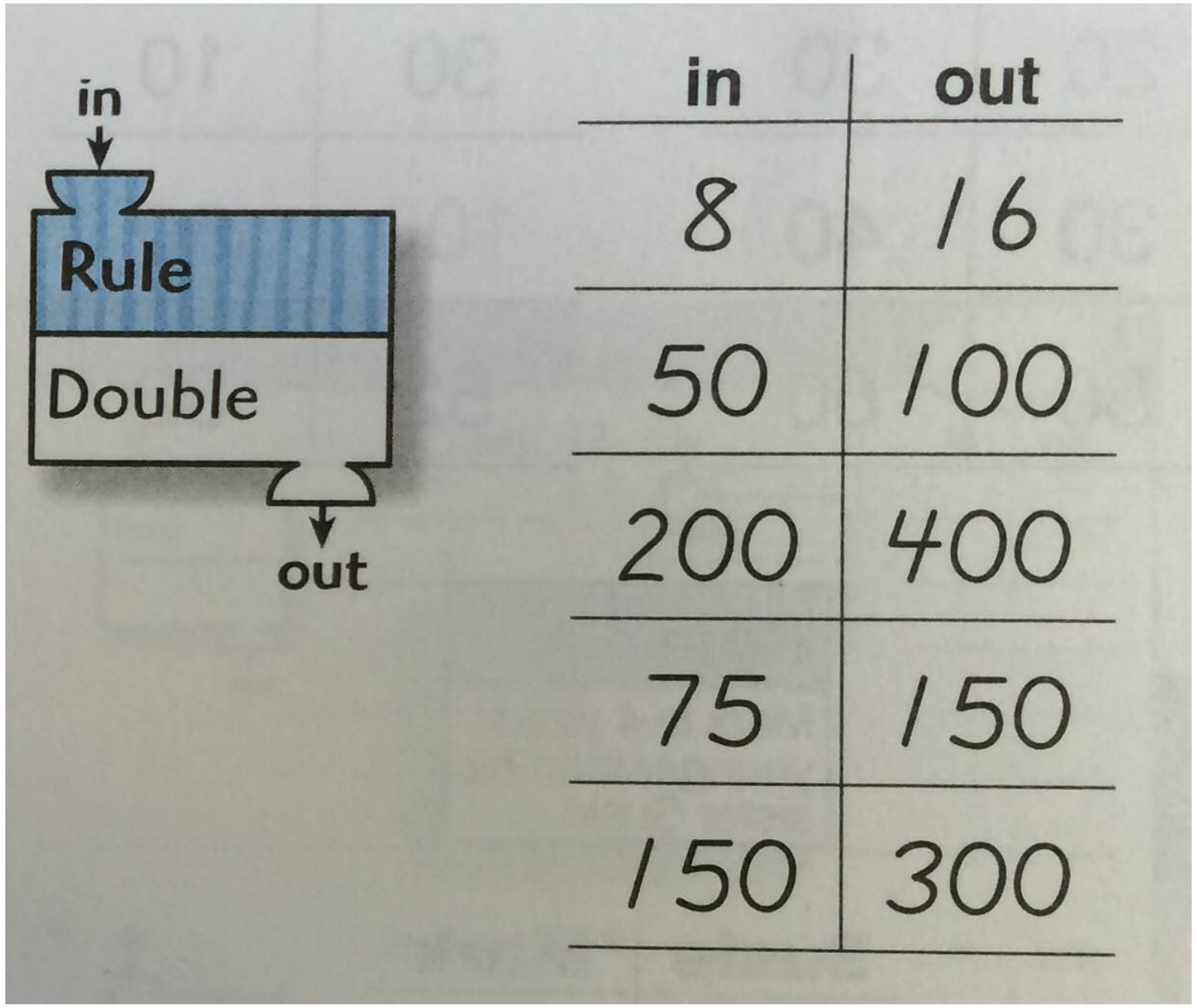
The **rule** for the Math Message problem is "Double the number." Write the word *Double* in the function machine.

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

Tell Me Something About This

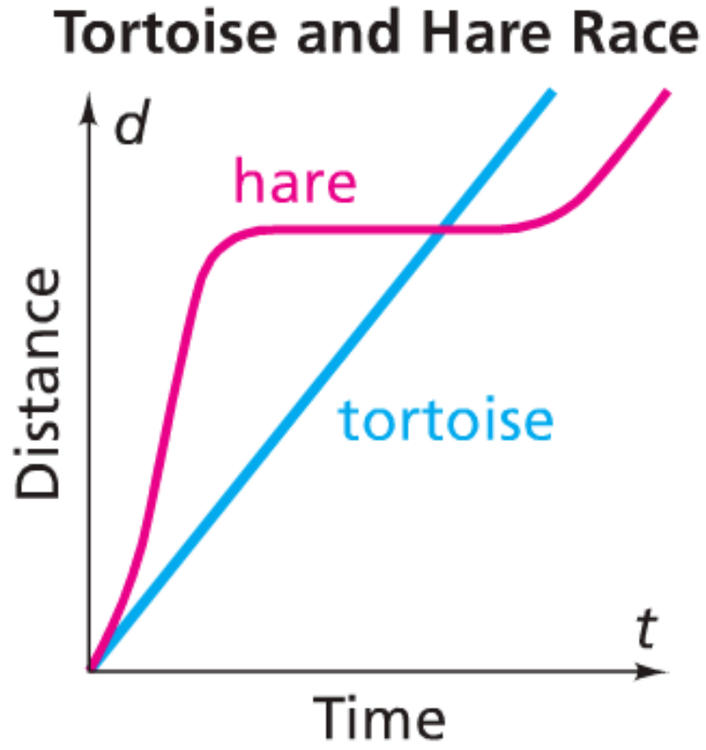


in	out
8	16
50	100
200	400
75	150
150	300

Gather Ideas as a Launch

By the end of this investigation, you will be able to answer questions like these.

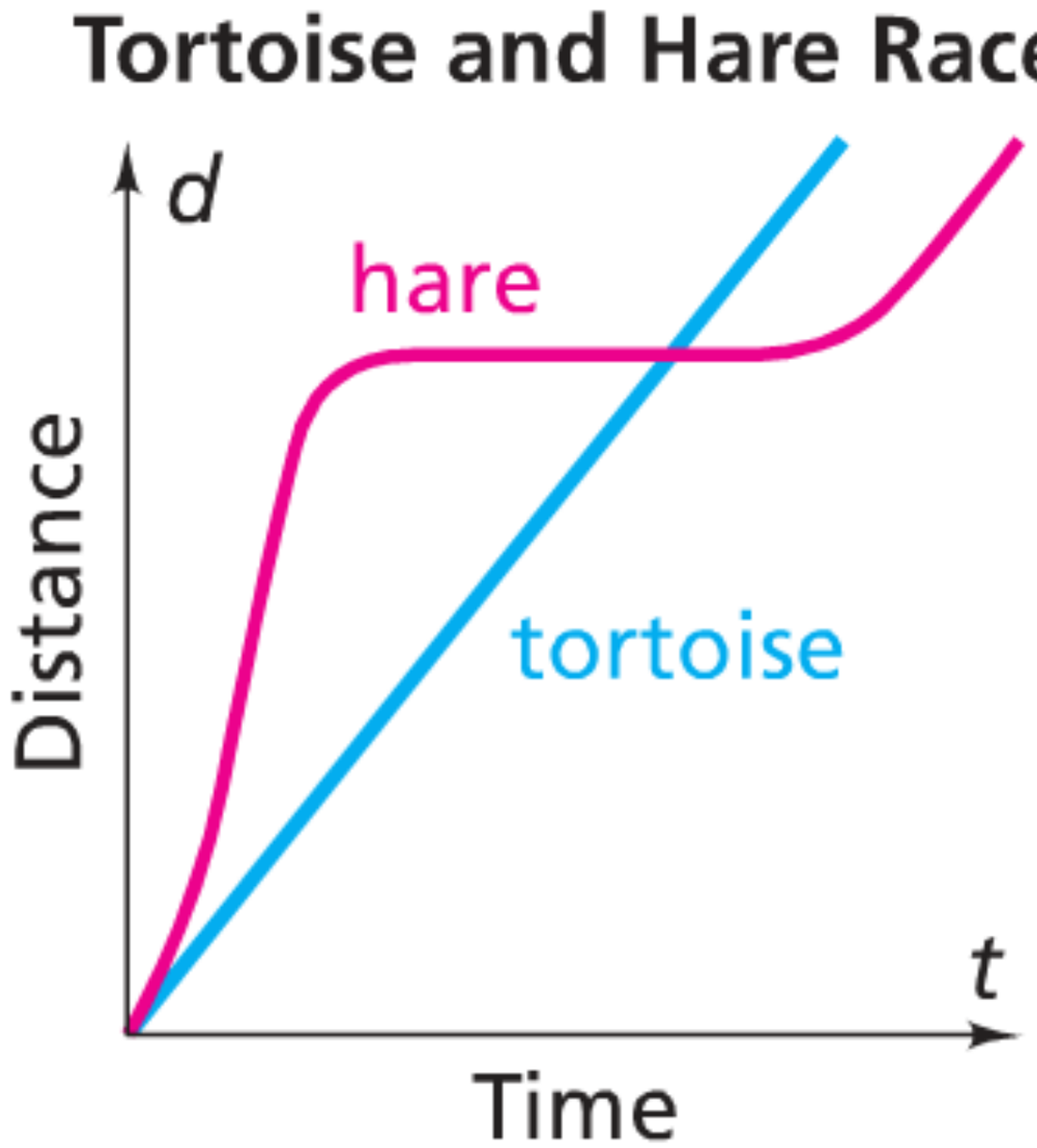
1. How can you locate a point on a coordinate plane using the point's coordinates?
2. You have a picture in the coordinate plane. What is the effect of changing all x-coordinates or all y-coordinates of the points in the picture by the same amount?
3. According to the graph, who won the race, the tortoise or the hare? How can you tell? What else does the graph tell you about the race?



You will learn how to

- plot points and read coordinates on a graph
- describe how transformations operate on ordered pairs

What's Going On Here?



Quit Telling Them Things They Could Figure Out For Themselves!

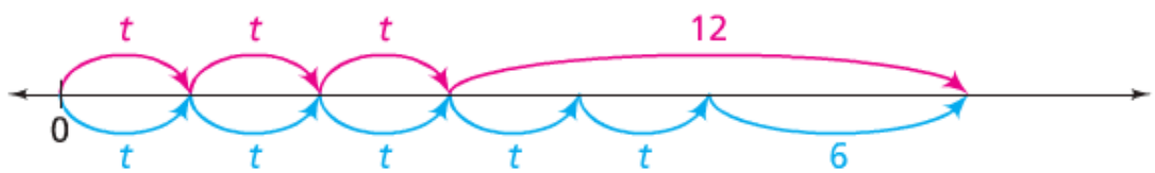
$$\sum_{n=1}^{5} n = 1+2+3+4+5$$

$$\sum_{n=-2}^{2} n^2 = 4+1+0+1+4$$

Stop Talking So Much!

Equality on the Number Line

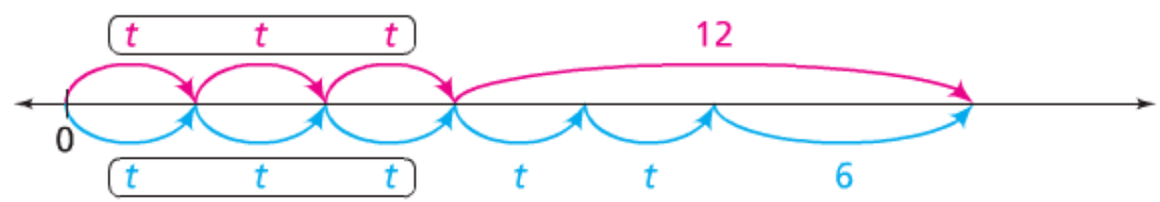
To illustrate the equation $3t + 12 = 5t + 6$, you can draw t as an unknown length. Whatever length you choose for t, you cannot compare it to the length of 6 or 12, because you do not yet know the value of t. You do know that every t has the same length.



The symbols above the number line show $3t + 12$. The symbols below the number line show $5t + 6$. The equation $3t + 12 = 5t + 6$ tells you that the two expressions are equal. So, when you draw the two expressions, they can start and end at the same point on the number line.

Look at the $3t$'s on the left above and below the line.

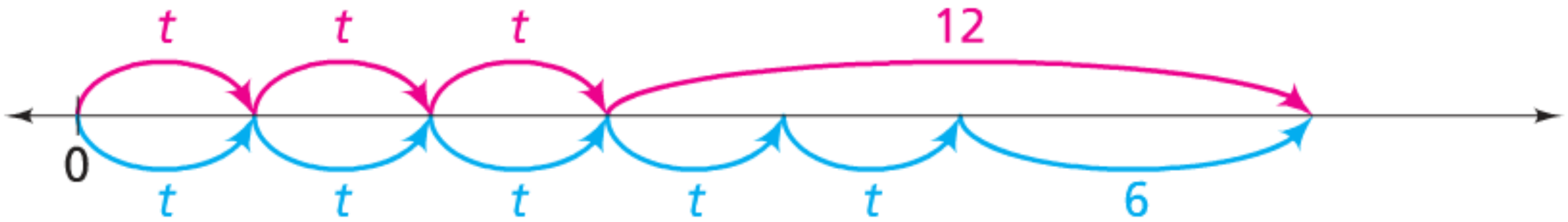
$3t$ is in each expression.



Suppose you ignore the $3t$'s on both the top and bottom. The 12 above the line and the $2t + 6$ below the line start and end at the same point on the number line. So they must be equal.

Ignoring the $3t$'s above and below the line is the same as subtracting $3t$ from both sides of the equation. Above the line, 12 units are left over, and below the line $2t + 6$ units are left over. Now you have an equation, $12 = 2t + 6$, that you can solve using bactracking.

Let Them Make Sense of Things



Ways to Honor Students' Ideas

- Get rid of the question.
- Get rid of the question *and/or* the numbers.
- Ask for questions.
- Ask about ideas, not answers.
- Gather their ideas as a launch instead of talking at them.

Reminder: Your students all have valid mathematical ideas about pretty much every problem or story.

Your job is to help them believe that.

Share in the chat now or tweet at me later (or both):

What's one new thing you might try with your students in the next week?

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What's one new thing you might try with your students in the next week?

(Hopefully some of you will share *What's Going On in This Graph?* with your kids tomorrow, or soon!)

(In case you missed it the first two or three times.)

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