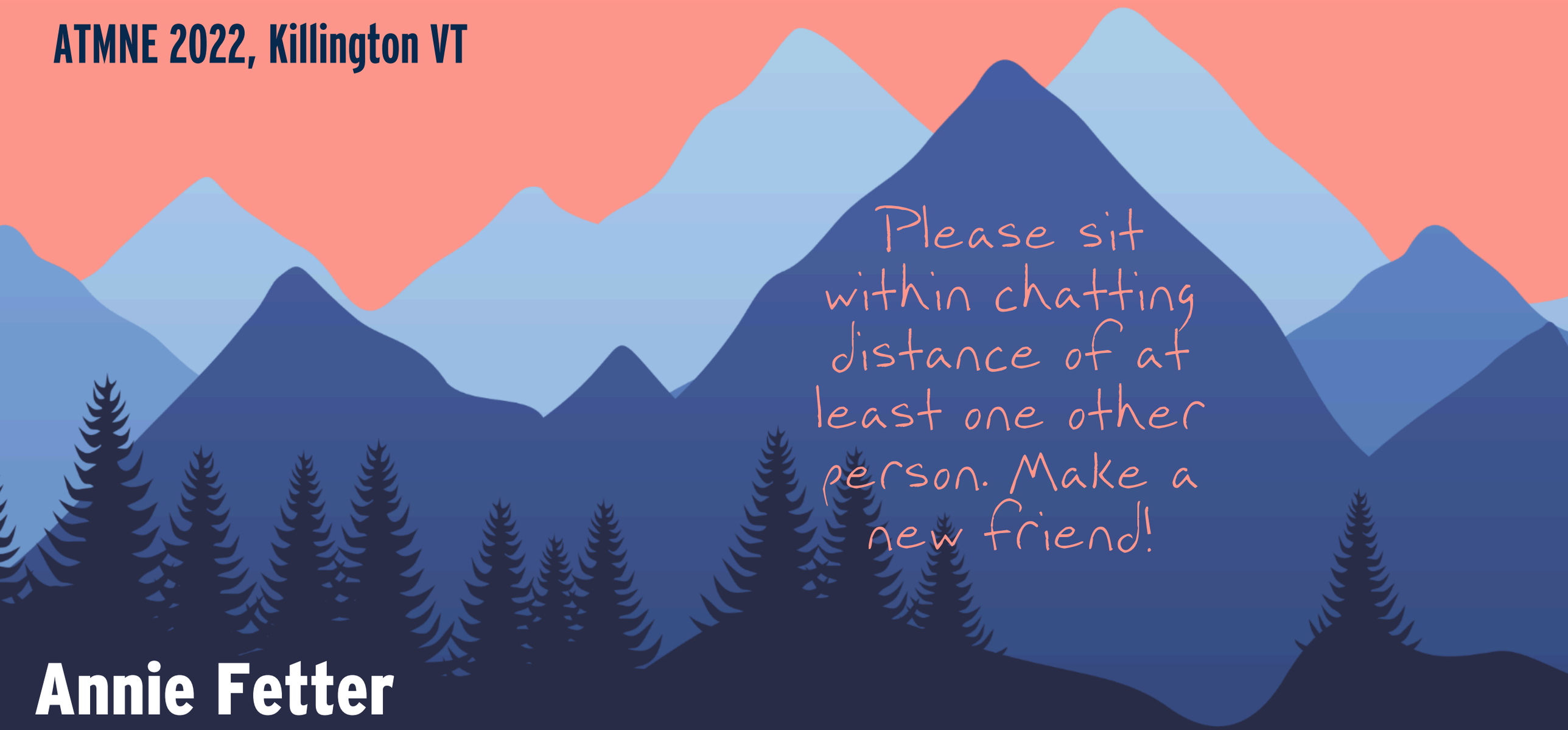
The Power of Students' Ideas

ATMNE 2022, Killington VT



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A PDF of the slides will be available at annie.mathematicalthinking.org after the session.

Thetford Panthers at the top of Division III

Softball

RANDOLPH— The Thetford Panthers reign supreme at the top of Division III softball as they silenced all doubters with a come from behind victory over number one seed, Bellows Free Academy of Fairfax 11-8. Three times the gutsy Thetford nine had to come from behind to cop the championship, including a demoralizing 3-0 first inning deficit following a bases loaded triple. Thetford had been able to load the bases in their half of the inning but had the door shut in their face.

Thetford, 16-1 for the year, had a formidible task during the tournament. Forced to play mainly Division IV competition during the year, they breezed through their schedule with more than a 10 run a game differential. "It is tough to teach the team guts and determination when we really hadn't been behind in a game all year long," according to Lickley. All three tourney games were different however, for Debbie Lickley's nine.

In their first victory over Peoples last Saturday, Thetford found themselves behind 4-1 in the fourth inning. Aggressive baserunning and timely hitting put four runs on the board for the Panthers and they were on their way. In Wednesday's semifinal game, it was much the same. Down by six runs, 9-3, Thetford rallied for runs in the sixth and eighth inning to pull out the victory. Sheila Fifield's sacrifice fly was the final difference in the 10-9 win.

WORDS OF WISDOM is given to catcher Michele Fifield in third inning by Debra Lickley. Down by three runs at the time, the advice must have worked as Thetford went on to win, 11-8.

"Before the final game, I told the girls we would have to force the issue and have BFA play our game. BFA had won back to back championships and we knew we had our work cut out for us."

The two previous tourney games taught the Panthers well. With the score tied at eight all going into the final inning, Thetford made their move. Judy Tallman, at the bottom of the order, singled to center and advanced to second on a perfect bunt single by short stop Cricket Doyle. A wild pitch advanced the runners to second and third but neither could advance on a groundout.

First baseman, Lyn Hill then came to the plate. The left handed power hitter laced a drive both past the right fielder and the ground rule double area, clearing the bases and putting victory within the Panther's grasp. A large contingent of Thetford rooters went wild in the stands as the entire team mobbed Hill after the round tripper.

Down 3-0, Thetford came back to tie the score in the top of the third. Two walks, sandwiched between a sacrifice put Michele Fifield and Annie Fetter at first and second. Sheila Fifield then surprised the shallow playing left fielder's head for a two run triple, coming home on a Bullet error. Thetford went ahead for the first time on a RBI single by Michele Fifield, scoring Tallman, and a two out, two run double by Sue McKinley. Thetford then led, 6-4 in the fourth.

Lickley was forced to change pitchers in the fifth as Sheila Fifield ran into trouble. Fetter, however, got into trouble herself, with the score tied 6-6 in the fifth. Three Panther errors and a finely executed squeeze bunt put the Bullets ahead once again, 7-6. Two strikeouts later, along with a flyout to center, the rally was over. The partisan Thetford crowd gave the team a loud welcome coming back to the bench for holding the Bullets to just one slim run.

Thetford went ahead again in the sixth inning on singles by Michele and Sheila Fifield and both crossing the plate on another RBI single by McKinley. Displaying good softball sense, the BFA Bullets tied it at 8-8 in the sixth on a combination of a walk, stolen base, bunt single down the third base line and their third squeeze play of the day. This set up the final inning rally by the Panthers.

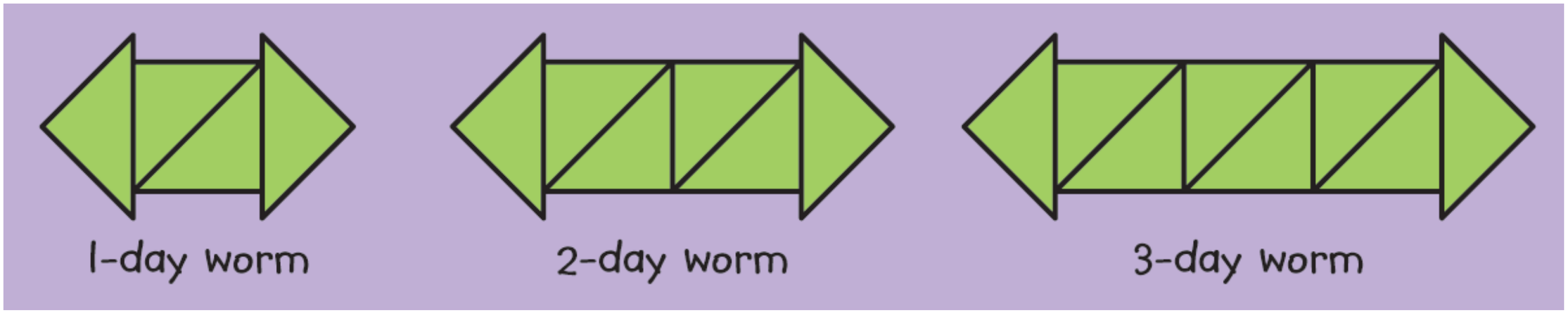
Thetford's win was particularly pleasing to Lickley. "We've been so close in the last couple of years. We've had good teams but couldn't seem to get past the first round. When we did, we just couldn't tie down the championship." The last division III crown for the Panther softballers was in 1978.

Annie Fetter, pitching in relief of Sheila Fifield was credited with the win. For the season, Fetter ended with a 4-1 record, Fifield racked up 12 wins against no losses.

THETFORD SCORES on a single by Lyn Hill driving in Michele Fifield from third base in victory for Division III softball championship game against BFA-Fairfax.

Bradford Journal Opinion
June 16, 1982

Growing Worms Scenario



Growing Worms Scenario

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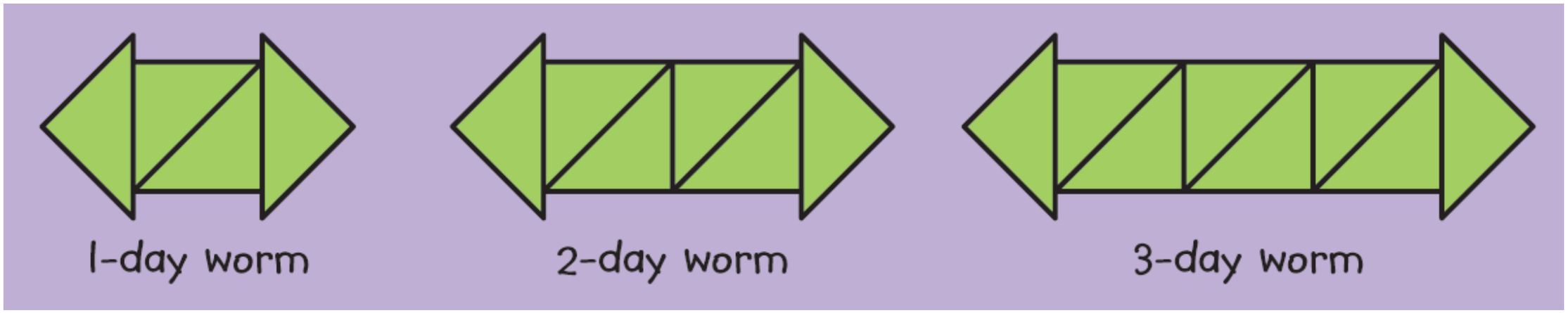

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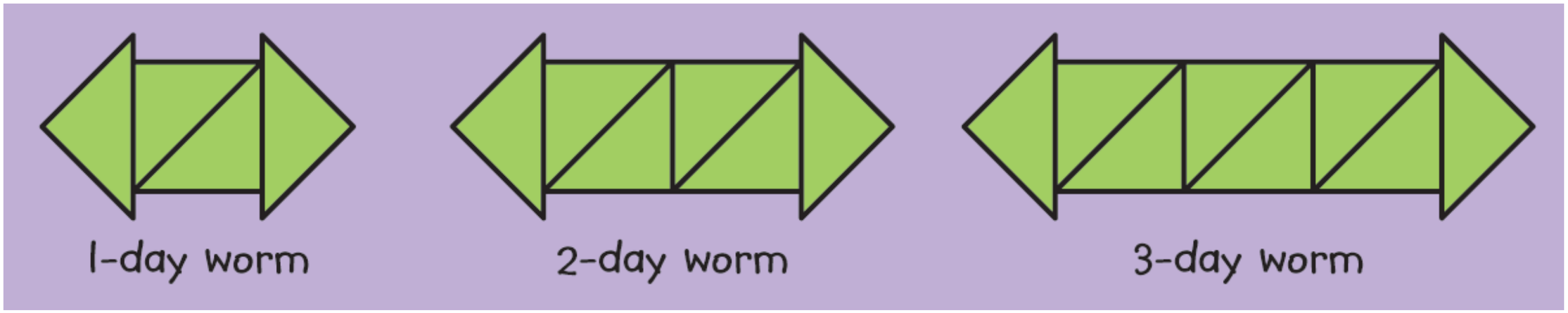
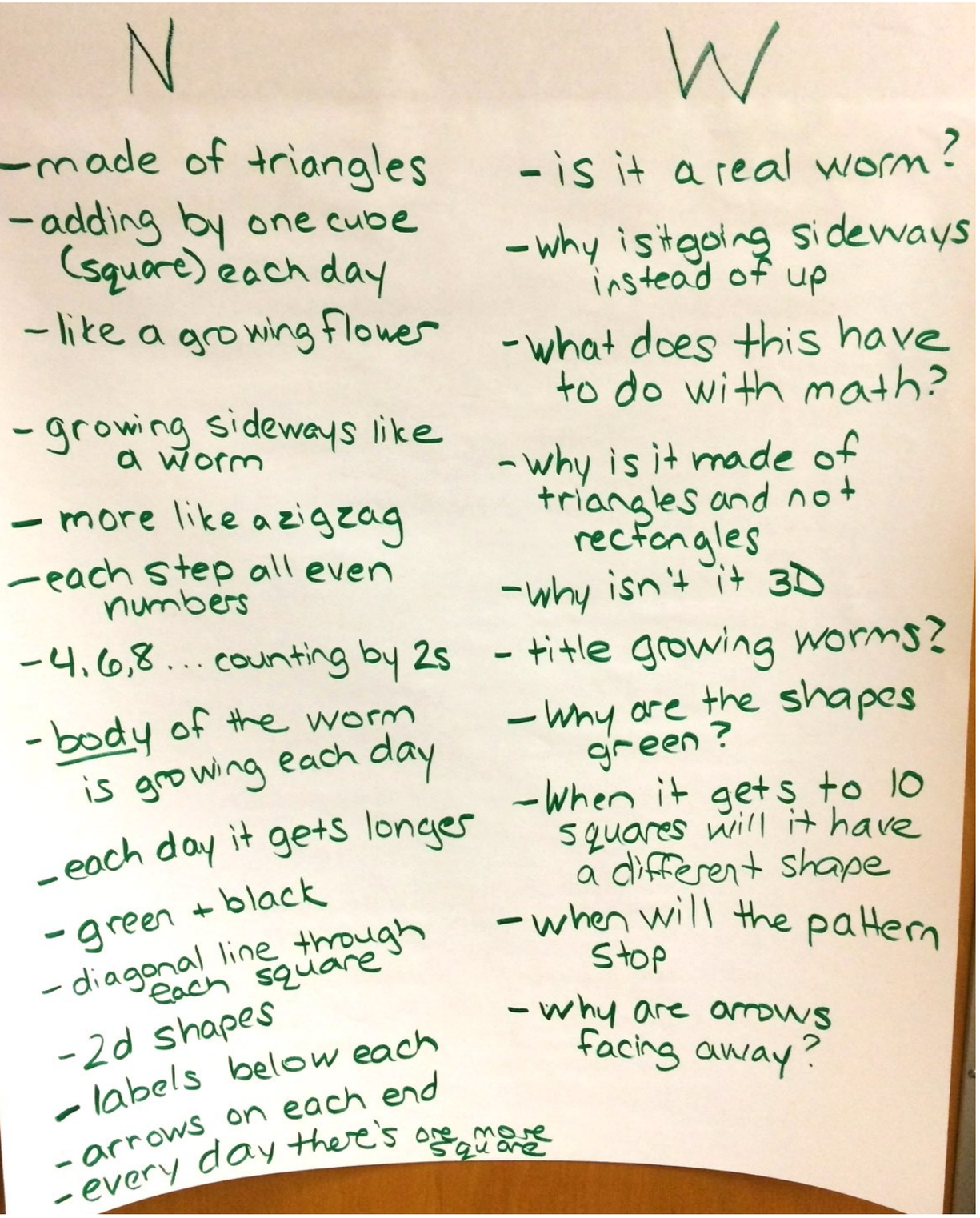


I Notice	I Wonder

Growing Worms Student NW

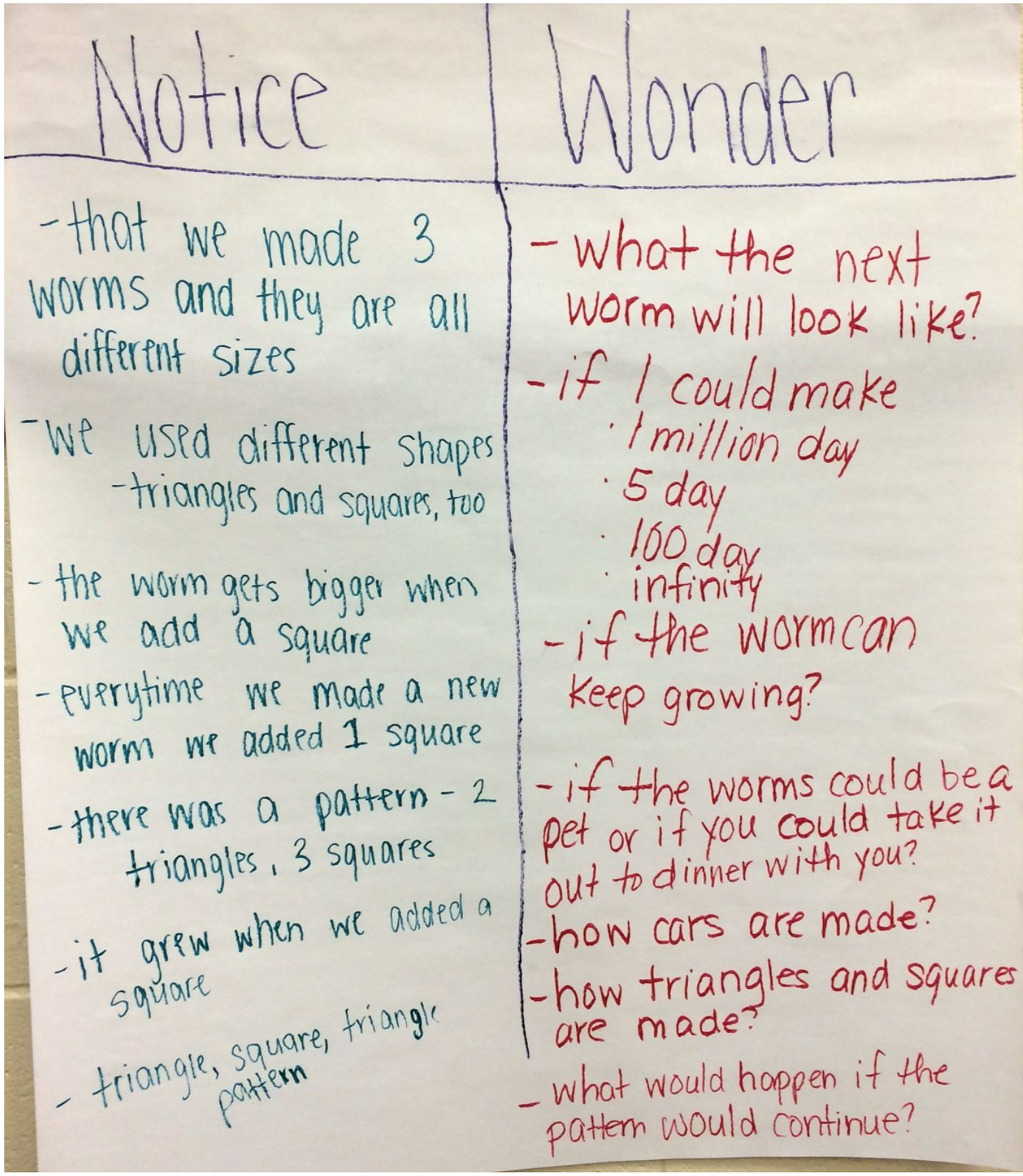


N

- made of triangles
- adding by one cube (square) each day
- like a growing flower
- growing sideways like a worm
- more like a zigzag
- each step all even numbers
- 4, 6, 8 ... counting by 2s
- body of the worm is growing each day
- each day it gets longer
- green + black
- diagonal line through each square
- 2d shapes
- labels below each
- arrows on each end
- every day there's one more square

W

- is it a real worm?
- why is it going sideways instead of up
- what does this have to do with math?
- why is it made of triangles and not rectangles
- why isn't it 3D
- title growing worms?
- why are the shapes green?
- When it gets to 10 squares will it have a different shape
- when will the pattern stop
- why are arrows facing away?



Notice

- that we made 3 worms and they are all different sizes
- We used different shapes
  - triangles and squares, too
- the worm gets bigger when we add a square
- everytime we made a new worm we added 1 square
- there was a pattern - 2 triangles, 3 squares
- it grew when we added a square
- triangle, square, triangle pattern

Wonder

- what the next worm will look like?
- if I could make
  - 1 million day
  - 5 day
  - 100 day
  - infinity
- if the worm can keep growing?
- if the worms could be a pet or if you could take it out to dinner with you?
- how cars are made?
- how triangles and squares are made?
- what would happen if the pattern would continue?

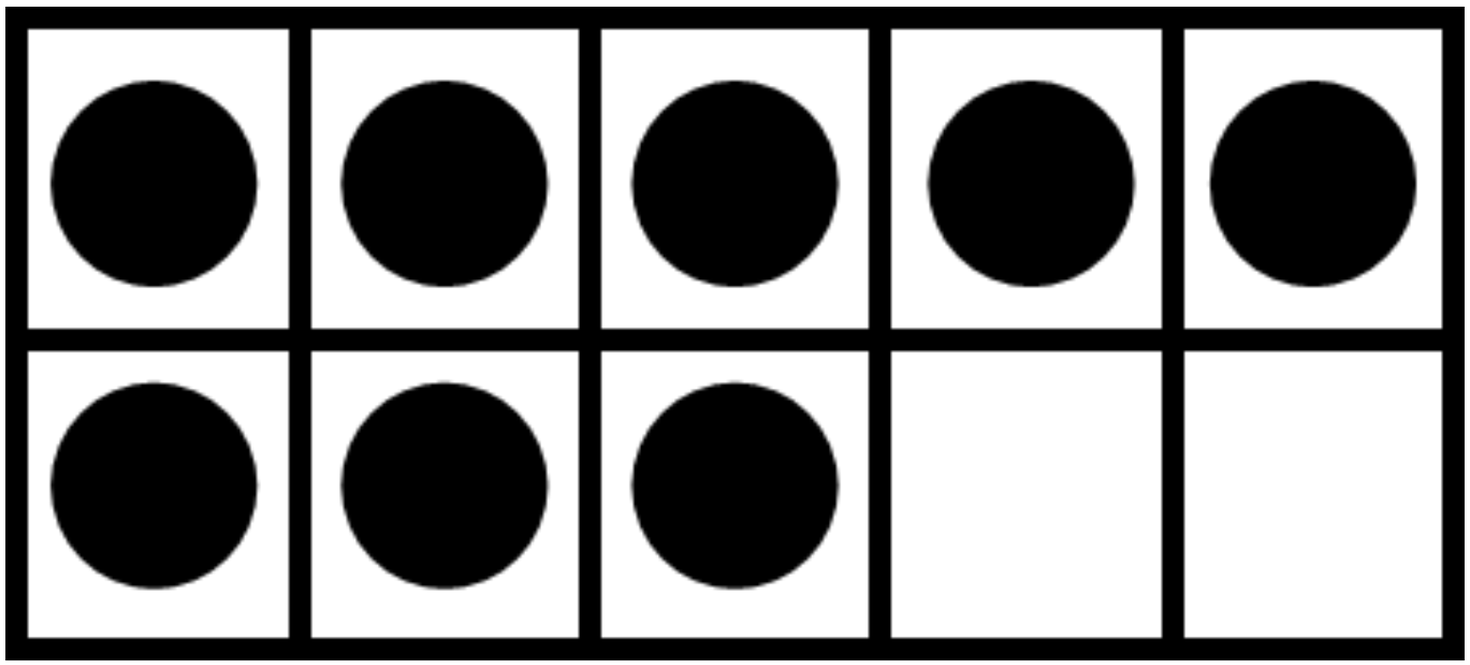
Growing Worms Movies

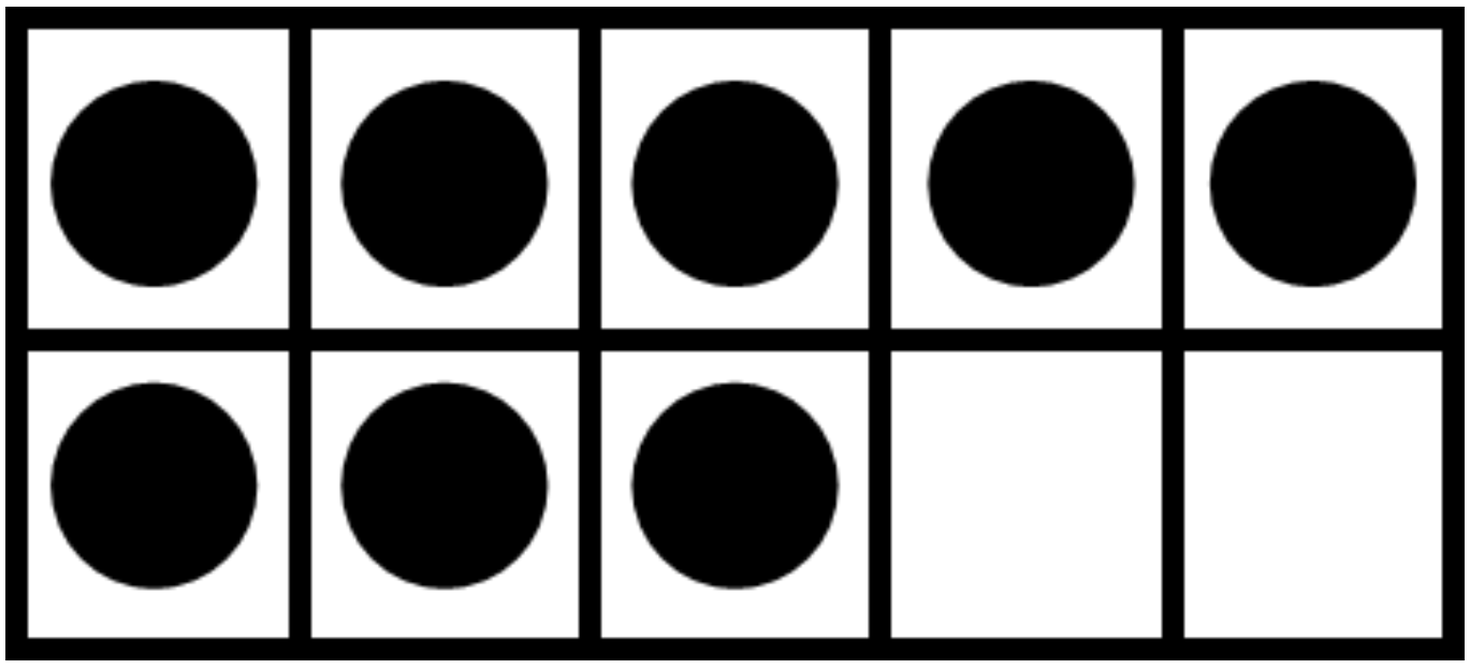
https://www.heinemann.com/pps/video.aspx

See, especially, the first three videos, where Val presents Growing Worms to 3rd graders using the same basic method we used today.

How Many? How Did You Count?

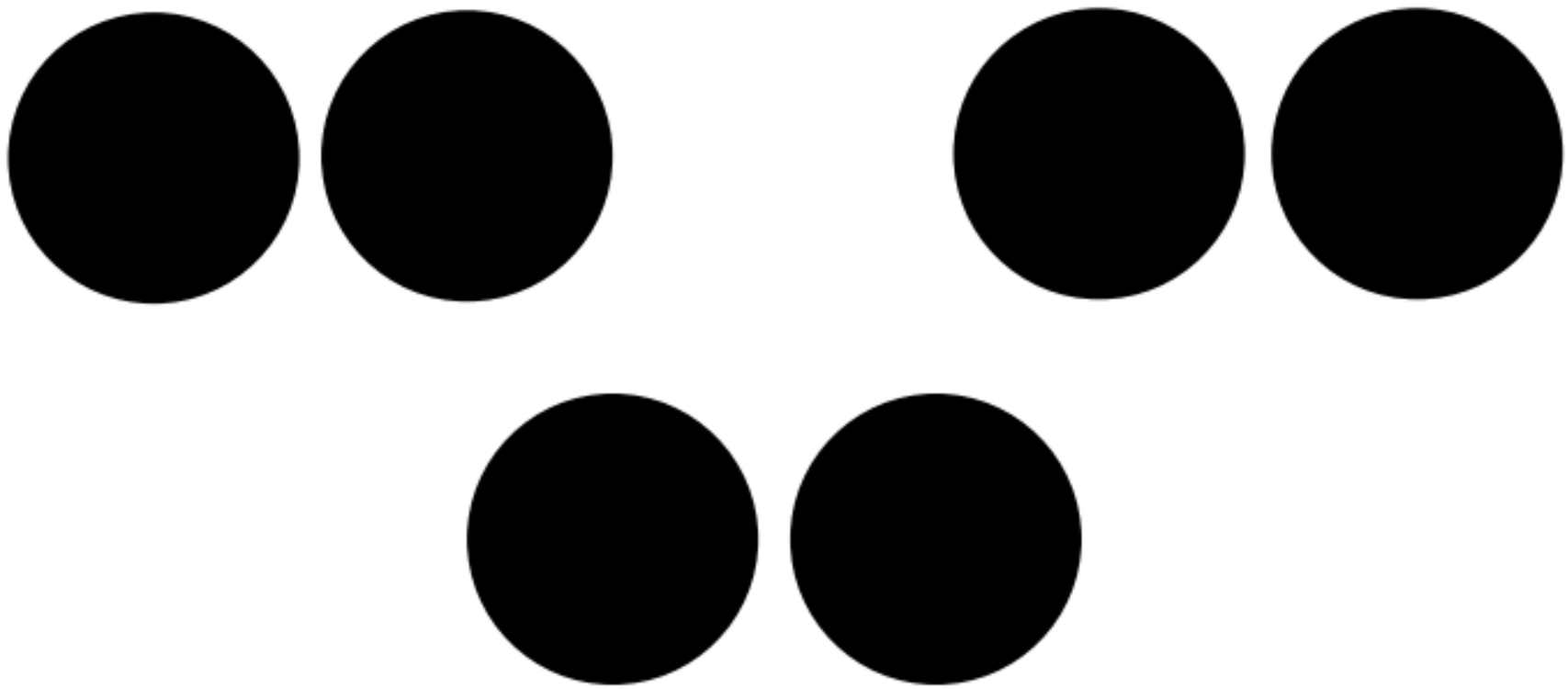
Put your thumb up when you have an answer and are ready to describe how you figured it out.





New Guidelines

- 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.



Dot Talks

26 + 49

23 x 25

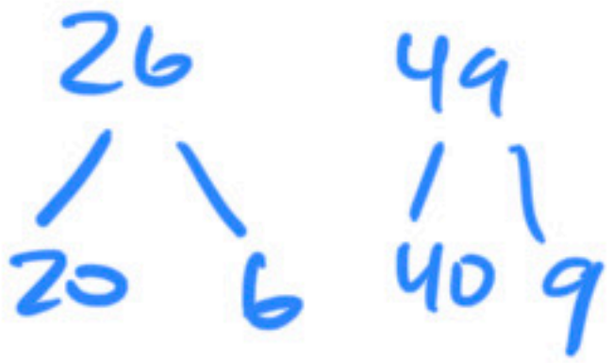
$26 - 1 = 25$

$49 + 1 = 50$

$25 + 50 = 75$

$49 + 20 = 69$

$69 + 6 = 75$



26 + 49

$20 + 40 = 60$

$6 + 9 = 15$

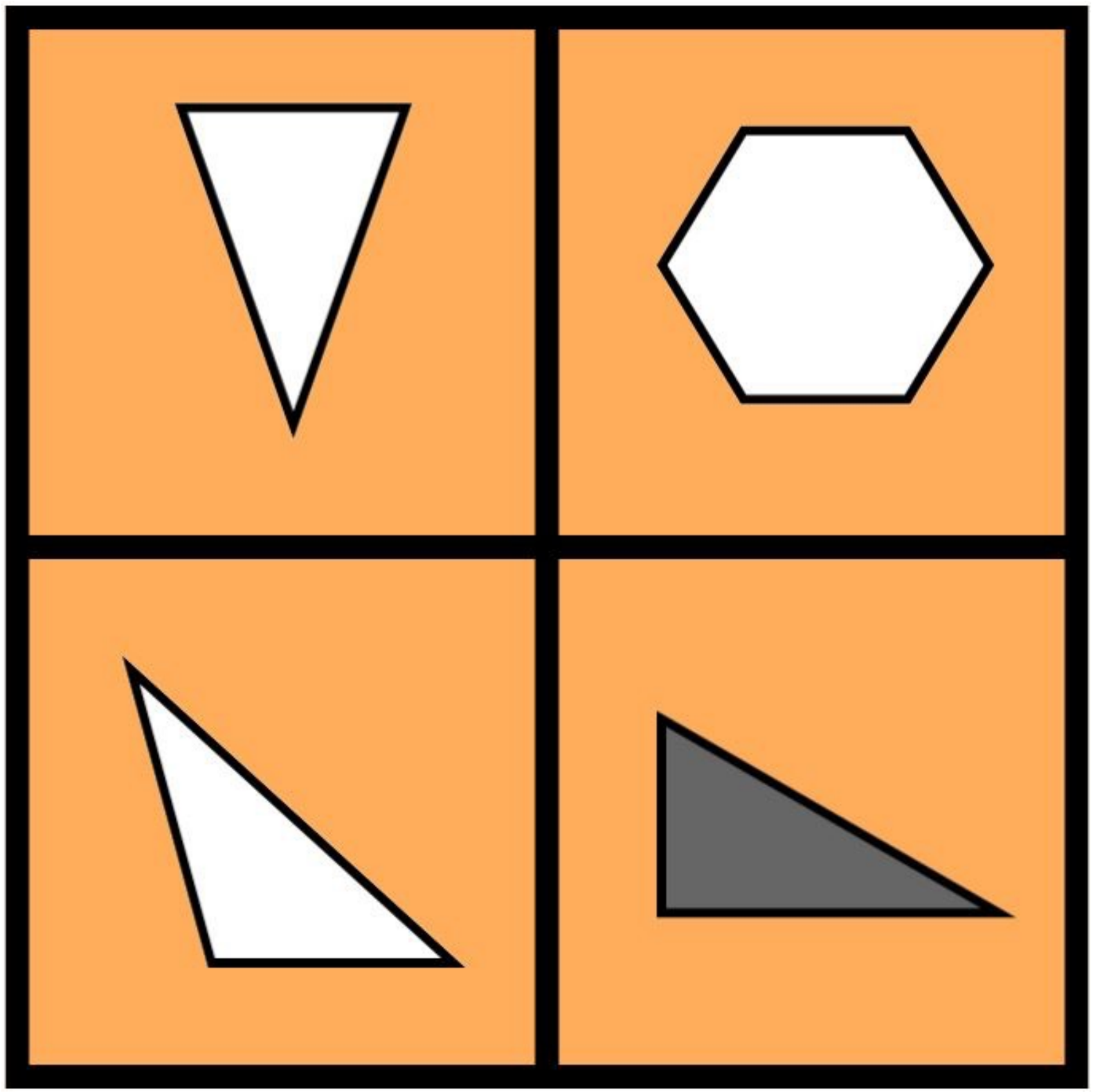
$60 + 15 = 75$

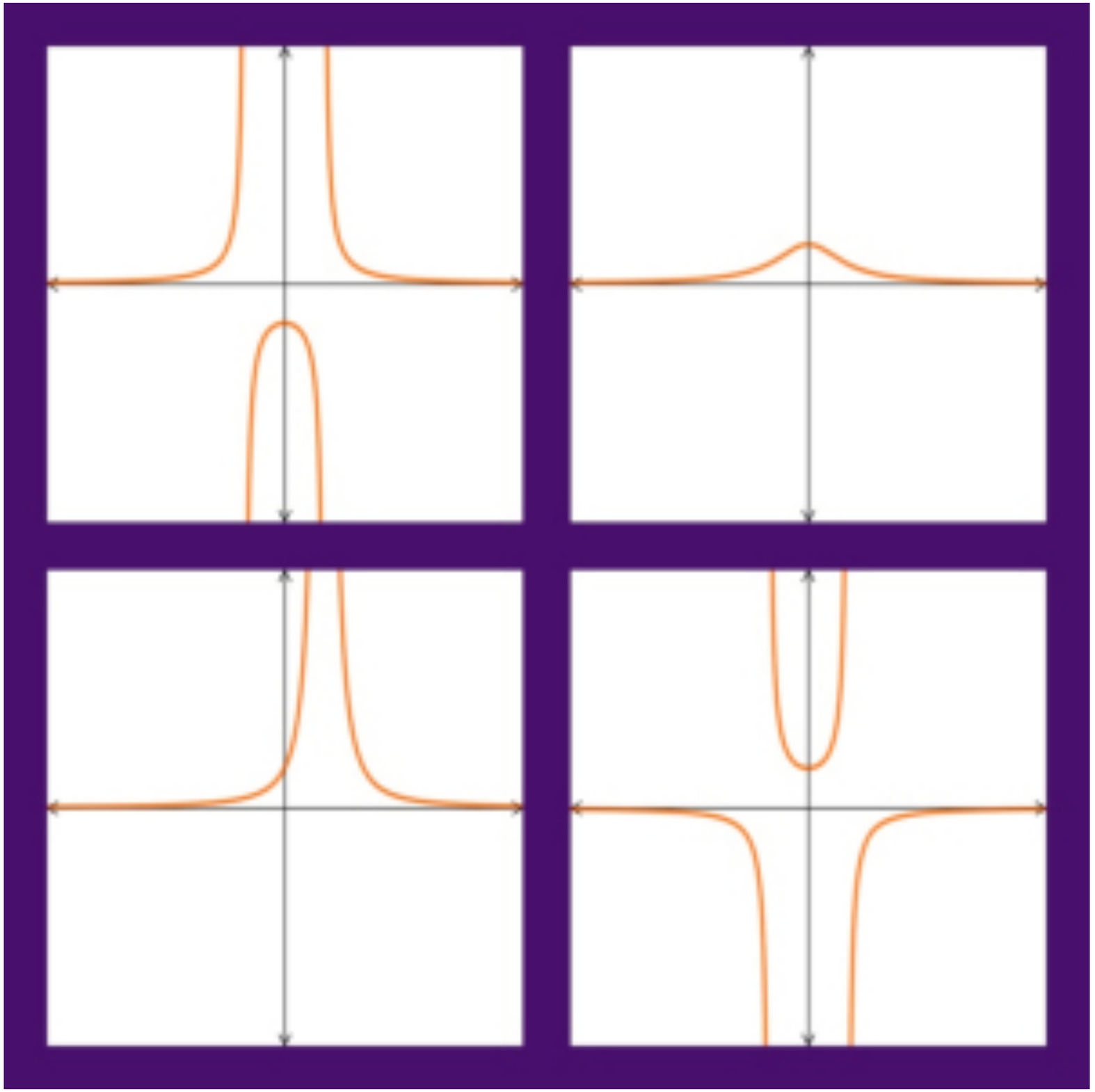
$26 + 4 = 30$

$49 - 4 = 45$

$30 + 45 = 75$

Number Talks





Which One Doesn't Belong?

Some apples are on a tree.

A horse eats some apples.

Some apples are left on the tree.

Numberless Word Problems

Routines That Focus on Ideas

- How Many? How Did You Count?
- Number Talks
- Which One Doesn't Belong?
- Numberless Word Problems

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

author of *Digging Deeper: Making Number Talks Matter Even More* (among other things)

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.

Sample 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.

State Test Problem, Revised

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

Your Job:
Believe All Your Students Have Ideas About Every Problem

Your Related Job:
Your Students Should Believe They Have Ideas About Every Problem

Eliciting Students' Ideas

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

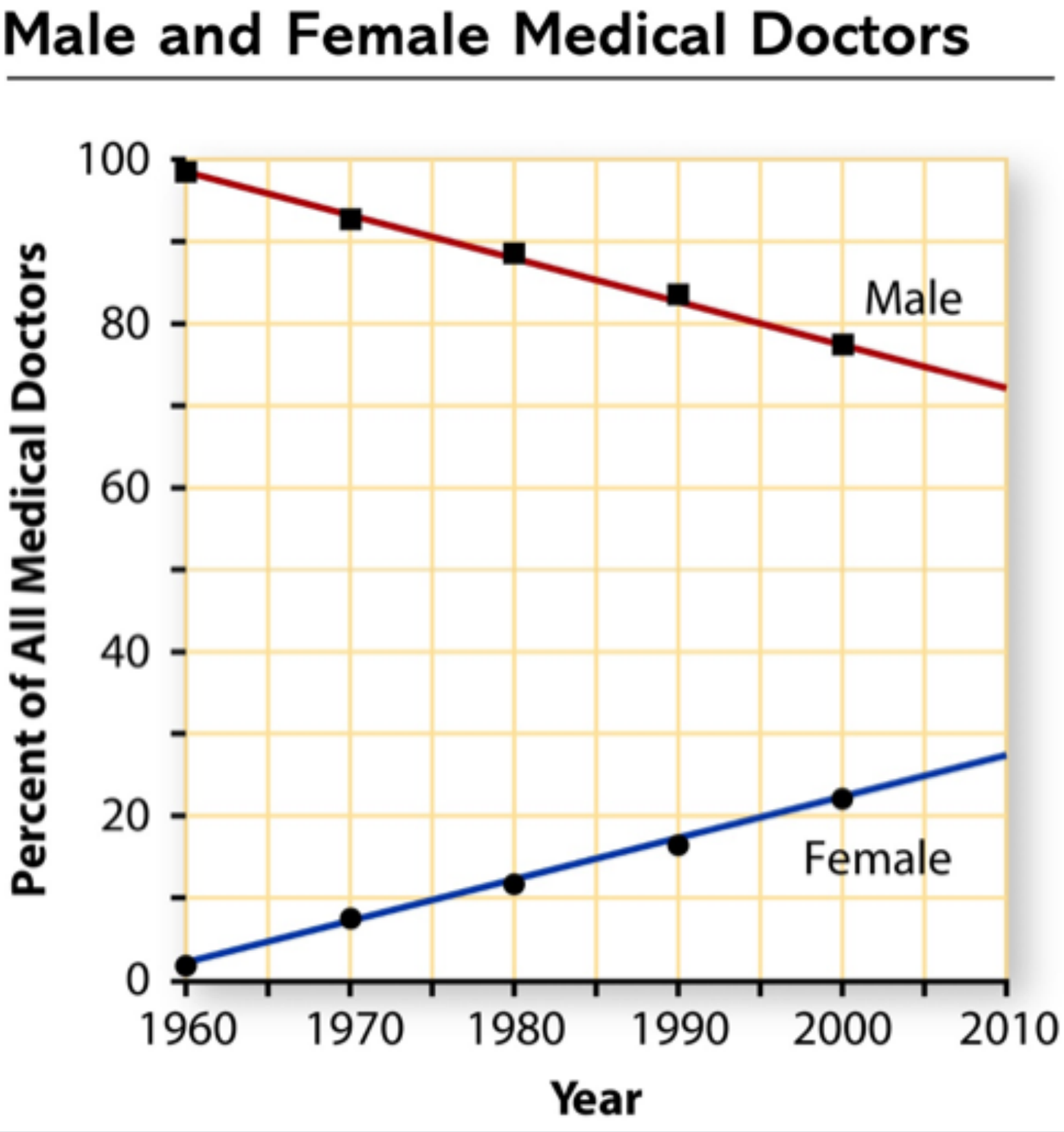
A: Get rid of the question. Literally.

Get Rid of the Question

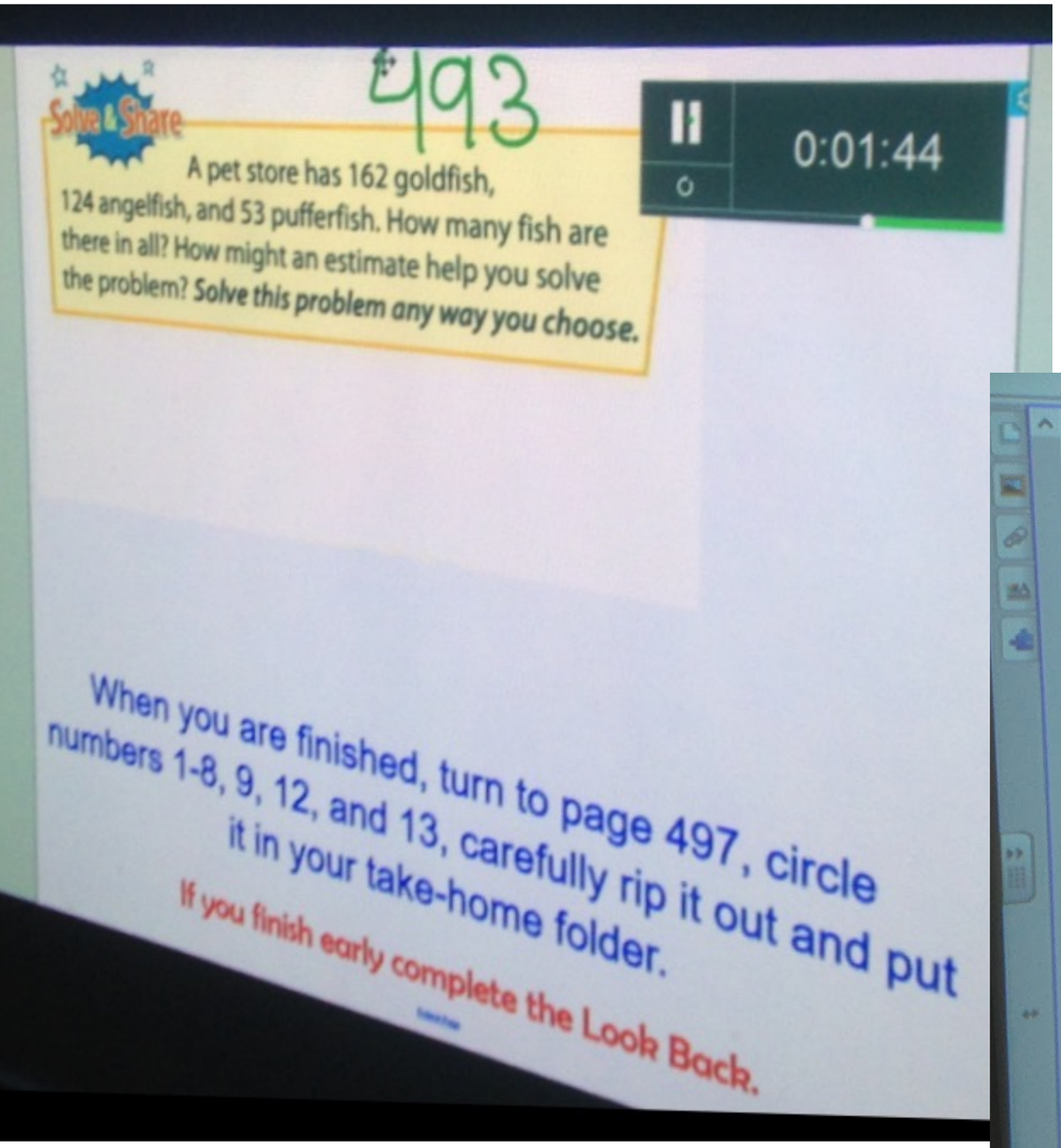
Apple juice costs 50¢. The juice machine accepts quarters, dimes, and nickels.

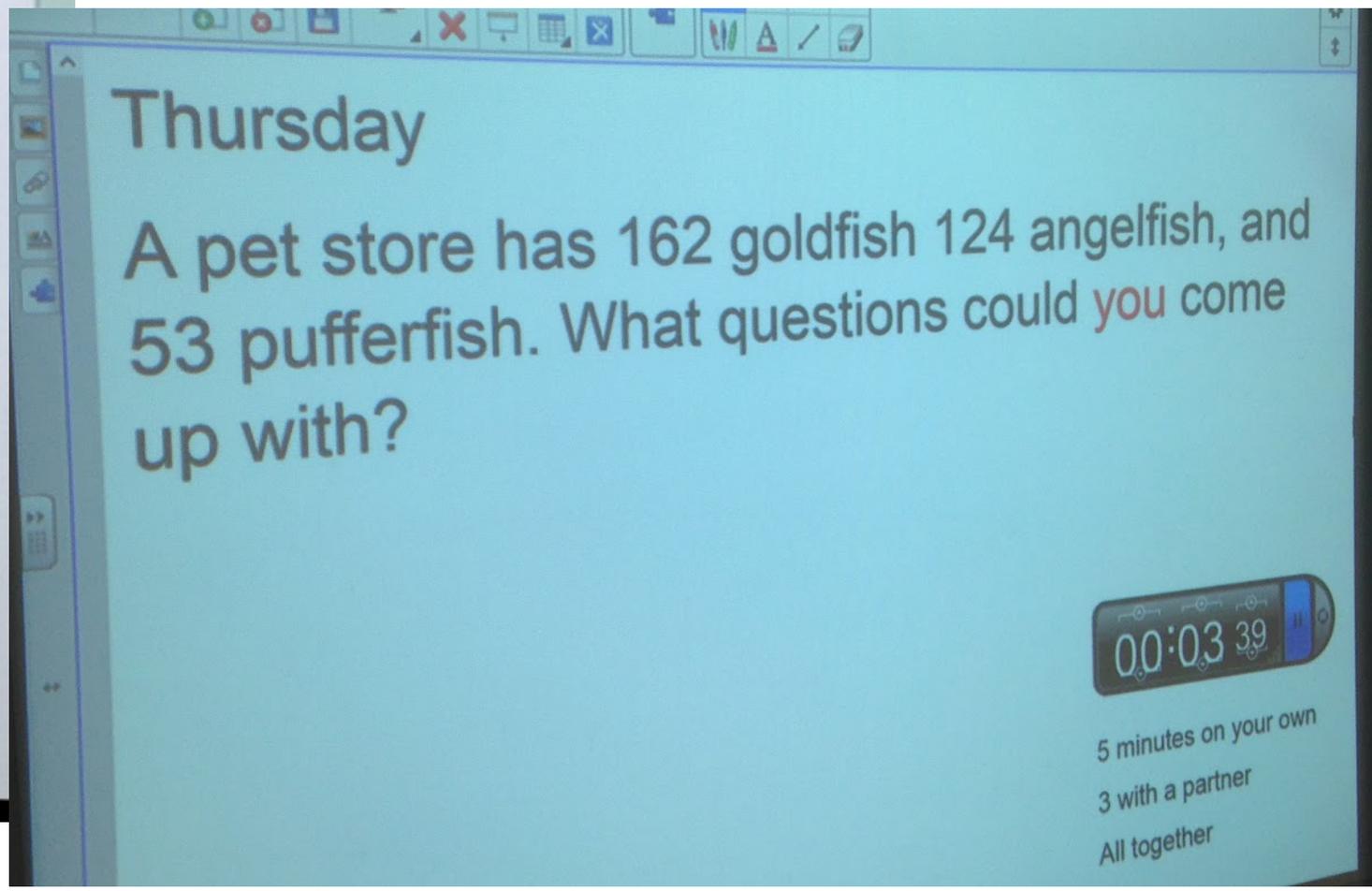
I Notice	I Wonder

Get Rid of the Question



Ask for Questions, Not Answers





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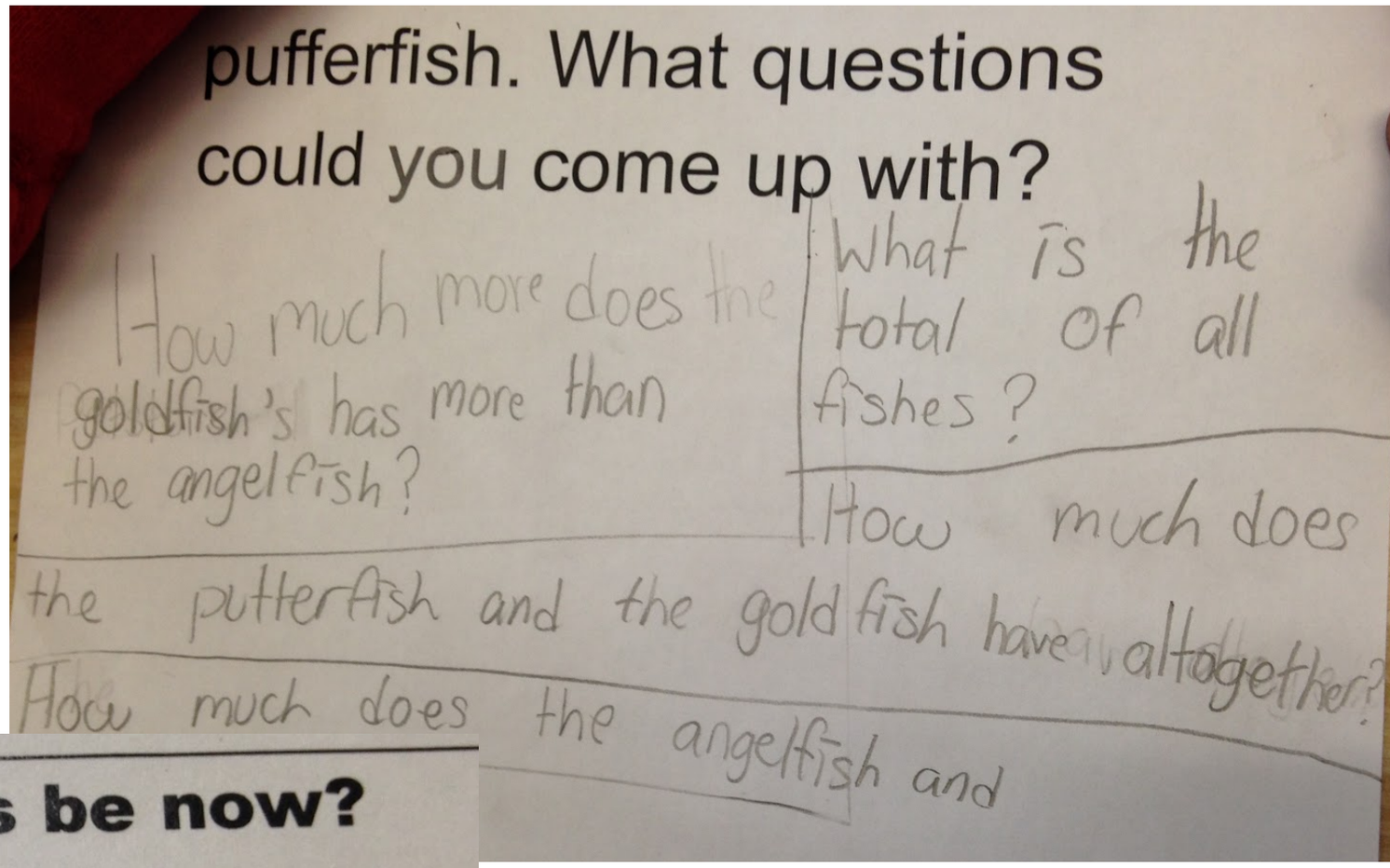
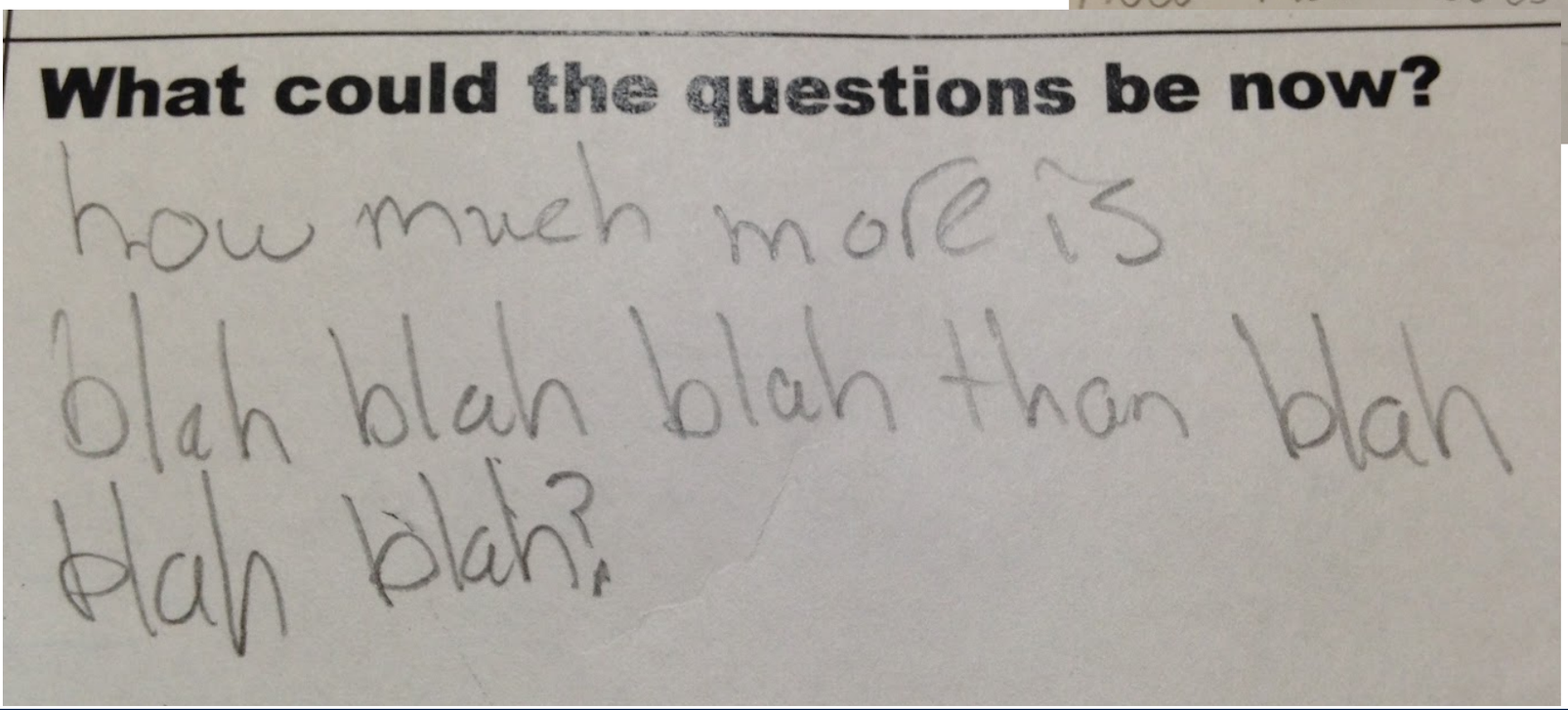




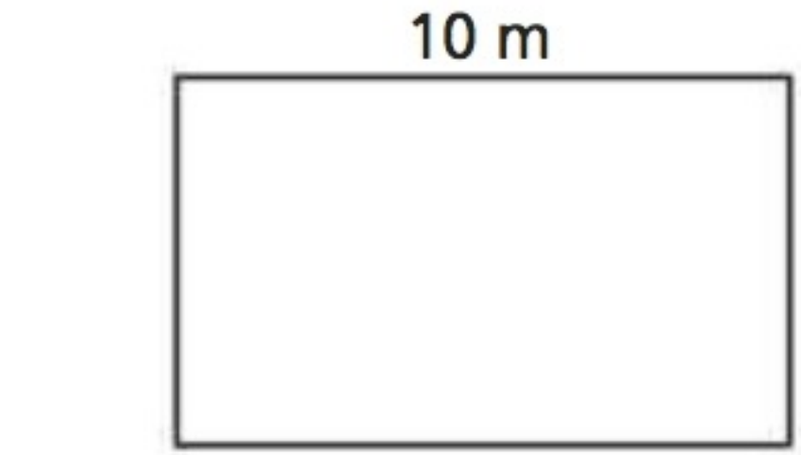
Eliciting Students' Ideas

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

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

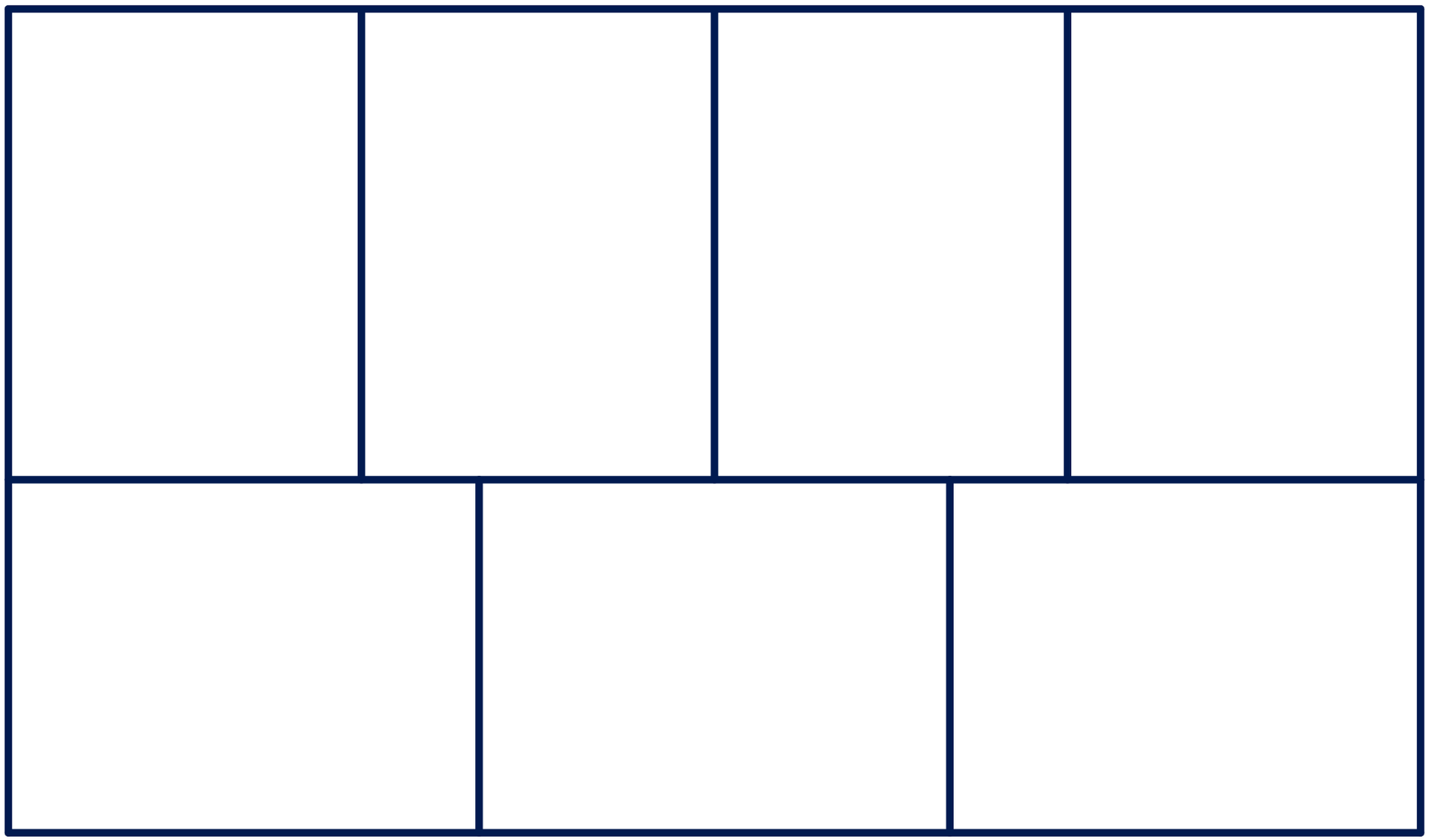
Get Rid of the Question and the Numbers

15. The area of the rectangle is [redacted] One side of the rectangle has a length of 10 meters.



Get Rid of the Question and the Numbers

The seven small rectangles in this figure are congruent.



Eliciting Students' Ideas

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

A: Give the answer and let the students do the work.

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?

Eliciting Students' Ideas

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

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

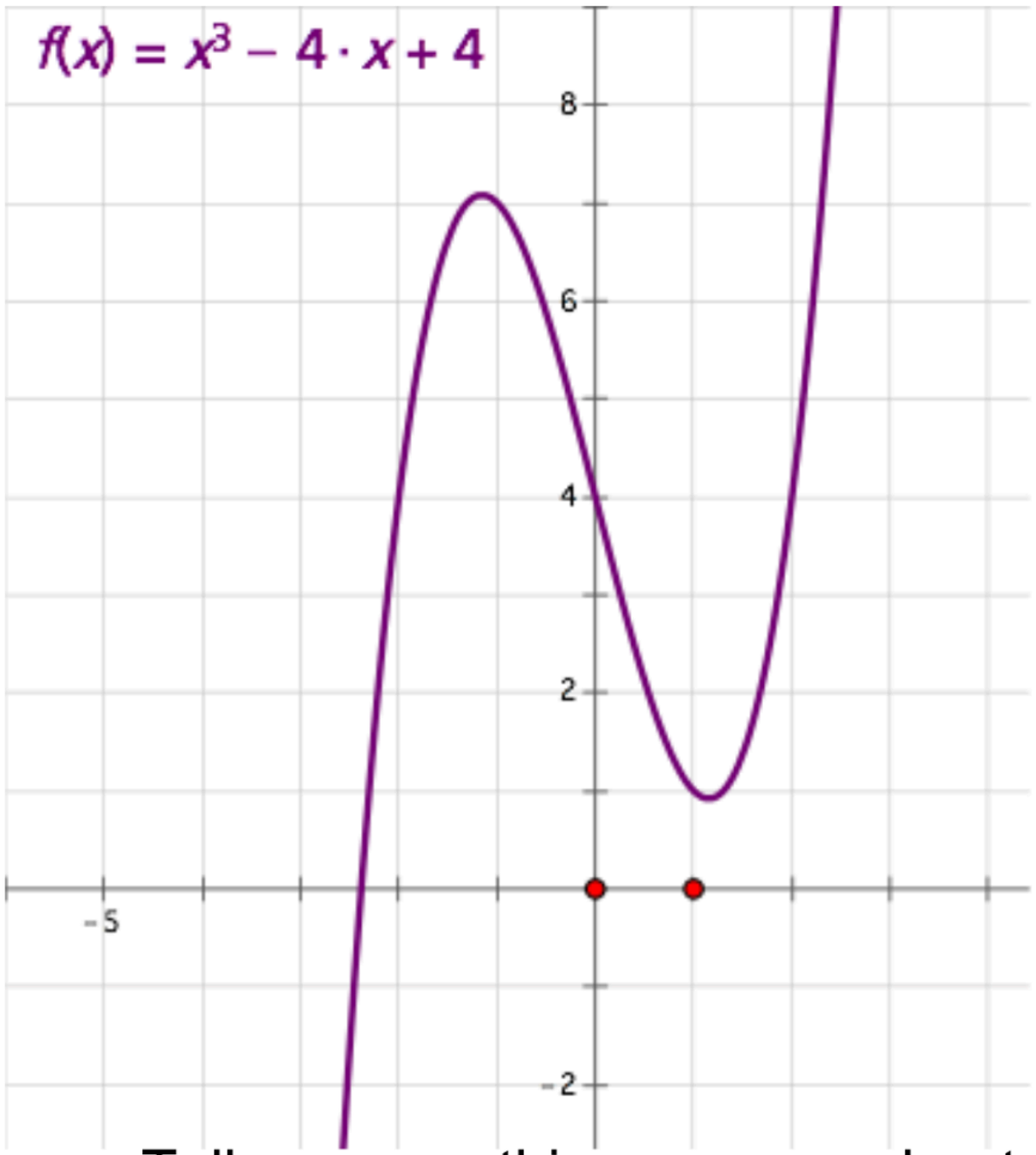
1. Suppose 5 U.S. dollars (5 USD) can be exchanged for 64 Mexican pesos. What operation would be used to find the value of 1 USD in pesos?

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.

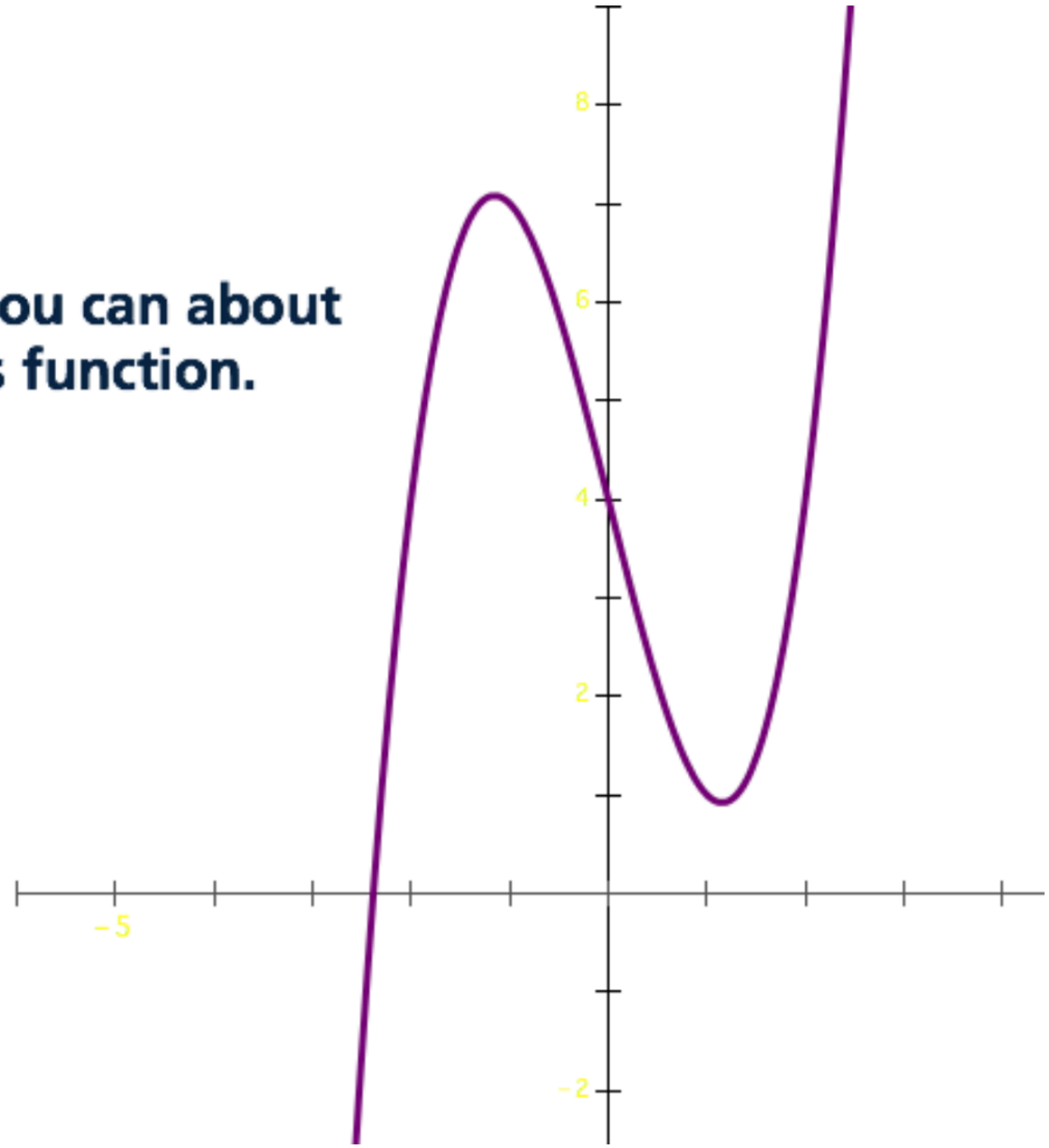
Ask About Ideas, Not Answers



Tell me everything you can about 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 Elicit Students' Ideas Rather Than Answers

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

Susie Hakansson: *Increase Underserved Students' Mathematical Agency by Using Equity Commentators in Lesson Study*

"Teachers are designing lessons for students to show their brilliance."

Things 5th Graders Say about NW-ing

"…it helps me see new things I wouldn't have seen."

"…there are multiple answers so you can't really be wrong with it."

"…helps me look at a problem in a way I never thought of."

"…you get to think about the problem more and you realize more."

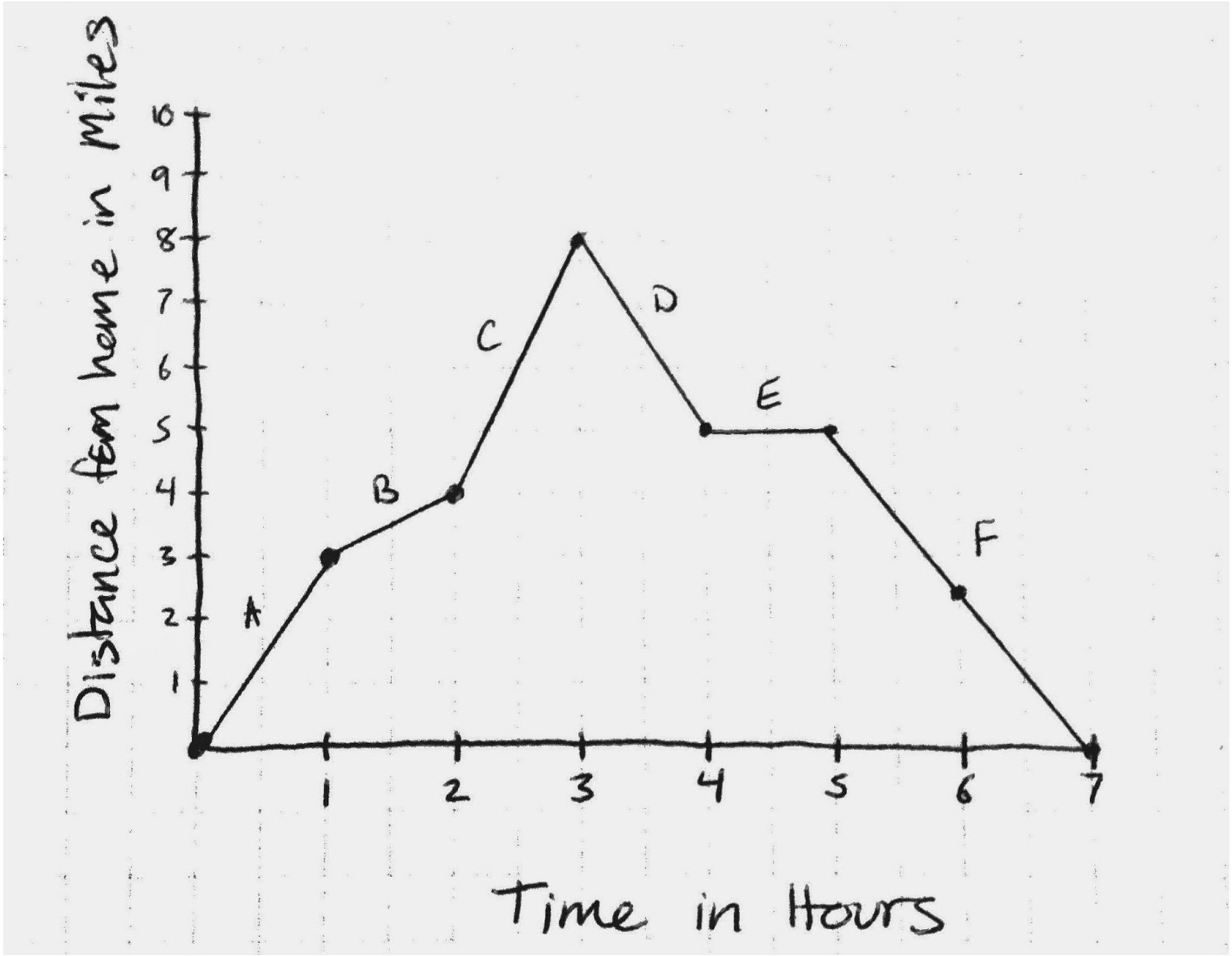
"…we don't have to do math at all, we just need to think on it without stress."

“You get to share your own thinking and no one can ruin it.”

—*Aya, Grade 2*

How Do You Do This in a Time Crunch?

courtesy of @TinaCardone



Tina Cardone 🏳️‍🌈
@TinaCardone

Replying to @MFAnnie

@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

5:36 PM · Nov 24, 2014 · Tweetbot for iOS

Replying to @MFAnnie

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

5:37 PM · Nov 24, 2014 · Tweetbot for iOS

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

Jessica Strom
@strom_win

Following

"We" dont give students enough credit! I had my Ss graph points for sinx & cosx, 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

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

What's one thing you noticed about this session?

What's one thing you're wondering?

You'll find a PDF of the slides at the top of my blog by tomorrow morning:

annie.mathematicalthinking.org