

The Power of Students' Ideas

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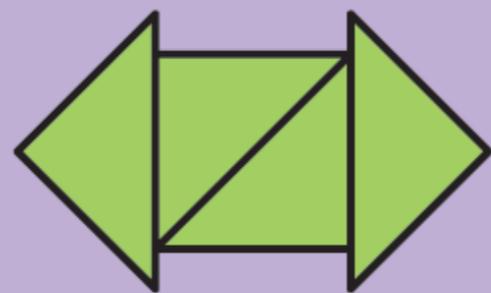
Please sit within chatting distance of at least one other person. Make a new friend!

A PDF of the slides and pointers to some related resources will be available on my blog after the session:
annie.mathematicalthinking.org

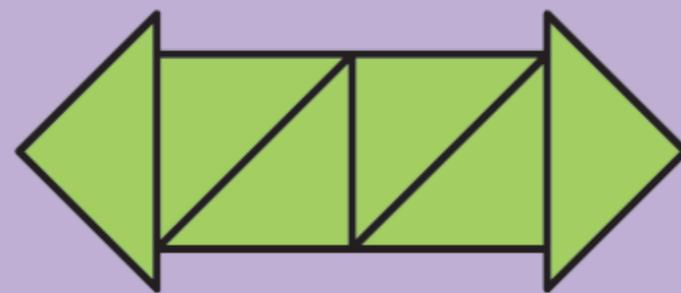
Annie Fetter
@MFAnnie
#NoticeWonder



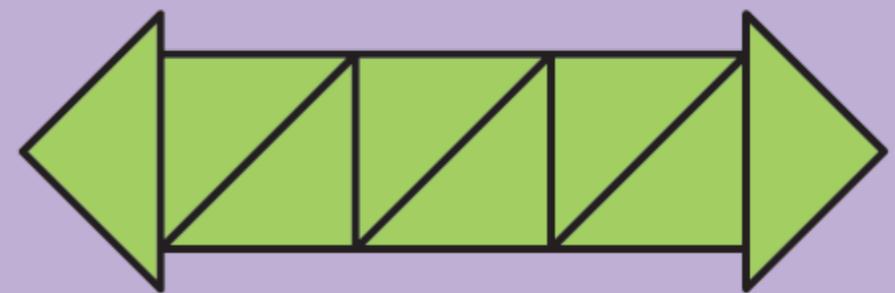
Growing Worms Scenario



1-day worm



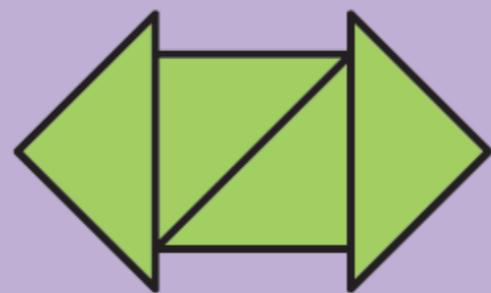
2-day worm



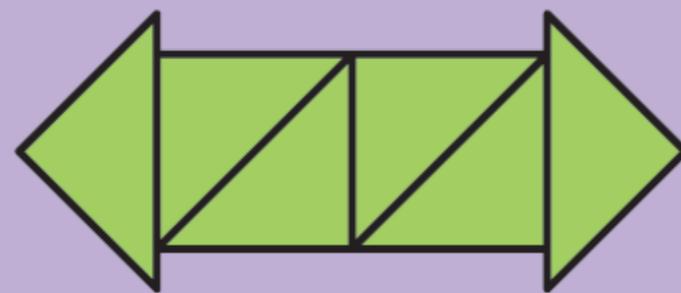
3-day worm

Growing Worms Scenario

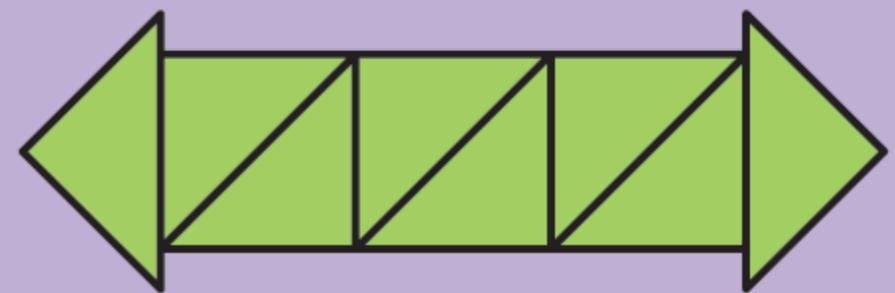
Growing Worms Scenario



1-day worm



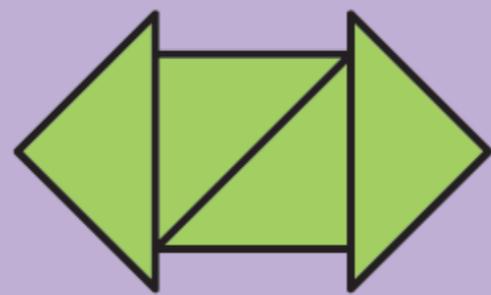
2-day worm



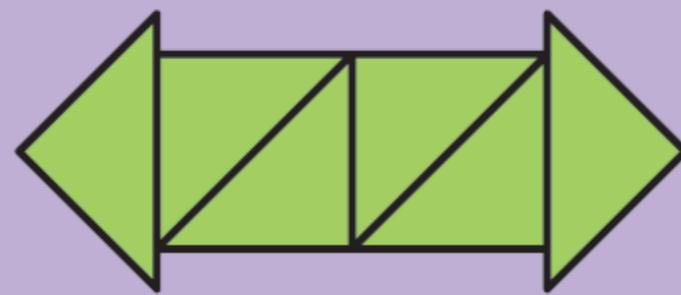
3-day worm

Growing Worms Scenario

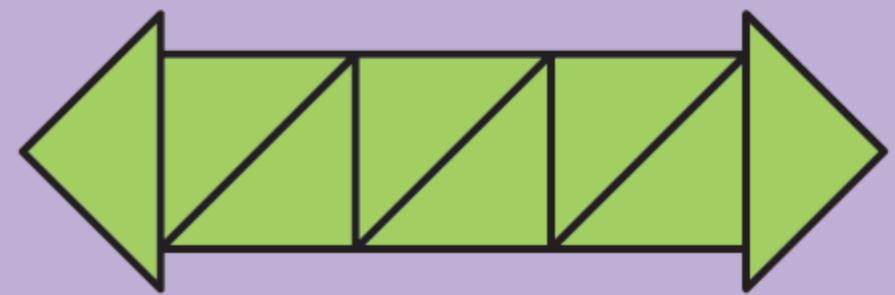
Growing Worms Scenario



1-day worm



2-day worm



3-day worm

I Notice

I Wonder

Growing Worms Student NW

N	W
- made of triangles	- is it a real worm?
- adding by one cube (square) each day	- why is it going sideways instead of up
- like a growing flower	- what does this have to do with math?
- growing sideways like a worm	- why is it made of triangles and not rectangles
- more like a zigzag	- why isn't it 3D
- each step all even numbers	- title growing worms?
- 4, 6, 8 ... counting by 2s	- why are the shapes green?
- <u>body</u> of the worm is growing each day	- when it gets to 10 squares will it have a different shape
- each day it gets longer	- when will the pattern stop
- green + black	- why are arrows facing away?
- diagonal line through each square	
- 2d shapes	
- labels below each	
- arrows on each end	
- every day there's ^{one more} square	

Notice	Wonder
- that we made 3 worms and they are all different sizes	- what the next worm will look like?
- We used different shapes - triangles and squares, too	- if I could make · 1 million day · 5 day · 100 day · infinity
- the worm gets bigger when we add a square	- if the worm can keep growing?
- everytime we made a new worm we added 1 square	- if the worms could be a pet or if you could take it out to dinner with you?
- there was a pattern - 2 triangles, 3 squares	- how cars are made?
- it grew when we added a square	- how triangles and squares are made?
- triangle, square, triangle pattern	- what would happen if the pattern would continue?

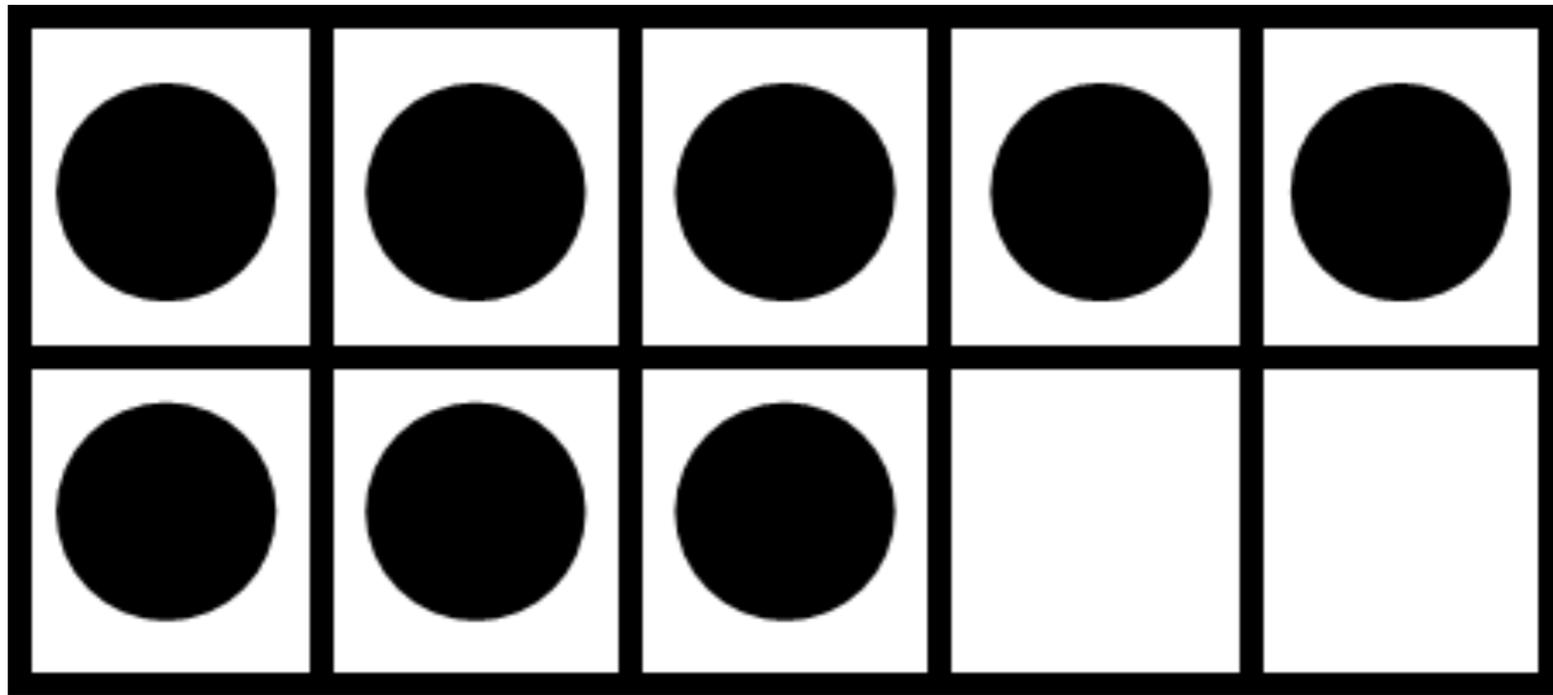
Growing Worms Movies

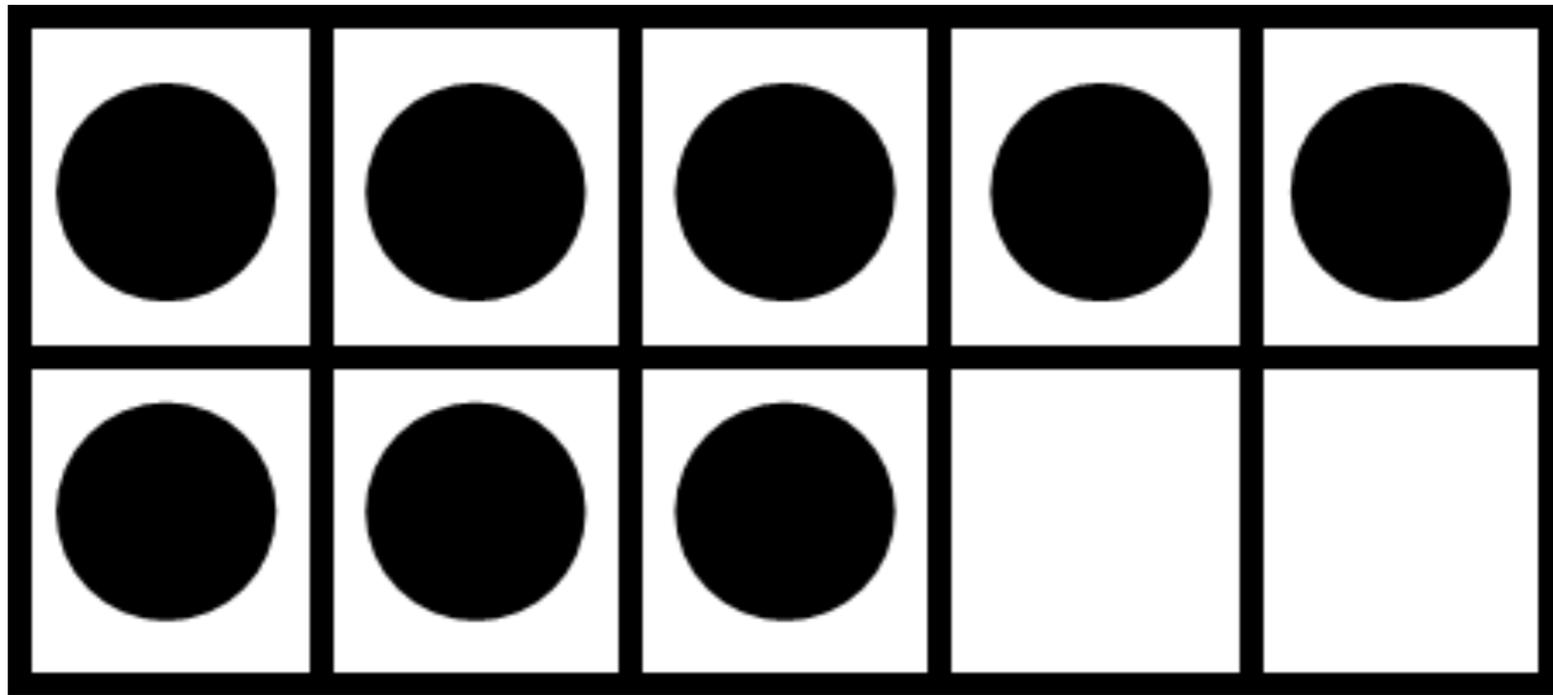
<https://www.heinemann.com/pps/video.aspx>

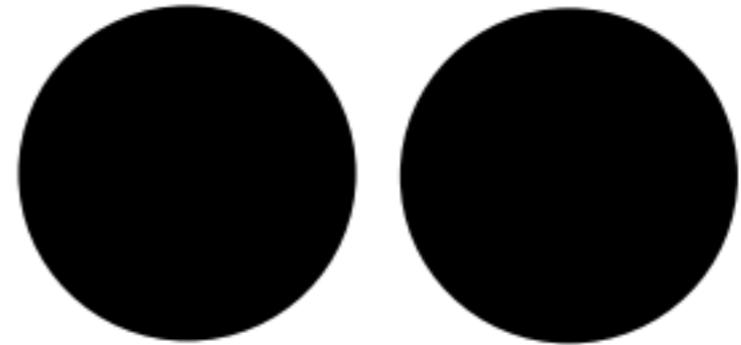
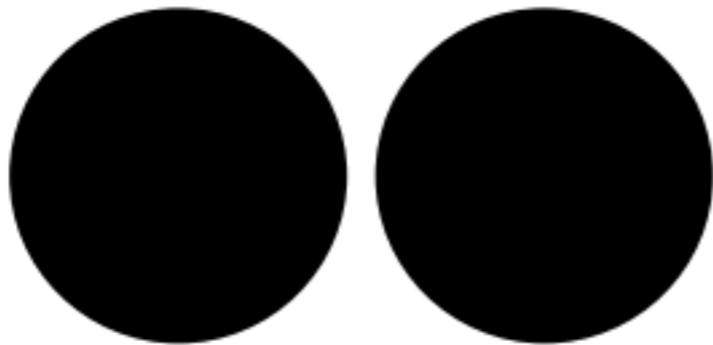
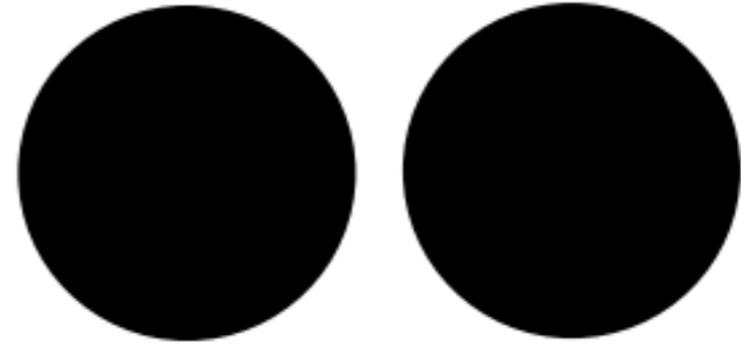
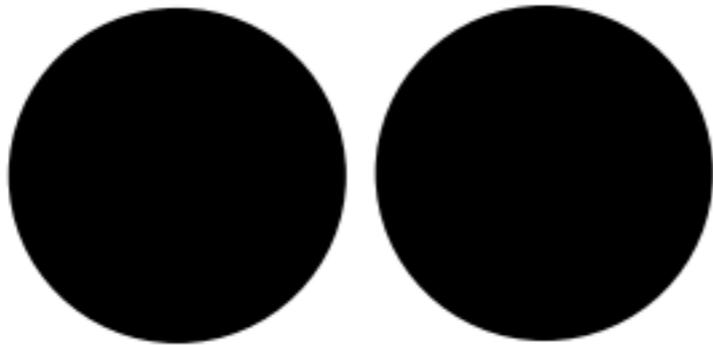
See, especially, the first three videos, where Val presents Growing Worms to 3rd graders using the same basic method we used today.

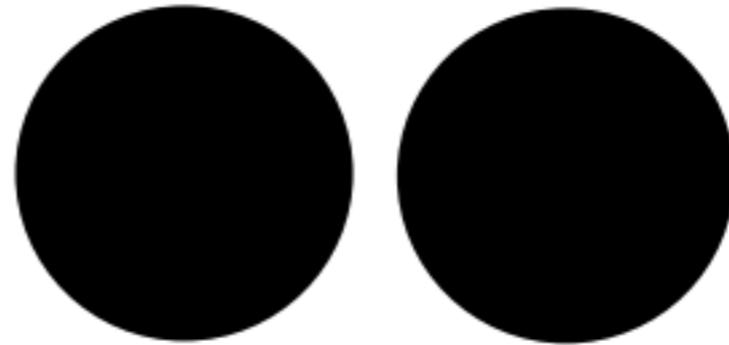
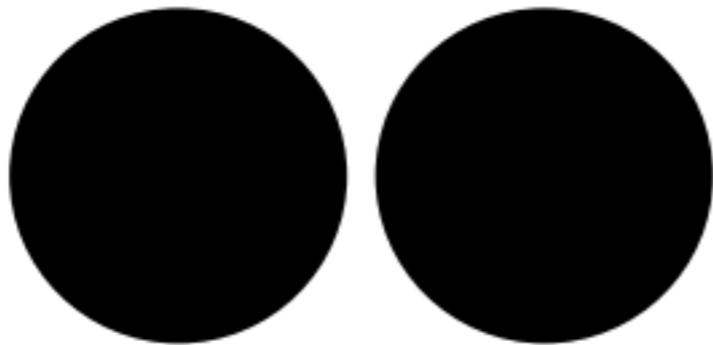
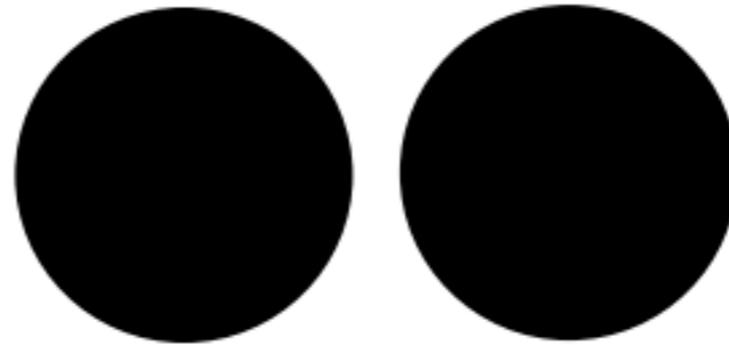
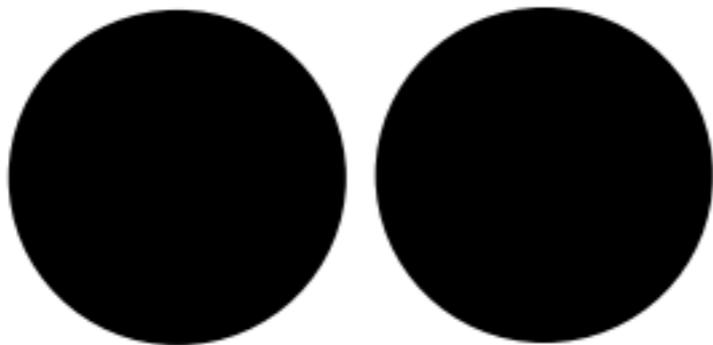
How Many? How Did You Count?

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



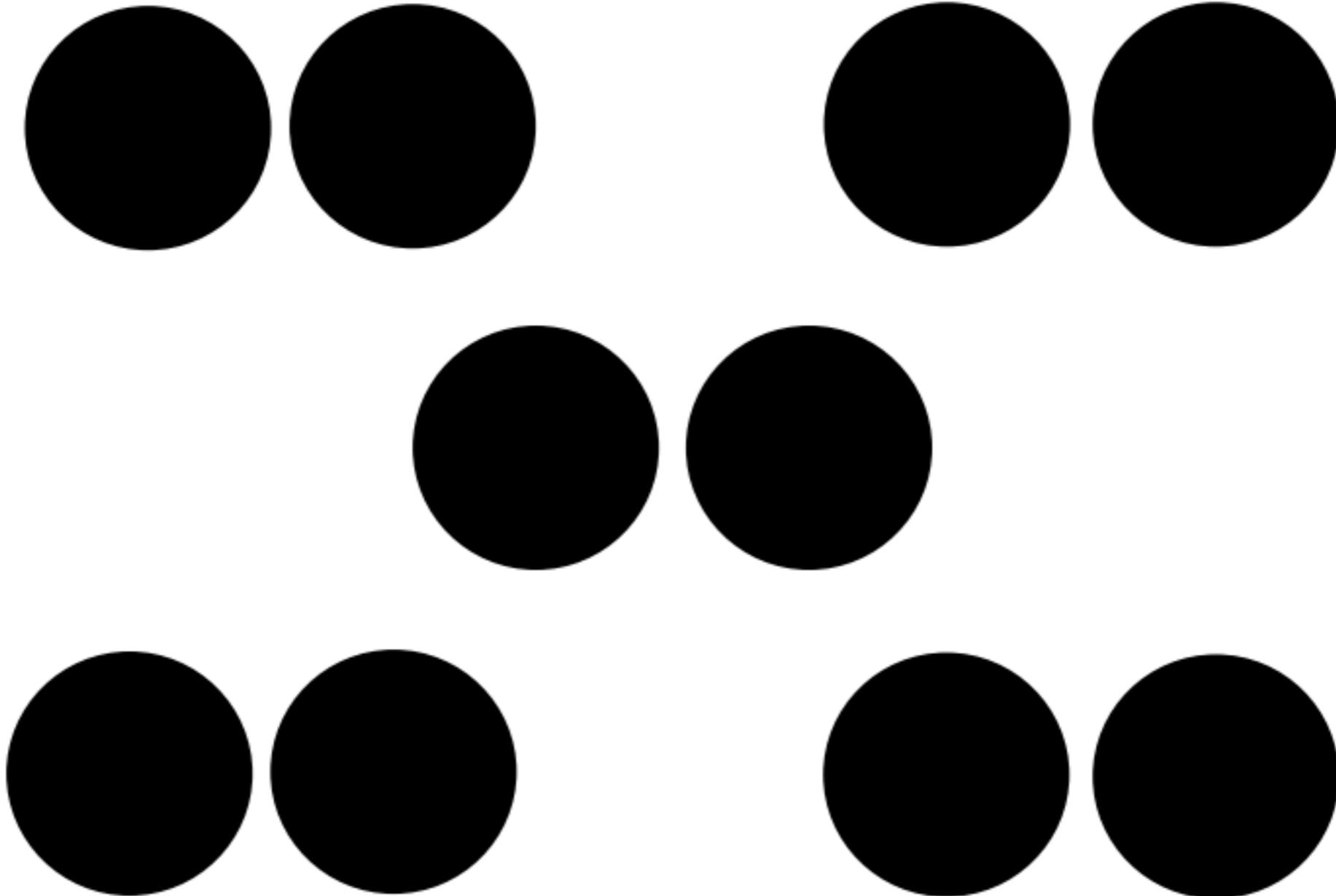






New Guidelines

- 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.

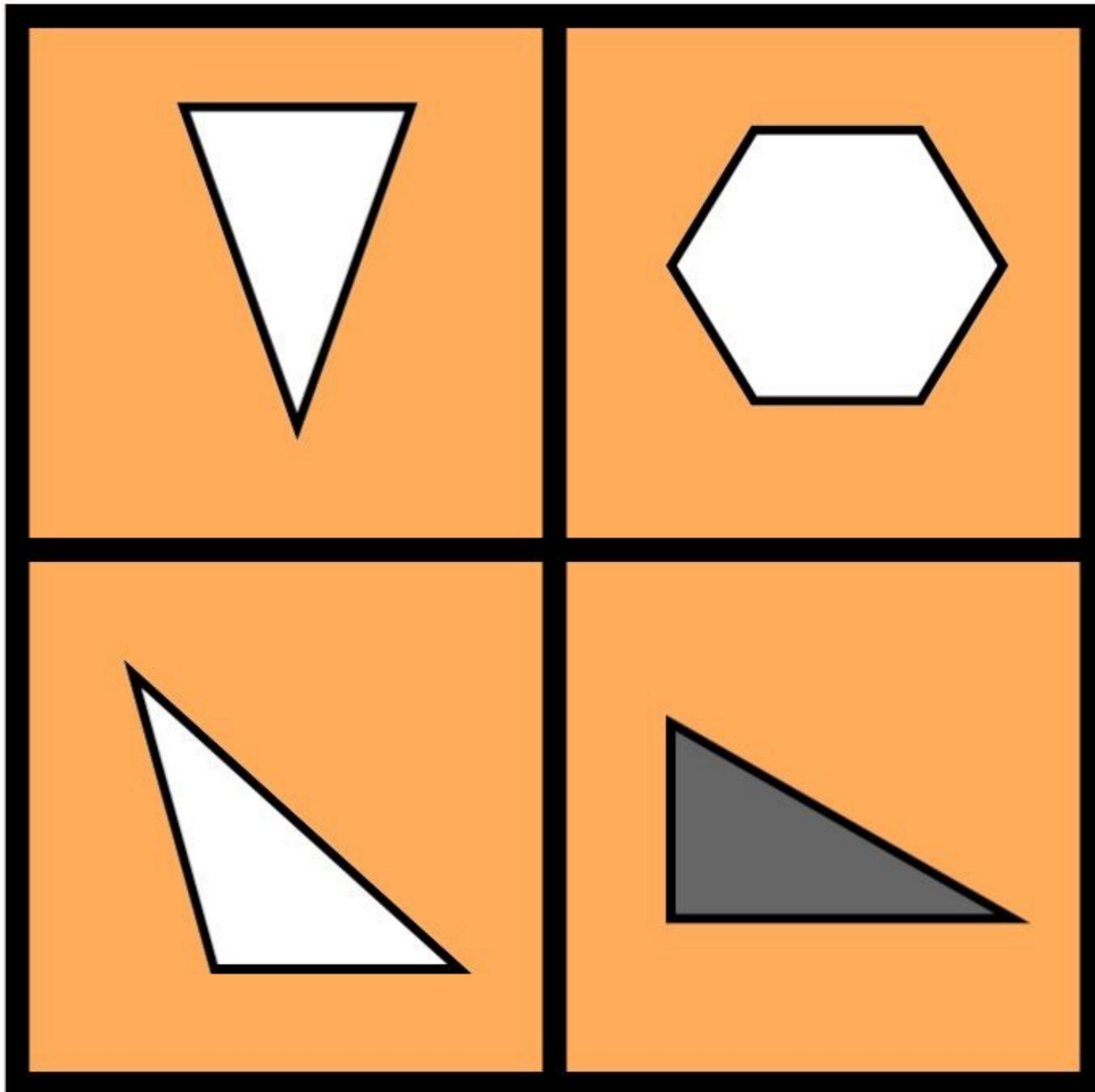


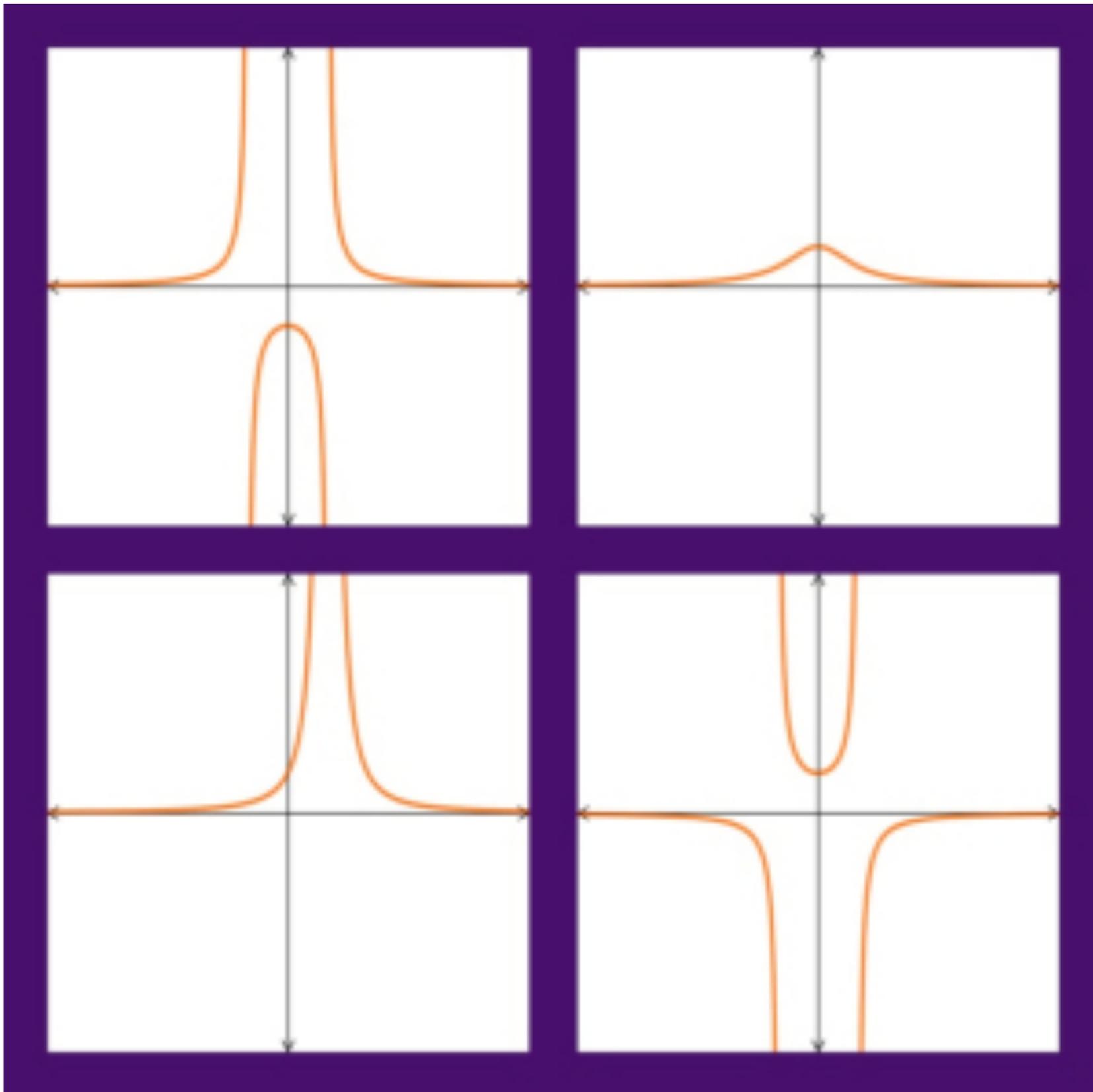
Dot Talks

26 + 49

23 x 25

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.

Sample 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

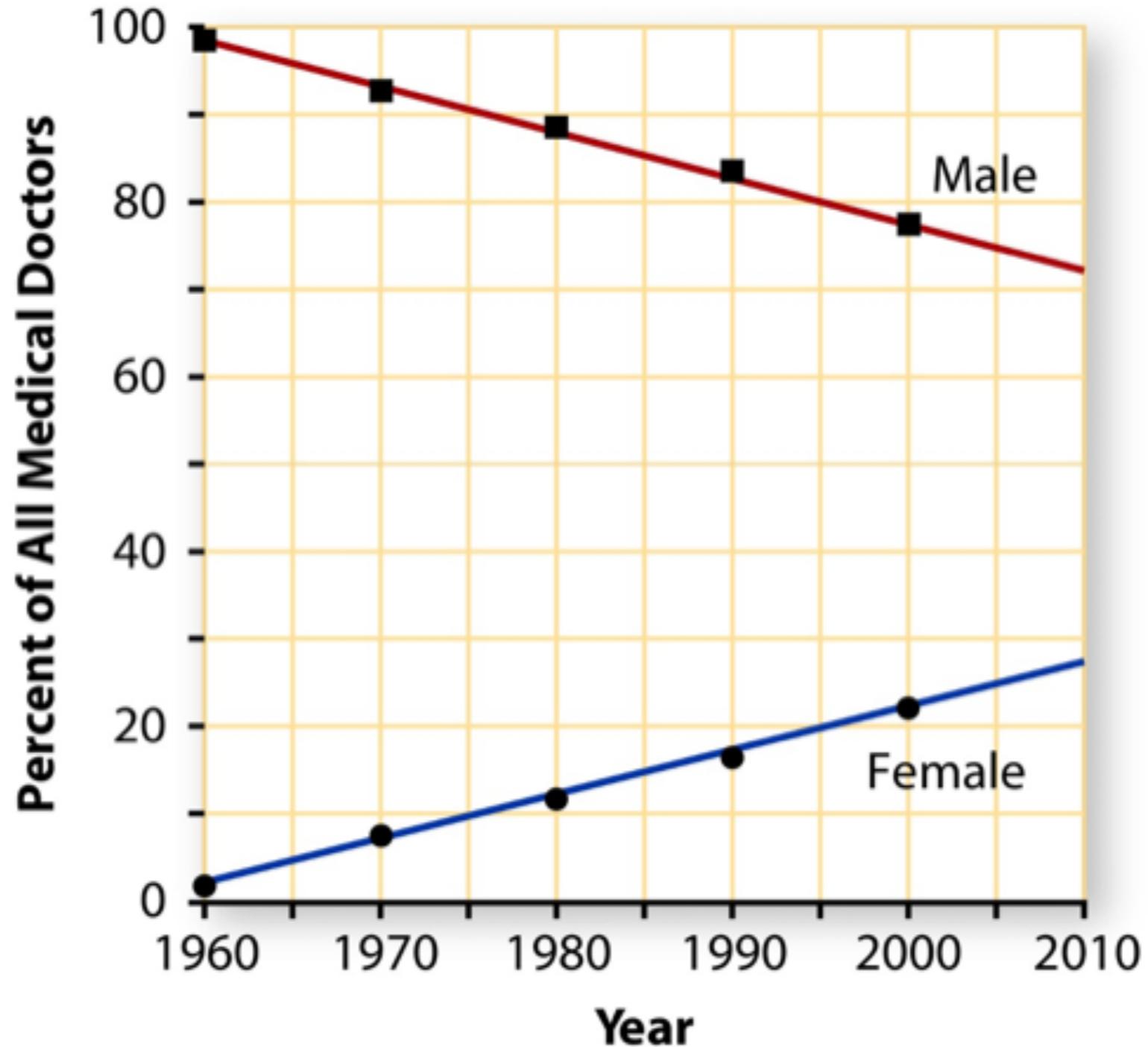
Apple juice costs 50¢. The juice machine accepts quarters, dimes, and nickels.

I Notice

I Wonder

Get Rid of the Question

Male and Female Medical Doctors



Ask for Questions, Not Answers

Solve & Share

493

A pet store has 162 goldfish, 124 angelfish, and 53 pufferfish. How many fish are there in all? How might an estimate help you solve the problem? *Solve this problem any way you choose.*

0:01:44

When you are finished, turn to page 497, circle numbers 1-8, 9, 12, and 13, carefully rip it out and put it in your take-home folder.

If you finish early complete the Look Back.

Thursday

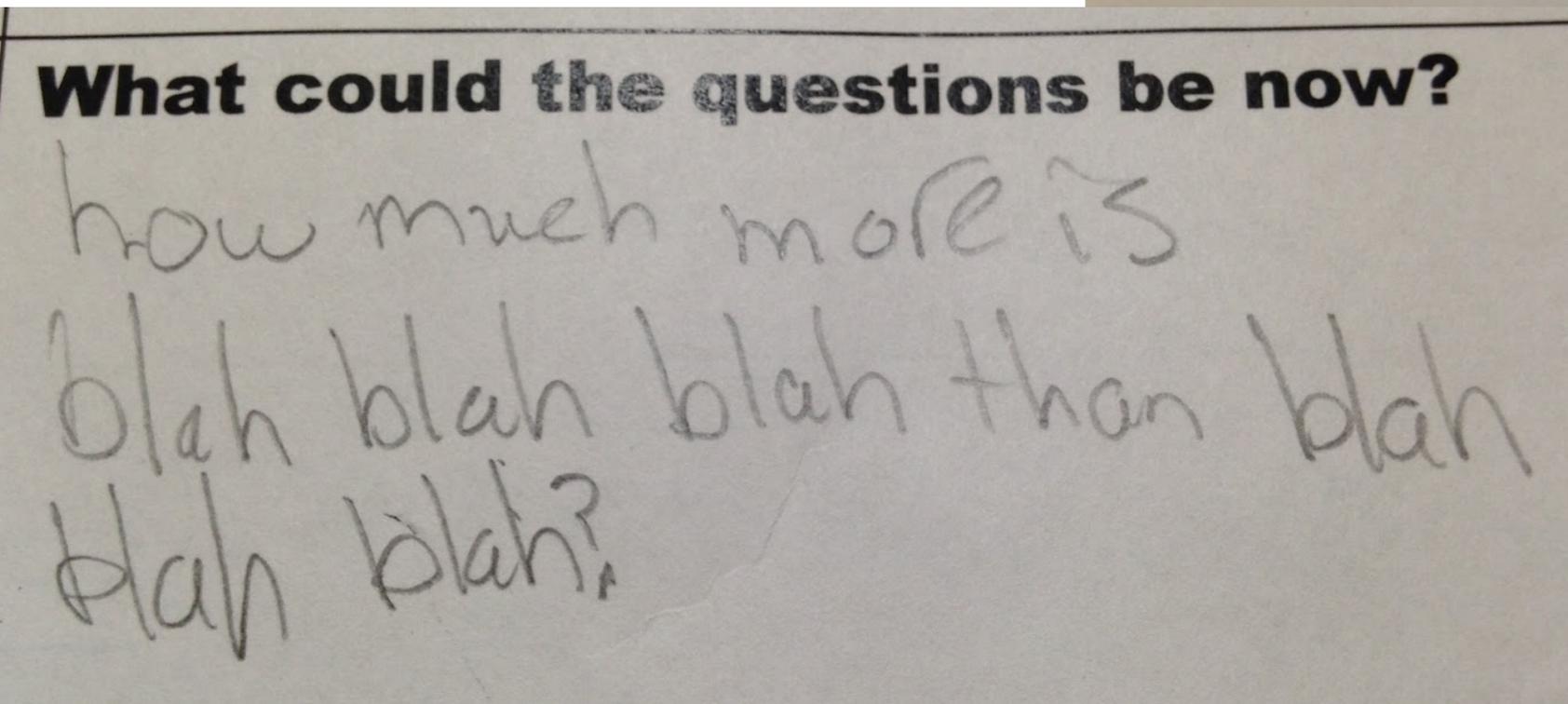
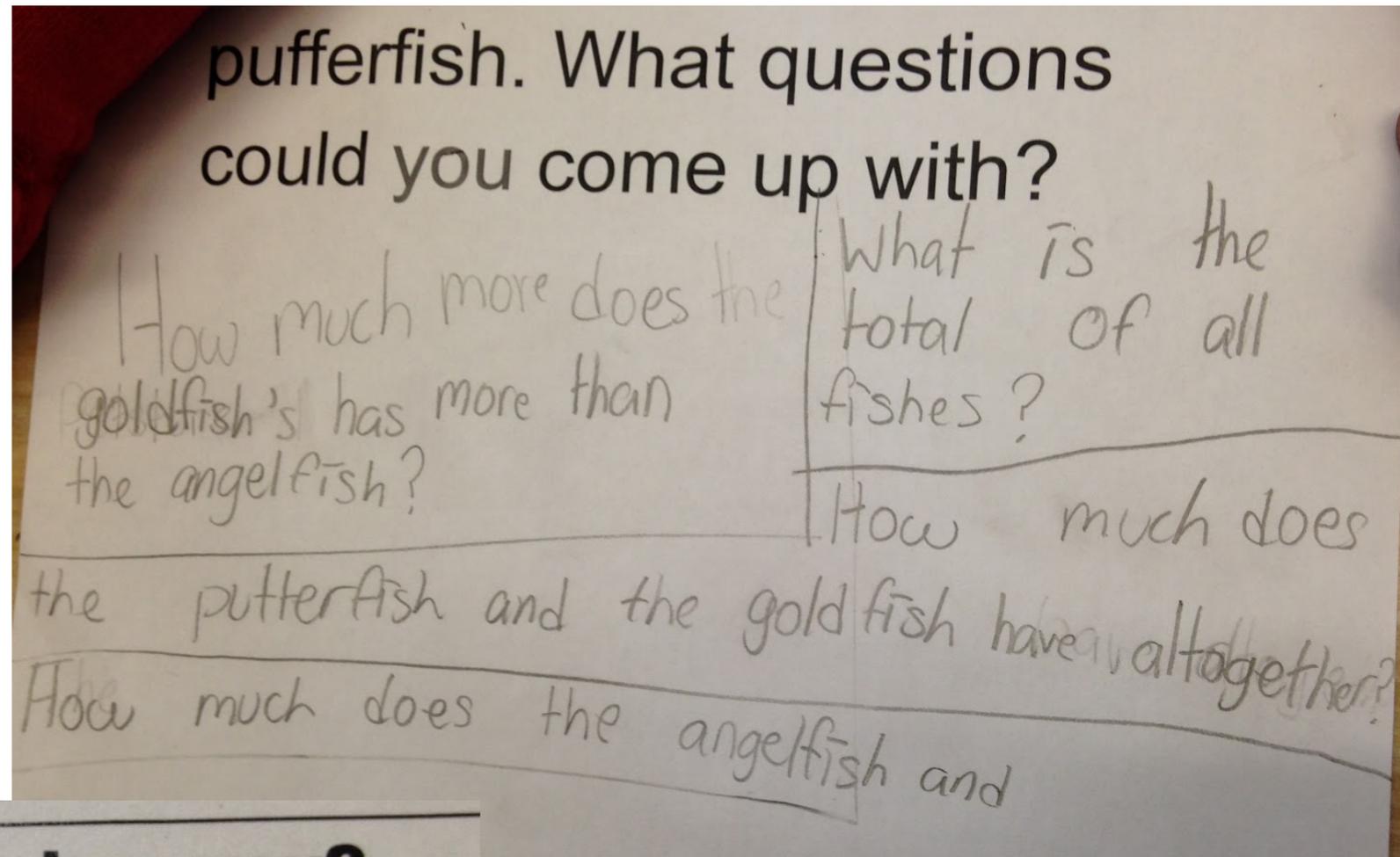
A pet store has 162 goldfish 124 angelfish, and 53 pufferfish. What questions could **you** come up with?

00:03 39

5 minutes on your own
3 with a partner
All together

Annie Fetter
@MFAnnie
#NoticeWonder

Ask for Questions, Not Answers



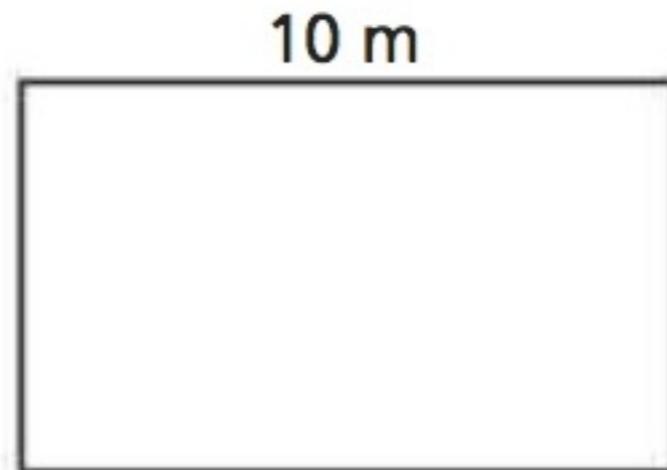
Eliciting Students' Ideas

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.

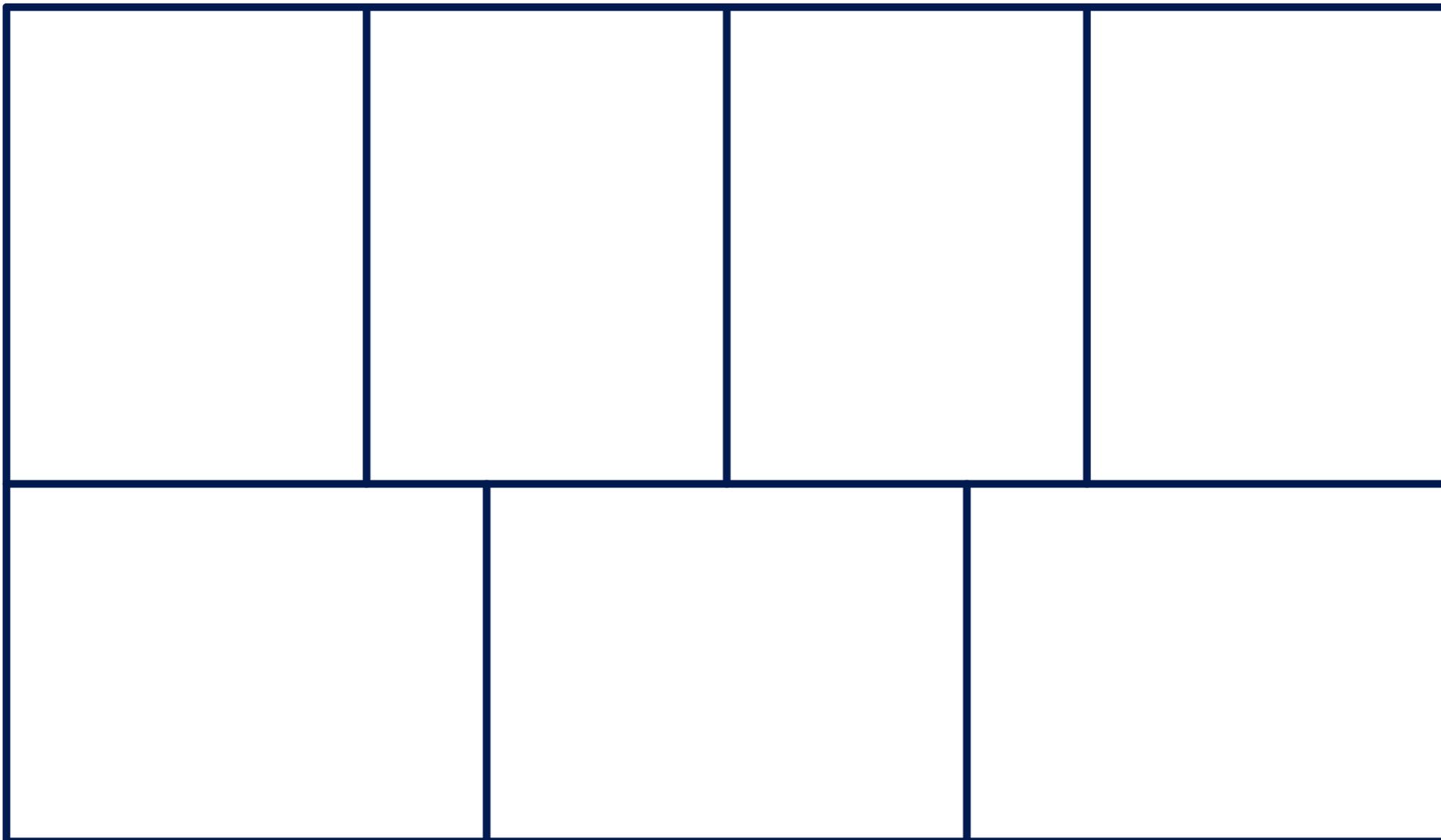
Get Rid of the Question and the Numbers

15. The area of the rectangle is 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

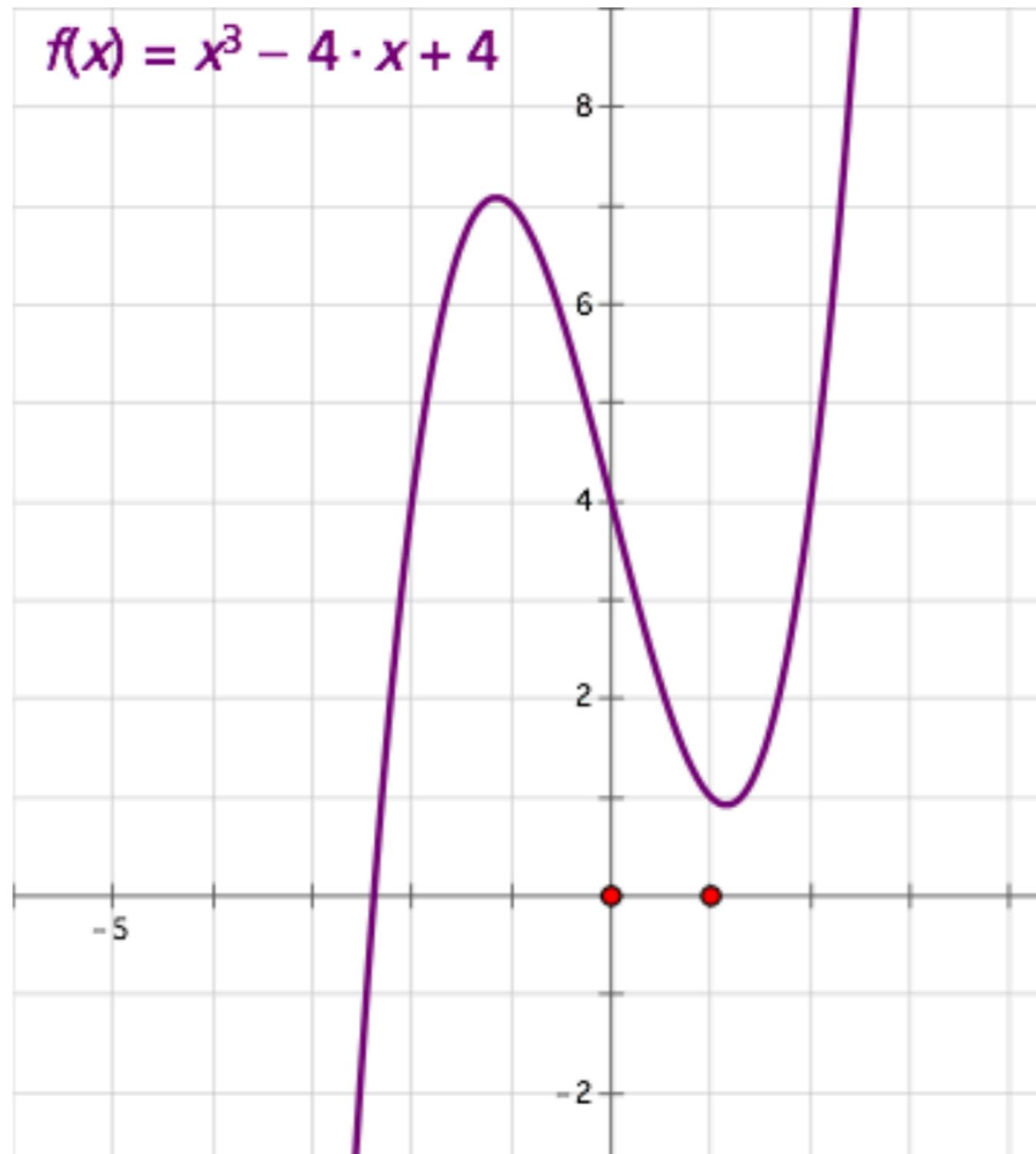
1. Suppose 5 U.S. dollars (5 USD) can be exchanged for 64 Mexican pesos. What operation would be used to find the value of 1 USD in pesos?

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.

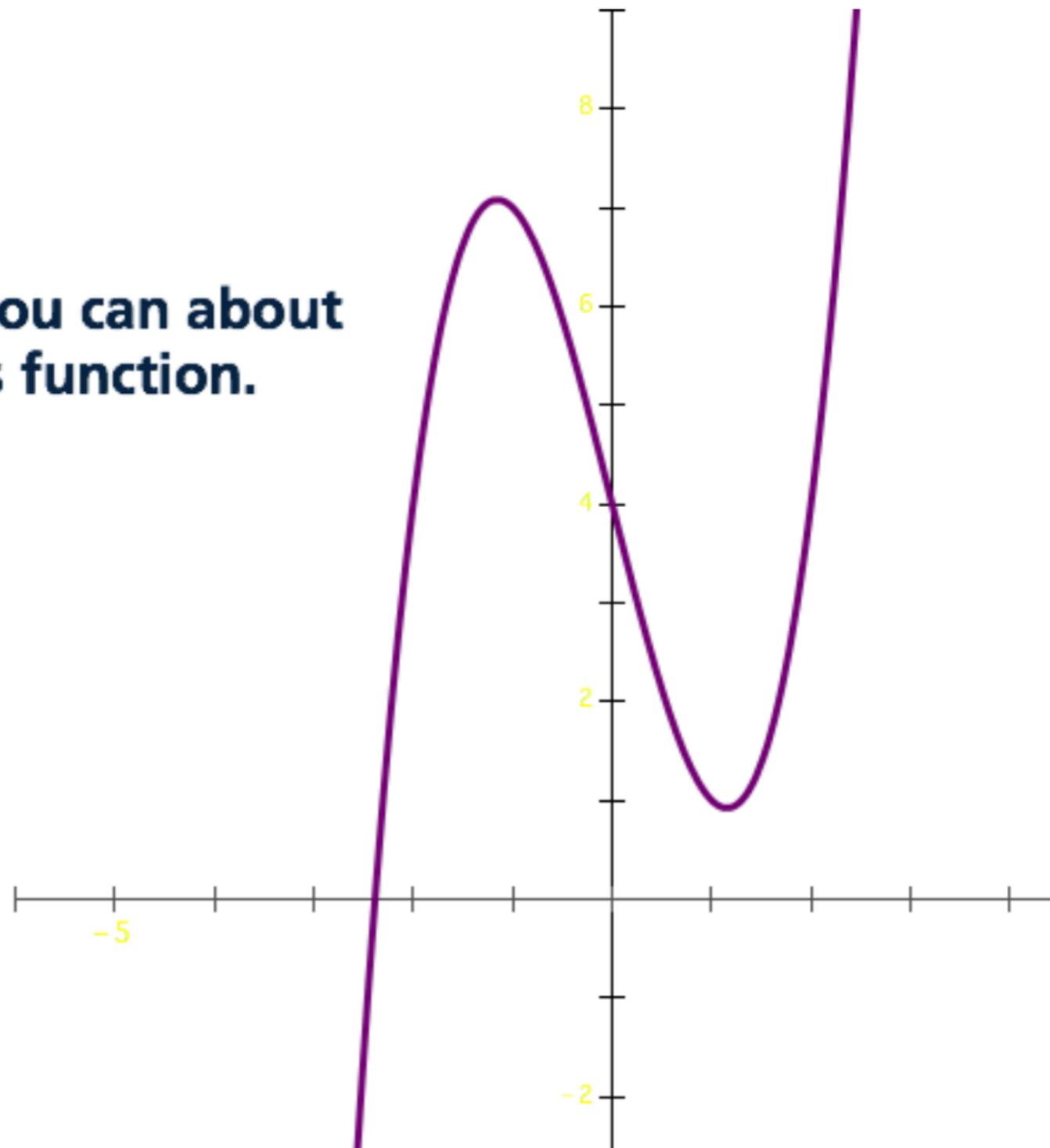
Ask About Ideas, Not Answers



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.

Thoughts from Other Sessions

Jackie Palmquist: *Number Talks for Secondary Students:
An Opportunity for Equity, Voice, and Mathematical
Reasoning*

<https://www.thumbsupmath.com/>

Thoughts from Other Sessions

Jessica Breur and Ella Hereth: *Let's Talk about It: Using Desmos to Encourage Math Conversations*

Using Desmos Snapshots to Share Students' Voices and Ideas

Thoughts from Other Sessions

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.”

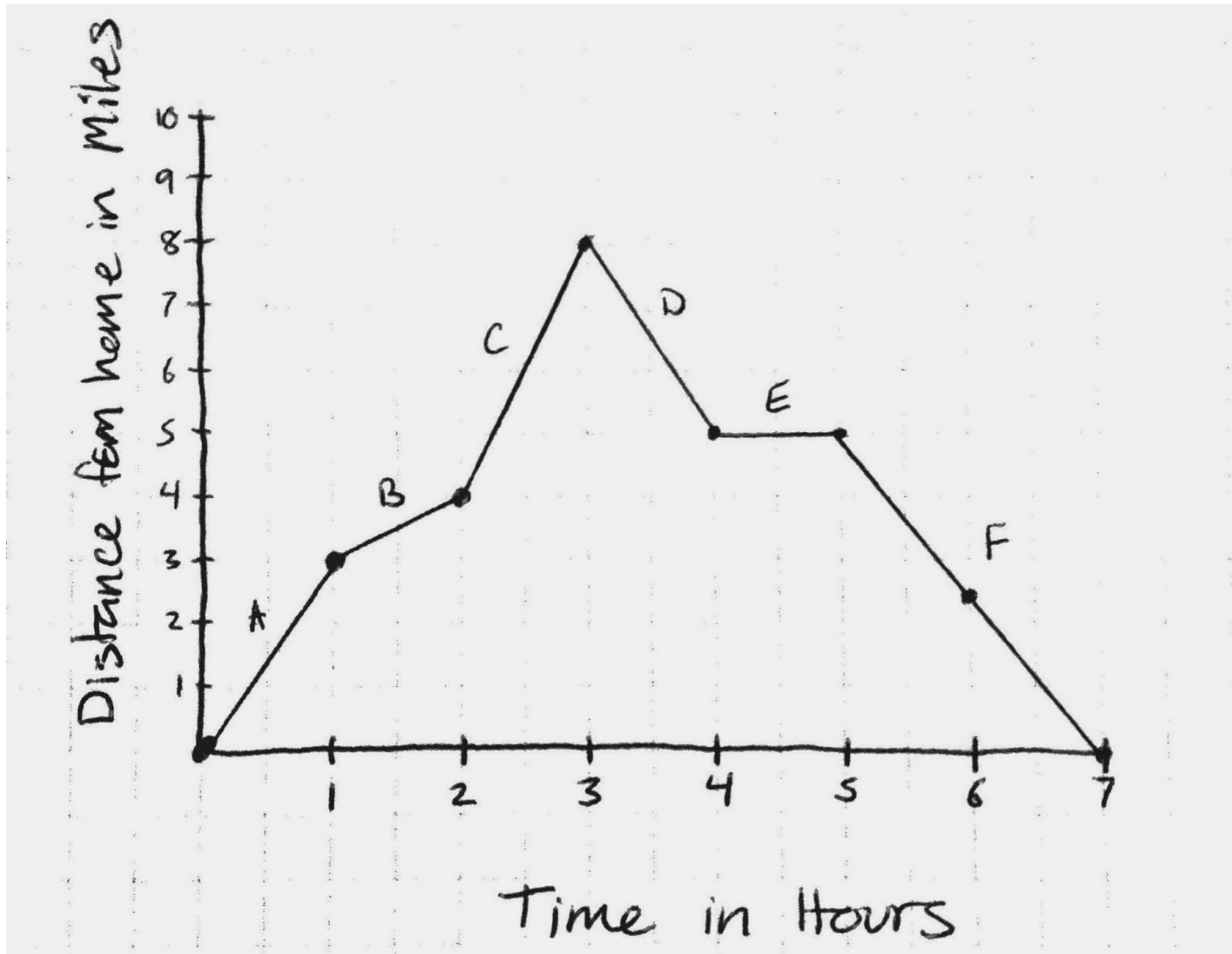
“...you get to think about the problem more and you realize more.”

“...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?





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>

Annie Fetter
@MFAnnie
#NoticeWonder



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

Annie Fetter
@MFAnnie
#NoticeWonder

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

Thanks for coming!