Is Sense-Making at the Core of Your Classroom?

Annie Fetter
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PCTM, August 2018

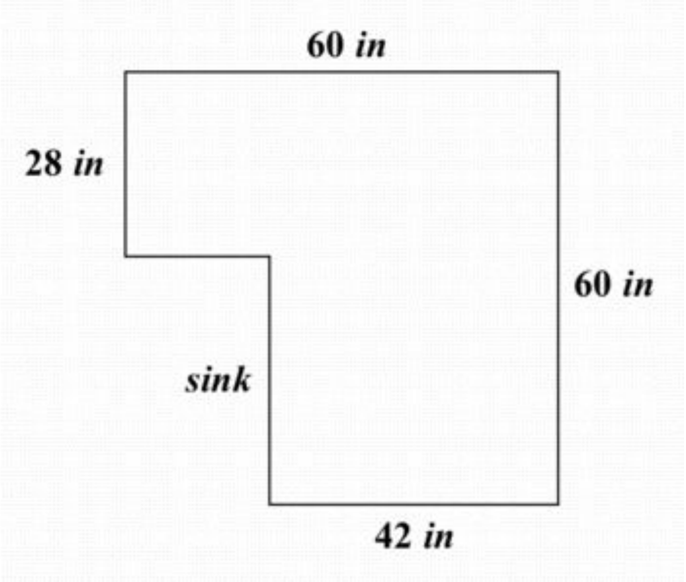
Teresa's Tiles

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?

Extra: What is the size, using whole numbers, of the largest square tile that could be used to tile the entire floor with no cut pieces?



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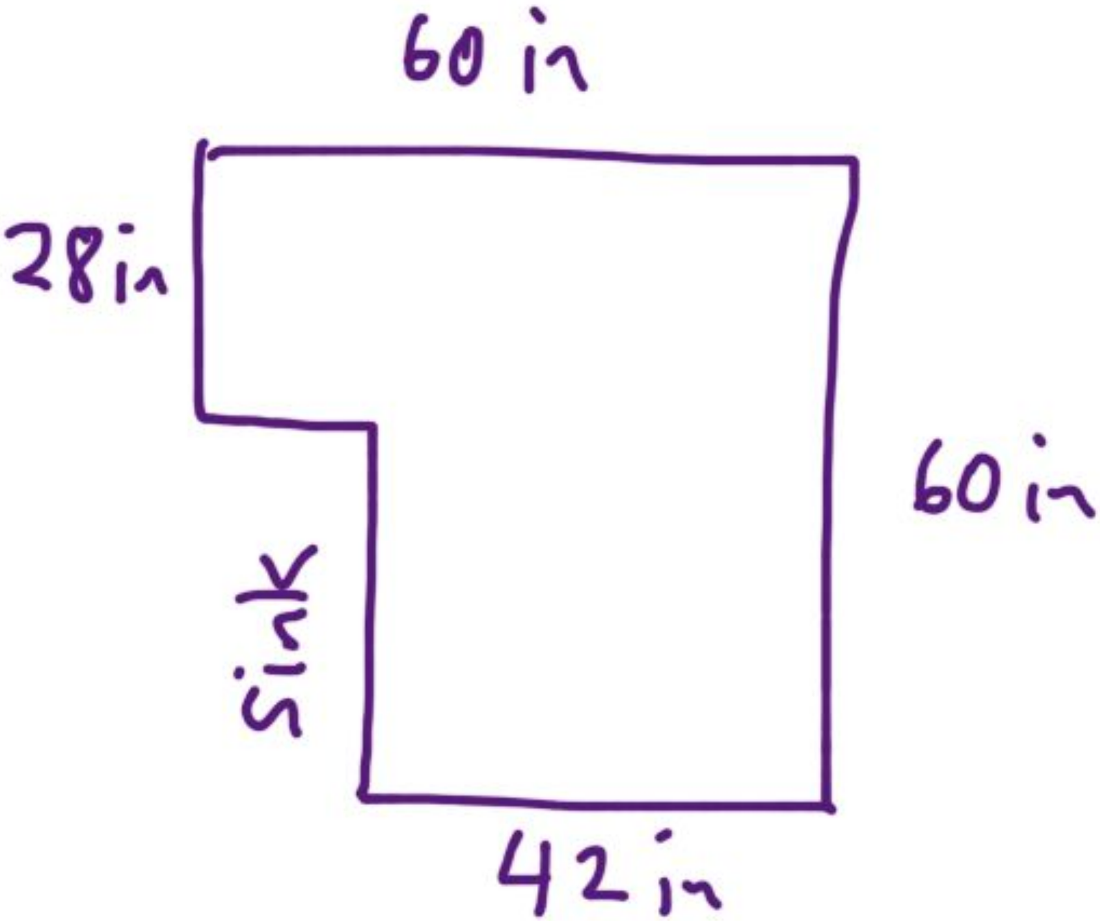

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Teresa's Tiles

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

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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.

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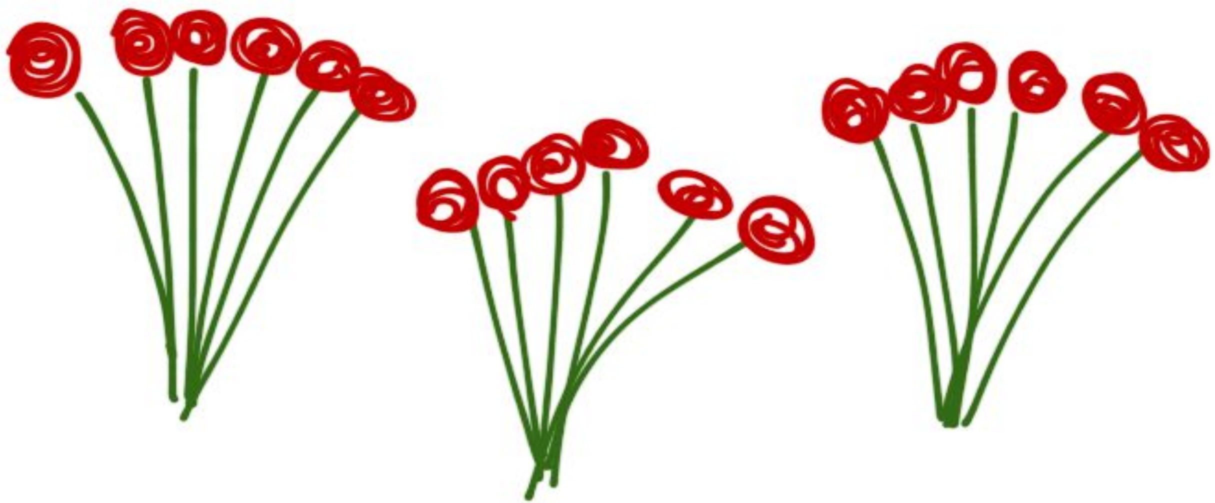
Sample Test Question Revised

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



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“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!!”

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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(wears sunscreen)
P(is a boy)
P(wears sunscreen | is a boy)

P(wears sunscreen *and* is a boy)
P(wears sunscreen *or* is a boy)
P(is a boy | wears sunscreen)

P(is a boy *or* a girl)

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Student Perceptions of Math and Sense Making

1. You aren’t supposed to sense-make when doing math.
2. You are supposed to use rules and algorithms and accept whatever answer results.
3. You are supposed to do what your teacher said, even when it doesn’t seem like a good idea.

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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.

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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.”

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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.

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Get Rid of the Question

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

I Notice	I Wonder

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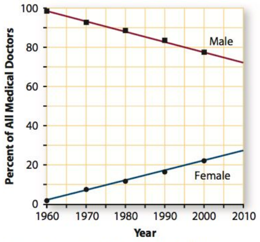
LESSON 2

Linear Equations and Inequalities

For most of the twentieth century, the vast majority of American medical doctors were men. However, during the past 40 years there has been a significant increase in the number of women graduating from medical schools. As a result, the percent of doctors who are women has grown steadily to nearly 25% in 2000. The graph on the next page shows this trend.

Susan Van Etten/PhotoEdit

Male and Female Medical Doctors



Source: www.ama-assn.org/ama/pub/article/171–195.html

Think About This Situation

Study the trends in the percentage of male and female medical doctors in the United States between 1960 and 2000.

a How would you describe the trends shown in the data plots and the linear models that have been drawn to match patterns in those points?

b Why do you suppose the percentage of women doctors has been increasing over the past 40 years?

c Would you expect the trend in the graph to continue 10 or 20 years beyond 2000?

d How would you go about finding function rules to model the data trends?

e If you were asked to make a report on future prospects for the percentages of male and female doctors, what kinds of questions could you answer using the linear models?

In this lesson, you will explore ways to express questions about linear functions as equations or inequalities. You will use tables, graphs, and symbolic reasoning to solve those equations and inequalities and to interpret your solutions in problem contexts.

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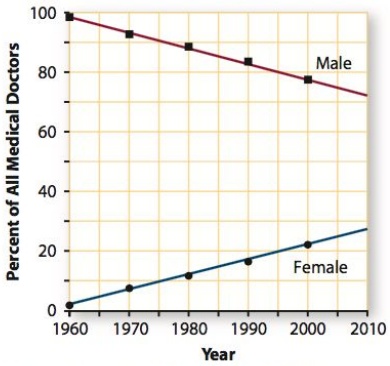
Male and Female Medical Doctors



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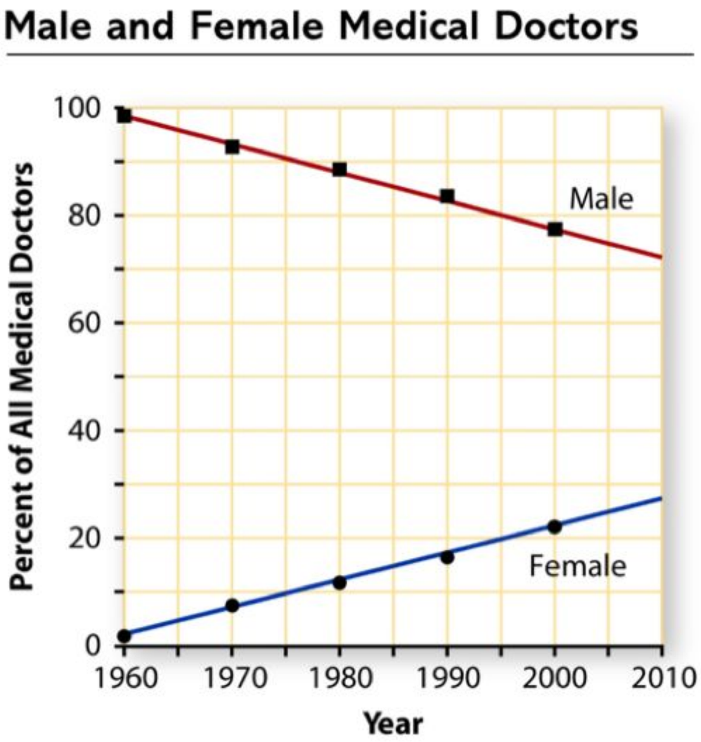
Get Rid of the Question



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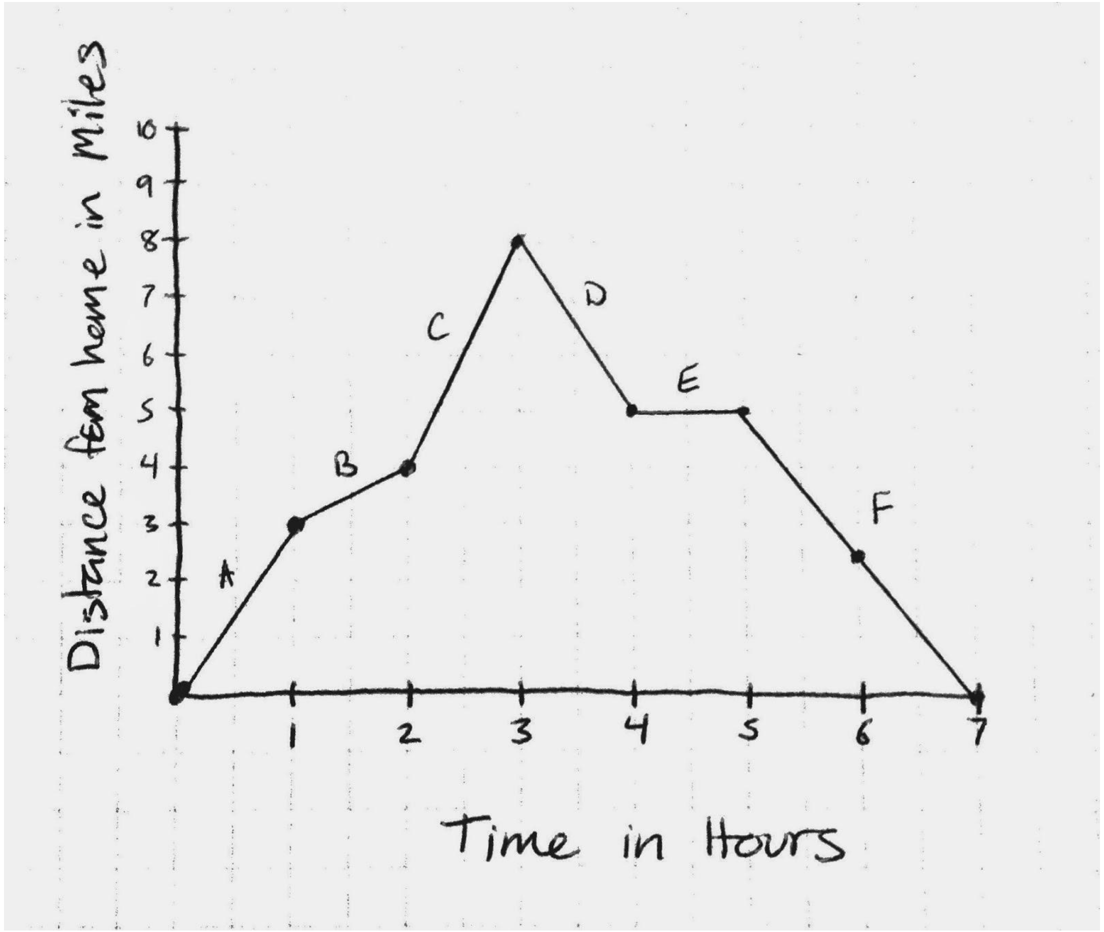
Tina Cardone @crstn85



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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...

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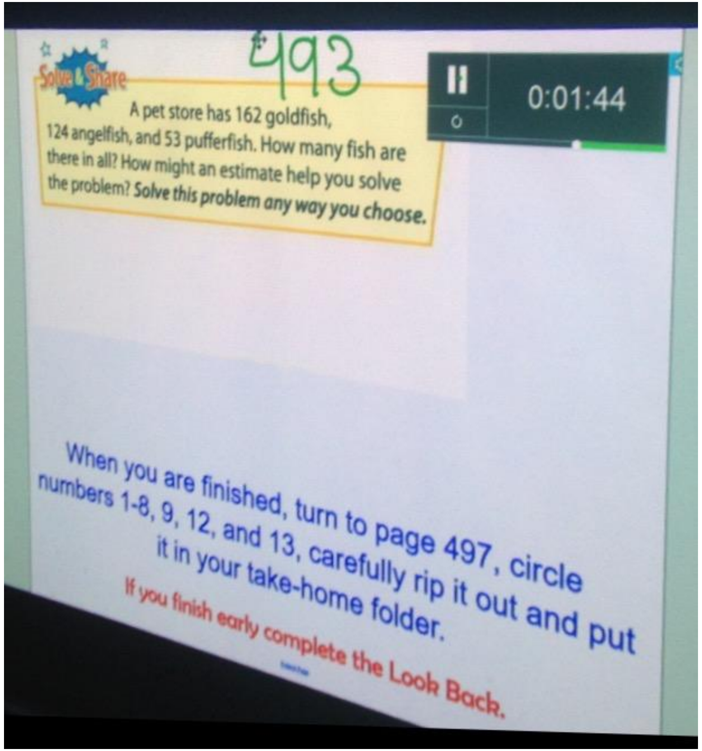
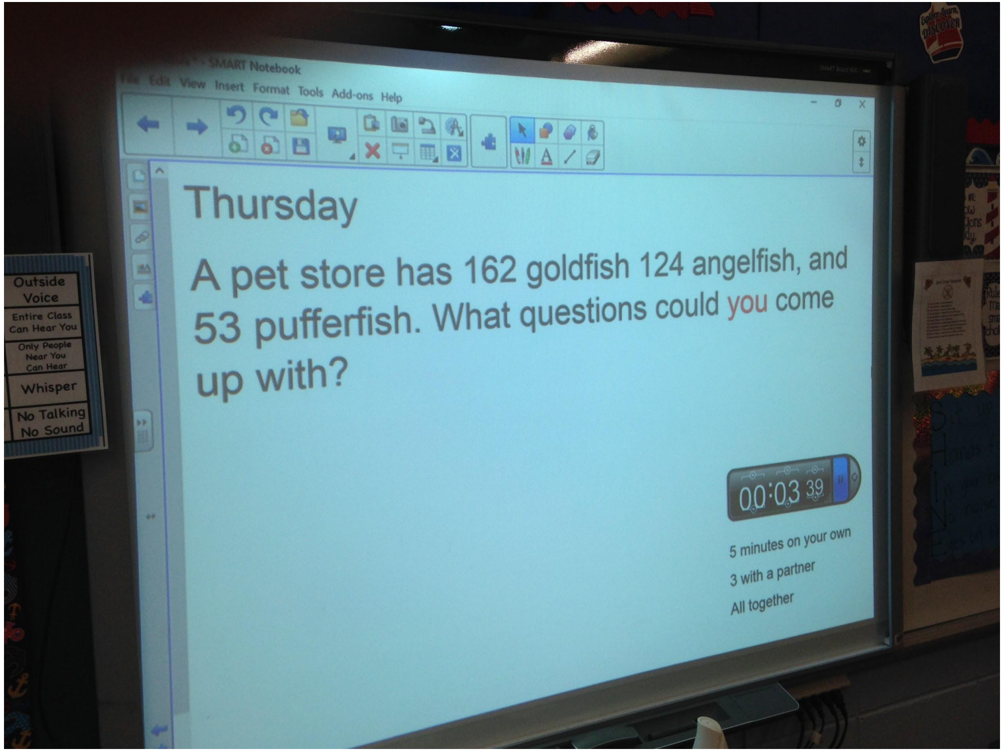
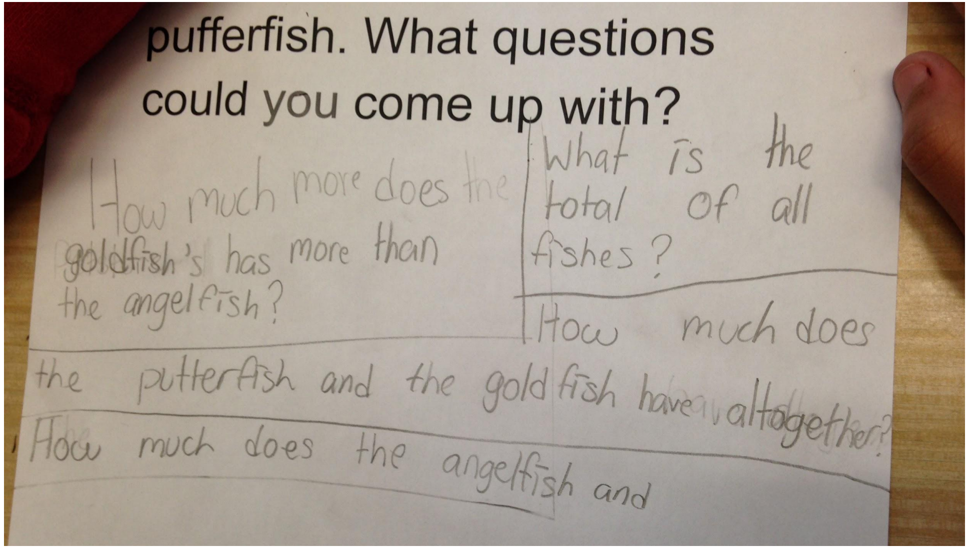
http://drawingonmath.blogspot.com/2014/11/distance-graph.html

Ask For Questions, Not Answers





@MFAnnie & @JSchwartz10a



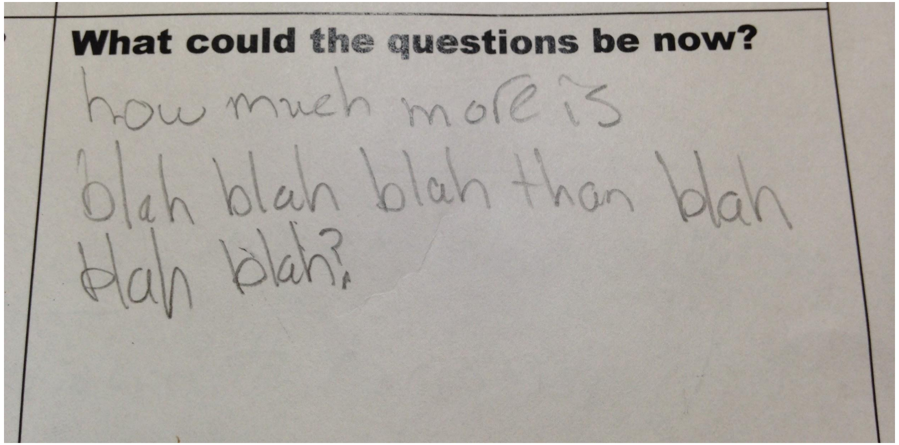
pufferfish. What questions could you come up with?

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



What could the questions be now?

how much more is blah blah blah than blah blah blah?

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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.

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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

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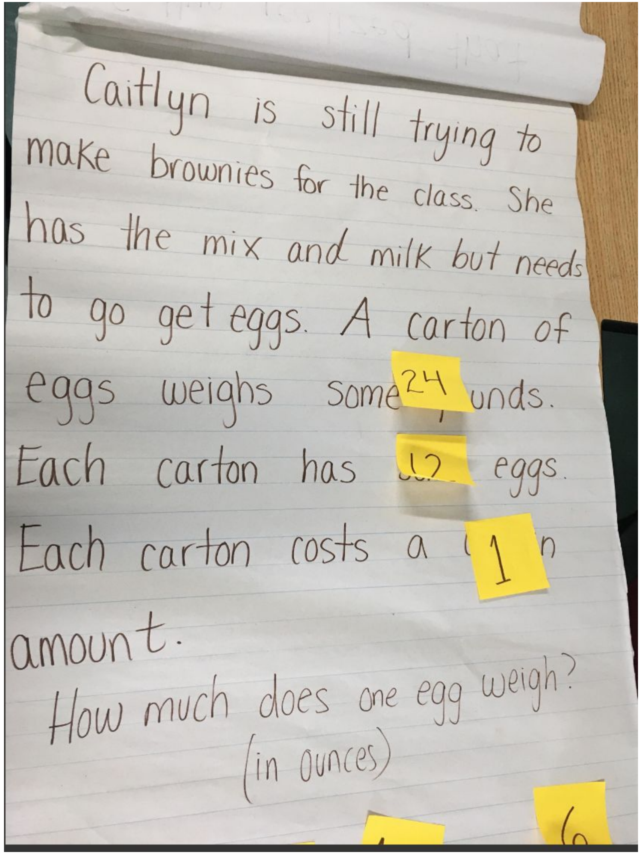

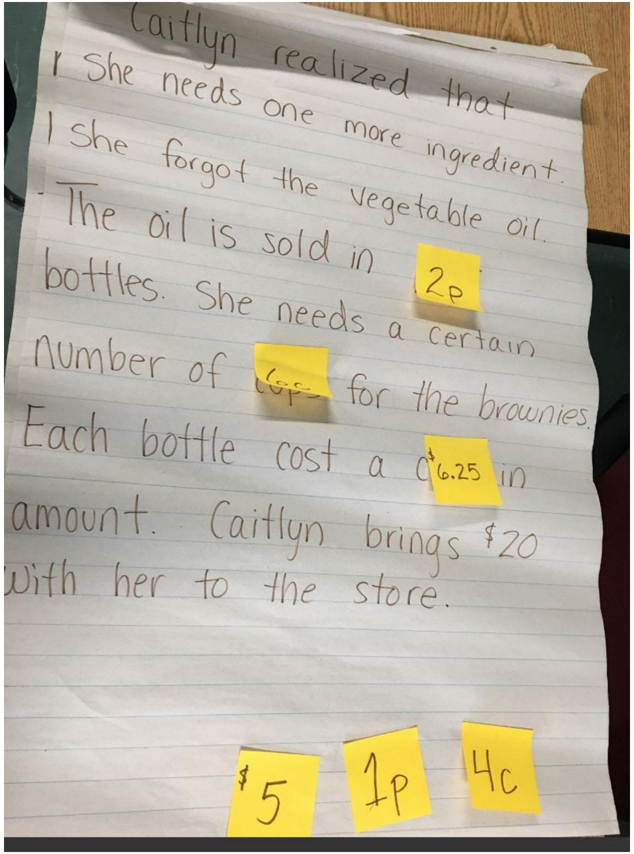

From Kat Kulis, grade 5, Windham Center School, Windham, CT

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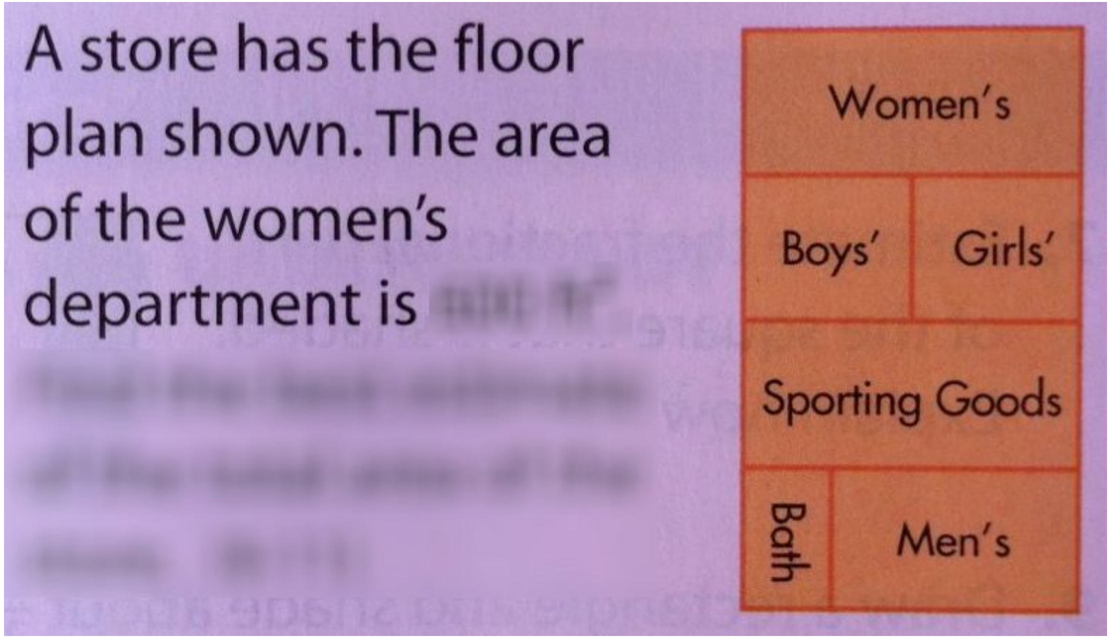
Get Rid of the Question <u>and</u> the Numbers



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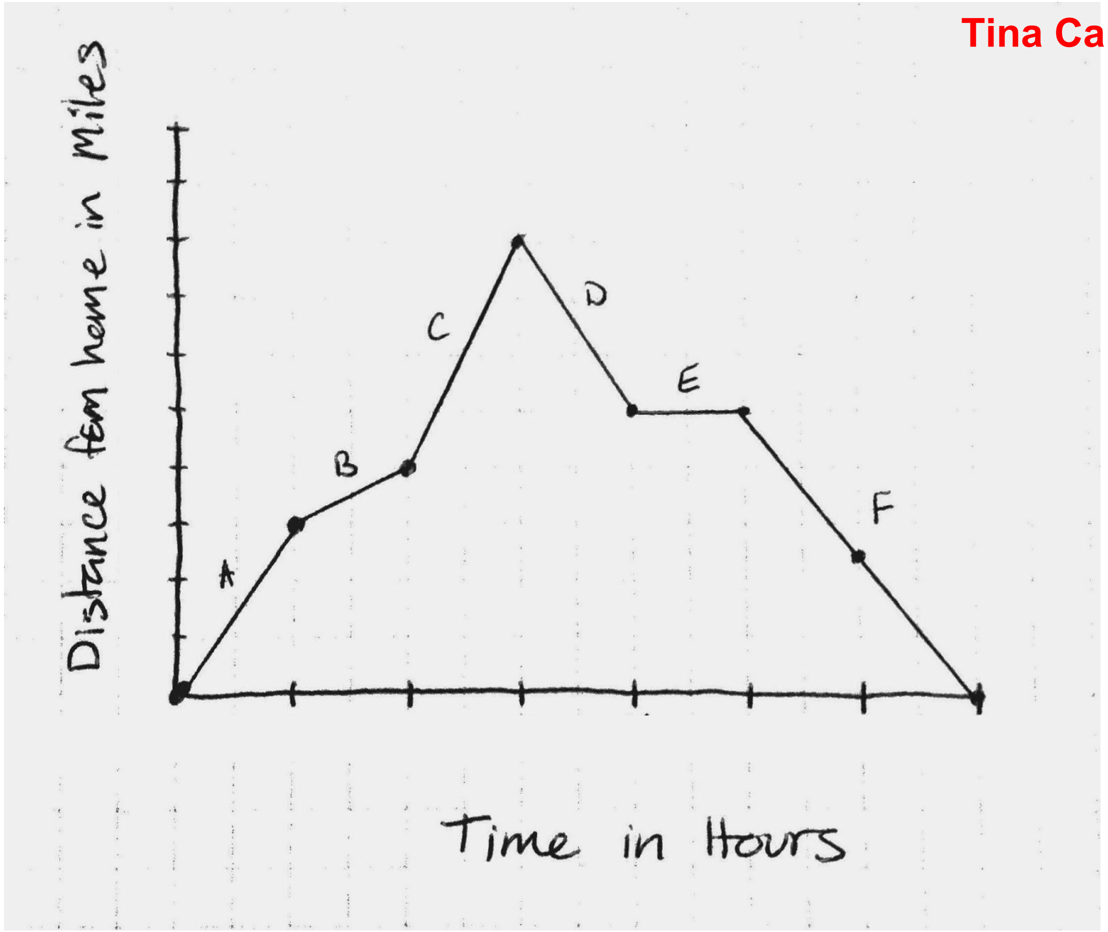
Tina Cardone @crstn85



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Numbers vs. Relationships

$$A = \pi r^2$$

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Encouraging Sense Making

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

A: Give the answer.

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Give the Answer

✦ Math Message Follow-Up

WHOLE-CLASS ACTIVITY

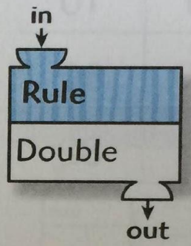
Draw or display a function machine and "What's My Rule?" table. (See Advance Preparation.)

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

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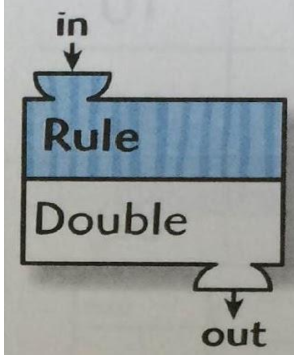
Give the Answer



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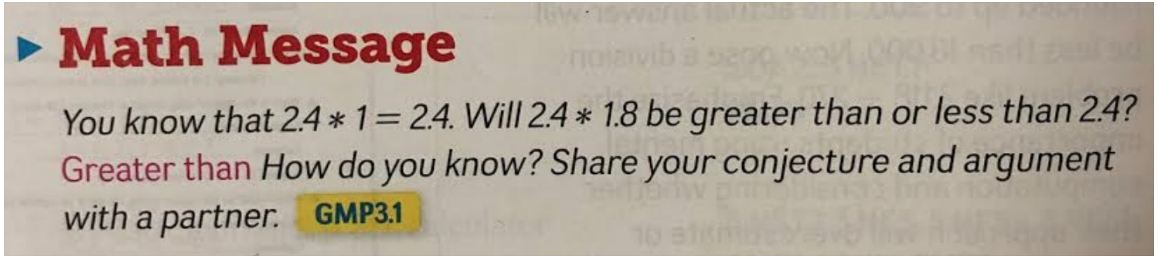

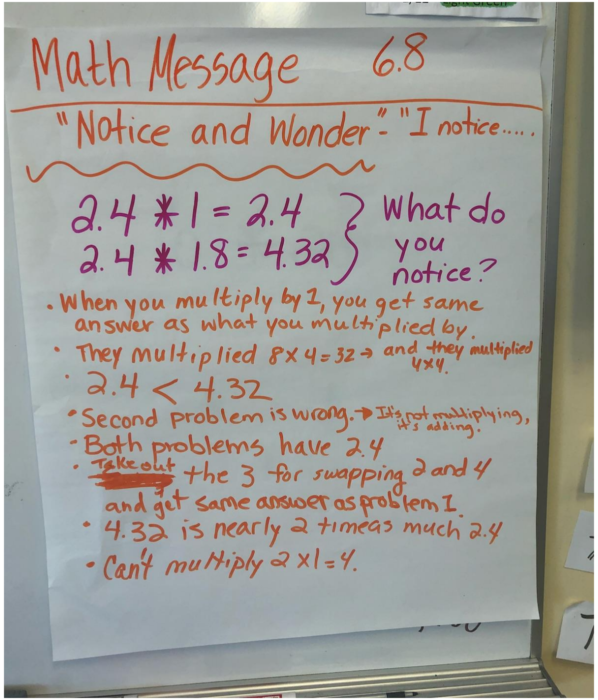

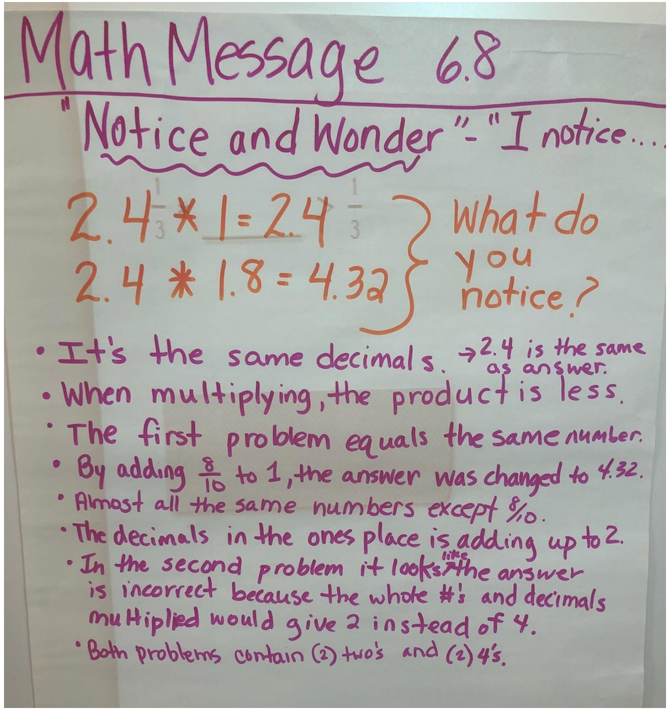

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Sally Nordyke, Grade 5, Daniel F. Ryan School 19, Passaic, NJ

Give *an* 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?

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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?"

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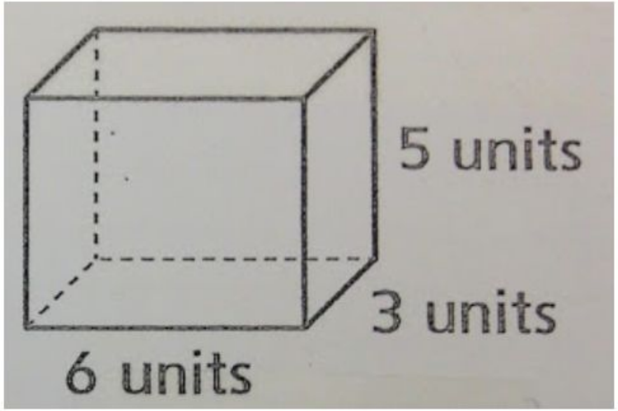
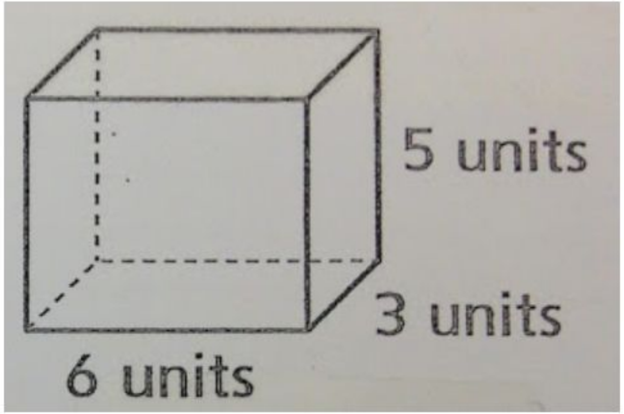
Ask About Ideas, Not Answers

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's blog, October 10, 2016)

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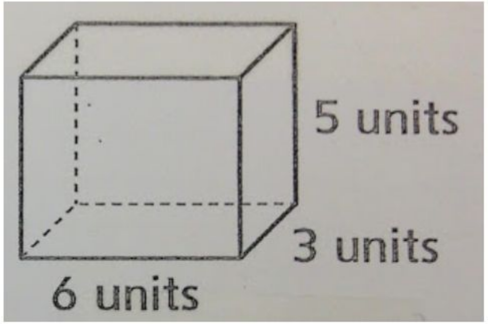
There's nothing inside.



Tell me everything you can about this figure.

It's a full cube with a top and everything else.

So if you times what's on the bottom (6 x 3) then you times the height you'll get the answer.

It has 4 sides.

The shape has 12 right (90 deg) angles.

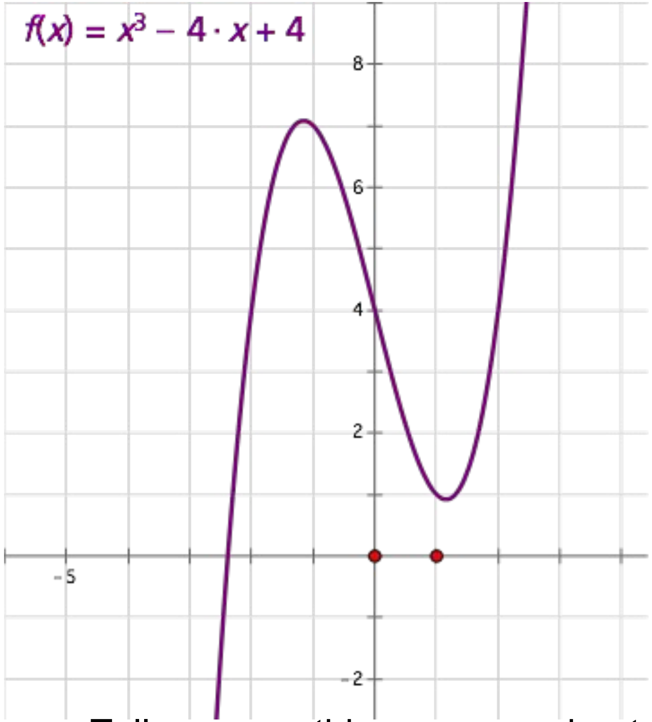
The perimeter is 14 units.

I know this shape is made up of squares.

@MFAnnie & @JSchwartz10a

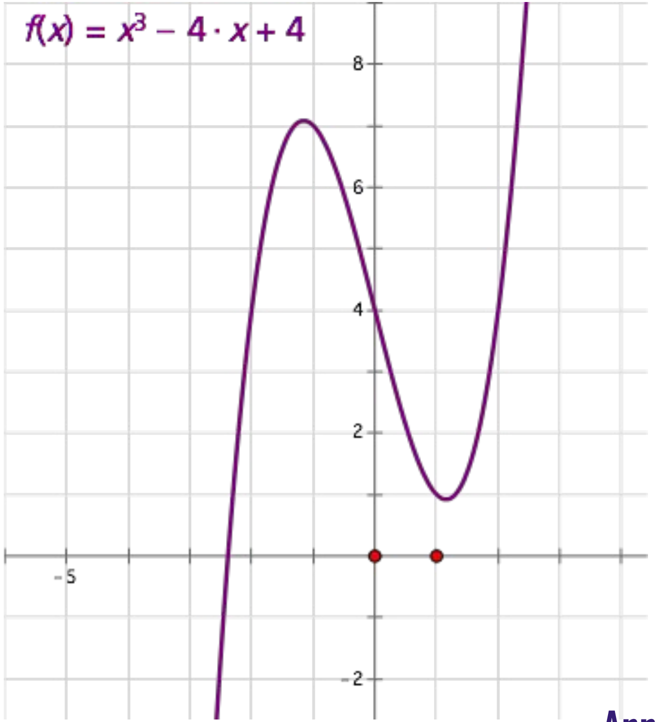
Ask About Ideas, Not Answers

It can be a little more complex:



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

instead of



Find the derivative of this function.

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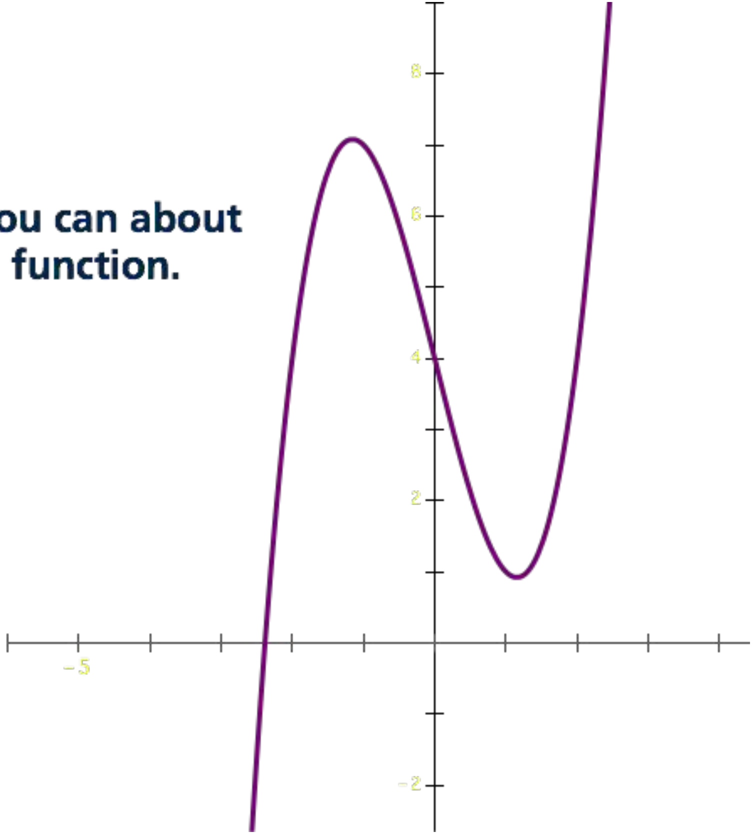
Ask About Ideas, Not Answers

Explain everything you can about the derivative of this function.



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Teacher Questions

"Why?"

"How do you know?"

"How did you decide?"

"Tell me more about that."

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“Phone in Pocket”

Are you asking ***idea-focused*** questions or ***answer-focused*** questions? Record yourself and find out!

#ToVForRatio

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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.

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Moment for Reflection and Personal (Possibly Public) Commitments

Thanks!

Annie

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