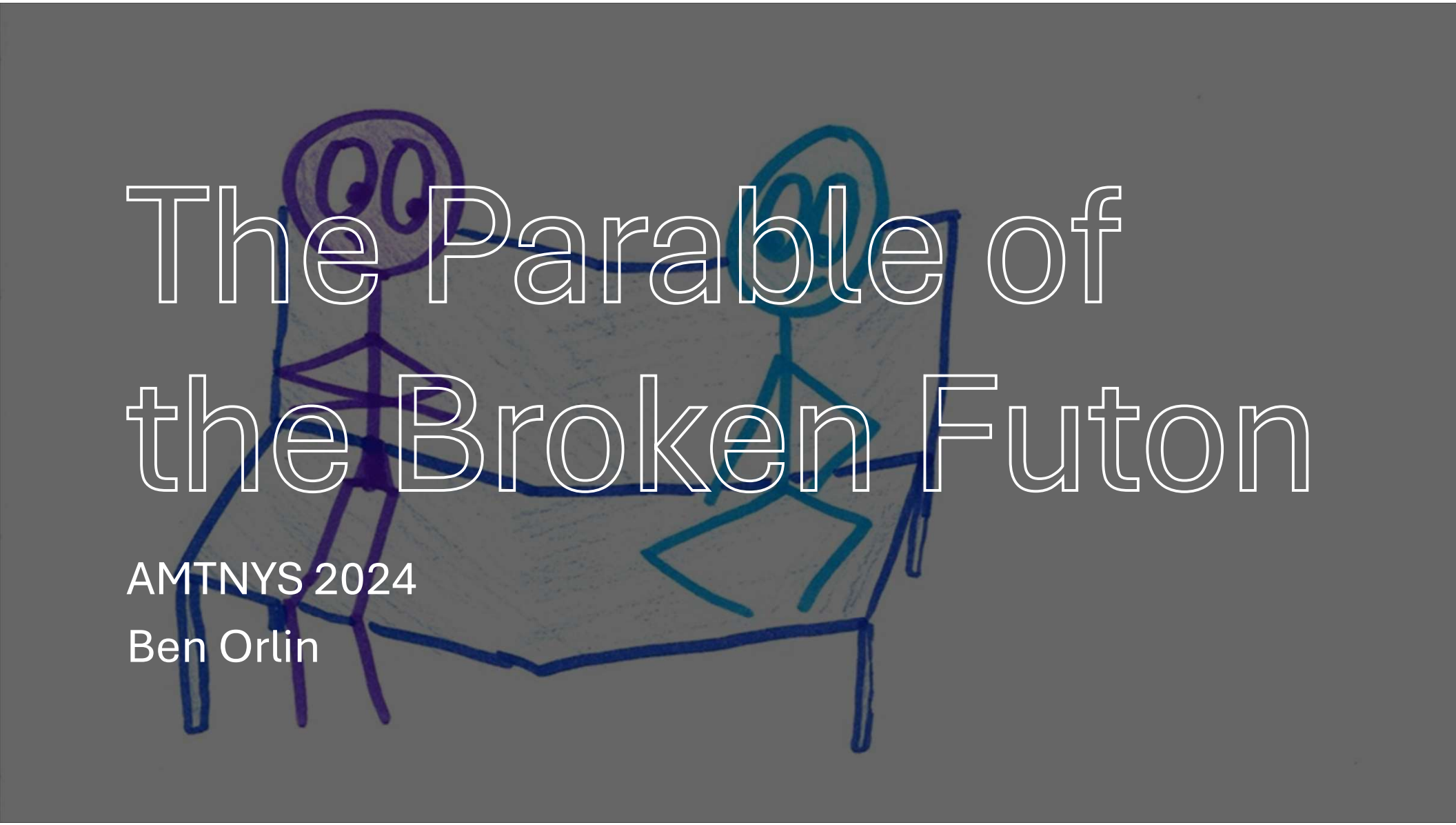
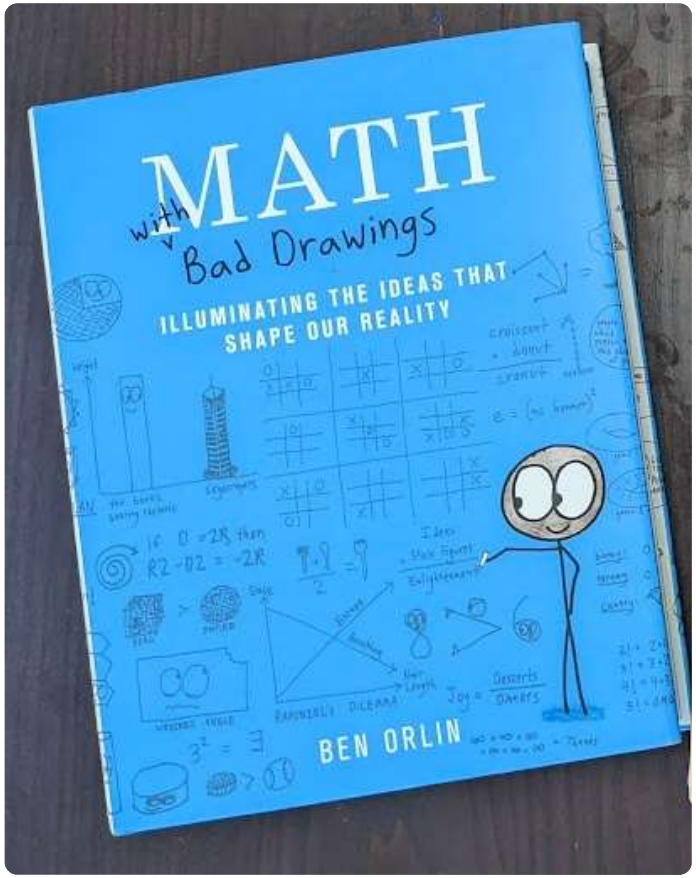
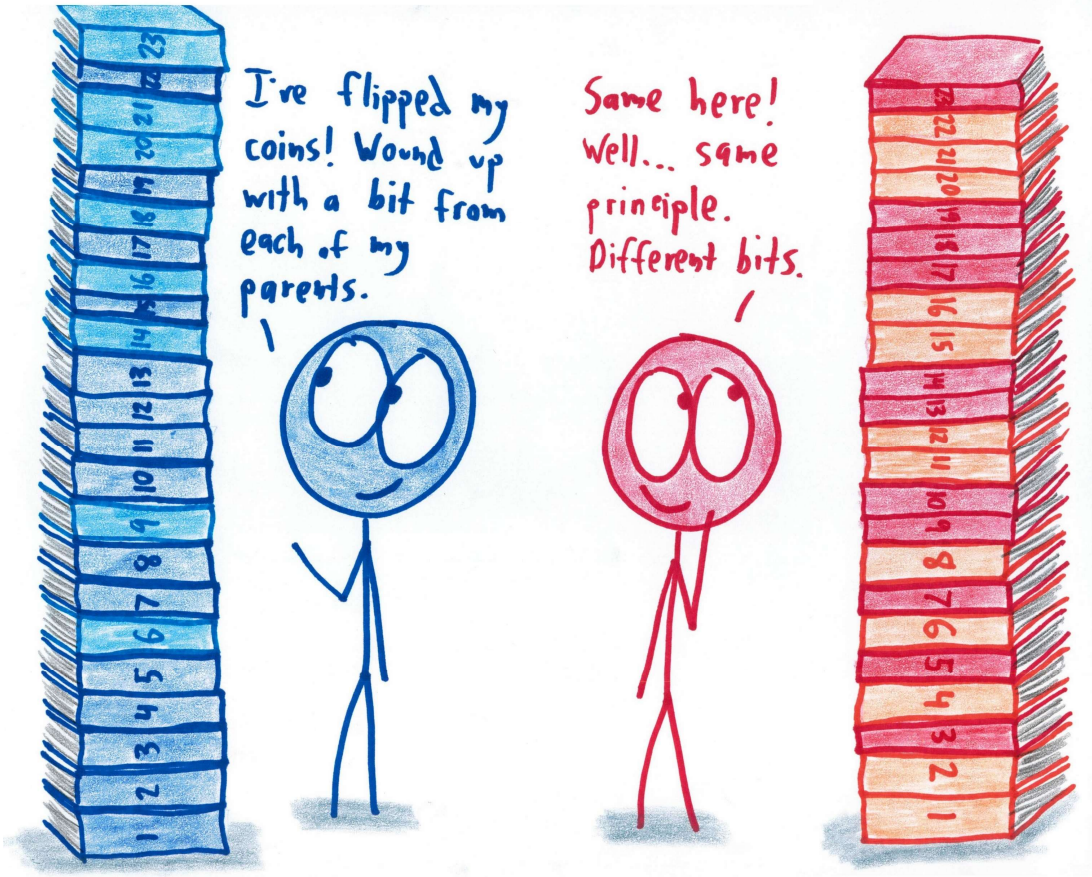


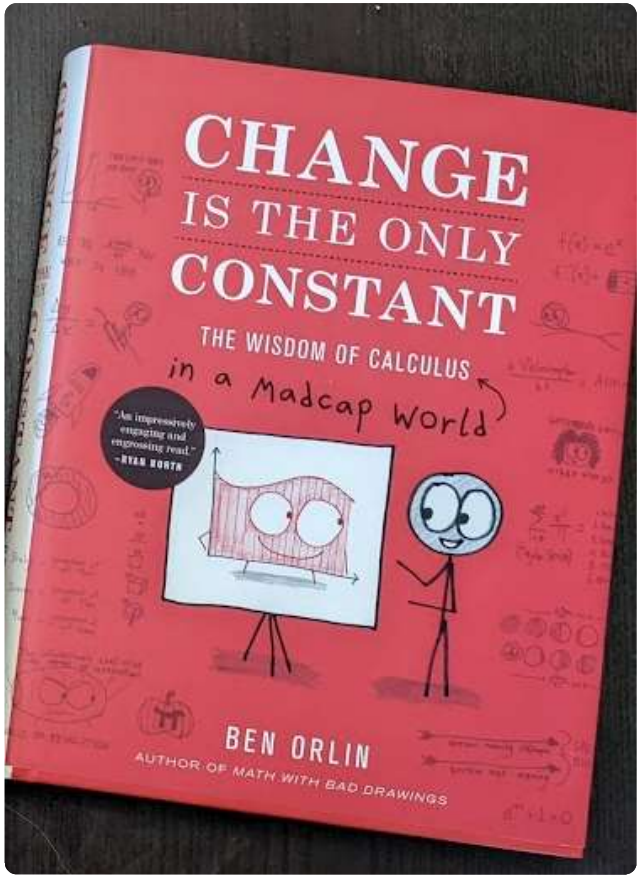
The Parable of the Broken Futon

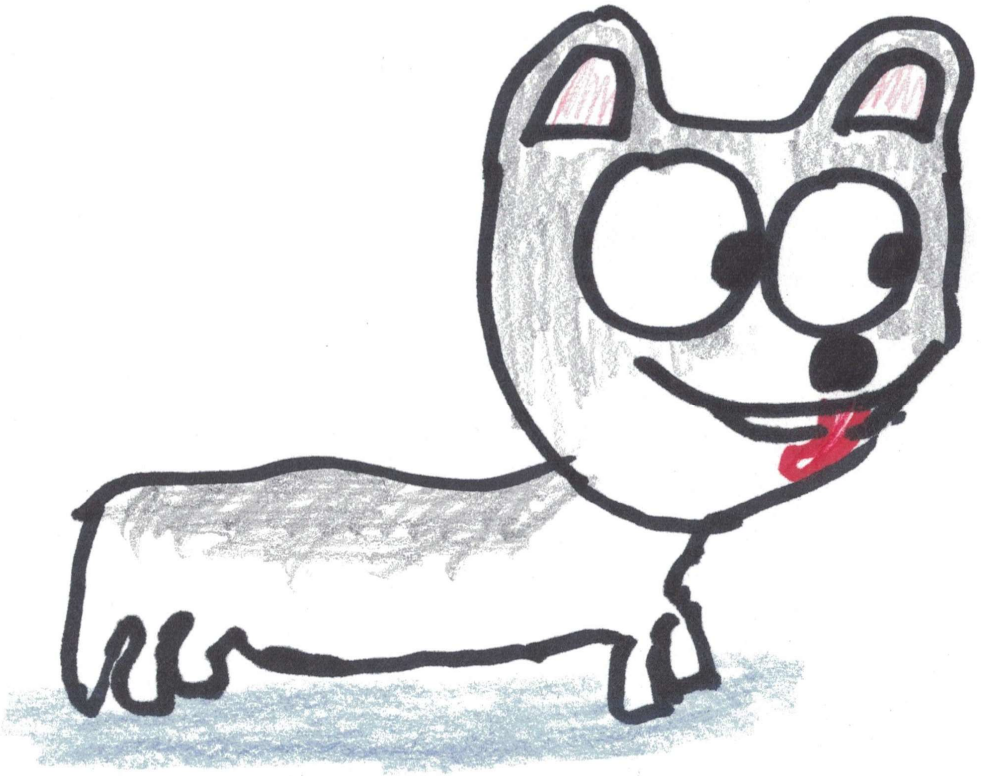
AMTNYS 2024

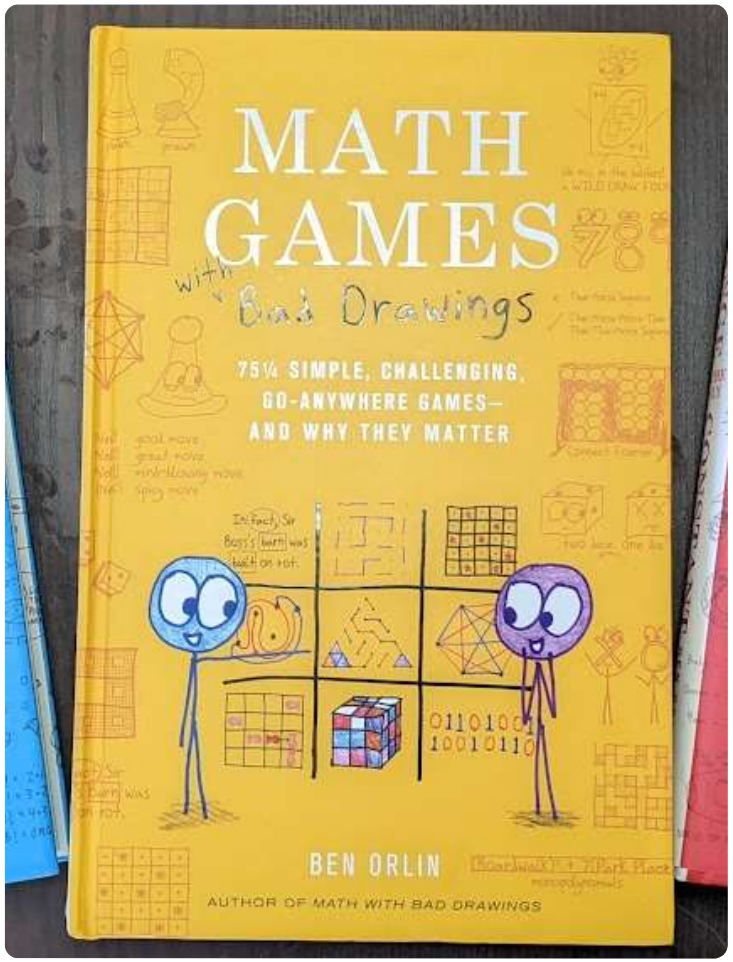
Ben Orlin


MATH
with
Bad Drawings
ILLUMINATING THE IDEAS THAT SHAPE OUR REALITY
BEN ORLIN


I've flipped my coins! Wound up with a bit from each of my parents.
Same here! Well... same principle. Different bits.


CHANGE
IS THE ONLY
CONSTANT
THE WISDOM OF CALCULUS
in a Madcap World
"An impressively engaging and engrossing read."
–RYAN NORTH
BEN ORLIN
AUTHOR OF MATH WITH BAD DRAWINGS




MATH
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75¼ SIMPLE, CHALLENGING, GO-ANYWHERE GAMES— AND WHY THEY MATTER
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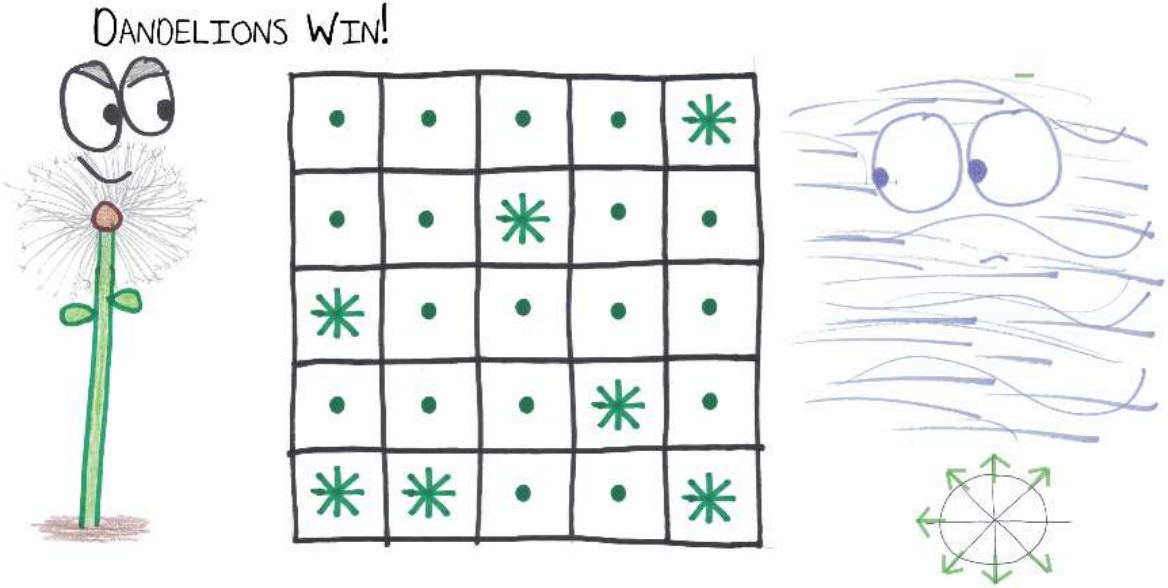
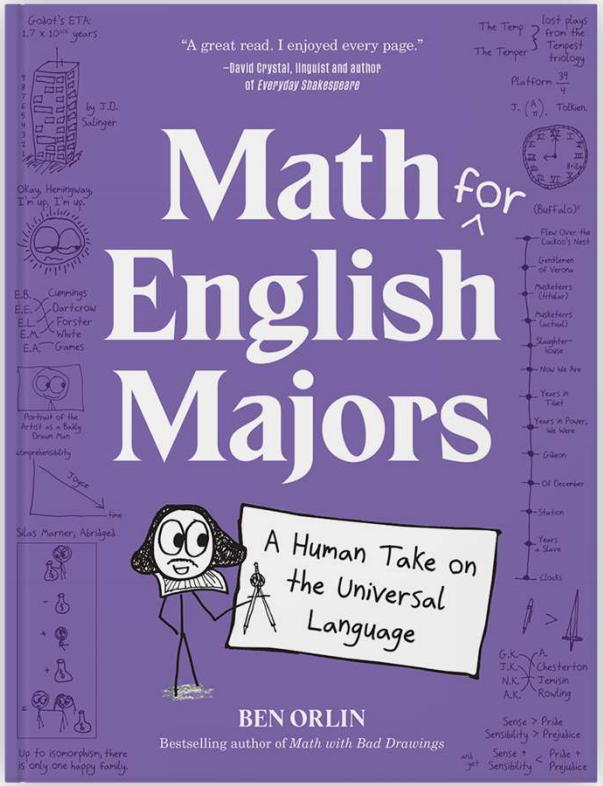
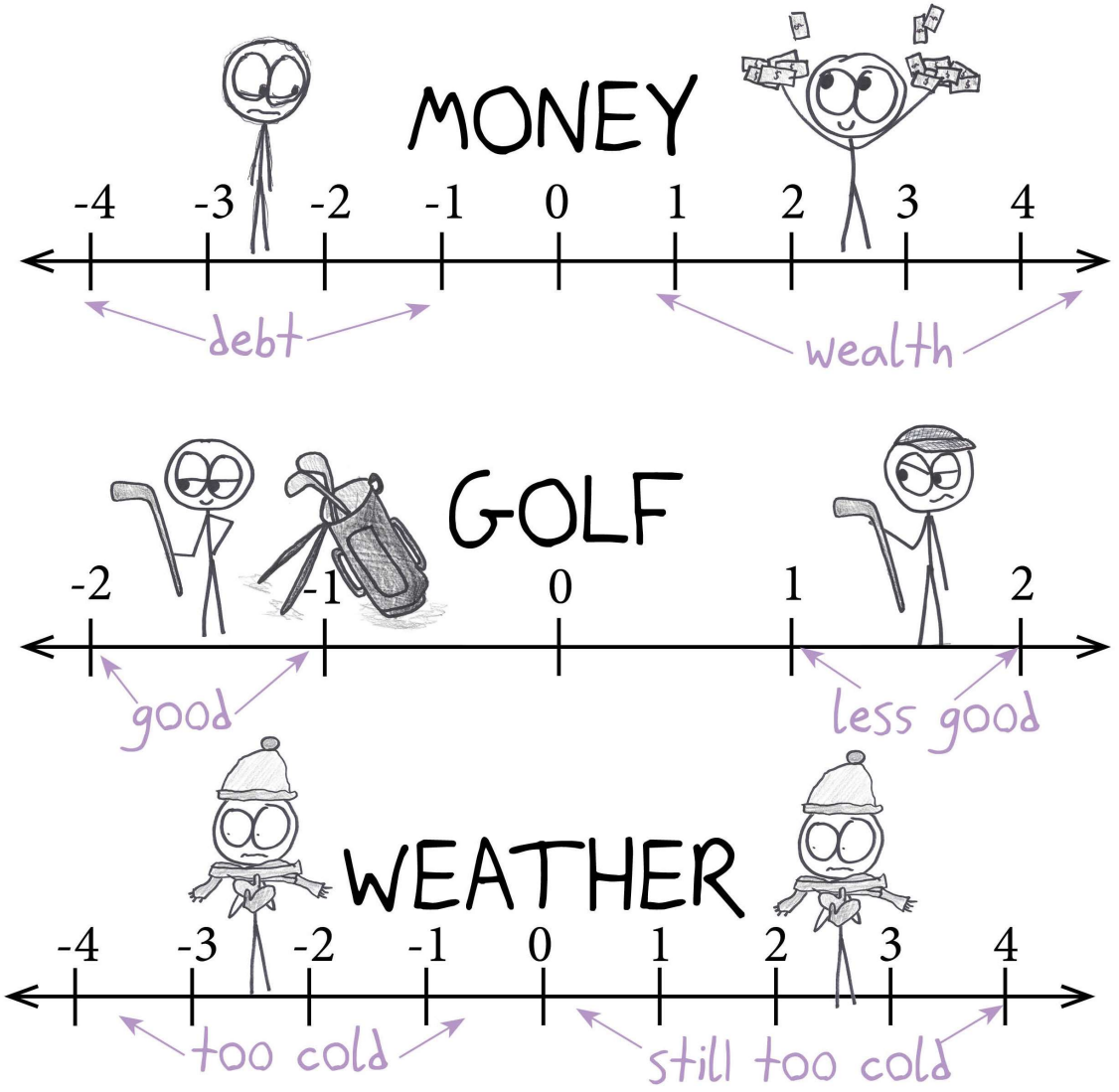
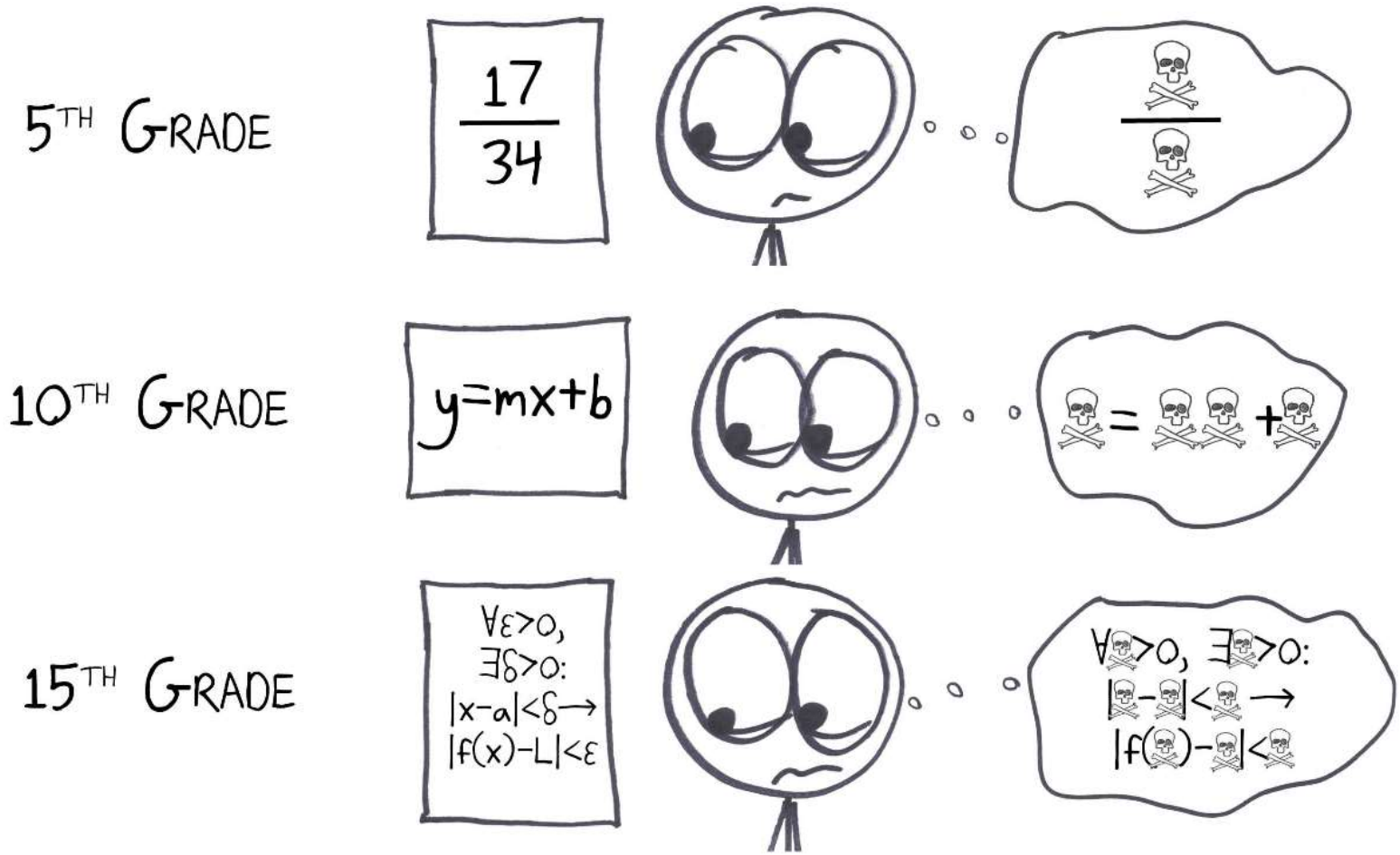

DANDELIONS WIN!


"A great read. I enjoyed every page."
–David Crystal, linguist and author of Everyday Shakespeare
Math for English Majors
A Human Take on the Universal Language
BEN ORLIN
Bestselling author of Math with Bad Drawings


MONEY
-4 -3 -2 -1 0 1 2 3 4
debt
wealth
GOLF
-2 -1 0 1 2
good
less good
WEATHER
-4 -3 -2 -1 0 1 2 3 4
too cold
still too cold

The Question

Does each person have a mathematical ceiling — a level beyond which they will never be able to advance?


5TH GRADE
17/34
10TH GRADE
y=mx+b
15TH GRADE
∀ε>0,
∃δ>0:
|x−a|<δ→
|f(x)−L|<ε

The Answer (from Teachers)

As long as we believe new research about neuroplasticity, there isnt a knowledge ceiling, only an effort and teaching ceiling.

@kthone219

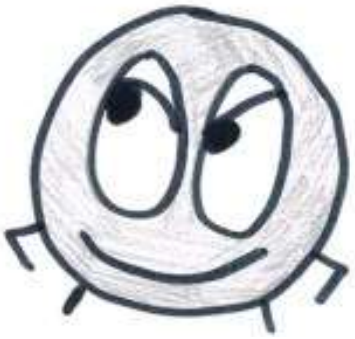
Definitely not. Just takes some a little (or a lot) longer. Desire to learn is essential. @MrDHopkins

I think the only ceiling is in the learners' evaluation of their own ability to do new things.

@AndersonOZB

No, because I reject the idea that even with time and persistence there are things that I couldn't learn.

@Mythagon



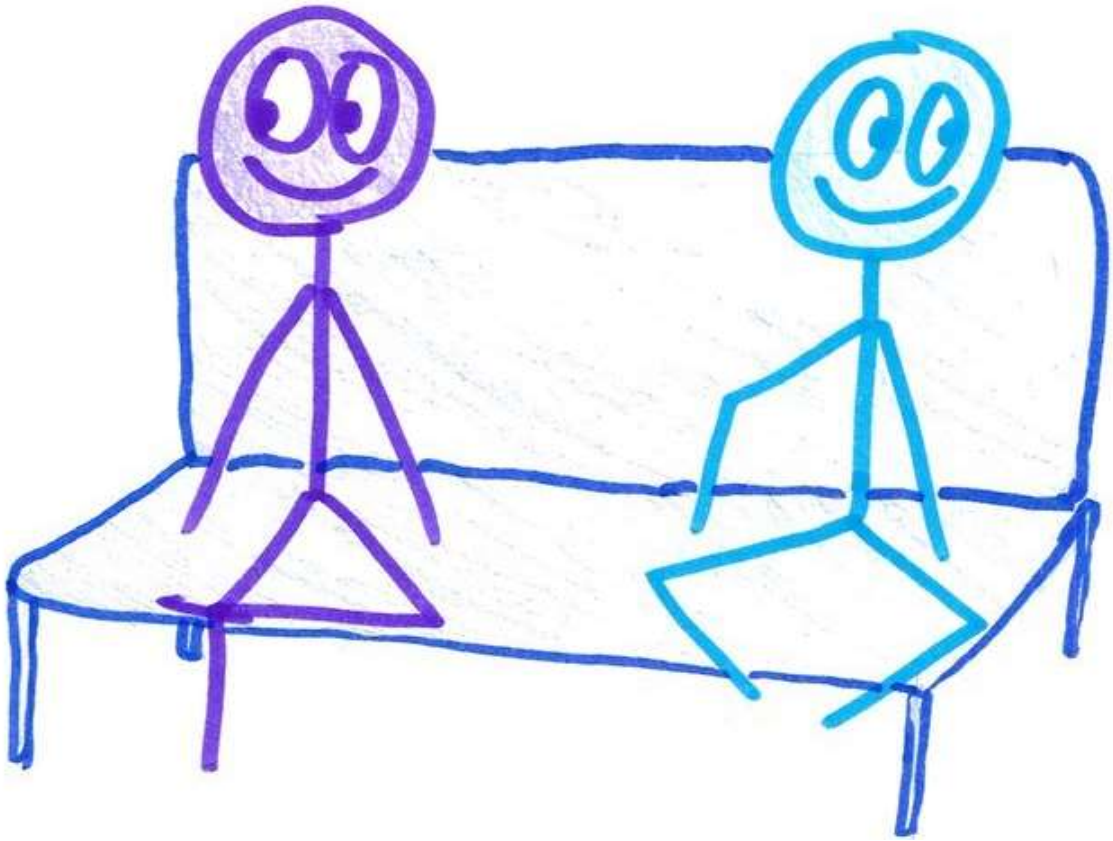
The Answer (from a Learner)

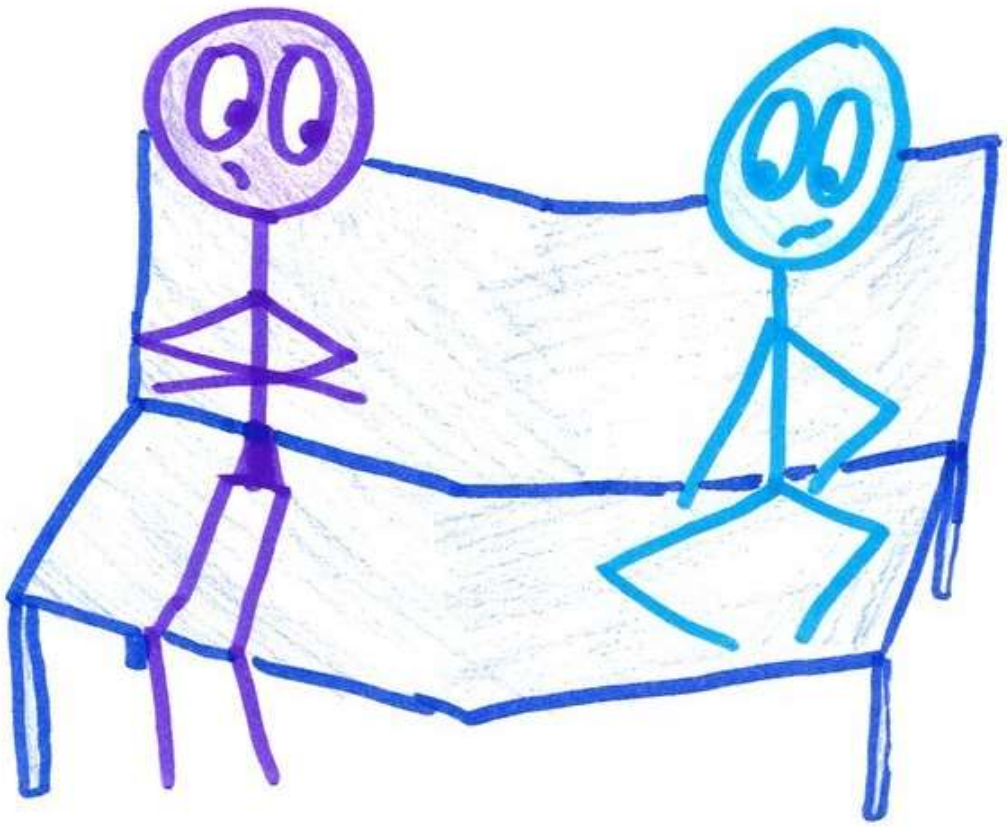
Yes. Yes. YES YES YES YES. And for some of us, the ceiling is pretty low.

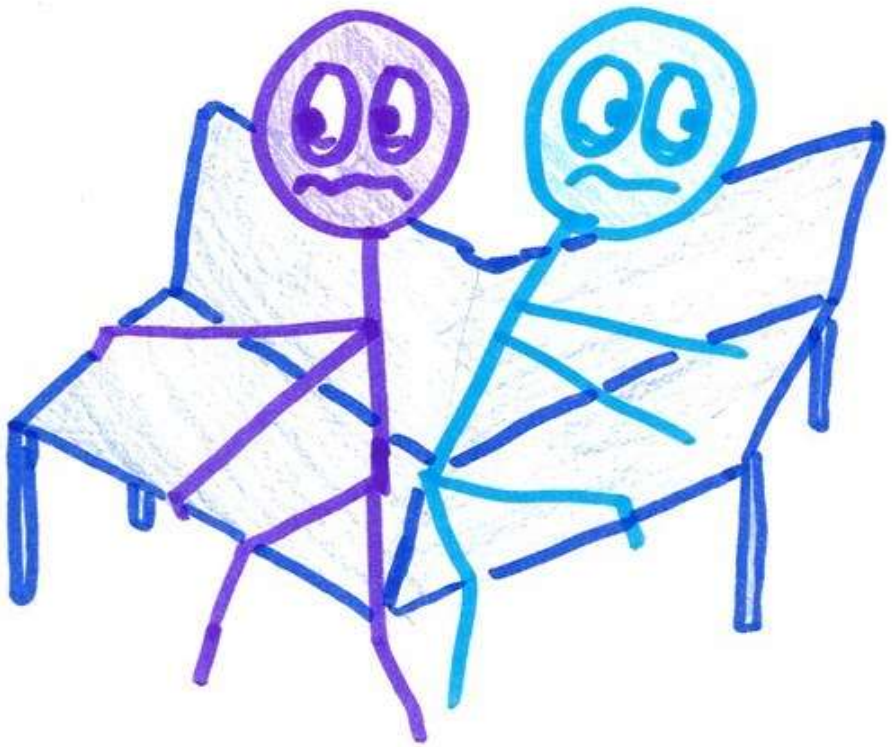
Teachers all say no This superannuated student with abundant grit/desire/effort/work/approaches strongly disagrees.

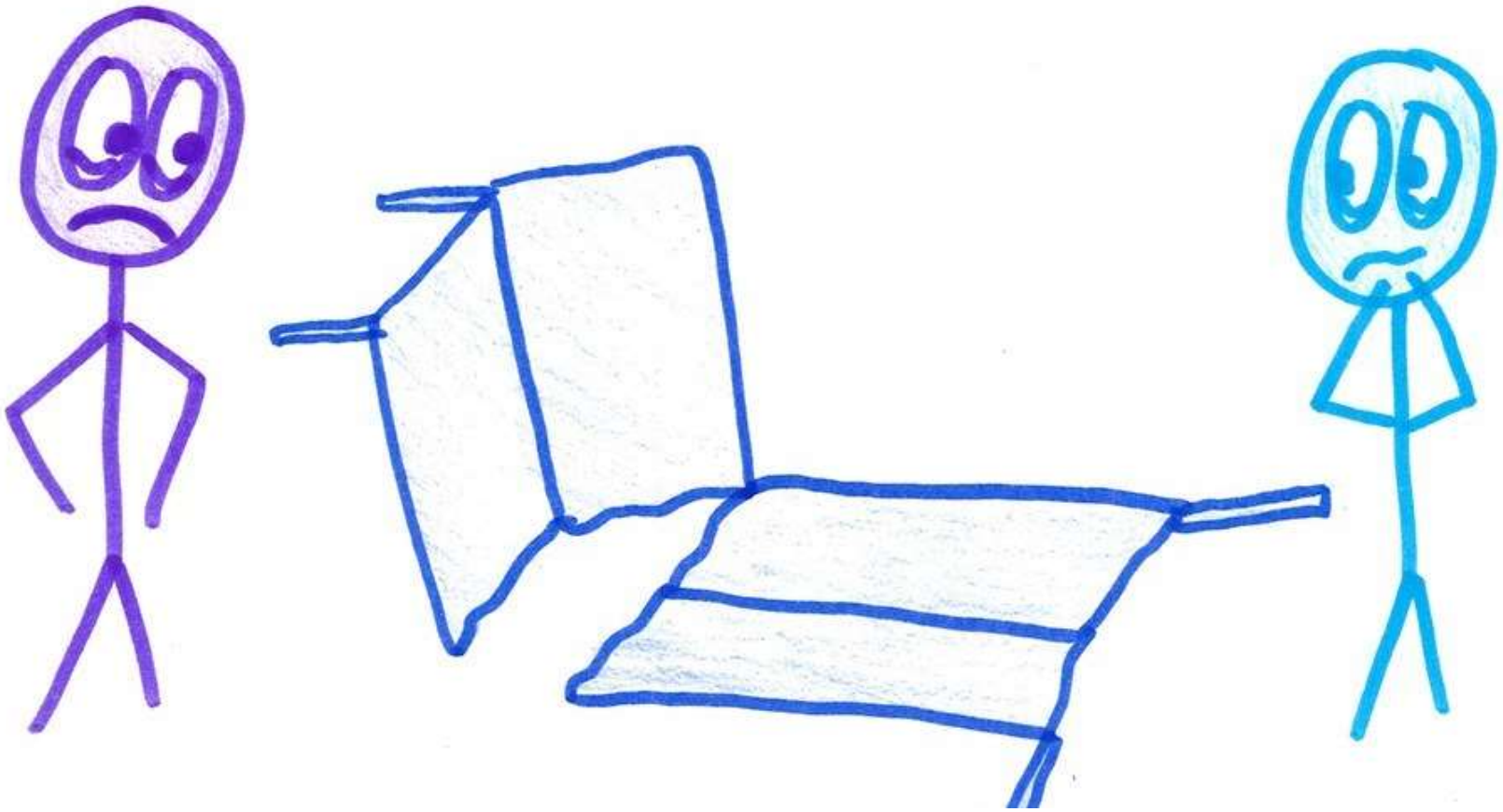
-Karen Carlson

The Parable of the Broken Futon





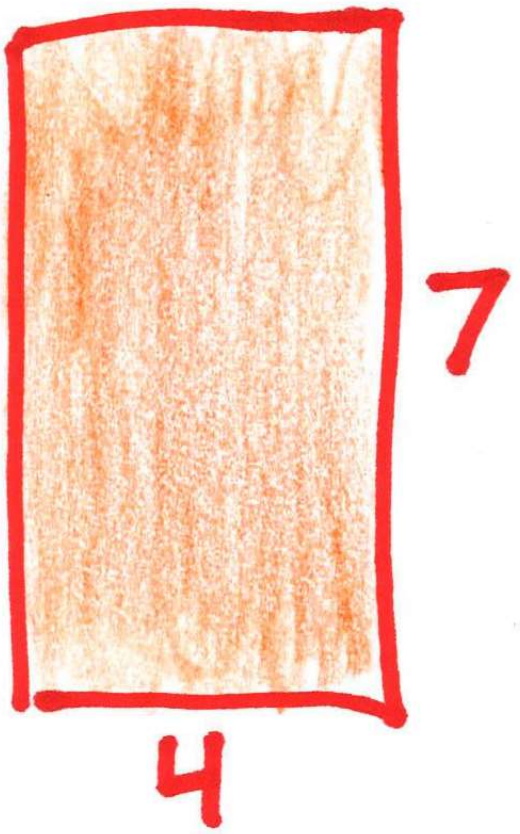




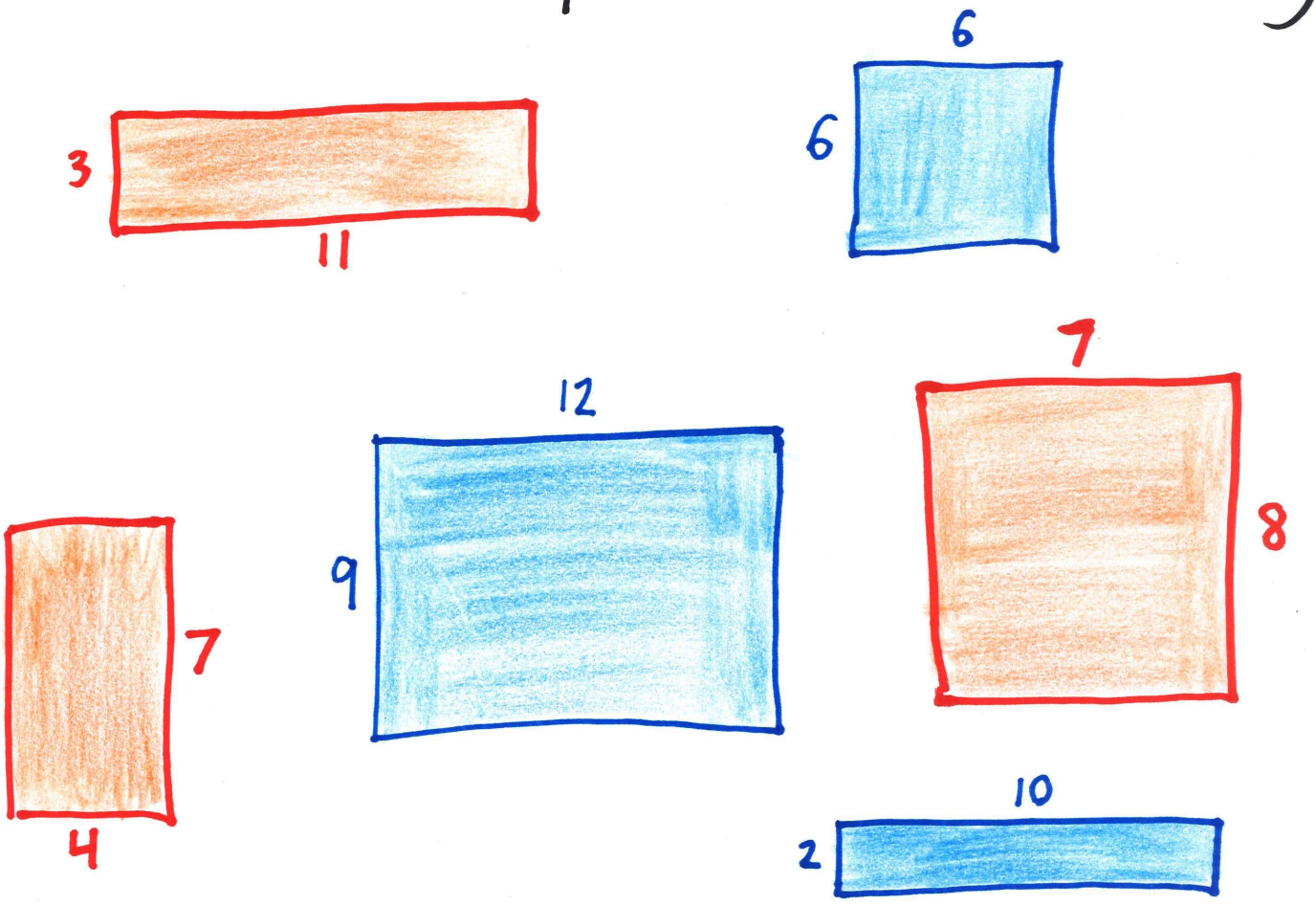
What are the background understandings that would help students thrive in your class?


Building a New Futon:
Two Case Studies

Case Study #1: Perimeter vs. Area



Find the area and perimeter of each rectangle.



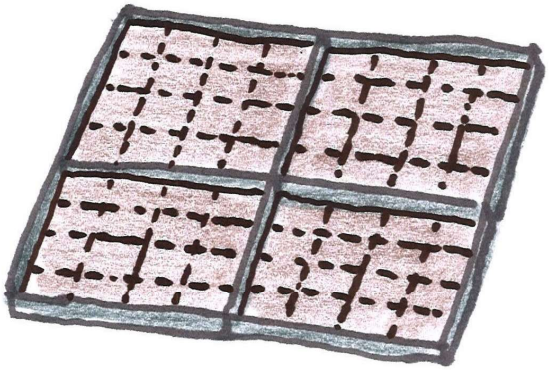
DEBATE OF THE CENTURY

PICK ONE

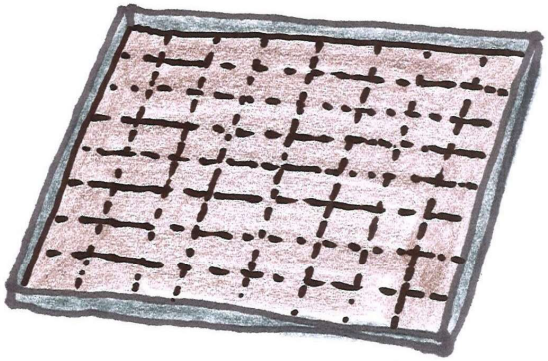
EDGE

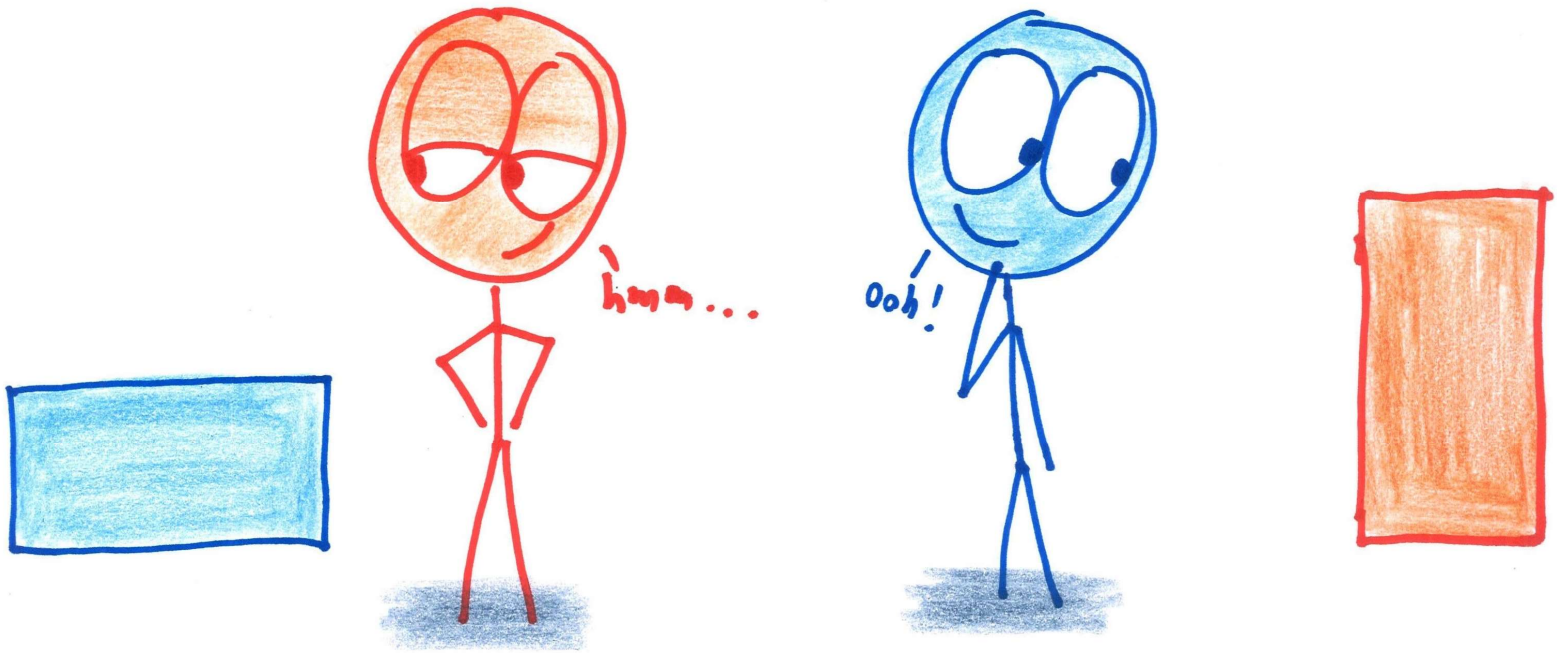
CENTER

4 pans

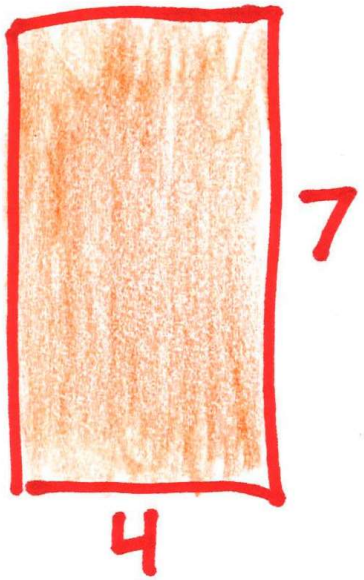


1 pan




hmm...
Ooh!

Here's a rectangle. Make another with...



...a **bigger area and bigger perimeter**

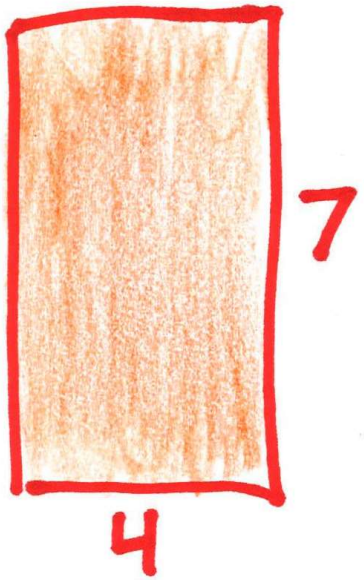
...a **smaller area and smaller perimeter**

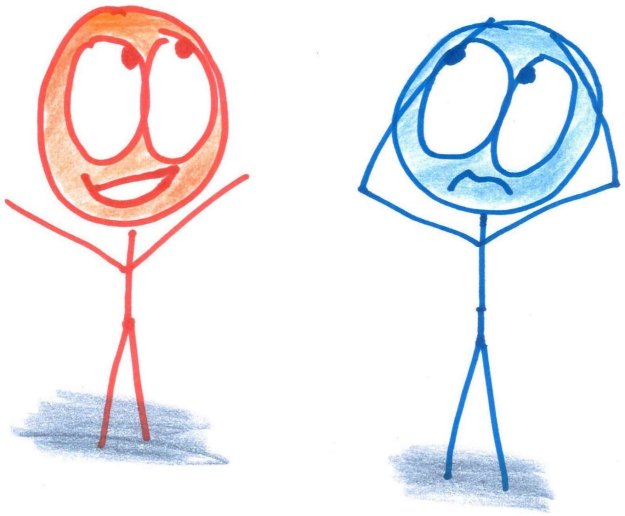
...a **smaller area and bigger perimeter**

...a **bigger area and smaller perimeter**

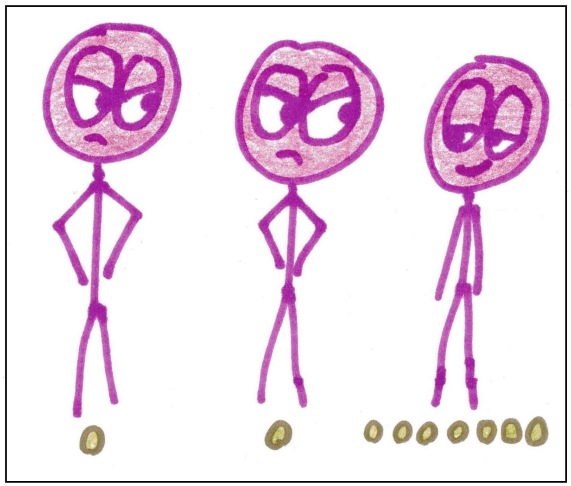
Here's a rectangle. Make another with...

...at least **double the perimeter**, and at most **half the area.**





Example #2:
Mean vs. Median



Averages: Mean, median & mode

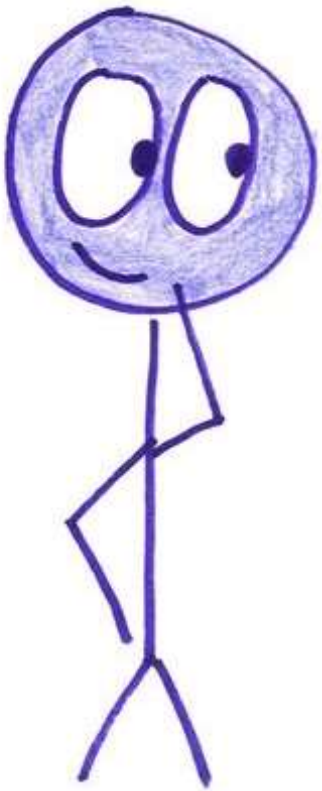
Data and Graphing Worksheet

Find the mean, median and mode for each set of numbers.

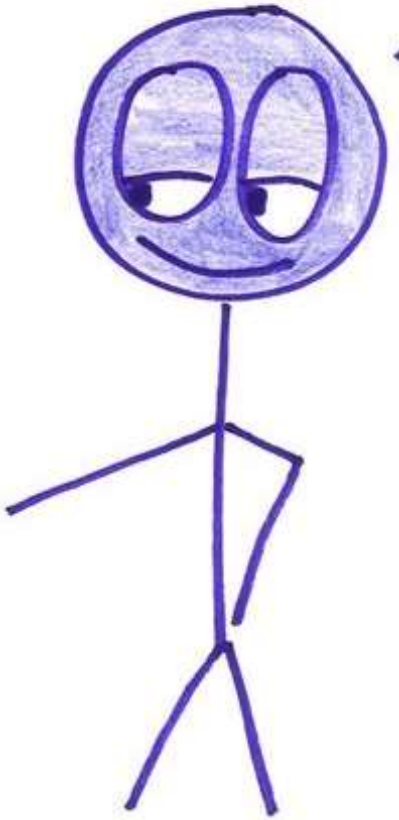
Show your work and write your answer in the space provided.

Given	Mean	Median	Mode
a. 4, 4, 3, 9, 5			
b. 8, 4, 5, 8, 5, 4, 8			
c. 10, 13, 11, 13, 13			

What would my starting salary be?



I'll put it this way: our average starting salary is $80,000!



you → $30,000

all your coworkers

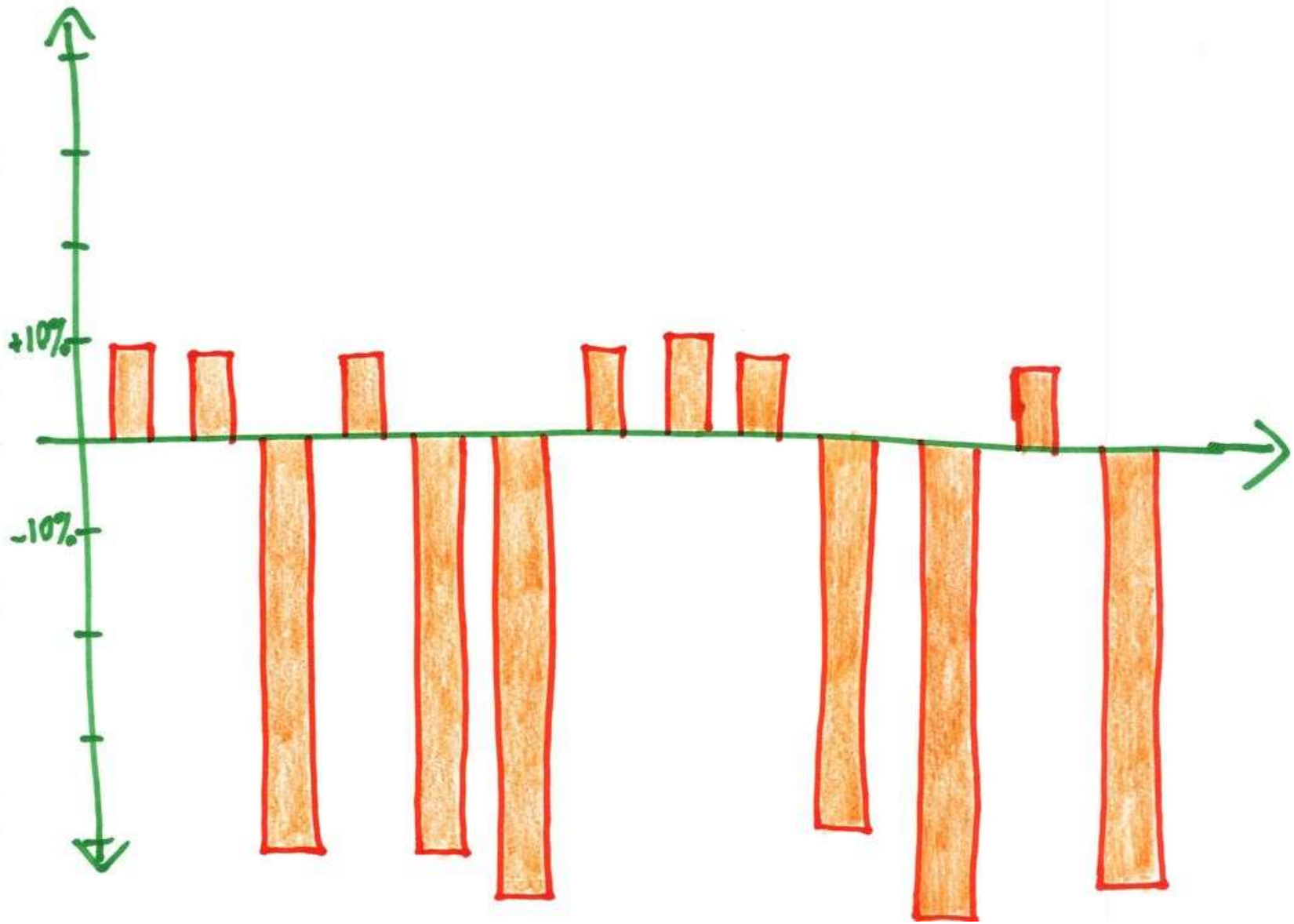
- $30,000
- $30,000
- $30,000
- $30,000
- $30,000
- $30,000

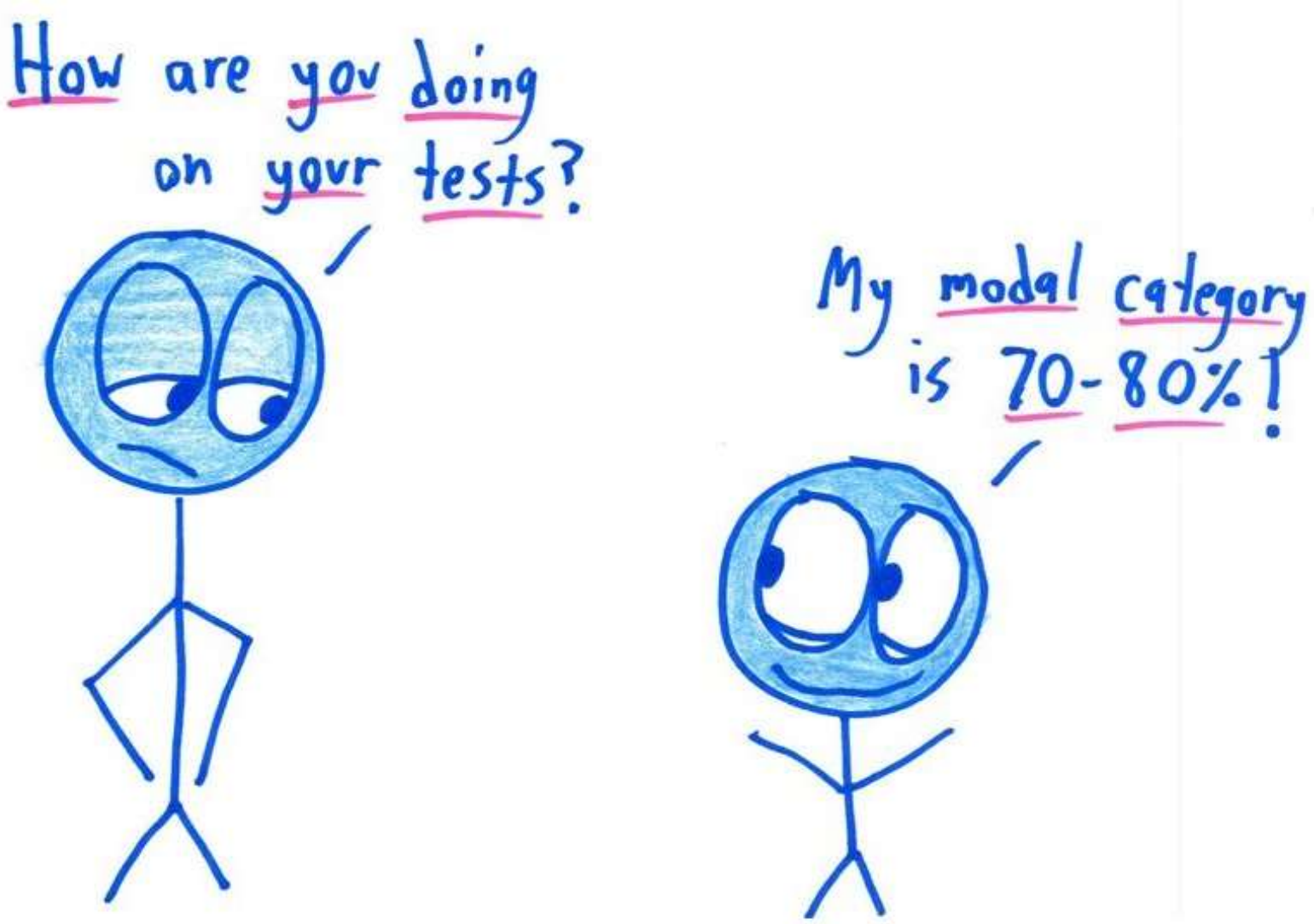
CEO's son → $430,000

Average: $80,000.

So, why should I invest with you?

Well, not to brag, but my fund has a median gain of 8% per year!


+10%
-10%


How are you doing on your tests?
My modal category is 70-80%!

Score Category	Number of Tests
90s	0
80s	0
70s	2
60s	1
50s	1
40s	1
30s	1
20s	1

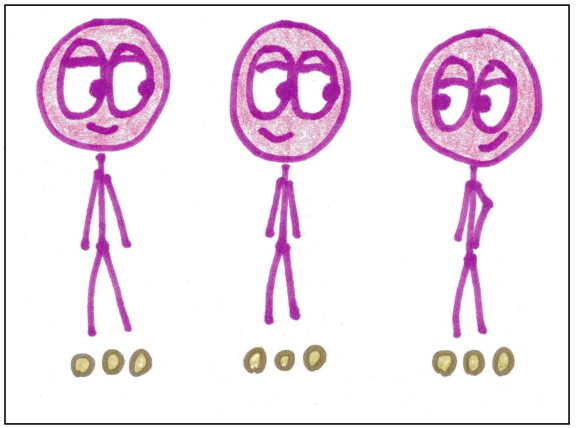
Divide nine coins among three pirates so that...

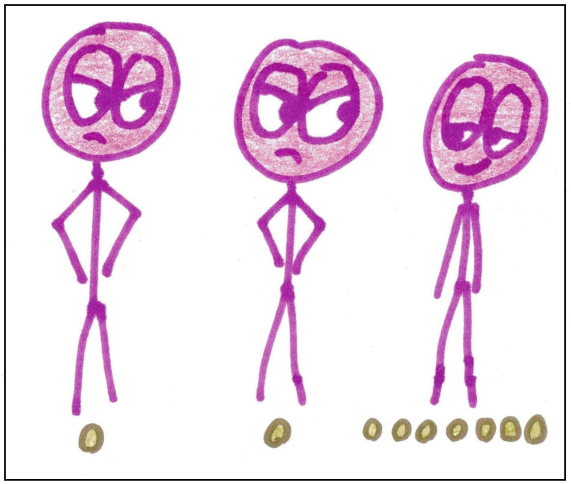
...**mean = median**.

...**mean < median**.

...**mean > median**.

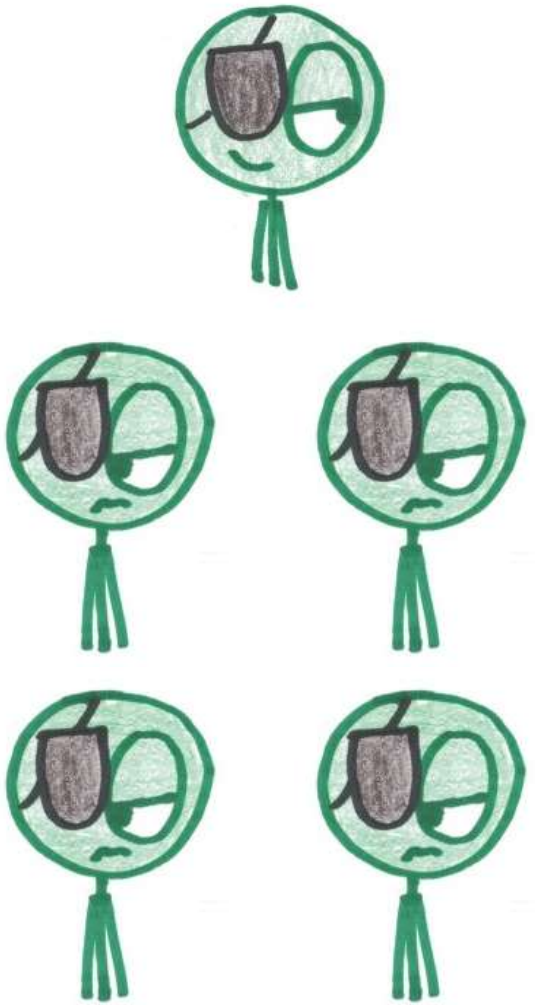
In each case, how will the pirates respond?





In a group of 5 pirates, the richest pirate suddenly finds 1000 gold coins…
…but won’t share them.

How does this affect the mean and median?



Final thought: Dignify the struggle.

This class makes me feel stupid. I'm so bad at graphing.

This class makes me feel

brilliant

~~stupid~~. I'm ~~so bad at graphing~~.

learning a conceptual framework devised by the greatest philosopher of the last millennium!

I failed the last test.

I must be terrible at math.

I failed the last test.

But I must ~~be terrible at math~~.
not overrate the capacity
of a highly artificial assessment
to measure the full richness
and breadth of my abilities.

Ugh! I just don't get how to work with negatives.

find this generalization of the natural numbers awkward and counterintuitive, putting me in the same place as centuries of mathematicians who

Ugh! I just ~~dont~~ didn't get how to work with negatives.

I'm nowhere near as good at math as this one classmate of mine.

"I'm nowhere near as good at math as this one classmate of mine," said young David Hilbert, before he became the most influential mathematician of his day.

Half the time, I have no idea what my teacher is saying.

Half the time, I have ~~no~~ some idea what my teacher is saying!

I'm no good at math.
I'm just too slow.

I'm so good at math!

I'm just prefer too go slowly

through intellectual achievements

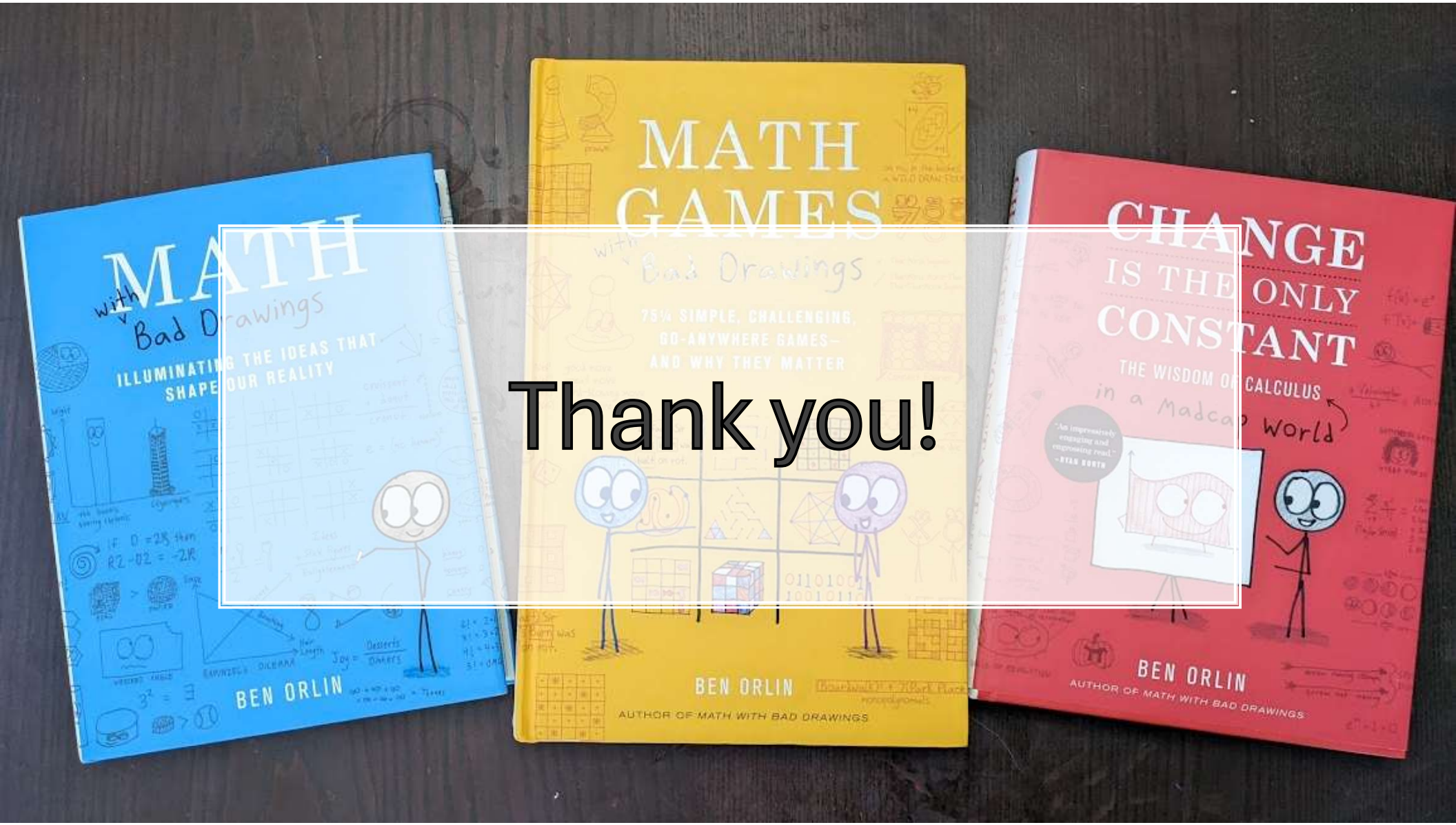
that took humanity dozens of

centuries the first time 'round.

Math just doesnt make sense.

Math just doesn't make sense.

Yet.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Thank you!