

Midpoint Formula and Counting - Logarithmic Style - MathFour

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I've never been a believer in the real number line. It just always felt wrong that between *any* two numbers, there's another number. Sure, you can go *between* two things – but is there a *number* there?



And then I think, “Well, add up the numbers you’re standing between and divide it by 2 – that’s the number between them.”

But it still doesn’t feel right.

I could be onto something, though.

I listened to Episode #110 of [Stuff To Blow Your Mind](#) called “Is math a human invention or a human discovery?” They pointed out that tiny babies can perceive quantities.

“Curious,” I thought.

Then I peeked at their math series, in particular the article on [What are Numbers?](#) Which led me to [Stanislas Dehaene](#) and his appearance on RadioLab’s episode on [Innate Numbers](#).

Here’s the discussion: www.radiolab.org/story/91698-innate-numbers

I was particularly interested when they noted (around minute 11) that *we don’t naturally switch* from logarithmic thinking to this 1-2-3-4-counting we do now!

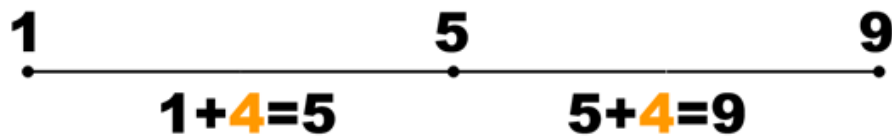
Around minute 12 in the audio, they consider the idea of midpoint. Dehaene notes that in logarithmic thinking, the midpoint between 1 and 9 isn’t 5, but 3.

The midpoint between 1 and 9 is... 3?

Here's how **we** think of the middle: "What do I add to 1 twice to get 9?"

We can add 4 to 1, twice, to get 9. So then we add it only once to get halfway there – and halfway there is 5.

Graphically it can look like this:

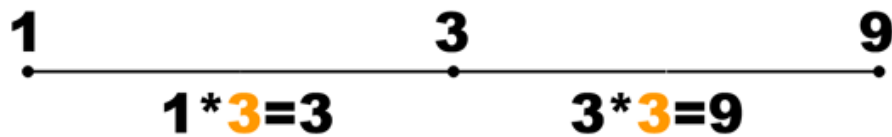


We could also use the fancy midpoint formula:

$$(x + y) * \frac{1}{2} = (1 + 9) * \frac{1}{2} = 10 * \frac{1}{2} = 5$$

Instead of adding, how about...

Dehaene notes that logarithmic thinkers **multiply** to find the midpoint! Like this:



These people think, "What do I multiply by 1 twice to get to 9?"

So the new fancy formula can be seen as this:

$$(x * y)^{\frac{1}{2}} = (1 * 9)^{\frac{1}{2}} = (9)^{\frac{1}{2}} = 3$$

Whoa!

So maybe we do have it wrong.

I've told thousands of students over the years that mathematicians just make this crap up. There's no truth to that "mathematics is the universal language" hoo-ha that they feed you in the movies.

Leopold Kronecker noted:

God made the integers; all else is the work of man.

And just maybe man has messed it up.

So is there really a number between any two numbers? Or is there just something "sort of" between any two numbers?

What does this mean to math learners?

Okay – now the bottom line. What does this mean to grownups teaching math – and the kids learning math?

Well – one thing is that we grownups can lay off. Let the kids learn their own ways. Let them [inquire](#), [discover](#) and develop their own methods for doing things.

If they're logarithmic thinkers (which they are from the start), let them ride that wave a while.

Also, remember that we, the grownups, have been conditioned out of logarithmic thinking. Which means that their way (the natural way) seems wrong.

But we are the ones who are wrong.

So if your kids don't believe [what you're feeding them](#). Let them doubt. They'll learn enough eventually to pay their rent, balance their checkbook and meet their friends halfway.

With or without our interruption.

[Buy Dehaene's *The Number Sense* on Amazon or get the old 1999 copy free.](#)

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