

Math isn't Scary

Slide: Intro

Let's start with a show of hands. Who here understands this?

Slide: Source code

It's a piece of source code, right? There's a for-loop, an if-statement, and so on. This is a pretty basic algorithm that counts how often an element appears in an array. It should be a piece of cake for most of you.

Now, raise your hands if you understand **this**?

Slide: Math equation

Don't be shy to put up those hands. :-)

As you probably guessed, this is a piece of math. In case you **didn't** recognize it, this is the "explicit formula for the prime counting function".

I'm not sure I completely understand this myself, to be honest – I just googled for "difficult math equation" and this is what came up.

(If you do want to know what it means, ask that guy who raised his hand.)

I get the sense that this slide is a lot more intimidating to most of you than the source code I just showed. I think I even heard somebody groan, "Uhf, math!"

Slide: Rage face

Math has a pretty bad reputation, not just among normal people, but also amongst us software developers.

Well, let's turn that frown upside down.

Slide: Happy rage face

The point I'm going to make in this talk is that math is actually pretty cool, and fun, and that it's not really very different from software development.

And – most importantly – I'll try to convince you that everyone here is already a lot better at math than you may think.

Let's start with why math is so reviled.

Slide: Putin looking disgusted

(By the way, nothing against Putin but I needed a photo of someone looking disgusted, and **for some reason** Putin comes up a lot.)

If you don't like math at all, if the thought of doing math makes you break out in hives, if you have nightmares of doing multiplication tables or trigonometry, then you, poor listener, may suffer from mathophobia, also known as math anxiety.

Slide: Math Anxiety

And where you did pick up this nasty-sounding affliction? Well, it's been said that "math anxiety is a disease caused by school".

Slide: Quote about math anxiety

So think about that for a second. The reason why math gives you the heebie-jeebies is because of the way it is taught in the traditional classroom.

If you're terrified of doing math, then you have this [point at slide]. It's a real thing and it affects just about every one of us.

Except of course for that handful of lucky people who actually **enjoy** doing math.

Slide: Big Bang Theory

But even for them, it's been suggested that they only succeeded in learning mathematics **despite** what they were taught in school.

Slide: How to play the piano despite years of lessons

I have this book, "How to learn piano despite years of lessons".

I only started to play the piano in my late twenties, because for years I had this limiting belief that becoming good at the piano was impossible unless you started when you were like 5 years old.

But it turns out that a lot of kids who take piano lessons end up hating the piano just about as much as they hate math. And for pretty much the same reasons too.

Slide: Bootcamp

For those of you who didn't take piano lessons, the way that playing the piano is taught is very similar to the way math is taught: you have to memorize a lot of facts and do practice drills, over and over and over [pull bored face].

There's no room for creativity or having fun. I mean, it's called "playing" the piano for a reason, you're supposed to play and mess about, right?

Well, try telling that to your drill instructor.

Slide: Player piano

There is no deeper understanding of music; it's just this mechanical process for playing the right notes at the right time. Just like high school math doesn't give you a deep understanding of mathematics, it's just this mechanical process for performing calculations.

The following story is something I heard quite a few times. It goes like this: "As a kid I used to like picking out tunes on the piano, so my parents decided I was talented and made me take music lessons."

Slide: Witch

“But my piano teacher was this horrible witch and I dreaded going, and I couldn’t stomach the thought of playing the piano for years afterwards.”

How sad is that? Taking piano lessons actually ruins music for a lot of young people. And how familiar does that sound to doing math?

Slide: How to play the piano despite years of lessons

(click)

*Slide: How to play *math**

I really wish this book existed, “how to play *math* despite years of lessons”.

And “play” is the right verb here too. Doing math should really be like playing a game or solving a puzzle.

If you feel you’re no good at math, then you’ll be glad to hear: it’s not you. You’re not defective. You just weren’t taught properly. Math anxiety is the result of bad teaching, simple as that.

Slide: Damaged box

So are we all irreparably damaged by our failed educations? Well, no I don’t think so. We may have suffered a minor setback, but that’s no reason to give up. Math is too beautiful for that.

This has all been a bit of a *downer* so far, so to cheer you up a bit, here’s a photo of people having a good time:

Slide: Happy people

They probably just solved some math problem, so now they are out celebrating in the streets. (“We found the answer...”)

I’ve said a few times now that math can be a lot of fun, something you can really enjoy doing.

Now, I suspect some of you may be a bit skeptical about that, so I’m going to back up my claim with the following piece of evidence:

Slide: Sudoku

I’m sure you all recognize this; it’s a Sudoku. This is played by millions of people all over the world. These things are super popular.

Now I know what you’re going to say, “That’s not math! That’s a puzzle!” And that’s true, it’s a puzzle... with numbers. Well, guess what math is: puzzles with numbers.

Solving puzzles is what humans like to do. We can’t resist it. It’s how our brains are wired. That’s why kids like games, because many games are about problem solving.

Whether you like it or not, this [point at slide] is math; you just don't think about it that way.

I hope I didn't just spoil Sudokus for you, but a lot of the math you learned in school – or were *supposed* to learn – isn't any more difficult than solving a Sudoku. In both cases, your brain is really doing the same thing.

My girlfriend Deanna, her brain freezes up just at the thought of having to do math. Yet, for some reason, she really likes this game:

Slide: Rummikub

This is Rummikub. It's a game where you arrange and rearrange numbers into certain patterns.

This game definitely exercises your math muscles. You have to use pattern-matching skills; you often have to think ahead several steps.

But she doesn't think about it as math, so it doesn't trigger the bad memories of school and how she used to get upset at doing her math homework.

(pause) She also beats me far too often at this game (which is getting a bit ridiculous).

Slide: Blackjack

Another game she likes is blackjack. To win at blackjack, you need to learn all about odds and probabilities. Again, it's mathematics!

The same thing is true for bridge, and poker, and tons of other games. Most games we play are very mathematical in nature.

(pause) I'm sorry to break it to you, but if you're the kind of person who likes these kinds of games and puzzles, then you just might be a closet mathematician.

*Slide: Source code ****

Let's say 5 years ago, or 2 years ago, or however long ago it was that you first started programming, if I showed you this piece of source code back then, it probably wouldn't have made any sense to you.

(click) You first had to learn the language – not just Swift but the language of computers and programming. How to use a compiler, what is a variable, what is a function, and a thousand other things.

It was probably quite tough to learn too, but eventually you did learn it and now you are fluent in Objective-C or Swift or whatever your favorite language is.

This sort of thing [point to slide] makes sense to you now, because you know how to speak the language. But it still looks like a bunch of gobbledygook to someone who isn't a programmer.

Slide: Math equation

Just like this looks like gobbledygook to someone who doesn't speak the language of math.

My point is that you're all intelligent, smart people. You're software developers; you do difficult things all day long. Math isn't any harder than what you do in your development jobs already.

And if you were able to learn how to program computers, I'd say you're pretty much able to learn anything. Even math.

What **you** do on a daily basis is what a professional mathematician does on a daily basis. You build these elaborate thought structures inside your head to think through a problem. You solve puzzles, you think creatively.

In many ways, you already act like a mathematician; you just don't speak the language yet.

Slide: So What?

OK, fine. Developers are like mathematicians. So what?

Why should we bother learning about calculus and statistics and algebra? What do we need that kind of math for anyway?

Well, I'd say for any piece of software that is interesting. Here are some examples.

Slide: Topics

If you want to make games, even simple 2D ones, it helps to know trigonometry. For 3D games you need to know about vectors and matrices and geometry.

(click) All of the hot areas of software development right now, machine learning, big data, computer vision, speech recognition, robotics... they all require solid math skills.

I have an interest in audio and digital signal processing, and that requires knowledge of complex numbers and Fourier analysis. Studying the math really helped me understand what I was doing.

If you want to get ahead in your field and you want to stay relevant, knowing a bit more about math will be very helpful. It will also make you a better programmer. And better programmers make more money.

Slide: Rich developer

(click)

Slide: How?

Let's say I've convinced you to give math a second chance. How do you go about it?

Slide: Math Overboard

Well, that "how to do math despite years of lessons" book does exist, sort of.

Math Overboard is the book that I used to brush up on my high school math. It's not perfect but it's a lot more accessible than most textbooks, and it's geared toward adults. This is a good place to start.

Slide: Khan Academy

Of course, there is also Khan Academy. It's free and they've got tons of lessons on pretty much all areas of math that are interesting to software developers.

Many universities now also offer free online versions of their courses, but you may want to start with something a bit easier such as Khan Academy.

If you just want to get your feet wet and explore some mathematical ideas without too much commitment, then I can recommend popular science books like this one:

*Slide: 50 Mathematical Ideas + Podcast ****

(click) Or this podcast from the BBC.

There are many entertaining stories about math and the people who practiced it over the ages. There's lots of intrigue and drama, but these stories also give you some appreciation for the art of mathematics and how fascinating it can be.

Slide: Puzzle books

If you do like puzzles and Sudokus and so on, then pick up a math puzzle book. They sell them at any bookstore, including at the airport, so why not pick one up on your way home?

The truth is, you can't really learn math by just reading about it, you also have to put it into practice. That means you'll need to do some hard thinking from time to time, and these math puzzle books are a great way to get started with that.

Slide: Project Euler

And if you're ready for a real challenge, check out Project Euler. This has lots of mathematical challenges and often you have to write a short program to solve them, so this trains both your math skills and your programming skills.

Slide: Roadmap

My advice is that you start easy, and get over this limiting belief that math is horrible. Read stories about mathematical discoveries and learn to see the beauty of mathematical ideas.

Then if you want to get serious, I suggest that you brush up on the basics of math first, using a book such as Math Overboard or Khan Academy.

From there on, it really depends on what you want to use math for. It's a big field, so it's impossible to learn it all, but books such as that 50 Mathematical Ideas You Need to Know can give you some idea of what is out there.

Slide: Climber

I'm not going to lie to you: learning math can be hard and frustrating. I get stuck all the time. But so what, learning anything new is always hard. Finding bugs and fixing them is hard too, but it's also half the fun.

It's OK to be confused. It's OK to struggle. It's OK to be wrong. Even professional mathematicians are in a constant state of confusion. No big deal. The thing that matters is that you're **thinking**, and that's what will literally make you smarter.

Slide: We all love math

Math isn't really that scary, all right? It's only as scary as programming is for a newbie, and you've all been there before and stuck with it, and look at you now.

So I hope I've inspired you to give math another go, and I wish you a safe and happy journey into the land of mathematical ideas.

Thank you!

Slide: Q.E.D.