

Mathematicians talking about Mathematics

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The moving power of mathematical invention is not reasoning but imagination. (A. DeMorgan)

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I do not know what I may appear to the world; but to myself I seem to have been only like a boy playing on the seashore and diverting myself in now and then finding a smoother pebble or a prettier shell than ordinary, whilst the great ocean of truth lay all undiscovered before me. (Sir Isaac Newton)

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A scientist worthy of the name, above all a mathematician, experiences in his work the same impression as an artist; his pleasure is as great and of the same nature. (Henri Poincaré)

Other people talking about Mathematics

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Beware the mathematician and others who make false prophecies. The danger already exists that the mathematicians have made a pact with the Devil to darken the spirit and confine Man within the bonds of Hell. (St. Augustine)

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Math class is tough! (Barbie)

Why learn math?

Why learn math?

Appeared in “Facebook Questions”:

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Why do we need to learn math? When are we going to need it after high school?

Why learn math?

Tomas McIntee of Appalachian State University:

Why learn math?

Tomas McIntee of Appalachian State University:

- 1 Finance.

Why learn math?

Tomas McIntee of Appalachian State University:

- 1 **Finance.** Understanding how exponential functions work is critical to anyone who is going to carry a debt or an investment. Most people will do both, so you'll want to be able to understand how exponential functions work and at least how to work through things with the aid of a calculator.

Why learn math?

② **Logistics.**

Why learn math?

- 2 Logistics.** Knowing your arithmetic will help you not get shortchanged, understand what's a good deal and not, tip socially appropriate amounts, work through your taxes, et cetera. Money is all about numbers. So if you plan on actually using money, and using it efficiently, know your arithmetic. Arithmetic is also important in cooking and all kinds of planning. A calculator can handle much of it for you, but if you don't understand arithmetic very well, you won't realize when you've made a mistake by punching the wrong button of the calculator.

Why learn math?

- 3 **Everyday engineering.**

Why learn math?

- 3 **Everyday engineering.** Geometry tells you everything about how things are shaped. If you plan on building or renovating anything, or figuring out what will fit in a given room, know your geometry.

Why learn math?

- ④ **Gambling.**

Why learn math?

- ④ **Gambling.** Some of us gamble with money in Vegas or on Wall Street; others gamble with life and limb, or with houses and cars. Whether you're weighing the side effects of a medical treatment or buying beachfront property, understanding how probability works is important to making informed decisions involving risk.

Why learn math?

5 Science.

Why learn math?

- 5 **Science.** Understanding how statistical significance works is a major boon to understanding how the world works, and especially how science works. In a democratic society, your voice is helping set policy - and if you don't understand science, you don't understand reality.

Why learn math?

6 Career.

Why learn math?

- 6 **Career.** A lot of the good jobs involve math. Want to become an engineer? Work in a laboratory? Perhaps in an accounting office? You need to be comfortable with math.

Why learn math?

7 Logic.

Why learn math?

- ⑦ **Logic.** If you want to understand logic thoroughly, you have two choices: Study it through philosophy, or study it through math. I took both routes, personally; but understanding how logic works is a great aid in life, from recognizing bad arguments to working your way through important life decisions.

Why learn math?

- 7 **Logic.** If you want to understand logic thoroughly, you have two choices: Study it through philosophy, or study it through math. I took both routes, personally; but understanding how logic works is a great aid in life, from recognizing bad arguments to working your way through important life decisions.

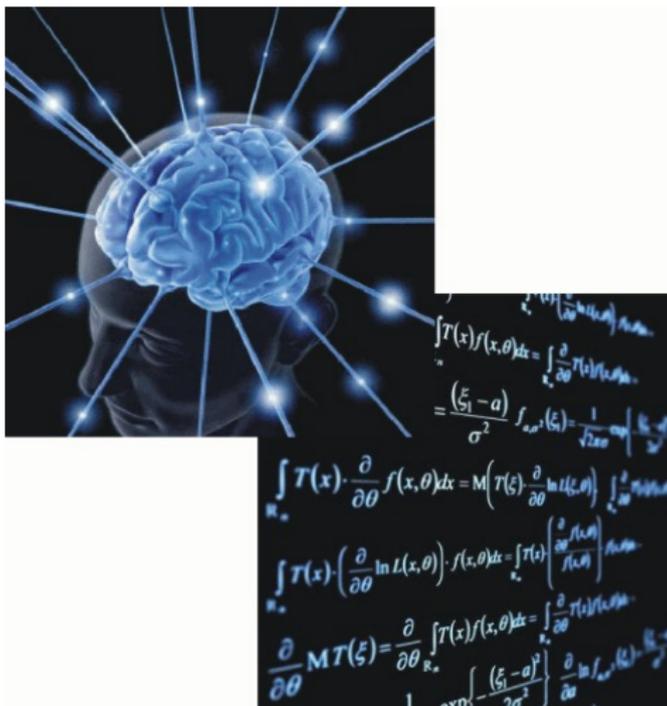
So if someone is going to take care of you for the rest of your life and guide you through it, perhaps you don't need math at all.

Why learn math?

My additional response:

Why learn math?

My additional response:



What makes a piece of mathematics worth studying?

What makes a piece of mathematics worth studying?

- beauty

What makes a piece of mathematics worth studying?

- beauty
- utility

What makes a piece of mathematics worth studying?

- beauty
- utility
- historical importance

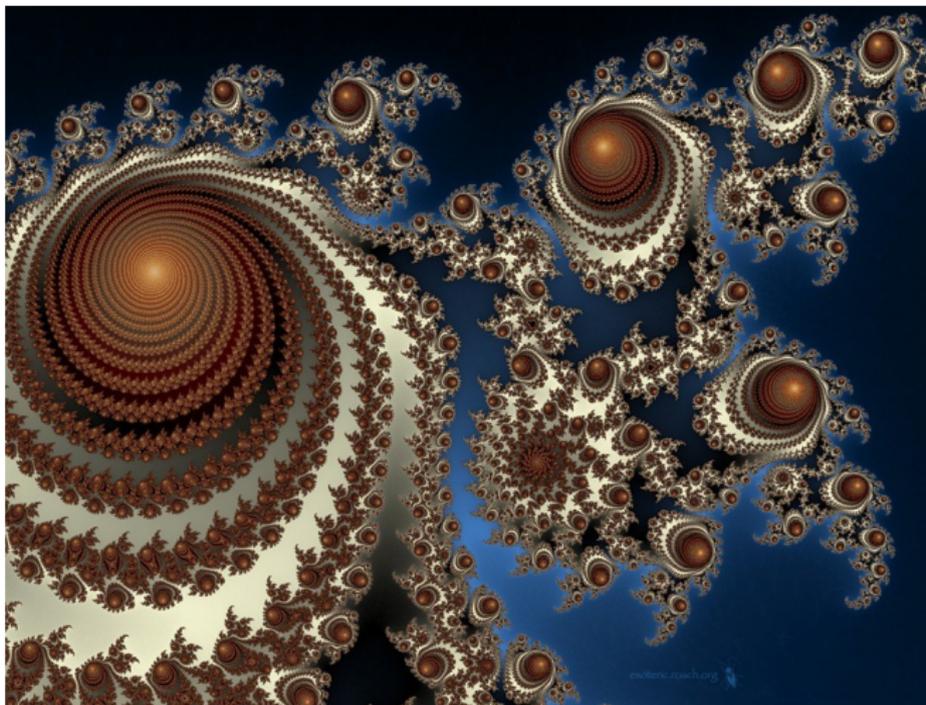
Beauty

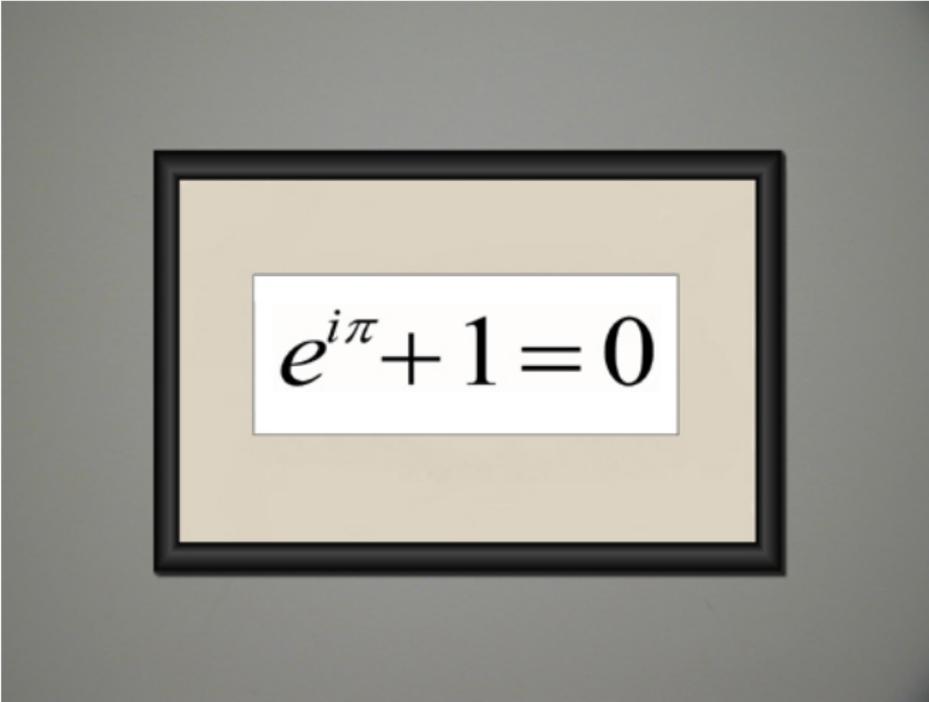


Beauty



Beauty



The image shows a mathematical equation, $e^{i\pi} + 1 = 0$, centered within a white rectangular box. This box is set against a light beige background, which is itself enclosed in a dark grey frame. The entire composition is centered on a dark blue horizontal bar at the top of the slide, which contains the word "Beauty" in white text.
$$e^{i\pi} + 1 = 0$$

Hubble's Law: $v = H_0 d$

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Maxwell's Equations:

$$\nabla \cdot B = 0$$

$$\nabla \times E = -\partial B / \partial t$$

$$\nabla \times H = \partial D / \partial t + J$$

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Riemann zeta function: $\zeta(s) = \sum_{n=1}^{\infty} \frac{1}{n^s}$

Historical importance

- $\sqrt{2}$ is irrational

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- Fermat's Last Theorem: $x^n + y^n = z^n$ for $n > 2$

Historical importance

- $\sqrt{2}$ is irrational
- Fermat's Last Theorem: $x^n + y^n = z^n$ for $n > 2$
- axiomatic geometry

Goals for today

Give you lots more things to try and cover in an already too-crowded math curriculum.

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Help you learn to see things the way a mathematician does.

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Help you learn to see things the way a mathematician does.

- see math everywhere and delight in it

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Help you learn to see things the way a mathematician does.

- see math everywhere and delight in it
- find joy in figuring things out

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- focus on the big picture

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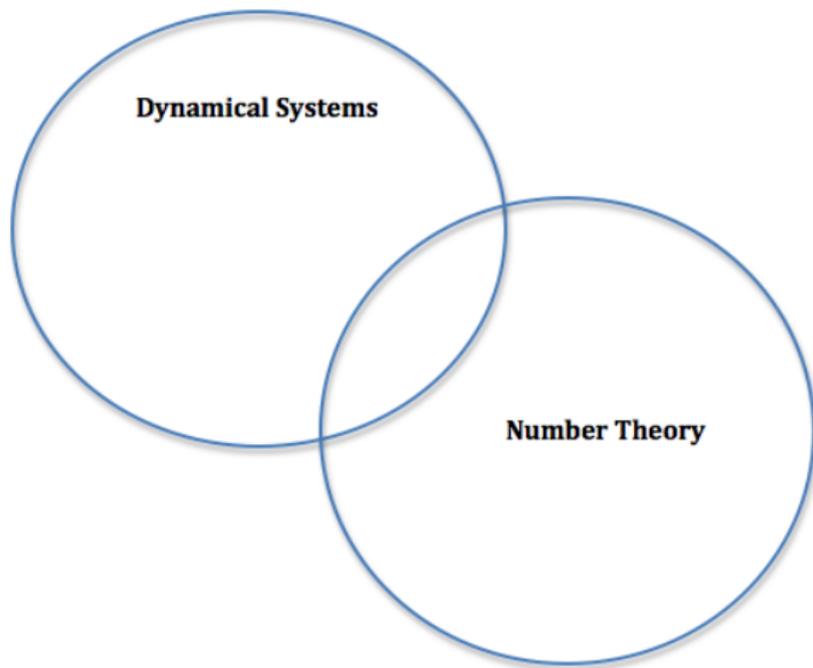
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Help you learn to see things the way a mathematician does.

- see math everywhere and delight in it
- find joy in figuring things out
- see connections between different areas of math
- focus on the big picture
- look for underlying structure and opportunities for abstraction

My research

My research



Dynamical systems

- change over time

Dynamical systems

- change over time
- what happens next depends on current state

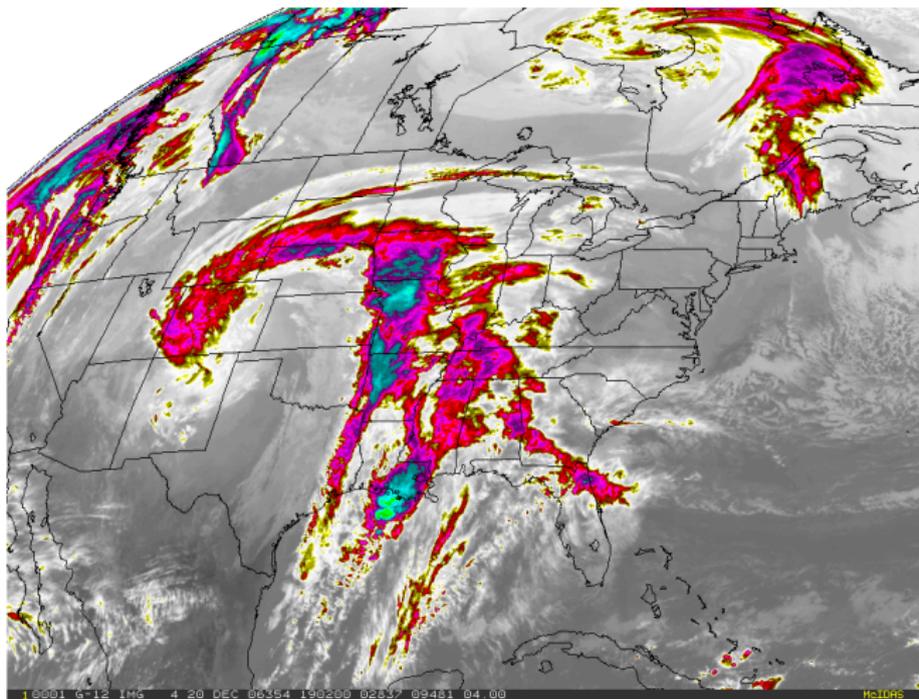
Dynamical systems

- change over time
- what happens next depends on current state
- “sensitive dependence on initial conditions”

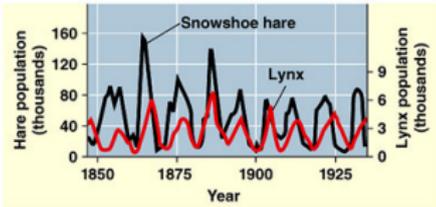
Examples of dynamical systems: Weather



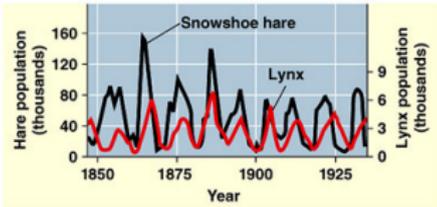
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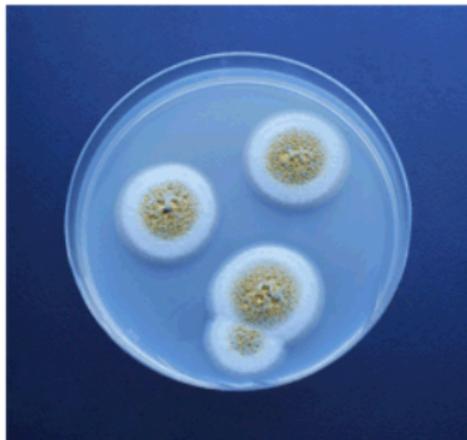
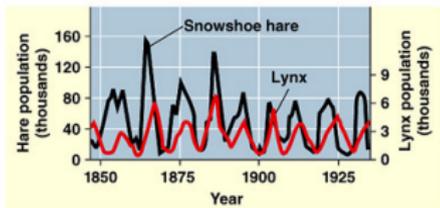
Examples of dynamical systems: Population



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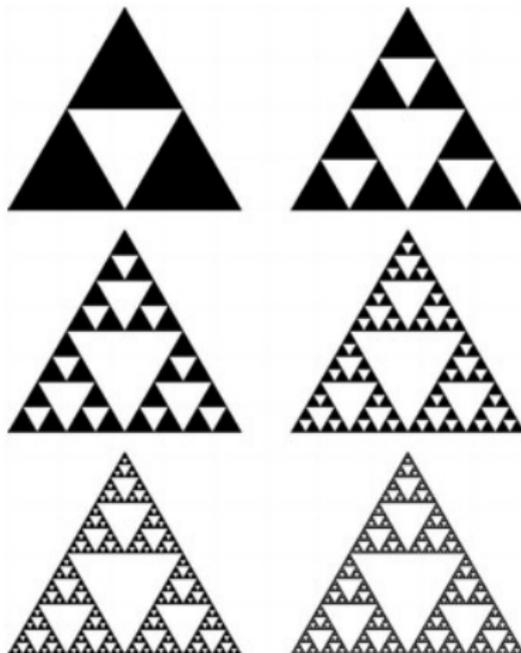


Examples of dynamical systems: Population



$$P(x) = \lambda x(1 - x)$$

Examples of dynamical systems: Sierpinski gasket



Number theory

- study of the integers $\mathbb{Z} = \{\dots, -3, -2, -1, 0, 1, 2, \dots\}$

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- prime numbers $\{2, 3, 5, 7, 11, \dots\}$
- cryptography

$$x^p \equiv x \pmod{p}$$

$$\begin{aligned}2^5 &= 32 = 6 \cdot 5 + 2 \\ &\equiv 2 \pmod{5}\end{aligned}$$

$$\begin{aligned}3^5 &= 243 = 48 \cdot 5 + 3 \\ &\equiv 3 \pmod{5}\end{aligned}$$

$$\begin{aligned}4^5 &= 1024 = 204 \cdot 5 + 4 \\ &\equiv 4 \pmod{5}\end{aligned}$$

Pascal's Triangle

1

Pascal's Triangle

1 1
1 1 1

Pascal's Triangle

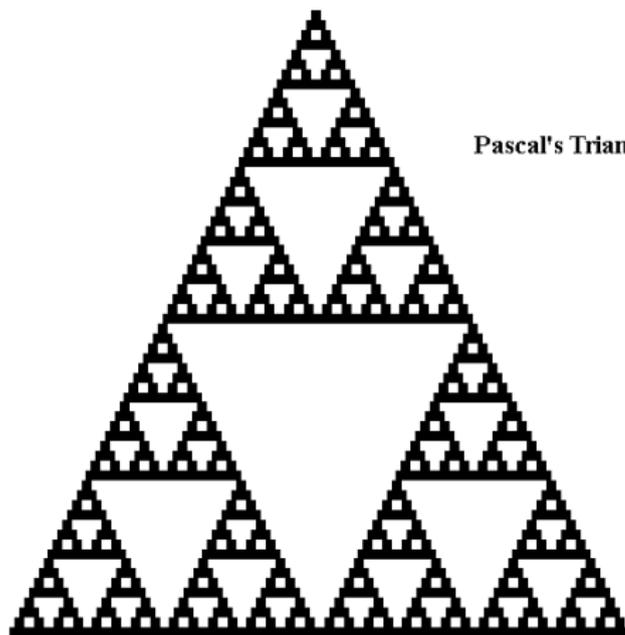
		1		
	1		1	
1		2		1

Pascal's Triangle

A partial Pascal's Triangle is shown, consisting of four rows of numbers. The numbers are arranged in a triangular shape, with each row having one more number than the row above it. The numbers are:

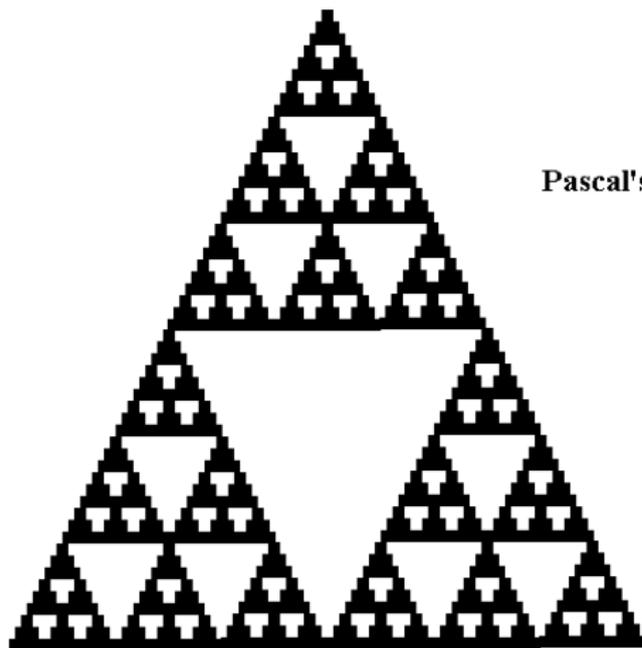
			1			
		1		1		
	1		2		1	
1		3		3		1

Pascal's Triangle Mod 2



Pascal's Triangle Mod 2

Pascal's Triangle Mod 3



Pascal's Triangle Mod 3

A final thought

“But you can’t prove it,” said Susan.

Hawk smiled his warm meaningless smile, “Provin’ don’t matter to me, knowin’s enough.”

“I want it all.”

– R.I. Parker, *Pale Kings and Princes*