



MENGEMBANGKAN KEMATANGAN
BERMATEMATIKA
DALAM JAMAN *AI* (YANG PENUH DENGAN MATEMATIKA)

Wono Setya Budhi

KEMAMPUAN KOMPUTER



MELAKUKAN PERHITUNGAN

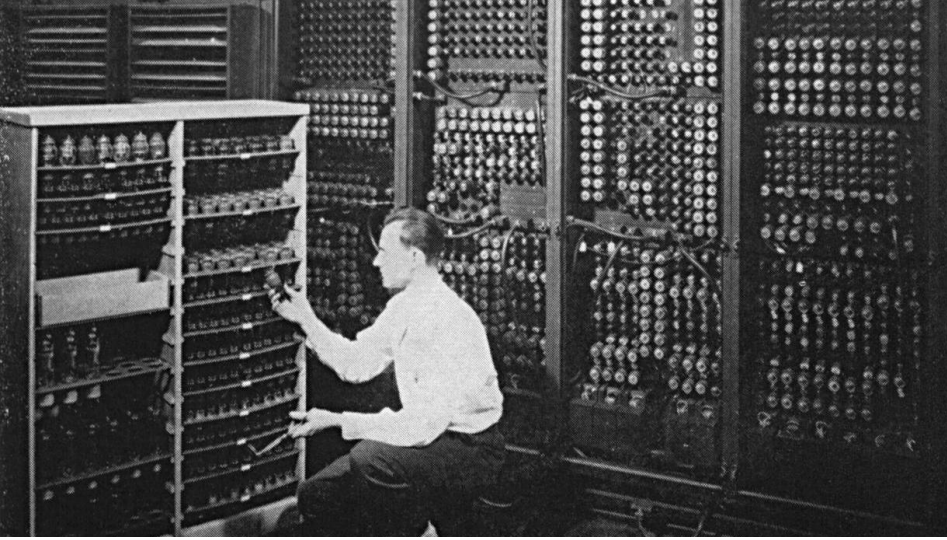


MELAKUKAN MANIPULASI EKSPRESI MATEMATIKA

A collage of mathematical terms and a software interface. On the left, a word cloud features terms like 'SYMBOLIC COMPUTATION', 'MANIPULATION', 'SCIENCE', 'FORMULAS', 'NUMERICAL', 'SYSTEMATICALLY', 'RATIONAL', 'MATHEMATICAL', 'NUMBER', 'ALGEBRA', 'SYSTEM', 'ASPECT', 'JOURNAL', 'PRACTICAL', 'COMPUTATION', 'SYMBOLIC', 'SYSTEMATICALLY', 'NUMERICAL', 'RATIONAL', 'MATHEMATICAL', 'NUMBER', 'ALGEBRA', 'SYSTEM', 'ASPECT', 'JOURNAL'. On the right, a software interface shows three panels for integration: 'Integrate x/(x^2)', 'Integrate x*ln(x^2)', and 'Integrate x*sqrt(1+ln(x))'. Each panel displays the original expression, a graph, and the resulting integral.



ARTIFICIAL INTELLIGENCE



MELAKUKAN PERHITUNGAN



MELAKUKAN MANIPULASI EKSPRESI MATEMATIKA



integrate $x/(x-1)$

integrate $x \sin(x^2)$

integrate $x \sqrt{1-\sqrt{x}}$

integrate $x/(x-1)$

Indefinite Integral
$$\int \frac{x}{x-1} dx = x + \ln|x-1| + C$$

Computing a complex-valued integral

Plot of the Integral

integrate $x \sin(x^2)$

Indefinite Integral
$$\int x \sin(x^2) dx = -\frac{1}{2} \cos(x^2) + C$$

Plot of the Integral

integrate $x \sqrt{1-\sqrt{x}}$

Indefinite Integral
$$\int x \sqrt{1-\sqrt{x}} dx = \frac{4}{315} \sqrt{1-\sqrt{x}} \left(4x^{3/2} - 20x^{5/2} + 8x^{7/2} - 8 \right) + C$$

Plot of the Integral

Alternative form of the Integral
$$\frac{4}{315} \sqrt{1-\sqrt{x}} \left(4x^{3/2} - 20x^{5/2} + 8x^{7/2} - 8 \right) + C$$

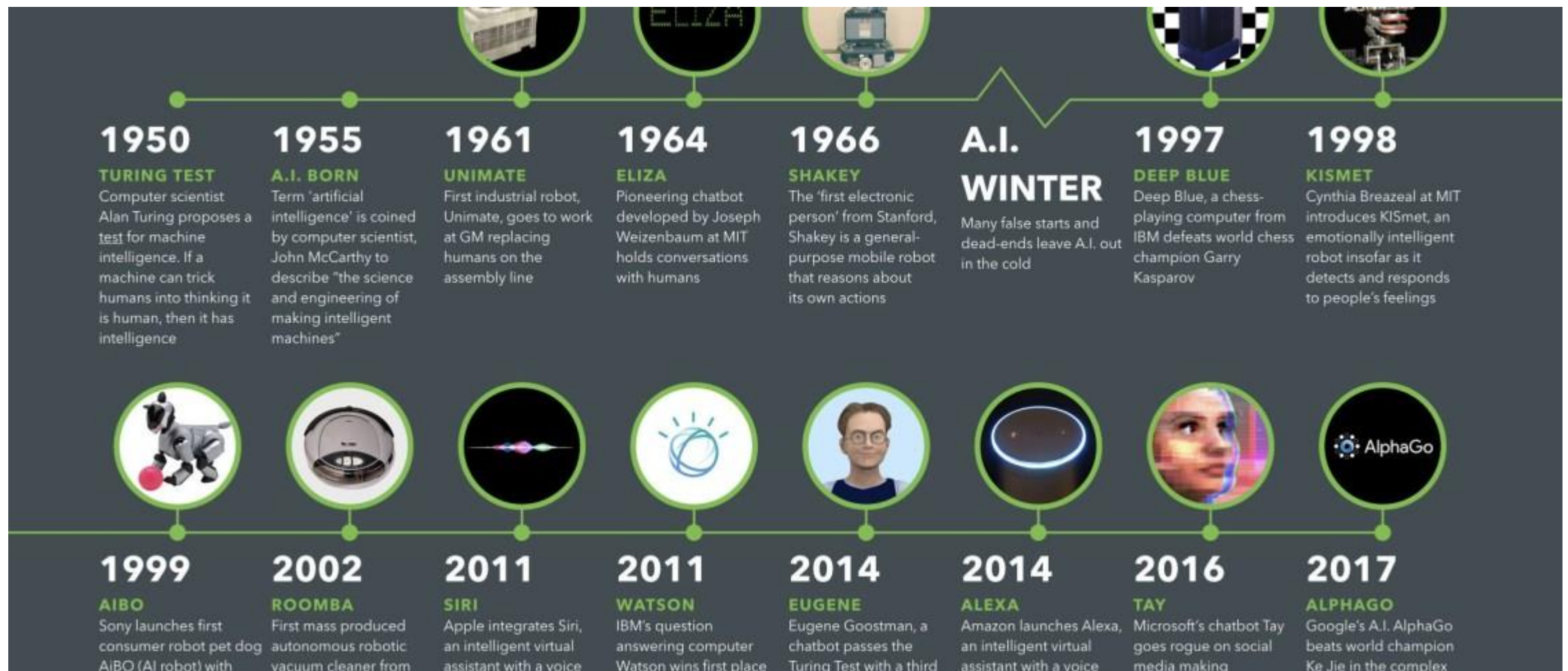
Alternative form of the Integral
$$\sqrt{1-\sqrt{x}} \left(\frac{4x^{3/2}}{45} - \frac{4x^{5/2}}{9} + \frac{8x}{225} - \frac{10\sqrt{x}}{315} - \frac{8}{315} \right) + C$$

Expanded form of the Integral
$$-\frac{8}{315} \sqrt{1-\sqrt{x}} x^{3/2} + \frac{4}{45} \sqrt{1-\sqrt{x}} x^{5/2} - \frac{8}{225} \sqrt{1-\sqrt{x}} x + \frac{8}{315} \sqrt{1-\sqrt{x}} \sqrt{x} + \frac{84\sqrt{1-\sqrt{x}}}{315} + C$$

*ARTIFICIAL
INTELLIGENCE*



PERKEMBANGAN AI



KEAMPUHAN AI

China's CCTV surveillance network took just 7 minutes to capture BBC reporter

Jon Russell @jonrussell / 1:50 PM GMT+7 • December 14, 2017

 Comment

<https://techcrunch.com/2017/12/13/china-cctv-bbc-reporter/>

<https://twitter.com/i/status/939832896604565505>



KEAMPUHAN AI

- <https://twitter.com/i/status/939832896604565505>

← Tweet



BBC News (World) 
@BBCWorld



How long can a BBC reporter stay hidden from CCTV cameras in China? [@TheJohnSudworth](#) has been given rare access to put the world's largest surveillance system to the test



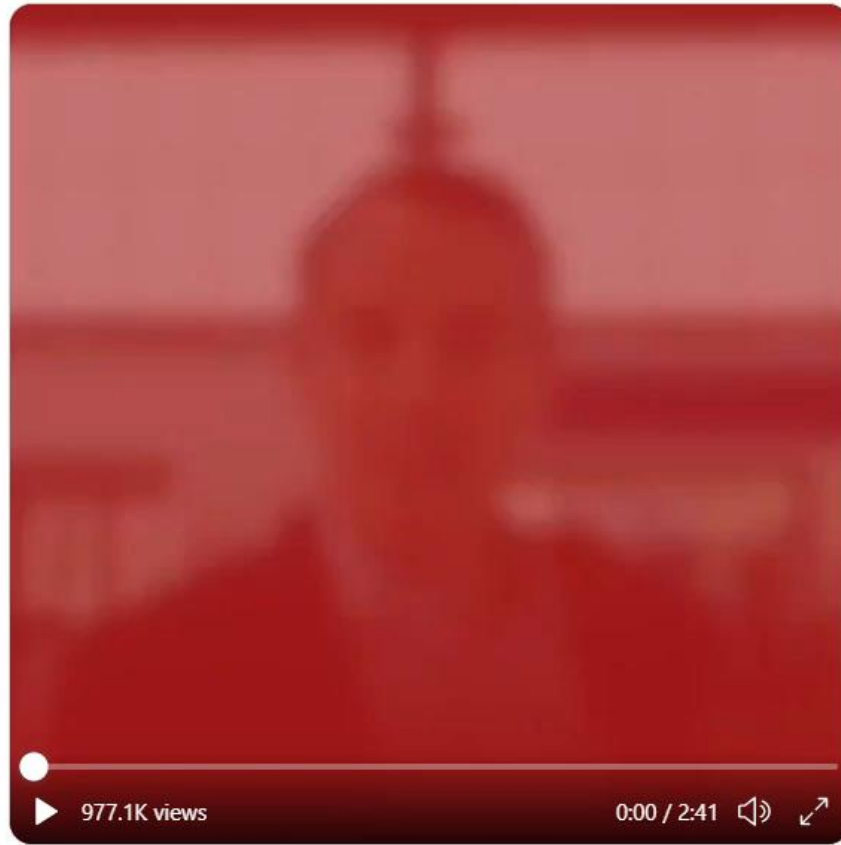
← Tweet



BBC News (World) 
@BBCWorld



How long can a BBC reporter stay hidden from CCTV cameras in China? [@TheJohnSudworth](#) has been given rare access to put the world's largest surveillance system to the test



7:23 PM · Dec 10, 2017 · Twitter Media Studio

8,894 Retweets **2,572** Quote Tweets **8,744** Likes

PERLUKAH BELAJAR MATEMATIKA LAGI

THE
NATIONAL
INTEREST

[Submissions](#) | [Subscribe](#) | [Contact](#) | [Advertising](#) | [About](#) | [Search](#) 

[Magazine](#) | [Blogs](#) | [Military](#) | [Economics](#) | [Technology](#) | [Regions](#)



SUBSCRIBE

July 3, 2020 | *Topic:* Education | *Region:* Asia | *Tags:* China, Artificial Intelligence, Math, Surveillance, Great Power Competition

Why China's Race For AI Dominance Depends On Math

Forget about “AI” itself: it’s all about the math, and America is failing to train enough citizens in the right kinds of mathematics to remain dominant.

by [Michael Auslin](#)

PERLUKAH BELAJAR MATEMATIKA LAGI



Why China's Race For AI Dominance Depends On Math

Forget about “AI” itself: it’s all about the math, and America is failing to train enough citizens in the right kinds of mathematics to remain dominant.

by [Michael Auslin](#)



THE WORLD first took notice of Beijing's prowess in artificial intelligence (AI) in late 2017, when BBC reporter John Sudworth, hiding in a remote southwestern city, was located by China's CCTV system in just seven minutes. At the time, it was a shocking demonstration of power. Today, companies like YITU Technology and Megvii, leaders in facial recognition technology, have compressed those seven minutes into mere seconds. What makes those companies so advanced, and what powers not only China's surveillance state but also its broader economic development, is not simply its AI capability, but rather the math power underlying it.



facial recognition technology, have compressed those seven minutes into mere seconds. What makes those companies so advanced, and what powers not only China's surveillance state but also its broader economic development, is not simply its AI capability, but rather the math power underlying it.



The race for AI supremacy has become perhaps the most visible aspect of the great power competition between America and China. The world's dominant AI power will have the ability to shape global finance, commerce, telecommunications, warfighting, and computing. President Donald Trump recognized this last February by signing an executive order, the "American AI Initiative," designed to protect U.S. leadership in key AI technologies. In just a few years, American corporations, universities, think tanks, and the government have devoted hundreds of policy papers and projects to addressing this challenge.

Yet forget about "AI" itself. It's all about the math, and America is failing to train enough citizens in the right kinds of mathematics to remain dominant.

AI IS not simply a black box that will grow if unlimited funds are poured into it. Dozens of think tank projects and government reports won't mean anything if Americans can't maintain mastery over the fundamental mathematics that underpin AI. Calls for billions of dollars in related investments won't add up without the abstract math ability needed to transform the economy or military.

What we call "AI" is in fact a suite of various algorithms and distinctive developments that draw heavily from advanced mathematics and statistics. Take deep neural networks, which have understandably become a CIO/CTO buzzword, as an example. These are not artificial brains. They are stacks of information-transforming modules that "learn" by repeatedly computing a chain of what are known as gradients (something rarely taught in high school calculus), which are the backbone of a family of algorithms known as backpropagation.





The race for AI supremacy has become perhaps the most visible aspect of the great power competition between America and China. The world's dominant AI power will have the ability to shape global finance, commerce, telecommunications, warfighting, and computing. President Donald Trump recognized this last February by signing an executive order, the “American AI Initiative,” designed to protect U.S. leadership in key AI technologies. In just a few years, American corporations, universities, think tanks, and the government have devoted hundreds of policy papers and projects to addressing this challenge.





The race for AI supremacy has become perhaps the most visible aspect of the great power competition between America and China. The world's dominant AI power will have the ability to shape global finance, commerce, telecommunications, warfighting, and computing. President Donald Trump recognized this last February by signing an executive order, the "American AI Initiative," designed to protect U.S. leadership in key AI technologies. In just a few years, American corporations, universities, think tanks, and the government have devoted hundreds of policy papers and projects to addressing this challenge.

Yet forget about "AI" itself. It's all about the math, and America is failing to train enough citizens in the right kinds of mathematics to remain dominant.

AI IS not simply a black box that will grow if unlimited funds are poured into it. Dozens of think tank projects and government reports won't mean anything if Americans can't maintain mastery over the fundamental mathematics that underpin AI. Calls for billions of dollars in related investments won't add up without the abstract math ability needed to transform the economy or military.

What we call "AI" is in fact a suite of various algorithms and distinctive developments that draw heavily from advanced mathematics and statistics. Take deep neural networks, which have understandably become a CIO/CTO buzzword, as an example. These are not artificial brains. They are stacks of information-transforming modules that "learn" by repeatedly computing a chain of what are known as gradients (something rarely taught in high school calculus), which are the backbone of a family of algorithms known as backpropagation.





Yet forget about “AI” itself. It’s all about the math, and America is failing to train enough citizens in the right kinds of mathematics to remain dominant.





The race for AI supremacy has become perhaps the most visible aspect of the great power competition between America and China. The world's dominant AI power will have the ability to shape global finance, commerce, telecommunications, warfighting, and computing. President Donald Trump recognized this last February by signing an executive order, the "American AI Initiative," designed to protect U.S. leadership in key AI technologies. In just a few years, American corporations, universities, think tanks, and the government have devoted hundreds of policy papers and projects to addressing this challenge.

Yet forget about "AI" itself. It's all about the math, and America is failing to train enough citizens in the right kinds of mathematics to remain dominant.

AI IS not simply a black box that will grow if unlimited funds are poured into it. Dozens of think tank projects and government reports won't mean anything if Americans can't maintain mastery over the fundamental mathematics that underpin AI. Calls for billions of dollars in related investments won't add up without the abstract math ability needed to transform the economy or military.

What we call "AI" is in fact a suite of various algorithms and distinctive developments that draw heavily from advanced mathematics and statistics. Take deep neural networks, which have understandably become a CIO/CTO buzzword, as an example. These are not artificial brains. They are stacks of information-transforming modules that "learn" by repeatedly computing a chain of what are known as gradients (something rarely taught in high school calculus), which are the backbone of a family of algorithms known as backpropagation.





AI IS not simply a black box that will grow if unlimited funds are poured into it. Dozens of think tank projects and government reports won't mean anything if Americans can't maintain mastery over the fundamental mathematics that underpin AI. Calls for billions of dollars in related investments won't add up without the abstract math ability needed to transform the economy or military.




The race for AI supremacy has become perhaps the most visible aspect of the great power competition between America and China. The world's dominant AI power will have the ability to shape global finance, commerce, telecommunications, warfighting, and computing. President Donald Trump recognized this last February by signing an executive order, the "American AI Initiative," designed to protect U.S. leadership in key AI technologies. In just a few years, American corporations, universities, think tanks, and the government have devoted hundreds of policy papers and projects to addressing this challenge.



Yet forget about "AI" itself. It's all about the math, and America is failing to train enough citizens in the right kinds of mathematics to remain dominant.

AI IS not simply a black box that will grow if unlimited funds are poured into it. Dozens of think tank projects and government reports won't mean anything if Americans can't maintain mastery over the fundamental mathematics that underpin AI. Calls for billions of dollars in related investments won't add up without the abstract math ability needed to transform the economy or military.

What we call "AI" is in fact a suite of various algorithms and distinctive developments that draw heavily from advanced mathematics and statistics. Take deep neural networks, which have understandably become a CIO/CTO buzzword, as an example. These are not artificial brains. They are stacks of information-transforming modules that "learn" by repeatedly computing a chain of what are known as gradients (something rarely taught in high school calculus), which are the backbone of a family of algorithms known as backpropagation.



What we call “AI” is in fact a suite of various algorithms and distinctive developments that draw heavily from advanced mathematics and statistics. Take deep neural networks, which have understandably become a CIO/CTO buzzword, as an example. These are not artificial brains. They are stacks of information-transforming modules that “learn” by repeatedly computing a chain of what are known as gradients (something rarely taught in high school calculus), which are the backbone of a family of algorithms known as backpropagation.



The race for AI supremacy has become perhaps the most visible aspect of the great power competition between America and China. The world's dominant AI power will have the ability to shape global finance, commerce, telecommunications, warfighting, and computing. President Donald Trump recognized this last February by signing an executive order, the "American AI Initiative," designed to protect U.S. leadership in key AI technologies. In just a few years, American corporations, universities, think tanks, and the government have devoted hundreds of policy papers and projects to addressing this challenge.

Yet forget about "AI" itself. It's all about the math, and America is failing to train enough citizens in the right kinds of mathematics to remain dominant.

AI IS not simply a black box that will grow if unlimited funds are poured into it. Dozens of think tank projects and government reports won't mean anything if Americans can't maintain mastery over the fundamental mathematics that underpin AI. Calls for billions of dollars in related investments won't add up without the abstract math ability needed to transform the economy or military.

What we call "AI" is in fact a suite of various algorithms and distinctive developments that draw heavily from advanced mathematics and statistics. Take deep neural networks, which have understandably become a CIO/CTO buzzword, as an example. These are not artificial brains. They are stacks of information-transforming modules that "learn" by repeatedly computing a chain of what are known as gradients (something rarely taught in high school calculus), which are the backbone of a family of algorithms known as backpropagation.





And contrary to what some prominent AI advocates—like Kai-fu Lee, author of the *AI Superpowers*—argue, it's not simply all about data. Lee is famous for saying that, today, data is the **oil** of the early twentieth century, and that China, which has the most data, is the new Saudi Arabia. Yet without the right type of math, and those who can creatively develop it, all the data in the world will only take you so far—and certainly not far enough into the future AI advocates boldly envision.

SEKARANG MATEMATIKA LEBIH BERPERANAN

- <https://www.youtube.com/watch?v=ZEQjjv67qUQ&list=PLbXrmJYZlhempvIvIyPIG58F>



 YouTube^{ID}

Search



The Era of Mathematics

2,953 views • Feb 24, 2020

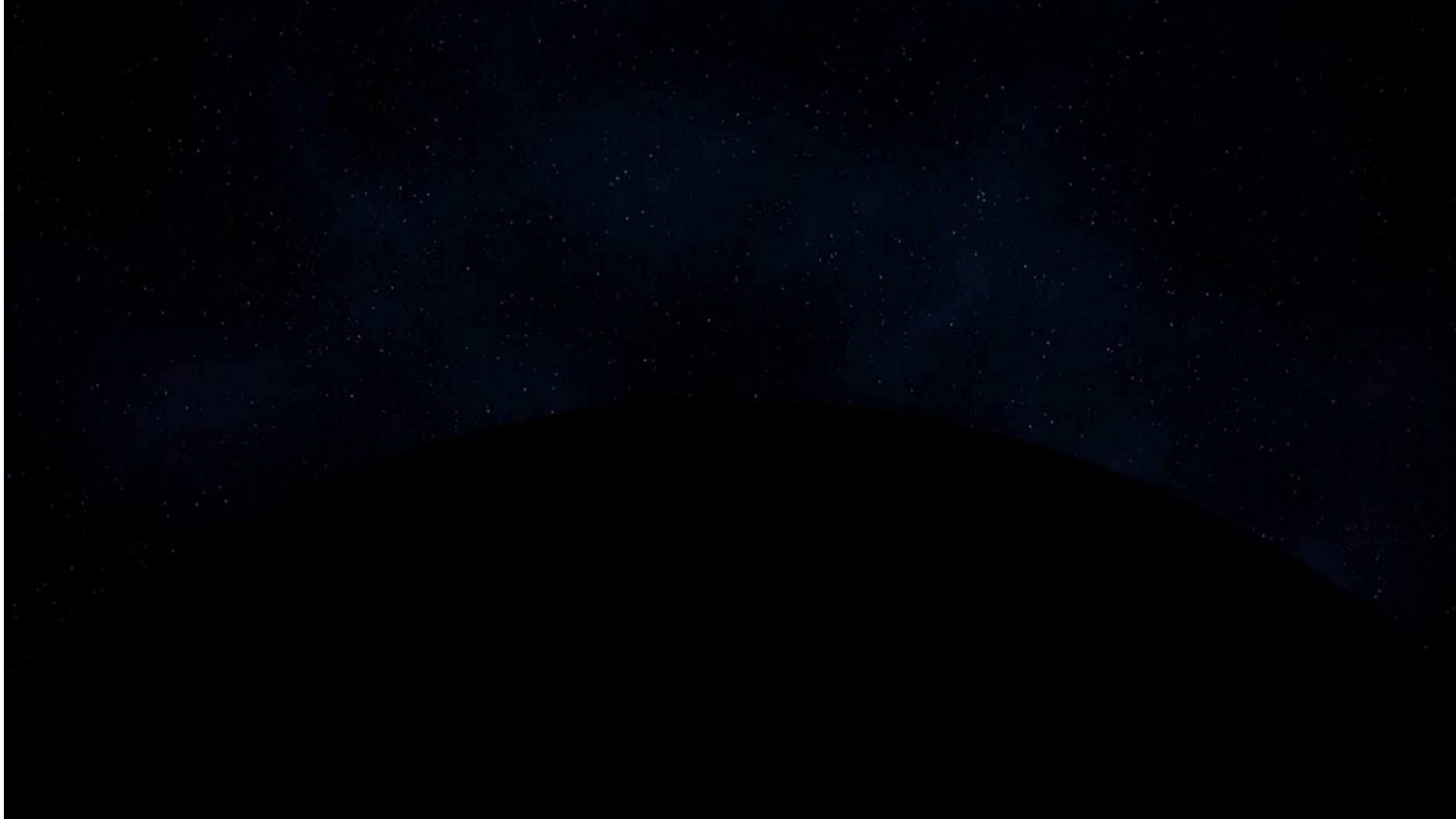


European Mathematical Society
157 subscribers

SUBSCRIBE

The profound impact of mathematics on life and business in the 21st century

ERA OF MATHEMATICS



PERSOALANNYA MATEMATIKA YANG SEPERTI APA?

- Kumpulan rumus.
- Memberikan contoh bagaimana rumus digunakan.
- Belajar Algoritma.
- Belajar Menggunakan Perangkat Lunak.

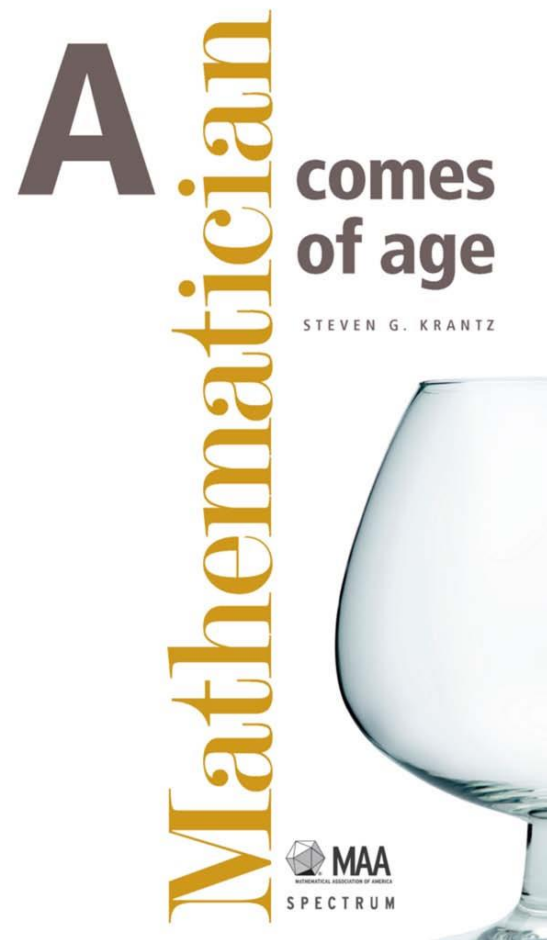
KEGIATAN YANG MENDUKUNG PENGEMBANGAN MATEMATIKA

- Melakukan Eksplorasi/Investigasi
- Berani mencoba!
- Selalu mencari cara lain.
- Pahami sampai diri kita mengerti, bukan karena percaya kepada guru dan lain sebagainya.
- Mempunyai kepercayaan bahwa dirinya akan bisa menyelesaikan masalah tersebut.



Jo Boaler

BERBEDA DENGAN LAIN: KEMATANGAN BERMATEMATIKA



CHAPTER 1

Introductory Thoughts

Mathematical maturity is like pornography: I don't know what it is, but I know it when I see it.

John P. D'Angelo (mathematician)

A mathematician is mature up to the point where he becomes interested in mathematics.

Vladimir I. Arnol'd (mathematician)

I believe that a scientist looking at nonscientific problems is just as dumb as the next guy.

Richard Feynman (physicist)

Mathematics is the queen of the sciences.

Carl Friedrich Gauss (mathematician)

What I look forward to is continued immaturity followed by death.

Dave Barry (comic)

I, specifically, arrived at NYU intent on achieving a double major in film and ... physics. Once I was informed of the required workload, especially the number of math classes I would have to take, I abandoned my scientific aspirations on the spot and focused my energy on filmmaking.

Nicolas Falacci (filmmaker)

1.0 Chapter Overview

What is mathematical maturity? How can we identify it? Perhaps more importantly, how can we recognize when it is not there, and then determine to do something about it? These are essential questions for any mathematics teacher, and ones that we must learn together to answer.

BERBEDA DENGAN LAIN: KEMATANGAN BERMATEMATIKA



Mathematical maturity is like pornography: I don't know what it is, but I know it when I see it.

John P. D'Angelo (mathematician)



I never had a better feeling at working a problem or just as dumb as the next guy.

Richard Feynman (physicist)

Mathematics is the queen of the sciences.

Carl Friedrich Gauss (mathematician)

What I look forward to is continued immaturity followed by death.

Dave Barry (comic)

I, specifically, arrived at NYU intent on achieving a double major in film and ... physics. Once I was informed of the required workload, especially the number of math classes I would have to take, I abandoned my scientific aspirations on the spot and focused my energy on filmmaking.

Nicolas Falacci (filmmaker)

1.0 Chapter Overview

What is mathematical maturity? How can we identify it? Perhaps more importantly, how can we recognize when it is not there, and then determine to do something about it? These are essential questions for any mathematics teacher, and ones that we must learn together to answer.



Jo Boaler

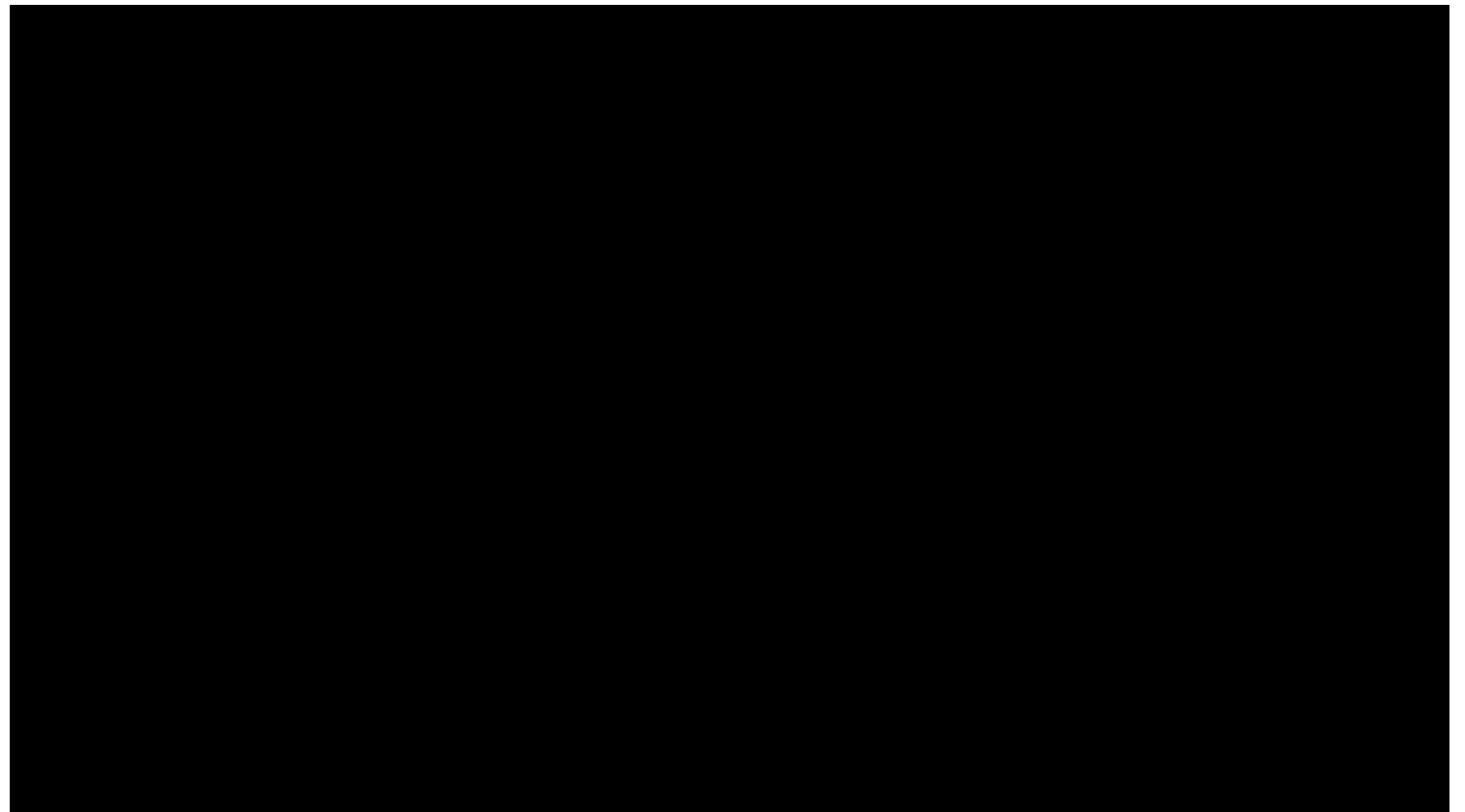
TED^x Stanford 2016
x = independently organized TED event

KEADAAN SUDAH BERBEDA

[HTTPS://WWW.YOUTUBE.COM/
WATCH?V=3ICOSEGQQTU](https://www.youtube.com/watch?v=3ICOSEGQQTU)

How you can be good at math, and other surprising facts about learning | Jo Boaler | TEDxStanford

KEMAMPUAN MATEMATIKA DAPAT DIKEMBANGKAN



SELAMA INI ADA PEMAHAMAN YANG PERLU
DIPERBAIKI TENTANG KEMAMPUAN MATEMATIKA



Jo Boaler



BERBEDA DENGAN YANG LAIN, BELAJAR MATEMATIKA
AKAN BERKEMBANG JIKA PERNAH MELAKUKAN
KESALAHAN DAN PERCAYA DAPAT MELAKUKAN



CONTOH2 KEMATANGAN BERMATEMATIKA



Mampu memanfaatkan situasi khusus

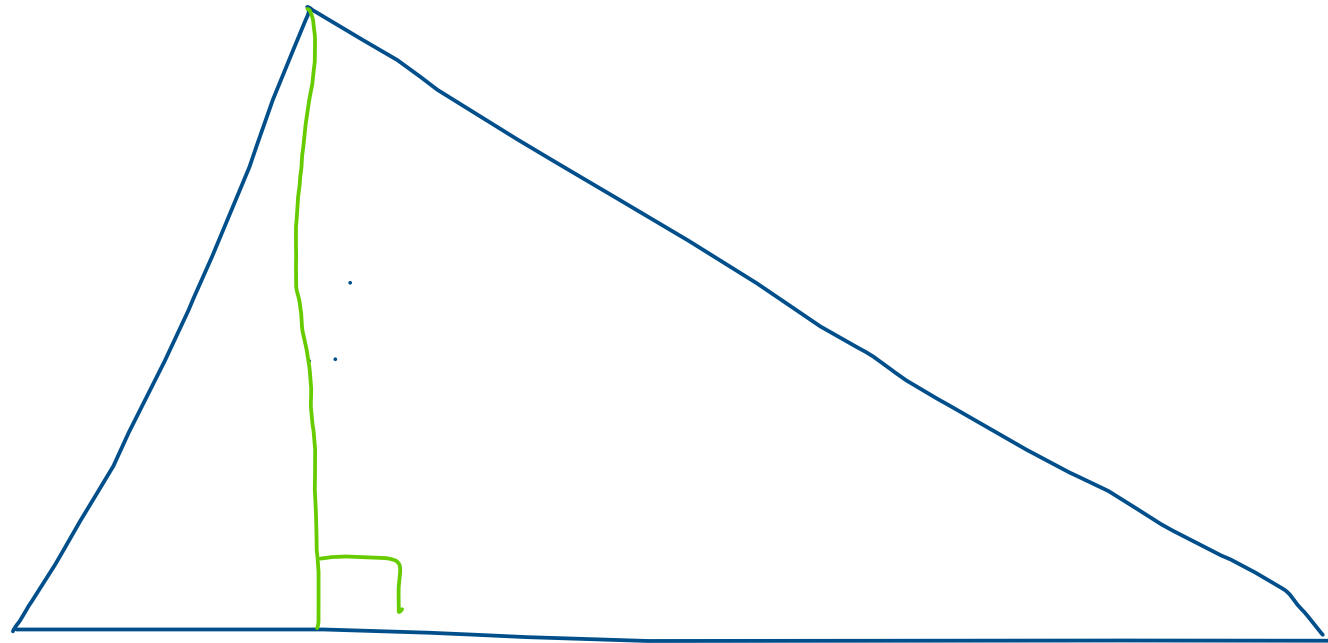


- Karena nilainya dekat dengan 100, manfaatkan!
- $(100 - 3)(100 - 5) =$
- $10.000 - 8 \times 100 + 3 \times 5$
- $= 9215$

CONTOH2 KEMATANGAN BERMATEMATIKA

$$\begin{array}{r} 112 \times 103 = 11536 \\ \begin{array}{r} 112 \\ \times 103 \\ \hline 336 \\ 112 \\ \hline 11536 \end{array} \\ \end{array}$$
$$\begin{aligned} 112 \times 103 &= 112 \times (100 + 3) \\ &= 112 \times 100 + 112 \times 3 \\ &= 11200 + 336 \\ &= 11536 \end{aligned}$$
$$\begin{array}{r} \overset{\times}{112} \times \overset{\times}{103} = 11536 \\ 112 + 3 = 115 \\ 12 \times 3 = 36 \end{array}$$

CONTOH2 KEMATANGAN BERMATEMATIKA



CONTOH2 KEMATANGAN BERMATEMATIKA



Buy the cover art → [Illustration by George Dawmay for TIME; Redux](#)

100 WOMEN
OF THE YEAR

WORLD

1928: Anna May Wong

CONTOH2 KEMATANGAN BERMATEMATIKA

- 17, 27, 37, ..., 157 bertambah 10 setiap kali, ada berapa banyak?
- 10, 20, 30, ..., 150

CONTOH2 KEMATANGAN BERMATEMATIKA

- 1, 2, 4, 8, ? Berapa nilai berikut...

CONTOH2 KEMATANGAN BERMATEMATIKA

- Mensimulasikan peristiwa random dengan menggunakan bilangan modulo yang sangat besar.

ADA YANG MENCOBA MEDESKRIPSIKAN KEMATANGAN BERMATEMATIKA

The Definitive Glossary of Higher Mathematical Jargon

LANGUAGE OF HIGHER MATH, FOUNDATION OF HIGHER MATH

Home » Vault » Language of Higher Math » The Definitive Glossary of Higher Mathematical Jargon

Mathematical Maturity

The quality of having a **general understanding** and **mastery** of the way mathematicians operate — and the language they use to communicate ideas. These include, among others:

- The ability to identify and state **mathematical patterns**
- The ability to raise interesting **mathematical questions**
- The ability to carry out **generalizations**
- The ability to understand and make use of **higher mathematical jargon**
- The ability to make **sound judgments** on the quality and the validity of a proof
- The ability to think through the **implications** of a definition or a proposition
- The ability to fill in the **preliminaries** on one's own
- The ability to construct and present a **proof** or a **disproof** of a typical claim

In general, mathematical maturity allows one to operate intellectually in an independent, standalone manner, and like **mathematical intuition**, can be a product of both knowledge and experience.

ADA YANG MENCOBA MEDESKRIPSIKAN KEMATANGAN BERMATEMATIKA

Mathematical Maturity

The quality of having a **general understanding** and **mastery** of the way mathematicians operate — and the language they use to communicate ideas. These include, among others:

- The ability to identify and state **mathematical patterns**
- The ability to raise interesting **mathematical questions**
- The ability to carry out **generalizations**
- The ability to understand and make use of **higher mathematical jargon**
- The ability to make **sound judgments** on the quality and the validity of a proof
- The ability to think through the **implications** of a **definition** or a **proposition**
- The ability to fill in the **preliminaries** on one's own
- The ability to construct and present a **proof** or a **disproof** of a typical claim

In general, mathematical maturity allows one to operate intellectually in an independent, standalone manner, and like **mathematical intuition**, can be a product of both knowledge and experience.

KEMATANGAN BERMATEMATIKA: MELAKUKAN HAL BERIKUT

- Make and use connections with other problems and other disciplines
- Fill in missing details
- Spot, correct and learn from mistakes
- Winnow the chaff from the wheat, get to the crux, identify intent
- Recognize and appreciate elegance
- Think abstractly
- Read, write and critique formal proofs
- Draw a line between what you know and what you don't know
- Recognize patterns, themes, currents and eddies
- Apply what you know in creative ways
- Approximate appropriately
- Teach yourself
- Generalize
- Remain focused
- Bring instinct and intuition to bear when needed

M A T H E M A T I C A L
C R E A T I V E
C O M P E T E N T
I N T U I T I V E
C U R I O U S
R E S I L I E N T
A U T H E N T I C
A N A L Y T I C A L

APAKAH KEMATANGAN BERMATEMATIKA DIPERLUKAN BIDANG LAIN

- Kematangan bermatematika tidak hanya digunakan untuk matematika saja, tetapi untuk berbagai kegiatan.

KESIMPULAN

- Marilah kita pikirkan pendidikan/kurikulum masa yang akan datang.
- Marilah kita bersikap dalam menghadapi perubahan yang luar biasa ini.



TERIMA KASIH