Math Changes Everything

The Importance of Mathematics to the U.S.: An Industry Perspective

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a^2 + b^2 = c^2
Mathematics, a human endeavor.
The universe cannot be read until we have learnt the language and become familiar with the characters in which it is written. It is written in mathematical language, and the letters are triangles, circles and other geometrical figures, without which means it is humanly impossible to comprehend a single word.

OPERE IL SAGGIATORE, P. 171.
Mathematics, is the language of Transformation.
Rivest, Shamir & Adleman

RSA Encryption

Security Data Protection
Humans

Mathematics

Prosperity
Security
Health of Human
Health of Planet
Math

Prosperity

- Innovation
- Ecosystem
- Workforce & Education
- Economic Growth
Math fuels Innovation

Problem Solving

Quantitative Analysis

Modeling & Simulation

Optimization

Data Analysis
From algorithms to AI, mathematics fuels breakthroughs.
Math drives an Innovation Ecosystem

Fostering Collaboration

Accelerating Discovery
Accelerating discovery with AI for materials science.

IPAM
Math is the foundation of our
Workforce & Education

Gateway to a skilled workforce
Math teaches analytical thinking, decision making, creativity and cross-disciplinary collaboration

Foundation of STEM
Math is the common language, and only discipline that can stand independently

Growing and Attracting Top Talent
Investment in math is critical for U.S. technology leadership
Others are strategically investing in mathematics education.

STEM graduates as a share of all tertiary education degree recipients in selected countries in 2022 (in percent)*

MY: 43.5
TN: 37.9
AE: 36.2
DE: 35.8
BY: 34.6
IN: 34.0
KR: 30.2
GB: 22.8
US: 19.6
BR: 17.5

Math is the cornerstone of Economic Growth

Technology

Finance

Manufacturing
Math is the basis for

Artificial Intelligence

AI is the result of advanced algorithms, the availability of massive data, and access to high-performance computation.
Math is the foundation of our

Financial Systems

Most trading is electronic and automated.

The international banking system depends on math.
Math revolutionizes Manufacturing, Transport, & Infrastructure

Math models drive optimal resource utilization, traffic flow modeling, route and schedule optimization, infrastructure design, logistics management, safety analysis, and much more...
Math changes

Modern Defense

Physical & Cyber Battlefields

Advancements in math required to model complex battlefields.

Hybrid Threat Neutralization

Large-scale simulation capabilities needed to generate strategies & tactics.

Disrupting Large-Scale Attacks

Game theoretical methods for building effective strategies.
Math supports Nuclear Capability

Detect Nuclear Testing Worldwide

Signal processing enables the U.S. to identify nuclear testing events.

Maintaining Nuclear Capability

HPC-driven models help us understand aging of nuclear weapons.

High-Altitude Defense

Driven by targeting & detection algorithms.
Math enables Cybersecurity

Data Protection
Math is the underlying basis of encryption, fundamental in making and breaking data protection.

Network Resilience
Math models simulate and analyze network structures, aiding in design process.

Intrusion Detection & Prevention
Math algorithms analyze network traffic patterns to identify anomalies.

Vulnerability Assessment
Math-driven tools determine potential weaknesses and guide corrective measures.
Math enhance our Network Awareness

Thwart Terror Networks

Limit Foreign Social Media Influence

Geospatial Awareness
Math helps

Thwart Terror Networks

Math models and algorithms, can aid in uncovering and dismantling terror networks by revealing key nodes and identifying structural patterns.
Math helps

Limit Foreign Social Media Influence

Math models and analysis can assist in comprehending and limiting foreign social media influence campaigns by identifying key influencers and detecting coordinated behaviors.
Math improves Geospatial Awareness

Math models can help uncover and interpret anomalies by identifying irregularities in geographical data and enabling the detection of spatial patterns.
Math

Health of Human

- Medical Imaging
- Patient Care
- Pharmaceutical Research
- Genomics & Bioinformatics
Math changes Everything

Math changes

Medical Imaging

Precise & Advanced Image Reconstruction

Math algorithms help create high-resolution and accurate images.

Diagnostics Accuracy

Math models analyze complex data for precise diagnosis.

Imaging Efficiency

Math-driven innovations reduce scan times and improve patient experiences.
Math advances Patient Care

Proactive & Personal Treatment
Math-driven analytics forecast patient outcomes and drive treatment.

Resource Optimization
Math models streamline healthcare operations.

Risk Stratification
Math algorithms enable optimized care for high-risk individuals.
Math revolutionizes Pharmaceutical Research

**Drug Discovery**

Computational math accelerates prediction of interactions between drugs and genomes.

**Optimized & Targeted Therapies**

Math models identify potential drug targets and precise dosages.

**Cost-Efficient Screening**

Compute models streamline virtual screening, reducing research time and costs.

**Predictive Analytics**

Predictive math models guide decisions in drug development pipelines.
Math changes Everything

Genomics & Bioinformatics

Genomic Sequencing

Vaccine Design

Personalized Medicine
Math enables

Genomic Sequencing

Mathematical models & combinatoric algorithms analyze vast genomic data and interactions within biological systems to unravel genetic codes.
Math contributes to

Vaccine Design

Math algorithms help design and improve vaccines, enhancing their effectiveness and safety.
Math supports personalized medicine.

Mathematical approaches interpret genetic variations, guiding tailored treatment strategies for individual patients.
Humans  Mathematics  Health of Planet

Prosperity  Security  Health of Human
Math empowers

Energy Optimization

Grid Efficiency & Management
Network models for efficiency, reliability, and control.

Power Plant Efficiency
Simulations & digital twins to enhance design and operation.

Carbon Emission Reduction
Math driven analysis for effective strategies.
Math facilitates

Crisis Resilience

Crisis Prediction
Predictive Modeling for early warnings and strategic decision-making.

Emergency Response & Aid
Algorithms and simulations for effective response plans and coordination.

Infrastructure Resilience
Analysis and simulations for strengthening design.
Math changes

Resource Allocation

Healthcare Management

Water Resource Control

Food Security & Planning

Supply Chain Logistics
Math models optimize

Healthcare Management

Healthcare resource distribution and improving access to medical services.
Math models guide

Water Resource Control

Addressing scarcity and promoting responsible use of water resources globally.
Math optimizes Food Security & Planning

Strategies to optimize safety, production, distribution, and accessibility.
Math governs

Supply Chain Logistics

Ensuring a rapid and efficient flow of essential goods.
Math Changes Everything

Math is a human endeavor...

...and the language of transformation

...across prosperity, security, people and planet.
A path to our future success
A path to our future success

Natural resources and abilities?

Certainly, but they only go so far
A path to our future success

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Certainly, but they only go so far

Passion for Innovation?

Absolutely, but the fire must be fed
A path to our future success

- Natural resources and abilities?
  - Certainly, but they only go so far

- Supportive Ecosystem?
  - Necessary, but not sufficient

- Passion for Innovation?
  - Absolutely, but the fire must be fed
A path to our future success

Strategic Investment in Mathematics Research
Q&A

Seeking input and dialogue on the critical role of mathematics