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PRACTICAL APPLICATIONS OF MATHEMATICS

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Abstract: This article explores the practical applications of mathematics in everyday life, engineering, economics, and technology. It demonstrates to technical college students that mathematics is not merely a theoretical discipline but a powerful tool for solving real-world problems. Examples, tables, and computational methods for various fields are provided.

1.Introduction.

Mathematics is one of the oldest and most universal sciences ever created by humankind. Many students perceive mathematics as nothing more than a collection of complex formulas and abstract concepts. In reality, however, mathematics is constantly applied in our daily lives, professional activities, and technology.

Throughout technical college education, students must acquire not only theoretical mathematical knowledge but also the practical skills to apply it. For a future engineer, geometric calculations are essential; for an economist, percentages and statistics are indispensable; for a programmer, logic and algorithms are fundamental — all of these are built upon mathematics.

The purpose of this article is to illustrate the real-world applications of mathematics through concrete examples and to encourage students to view this subject from a fresh perspective.

2. KEY FIELDS OF MATHEMATICAL APPLICATION

2.1. Mathematics in Engineering and Construction. Every specialist working in construction is in constant contact with geometry and algebra. The structural integrity of buildings, wall thickness, and foundation loads are all based on mathematical calculations.

For example, triangular structures are among the most widely used shapes in construction. The reason is that a triangle is the most stable geometric figure, and the relationship between its angles and sides is determined by the Pythagorean theorem:

$$\mathbf{a^2 + b^2 = c^2}$$

This formula is also used in laying electrical conduits correctly, in railway and road construction, and even in GPS navigation systems.

Table 1.

Key mathematical formulas used in construction

Task	Formula	Application
Right-angled triangle	$a^2 + b^2 = c^2$	Diagonal calculation
Area of a circle	$S = \pi \times r^2$	Domes and columns
Volume of a cuboid	$V = a \times b \times h$	Room volume calculation
Area of a trapezoid	$S = (\frac{a+b}{2}) \times h$	Landscape design

2.2. Mathematics in Economics and Finance

In the field of economics, not a single step can be taken without mathematics. Pricing, profit calculation, loans, and interest problems all require precise mathematical knowledge.

One of the most widely used formulas is the compound interest formula, which is applied to calculate bank deposits, loans, and investments:

$$\mathbf{A = P \times (1+\frac{r}{n})^{(n \times t)}}$$

Where: P = principal amount, r = annual interest rate (as a decimal), n = number of compounding periods per year, t = number of years, A = final amount.

For example, if you deposit 10,000 USD in a bank at an annual rate of 15%, after 3 years the deposit will amount to:

$A = 10{,}000 \times (1 + 0.15)^3 = 10{,}000 \times 1.521 \approx \$15{,}209$

2.3. Mathematics in Technology and Programming

Modern technologies are entirely built on a mathematical foundation. Computer programming, artificial intelligence, and cybersecurity all cannot exist without mathematics.

- Boolean algebra: the foundation of computer circuits
- Matrices and vectors: used in 3D graphics, games, and animation
- Statistics and probability theory: fundamental to machine learning
- Cryptography: number theory is used to encrypt data
- Differential equations: used in signal processing and engineering software

For example, at the core of Google Search lies the PageRank algorithm. This algorithm uses matrix multiplication to rank web pages by importance — a direct application of linear algebra.

2.4. Mathematics in Medicine and Biology

Mathematics also plays a vital role in medicine. Calculating drug dosages, creating disease spread models, and analyzing medical images all require mathematical knowledge.

In epidemiology, the SIR model is used to study the spread of disease. This model consists of three differential equations studying three groups of a population: susceptible (S), infected (I), and recovered (R).

Furthermore, Fourier analysis is used to process ECG (electrocardiogram) signals, while mathematical matrix transformations are used to process CT scanner and MRI images.

2.5. Mathematics in Ecology and Meteorology

Complex mathematical models are used for weather forecasting and environmental analysis. Studying atmospheric motion, climate change, and pollution spread is based on systems of differential equations.

For example, the exponential growth model is used to analyze population growth:

$$\mathbf{P(t) = P_0 \times e^{(r \times t)}}$$

This model is also used to forecast animal population dynamics, bacterial growth, and even the rise in the number of users on social networks.

3. CROSS-FIELD COMPARISON

Table 2.

Applications of mathematical concepts across different fields

Mathematical Field	Engineering	Economics	Technology
Algebra	Force calculation	Equation modeling	Programming code
Geometry	Design &	Land	Computer

Mathematical Field	Engineering	Economics	Technology
	drafting	surveying	graphics
Statistics	Quality control	Market analysis	Artificial intelligence
Differential calculus	Motion analysis	Dynamic pricing	Signal processing
Probability theory	Reliability testing	Risk assessment	Security systems

4. PRACTICAL PROBLEMS AND SOLUTIONS

Problem 4.1: Construction Calculation

Problem: A triangular metal structure is being installed on a building's roof. The base of the structure is 6 metres and its height is 4 metres. Find the length of the hypotenuse.

Solution: Using the Pythagorean theorem:

$c^2 = a^2 + b^2 = 6^2 + 4^2 = 36 + 16 = 52$

$c = \sqrt{52} \approx 7.21$ metres

Problem 4.2: Bank Deposit Calculation

Problem: A student deposited $5,000 in a bank at an annual compound interest rate of 18% for 2 years. What will the final amount be?

Solution: Using the compound interest formula:

$A = P \times (1+r)^t = 5{,}000 \times (1 + 0.18)^2$

$A = 5{,}000 \times 1.3924 \approx \$6{,}962$

Profit: \$6,962 − \$5,000 = \$1,962

5. CONCLUSION

Mathematics is not merely a subject taught in school or college — it is a universal tool applied across all areas of life. Whether you become an engineer, economist, programmer, doctor, or ecologist, mathematical knowledge will always be indispensable.

For technical college students, the most important thing is not to mechanically memorise mathematical formulas, but to understand their practical applications. Behind every formula lies a real problem and its solution.

A piece of advice for students who find mathematics challenging: if a formula seems hard to remember, first try to understand what problem it solves. Once the goal is clear, the method will follow naturally.

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