

5. WHY STUDY MATHEMATICS?*

Knowledge of mathematics, and any school or college subject, is a power. Mathematics has a special place in all subjects and more so in this technological age. Just as physical prowess can be developed by anyone, mathematical prowess can be developed by anyone. It is not limited to any nationality, gender, or race. A powerful person is held in high esteem by any society. There are so many high paying job opportunities available for a person good in mathematics, that the sky is the limit. Universities and well known industries are looking for people proficient in mathematics. By developing the mathematical power, anyone can get out of the rut of financial woes. Future careers need interdisciplinary studies that include mathematics as a major or concentration.

For many people, mathematics is a "dry subject". This is because they try to remember it as a set of rules or isolated facts, rather than a logically developed subject. If only people knew how the ideas are developed step by step, they would not be afraid of mathematics. Mathematics in its original sense stands for "skill, knowledge or science". All modern advances owe their existence to mathematics. Sciences such as Acoustics, Astronomy, Biology, Chemistry, Computer Science, Dynamics, Economics, Electricity, Hydrostatics, Magnetism, Mechanics, Medicine, Optics, Physics, Statistics, Thermodynamics, and arts such as Computer Graphics, Navigation, Engineering, Architecture, depend for their explanation on mathematics. There are many other topics in business and finance which we have not listed, but which use mathematics.

One or two examples in each of the listed fields should be sufficient to convince anyone. Please know that there are countless examples of mathematical applications in each of these areas. You can specialize in one of these fields and find out more. In Acoustics, the term 'decibel' is a Logarithmic term that measures loudness of sound; the speakers, microphones are constructed using mathematical properties of surfaces and curves. In Astronomy, the shape of the universe, the course of planets, prediction of eclipses, etc. can be studied using a mathematical law. In Biology, the genome project to study DNA is an application of pattern recognition, Linear Algebra and Topology. In Chemistry, Linear Algebra is used for data compression, 'Knot Theory' from topology is used in shapes of atoms. In Computer Science, Linear Algebra, Algebraic Geometry and Commutative Algebra are used in constructing hardware and software. In Dynamics, study of motion, resistance are studied using Calculus. In Economics, economic models are applications of Difference Equations, Linear Algebra and Statistics. In Electricity, current, resistance and capacity Complex numbers play an important part. In fact, Electrical Engineering is nothing but Applied Mathematics. Laws of Hydrostatics depend on Differential Equations. The laws of Magnetic attraction and repulsion are mathematical laws. In Mechanics and Mechanical Engineering Calculus and Geometry are used to construct robots. In Medicine, MRI is constructed using Calculus, Differential Equations and Linear Algebra. In Optics lenses are created using properties of curves and laws of reflection and refraction. Physics and various

branches of Physics are only Applied Mathematics. In Statistics, Combinatorics, Linear Algebra, and Calculus are used. In Thermodynamics Calculus is used. In Computer Graphics image processing use Linear Algebra. In Navigation, Plane and Spherical Trigonometry is used. Various branches of Engineering use mathematics so much that the subjects are meaningless if we remove the mathematics.

Architecture uses Trigonometry and Differential Equations. Dr. Thomas Sargent of New York University, 2011 Nobel Prize Winner in Economics, says how studying Calculus and upper level math courses is important to develop understanding in Economics.

Mathematical development happens very often long before the actual applications to technological advances. For instance, the Kepler's laws about elliptic motion around the planets on which the space travel depends were discovered more than three hundred years ago. Binary representation of numbers, which is expressing a number with the Place Value System of 2 and its powers, which is the main idea of computers, was discovered hundreds of years ago. Various results in algebra are now applied to chemistry, manufacturing, industries and computers.

Sometimes new mathematics is developed based on experiments. If any theory has to be made precise, it uses mathematical terms. Mathematics goes beyond a particular experiment or a particular phenomenon. Mathematics addresses its general aspects. Understanding the underlying mathematics leads to a deeper understanding of the phenomenon. We call this application mathematical modeling. Weather is predicted using mathematical modeling. Institutions use mathematical modeling to invest in the stock market.

“That very law which molds a tear,
And bids it trickle from its source,
That law preserves the earth a sphere,
And guides the planets in their course.”

This law and many similar laws are treated in the works of mathematics. Thus the value of mathematics as a body of knowledge is indisputable.

The value of mathematics as a discipline is also unquestionable. The study of mathematics involves a mental exercise best fitted for strengthening the thinking ability. Studying mathematics can easily lead to mastery over other subjects. Mathematics is a way to make the mind get into a habit of logically linked reasoning. The reasoning power, acquired by the study of mathematics, can be transferred to other parts of knowledge. The habit of clear and consecutive reasoning is established in the mind by successive journeys it takes into solving specific word problems or solving general word problems that require mathematical proofs. The study of mathematics strengthens both the intellect and memory and tends to impart us an assimilative memory, which makes us remember different topics of any subject we study or different events in life in a logical order

by intellectually active associations, rather than a sensuous memory which is memorizing by endless rehearsals or unconnected isolated facts.

Study of mathematics habituates us not only with steadfastness and perseverance but it creates in us a strong inclination to work. It tends us to make bitter enemies of inaction; it stores immense energy. The student of mathematics studies hard to understand abstract reasoning, a habit that makes him/her work hard even when the activity is not mathematics.

Mathematics makes the outlook towards life philosophical. It makes us humble and meek and does away with our vanity and self conceit. If you read the lives of great scientists like Carver, Newton, Einstein or Ramanujan, you will see their humility. The reason is that the mathematicians become aware of the mathematical problems they cannot solve. Mathematics subjects a man to the habits of patience, perseverance, unselfishness and humility.

The problems of mathematics are hard, but their solution leads to an exquisite pleasure from the sweets of intellectual conquest. Archimedes while taking his bath was so much elated at the discovery of the law of displacement of water that unable to contain himself he immediately ran naked into the street crying, "Eureka, Eureka I have found it, I have found it." Kepler enthusiastically studied mathematics in spite of poverty, public ridicule and persecution.

In summarizing, Mathematics is knowledge and hence it is power. It is a weapon, though a very heavy one. If we cannot wield that weapon, the fault is our own; because we could wield it if we would, by sheer patience and perseverance; and once wielded, that weapon is something awesome in our hands. It is the answer to make your life style better, have status, have money. Mathematics is essential to succeed in the modern technological society.