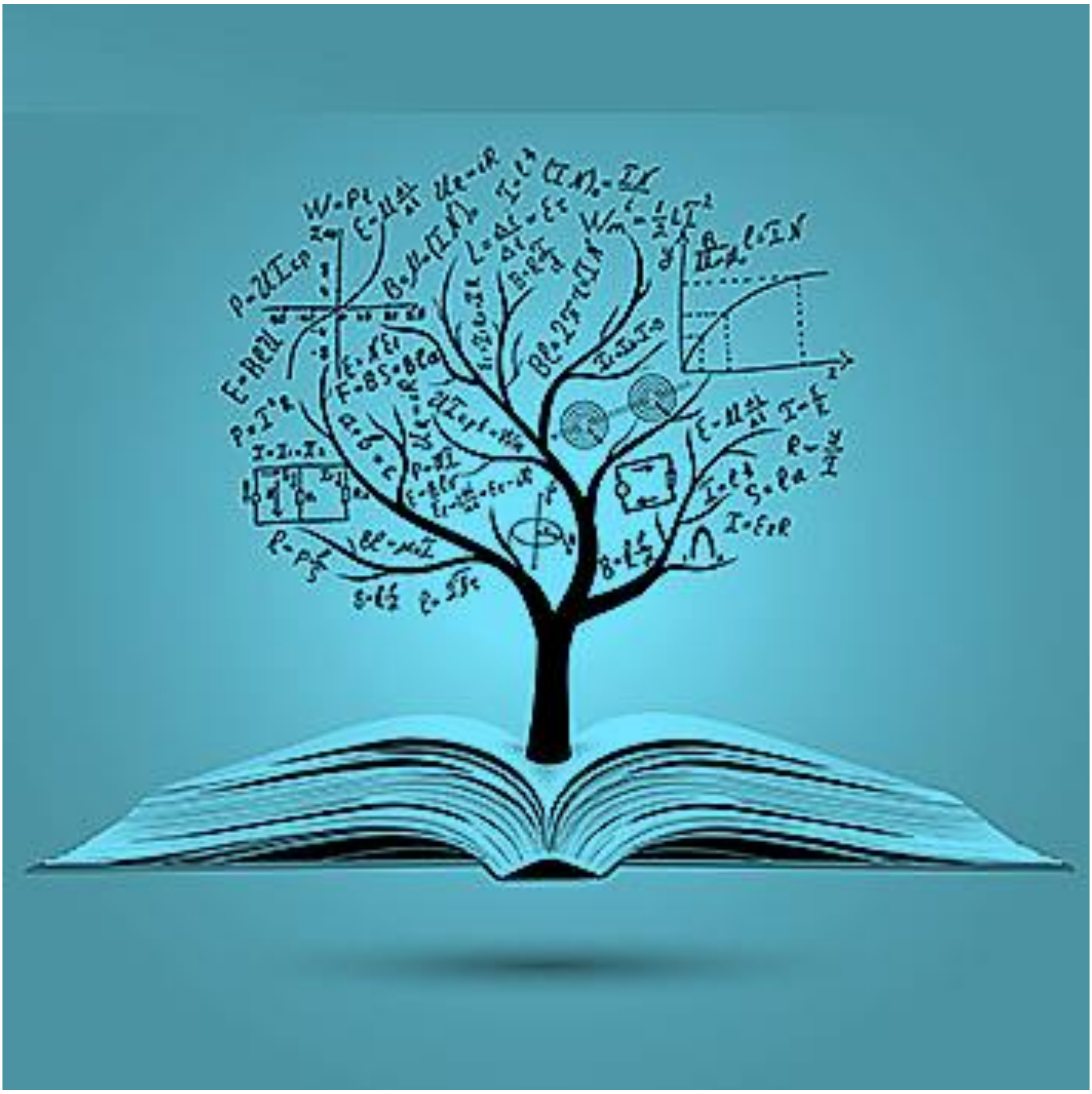
SVKM'S NMIMS Deemed to be UNIVERSITY

School of Mathematical Sciences

Think Mathematics and Think in Mathematics



https://www.groverclevelandhs.com/mathematics.html

NARSEE MONJEE INSTITUTE OF MANAGEMENT STUDIES

V. L. Mehta Road, Vile Parle, West

Mumbai 400 056, Maharashtra, India

1. Preamble

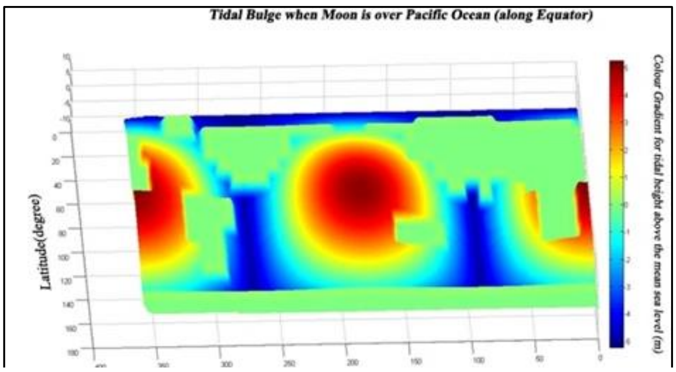
Mathematics is one of the most complex and intriguing languages developed by humans. It has also been remarkably successful in helping us understand the working of nature as well in creating new technologies.

Mathematics has therefore become central to all human activities and is now playing a crucial role in all aspects of technology and human development. Being well educated in mathematics therefore is critical to the future of our youngster and our nation.

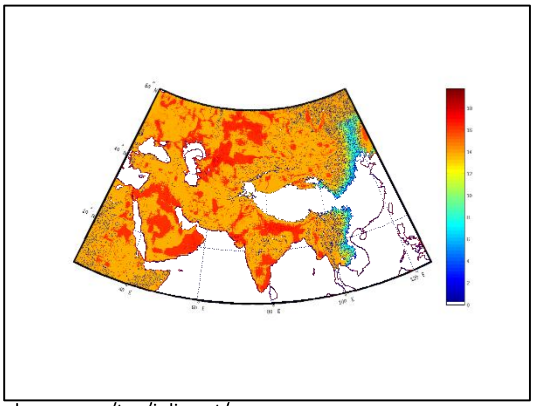
Narsee Monjee Institute of Management Studies has started a School of Mathematical Sciences.

The purpose of the school is the create a generation of well-educated and versatile mathematically included students who will be an asset to industry, academia and the society.

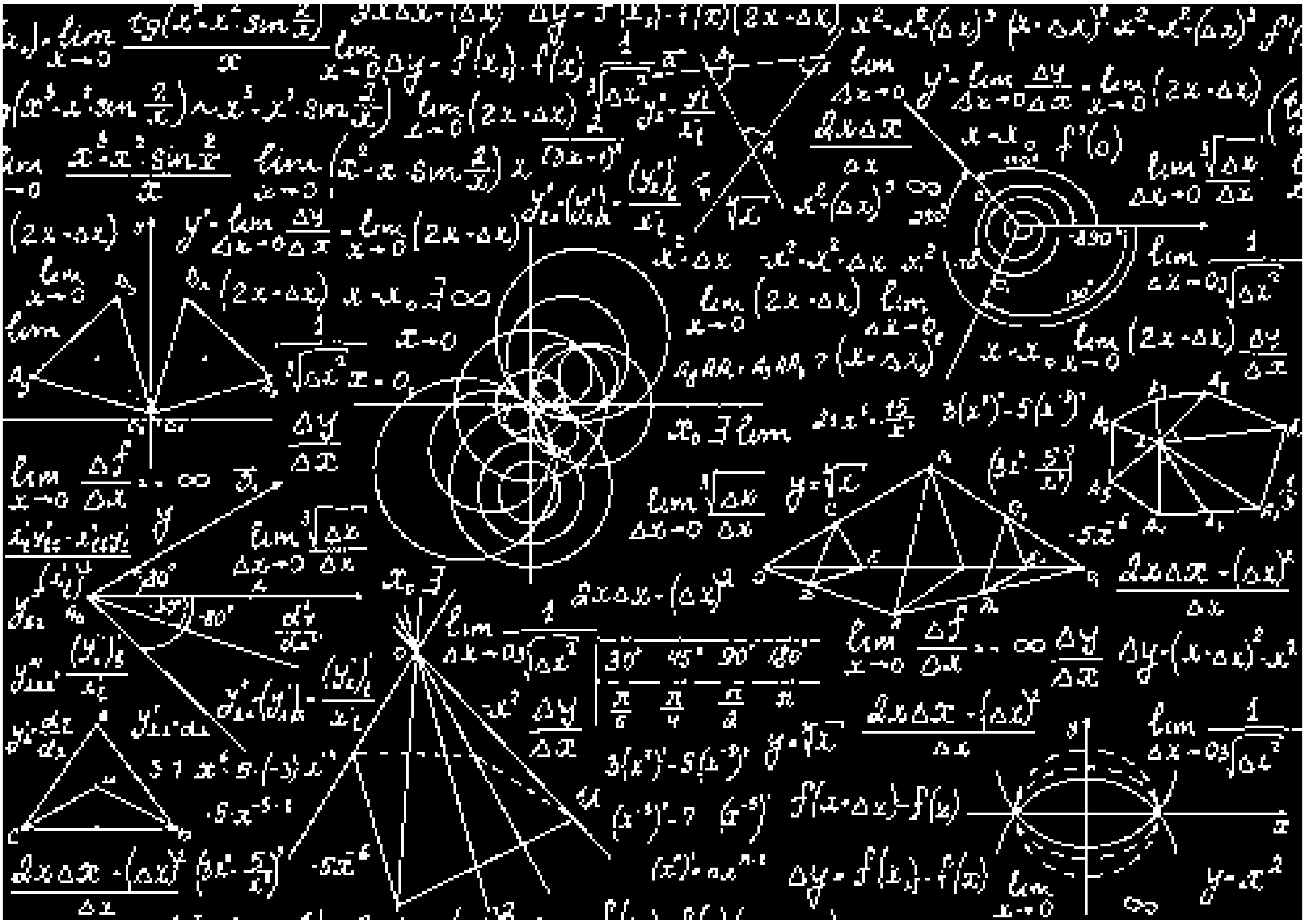
The school strives to expose students to both, pure and applied mathematics (including statistics) and Mathematics as used in Computer Science. It strives to make them versatile enough to take up any relevant challenges in their lives.



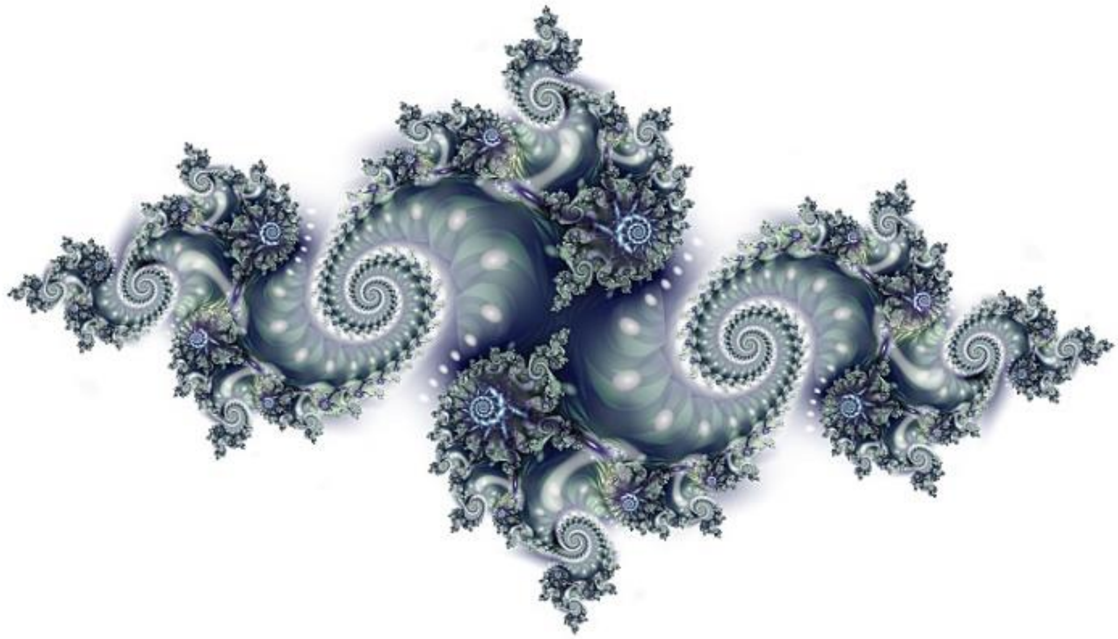
Vahia et al., 2013, 2017



https://orderinchoas.wordpress.com/tag/julia-set/



http://theconversation.com/yes-mathematics-can-be-decolonised-heres-how-to-begin-65963



https://orderinchoas.wordpress.com/tag/julia-set/

2. The language of Mathematics

"Are we here because maths is here or is maths here because we are here?"

Mathematics is a language in its own right. It possesses its own complex grammar and vocabulary, and it demonstrates the capability of expressing ideas that cannot readily be explained in other languages. Based on concepts of numbers, shapes and symmetries, Mathematics has developed into one of the most profound formats for explaining ideas. At one level it is entirely a human construct and at another level it seems to be the obvious and preferred language to gain insights into the workings of nature and human behaviour. In that sense it seems to reflect Nature's preferred way of defining the rules that govern the workings of both nature and life. This makes Mathematics unique.

2.2 Mathematics and reality

The language and structure of mathematics, its arguments and resultant conclusions have found a remarkable echo in the reality of human existence. Many complex behaviour patterns of diverse natural entities can be expressed far more efficiently - and in more insightful manner – when expressed in mathematical language. This uniqueness of mathematics makes it a powerful tool to understand nature. It is, therefore, not surprising that, historically, Natural and Social scientists have felt the need to borrow various structures from mathematics and have used them to explore their respective fields of interest, often with specific objectives in mind. This gives strength and power to mathematics – a privilege that is not granted to any other language.

The mathematical sciences now play an important role in a large part of contemporary human activities, encompassing the social sciences, economics, the physical sciences, engineering, business studies, with large-scale data management across all these disciplines and their allied subjects. Mathematics is used for not only for large data management but also in carrying out simulations, and the programming of devices and processes. For instance, mathematicians play a pivotal role in the front-line activities of hedge funds concerned with studies of currency and commodity fluctuations. It is now appreciated that in such cases, mathematics provides significant more insight than any other language.

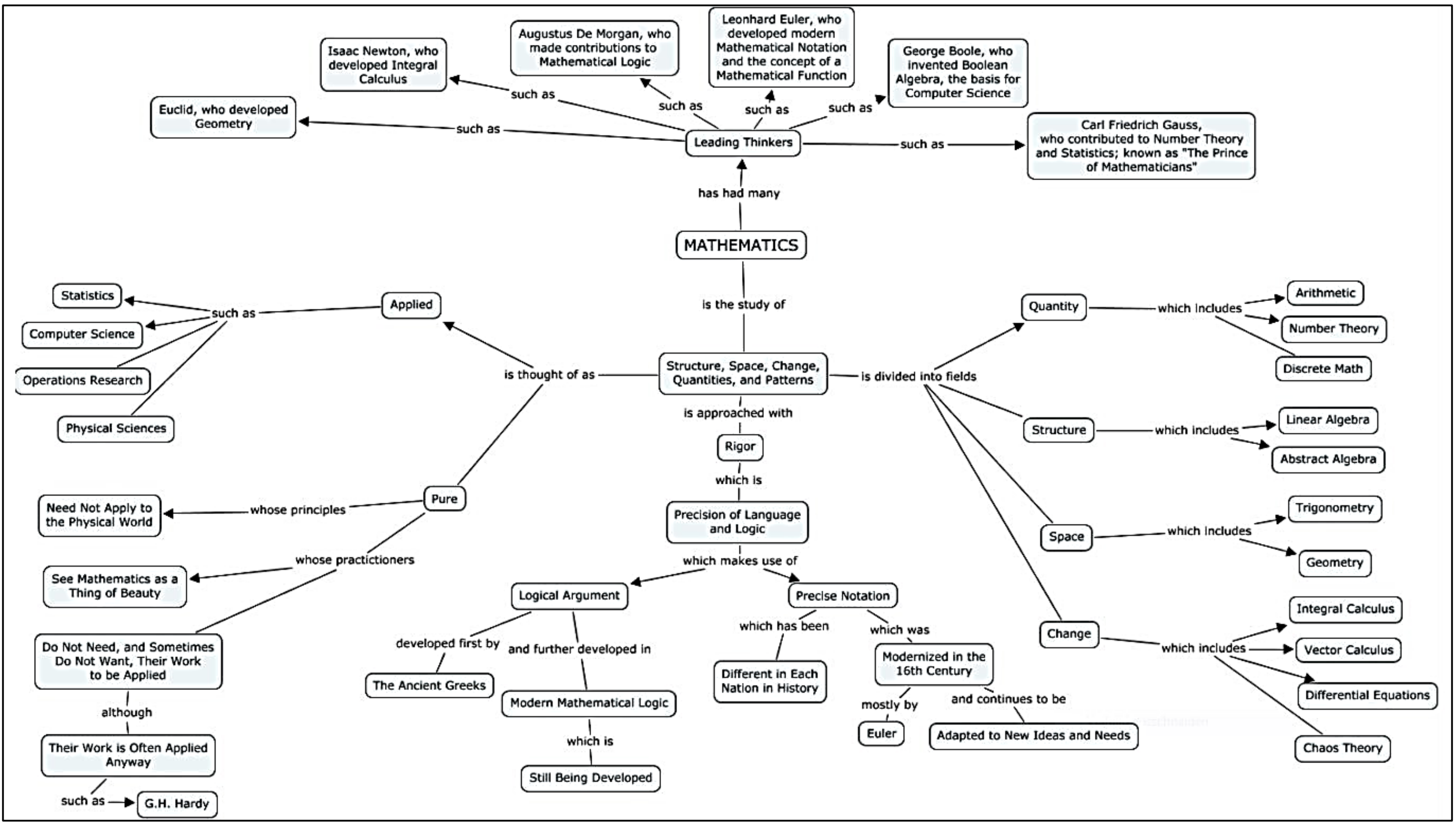
It is, therefore, both crucial and critical that we adopt mathematics as our primary language to understand nature and human civilisation.

At the same time, by its very nature, mathematics is not a natural language of the type that arises from common sounds and vocabulary. In that sense, mathematics is a completely artificial human construct. It is, most probably, the most recent human construct, arriving as a mode of human communication only relatively recently in the overall historical context. It is, unsurprisingly, more difficult to convey and to comprehend.

Mathematics has given us some profound concepts that we now take for granted. But the idea of = or zero have fundamentally altered our perspective of reality in a manner that we don't fully understand.

Conveying the grammar, literature and ideas of mathematics has, therefore, become a highly specialised task that needs to be undertaken with care and indulgence. Its complexity has to be recognised upfront. The simplest way of doing this is to present it in a manner such that it integrates well with human instinctive attitudes at a higher cognition level.

This remains the current challenge for all those engaged in mathematics education.



https://math.stackexchange.com/questions/1490397/how-to-categorize-measures-topologies-algebraic-structures-etc

3. School of Mathematical Sciences

By the time the students appear for their class XII examinations, they are clear about the subject they wish to pursue. A good school should let students interested in mathematics to pursue their interests immediately after class XII itself and explore various aspects of pure and applied mathematics.

A good school of mathematics, which incorporates both the pure and applied mathematics will allow interested young students to explore the entire complexity of nature and utility of mathematics and also provide them avenue for employment in academia, industry and service sector.

We have therefore started a school of Mathematical Sciences that exposed the students to the grammar of mathematics as it is applied in Pure Mathematics, Applied Mathematics (including Statistics) and Computer Science (including discrete Mathematics, and artificial intelligence and deep learning techniques).

In the first two years, the school exposes students to all aspects of mathematics, pure and applied and in the third year allow them to choose their preferred specialisation. This is done through course work and extensive hands on activities in mathematics that will give them an exposure to mathematics in action. The students are also exposed to lectures by speakers from industry and academia to give students a flavour of Mathematics and its relation to the real world.

The courses are designed so that for the four semesters the students would study a mix of pure and applied mathematics with a special emphasis on laboratory work and personality development. During the fifth and sixth semester, they would be exposed to specialised fields of their choice and would involve project activity.

Unique features

The philosophy of the programme will be to expose undergraduate students to pure and applied mathematics for the first two years. During this time, they will also be exposed to courses in pure and applied mathematics which will include a large number of applied mathematics course along with pure mathematics and a lot of exposure to visualisation and experimentation involving visualisation through computers and artwork.

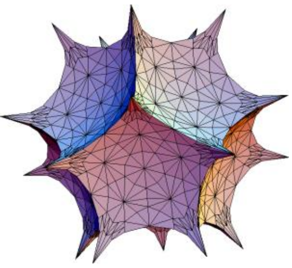
They will attend sessions where they can experience the power of mathematical sciences in various field through discussions with those who use Mathematics under various environments. In particular, the students will be exposed to coding and programming languages and ideas of discrete mathematics and artificial intelligence. The purpose of this approach is to allow students to understand various applications of mathematics in real life and in subjects of purely academic interest.

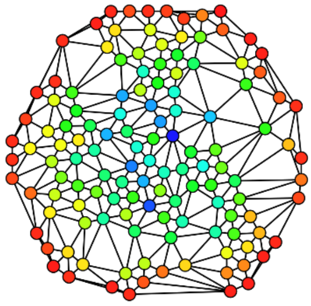
In the third year, the students will be asked to choose one of the many possible options such as

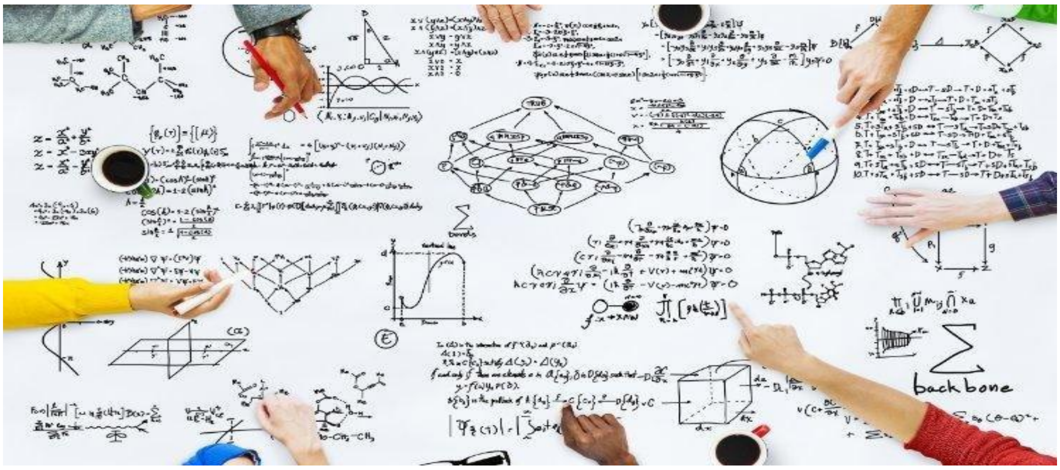
- Fine and performing art.
- Social organization.
- Social dynamics.
- Statistical studies.
- Engineering.
- Data Science.
- Physical sciences.
- Industrial Mathematics.

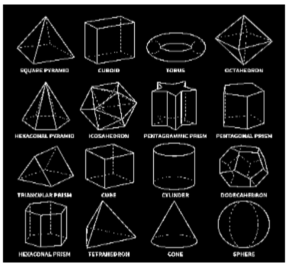
- Computer Science.
- Biomathematics.
- Mathematics.
- Education.
- Simulations and animations.
- Any other topic of human learning.
- Take additional online course on a subject with lesser emphasis on project activity.

The course will allow students to explore their love for mathematics and also give them necessary skill to use it in their professional life. The graduates from the school should therefore be able to take up a career amongst several branches of human activity where mathematics can significantly enhance our capability to advance the field.









Images from: http://xahlee.info/M/; https://towardsdatascience.com/graph-theory-helped-the-british-become-less-stinky-de4b439a7784; http://iora.nus.edu.sg/

4. Syllabus

Winter semesters			
	Semester 1	Semester 3	Semester 5*
Core Courses (4 credit)	Elementary Calculus	Complex Analysis	Fourier Analysis and Wavelets
	Linear Algebra	Multivariate Calculus	Sequence: Statistical and Deep Learning approaches
	Elementary number theory	Theory of Optimisation	Analytic Number theory
	Basics of programming	Partial Differential equations	Courses of choice. Students will choose a field of learning and they will be trained in how mathematics is used in the field with 8 credit points
	Numerical Methods	Abstract Algebra	
Enrichment Courses (1 credit)	Research Writing and Communication Skills	Logic of Mathematics	
	Personal and people management	Literature	

Summer Semesters			
	Semester 2	Semester 4	Semester 6*
Core Courses (4 credit)	Ordinary differential equations	Topology and geometry	Applied Linear Algebra
	Real Analysis	Functional Analysis	Coding theory
	Discrete Mathematics and Graph Theory	Vector Analysis	Project by students based on their choice of subject in semester 5
	Topology of Metric Spaces	Measure Theory	
	Elementary Probability	Statistics and Machine Learning	
Enrichment Courses (1 credit)	History of Mathematics	Micro economics	
	Environmental Sciences	Presentation techniques	

Summary

At the School of Mathematical Sciences, we have created a school where we nurture a small number of carefully selected students are nurtured to be versatile Mathematicians and can speak the language of Mathematics. The students who come out of our school have a good measure of exposure to and understanding of all three pillars of Mathematics namely Pure Mathematics, Applied Mathematics (including Statistics) and Mathematics of Computers and Data Sciences.

These students are therefore capable of translating any problem in any field of human learning into the language of Mathematics and then use all the tools of Mathematics to provide new insights into problems that are otherwise not so easy to analyse.

The students should then be able to go to any field of human activity and provide new insights into old problems and create novel solutions to the problems of real life.

They remain true to the motto of the school:

Think Mathematics;

Think in Mathematics

Creation of Mimansa Vahia