### Education

- A powerful enabling tool for individual empowerment
- To improve/enhance the ethical/intellectual level of the society
- To enable an individual to discover his drumbeat, his passion.
- Whereas teaching children and teenagers in the school requires certain social and emotional abilities: to empathise, to nurture and to discipline, the primary reason for going to a college is its intellectual ambience.
- The university education is supposed to introduce students to an intellectual culture mainly through a proliferation of such possibilities like: the beauty of mathematical discovery, the thrill of scientific understanding, the fascination of historical narrative, the mystery of theological speculation.

### Teaching

- (Parker Palmer) To teach is to create a space (for truth) in which the community of truth is practiced.
- As opposed to the passive passing of information to the student, it is supposed to increase the quality of a certain commodity-knowledge.
- Expose the student to the world of new and beautiful ideas
- Share the excitement of learning with the students
- Help the student in learning and understanding as opposed to rote learning of the material by the student.
- Teaching is successful only if its object is to expect students have certain experiences: intellectual, emotional and moral involving reading, writing and discussing.
- (F. Su) Creating an ambience where the student is accorded GRACE which gives people the dignity they don't necessarily have to earn. And where the worthiness of an individual does NOT depend upon the grades they earn.

### Five important principles of math pedagogy

- Begin with a question
- Need for student to struggle
- Teacher is not the answer key
- Willingness of the teacher to say 'yes' even when the thinking student has not got the answer right.
- Being guided by the philosophy that Math is not about following rules but about playing around.

### Learning
- (Benjamin Disraeli) Seeing much, struggling much and studying much are the three pillars of learning.
- (Whitney) Intelligence is proved not by the ease of learning but by understanding what is learnt.
- (S. Weil) Joy of learning is as indispensable in study as breathing is to running.

**What is mathematics**

- Mathematics is what mathematicians do
- An enterprise involving the 'human' understanding of mathematics
- Science of patterns
- Tiling the plane with regular polygons: Equilateral triangles, squares and hexagons, the only choices
- Platonic solids: As opposed to the possibility of regular polygons of all possible sides being drawn in the plane, there exist exactly five REGULAR solids in space bounded by congruent faces:
  Tetrahedron (four congruent triangles)
  Cube (six congruent squares)
  Octahedron (Eight congruent triangles)
  Dodecahedron (Twelve congruent petagons)
  Icosahedron (Twenty congruent triangles)
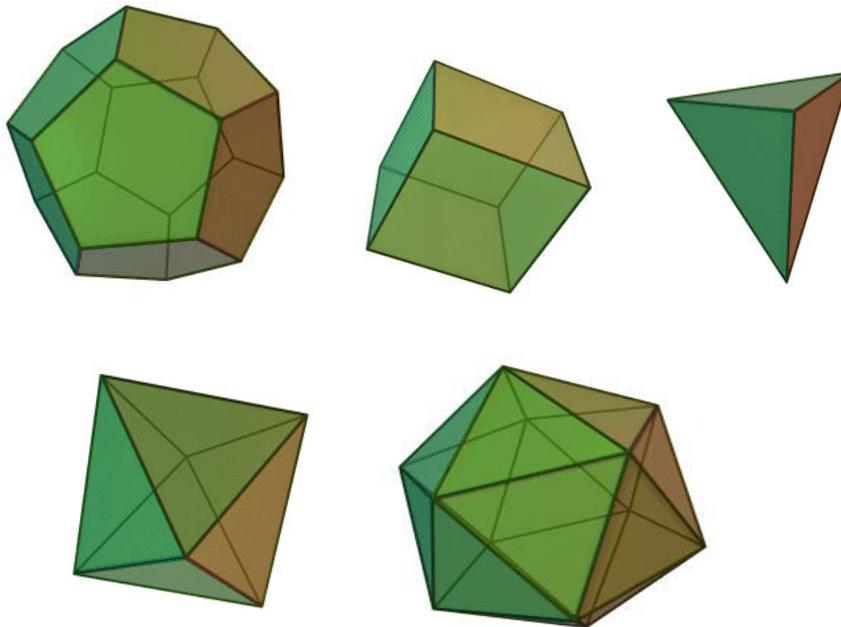
- Dividing a square into a finite number of congruent triangles (Monsky's theorem)
- Trisectors of angles of an arbitrary triangle always enclose an equilateral triangle (Morley's theorem)
- Nine point circle theorem
- Every simple closed curve in the plane admits four points on it enclosing a square (Toeplitz conjecture).

**c. Implications of some innocuous looking situations involving large numbers**
- Wheat and chessboard problem

- Tower of Hanoi (Brahma's tower)
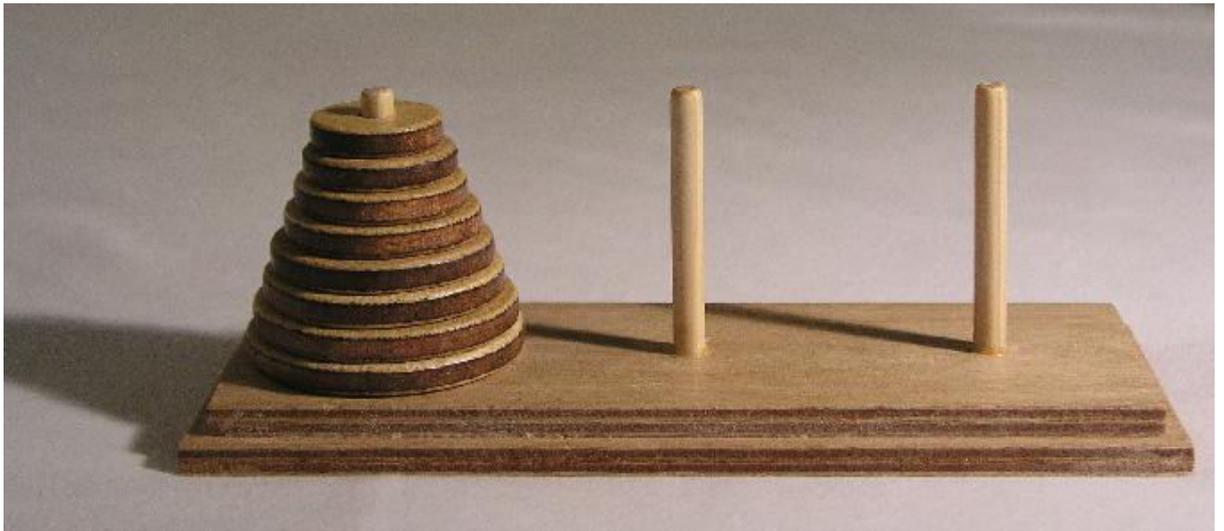


### Power of abstract thinking/theory

- Group theory and theoretical physics/chemistry/crystallography
- Hilbert space and quantum mechanics
- Algebraic geometry/Riemann zeta function and string theory
- Riemannian geometry and general theory of relativity
- Differential geometry and gamma-kniefe surgery
- Perron-Frobenius theorem and GPS technology
- Markov chains and Google search engine
- Complexity of prime number factorisation and credit card/ATM transactions

### Certain unique features of mathematics

- Unity (Arithmetic in higher dimensional Euclidean space and parallelizability)
- Universality (Validity of mathematical truth everywhere)
- Objectivity (Infallibility of mathematical logic/argument)
- Endurance (Eternal shelf-life of mathematical truth)
- Relevance (Applications of abstract mathematical theories for clear thinking and in science, technology and almost all human endeavours).

**Qualities that math fosters in us**

- Curiosity (Looking for order and patterns when there aren't apparently any)
- Courage, Patience (Getting well-rehearsed in failed attempts)
- Creativity (Attacking problems from multiple angles)
- Joy (Simple joy of solving problems as there are few better feelings than whenever the key clicks and the lock opens)
- Resilience (Through ungodly amounts of frustration)
- Persistence (Struggle is a large part of the learning process/reluctance to give up)
- Humility (Maths as a great leveller)
- Fallibility (Being prone to all sorts of mishaps, missteps)
- Attention to detail (Leaving nothing to chance, conjecture, intuition)