!dea

Who has seen a handsome boy? [Pause] No one! [Pause]

You see, a "handsome boy" is an idea – an ideal, an incorporeal perfect form. A particular handsome boy is an instance of the idea called "handsome boy." A particular handsome boy is a representation of the idea, handsome boy. [Pause] No one has seen a handsome boy. No one can!

Mathematics is a system of ideas – axiom systems. An axiom system, with its primitives, axioms and definitions, is an idea. [Pause] And there are hierarchies of ideas as described by Plato in his theory of Ideas. For example, the objects named as primitives inside an axiom system are ideas. Thus, in absolute geometry the primitive called "straight line" is an idea. [Pause] Can you draw a straight line? [Pause]   No one can.   What you draw is a representation of the idea.

When great men die, they become ideas. For example, Socrates, the man, is now an idea. An idea that has even greater attributes than Socrates, the man, had. Socrates, the man, is dead. Socrates, the idea, is alive – because an idea is permanent. Long live Socrates!

Ideas are permanent. An idea is *aspatial* (independent of and outside space) and *atemporal* (outside time). In the [allegory of the cave](#) expressed in *[The Republic](#)* *by Plato*, the things we ordinarily perceive in the world are characterized as shadows of the real things called ideas, which we do not perceive directly.

"A mathematician, like a painter or poet, is a maker of patterns. If his patterns are more permanent than theirs, it is because they are made with ideas," G.H. Hardy, the great 20th century English mathematician, said.

Compare poetry with math………. A poem is beautiful for the way of saying something. A poem is not an idea but a good poem reminds us of an idea – beauty. A concept of mathematics is an idea. A mathematics proof is not an idea but a procedure – a deductive method begun by Thales of Miletus long ago. But some proofs remind us of an idea – beauty.

Mathematics is for all time, for it embodies ideas. Ben Jonson said of Shakespeare: He was not **OF** an age, but for all time. This could be said of math – it is not **OF** an age, but for all time. Thus, mathematics is not invented but discovered.

The statements in mathematics are properties of ideas. Some of these properties evoke another idea – beauty. Here are a few.

- The area of a circle
- The volume of a sphere
- The Pythagorean Theorem
- The irrationality of the square root of 2
- There are exactly five regular polyhedra
- The Euclidean algorithm
- The fundamental theorem of arithmetic
- The derivative
- The Euler formula
- The fundamental theorem of algebra

- The number pi is transcendental
- The prime number theorem
- The intermediate value theorem
- The theorem of Lagrange
- Fermat's Last Theorem
- The four color theorem
- There is no Eulerian path over the Königsburg bridges
- Taylor's theorem

A statement that evokes beauty also has a certain power – showing up in different contexts or applications. The converse may be true!

In the golden age of Rome, straddling the first and the second centuries, at the time of the emperors, Trajan and Hadrian, there lived Plutarch, the priest of the temple of Apollo at Delphi -- in the Roman colony of Greece. The author of the immortal book, Parallel Lives, [Pause] Plutarch said in an essay "On Lectures" thus: A mind is a fire to be kindled, not a vessel to be filled. [Pause]

Antoine St. Exupery, author of the "Little Prince" as well as "The Wisdom of the Sands", said in the latter: "If you want to build a ship, don't drum up the men to gather wood, divide the work and give orders. Instead, teach them to yearn for the vast and endless sea." This is why you don't see too much homework nor too much specialization in competition training at Mathpath. Rather, you get many many fleeting glimpses of ideas and, hopefully, it will ignite a fire in your mind.

The "teacher at Mathpath" is an idea – the idea of a person who can ignite mathematical minds. Being an idea, it can never be attained. But the idea serves as the staff to look at as the Israelites did in their long wandering from Egypt.   Indeed some members of the faculty are close approximations of the idea of the MathPath teacher.

[Pause]

Plato's Dialogues are books which consist in the gradual approach towards a definition of certain ideas under their discussion. This is opposite to the method of mathematics where we begin with the definition as stipulated. Plato's famous Dialogue book, "Meno," opens with this question: "Can you tell me Socrates, can virtue be taught? Socrates replies that he must first know what virtue is before he can answer Meno's question. Socrates claims complete ignorance of virtue.

Down the centuries the debate has continued as to whether virtue can be taught. Luckily, "inspiring instruction" or instruction that inspires is more a skill than an idea like virtue. And a skill, like playing a piano, can be taught. "The attribute of inspiring is teachable," Herbert Wilf wrote recently in the Notices of the American Mathematical Society. This is why we must bring in teachers from schools and colleges who can learn from our best here - the art of inspiring mathematical minds.

[Pause]

Some of you will go on to become the makers of mathematical patterns – weavers of ideas. To some of you it will become a lonesome and serious pursuit. For there is a

great happiness in the very pursuit. The pursuit is as exhilarating as obtaining the prey.

But remember that the very thing called success is an idea. You can only reach an approximation of it. And moderate success is what it is - moderate. Extreme success is a neutral entity. Perelman or Grothendieck would know!

In your pursuit of success, whatever your sphere of activity, know that success is an idea. You can only come near it. This informs us not to abandon our obligations to Nature, including the civility to others.

[Pause]

By your extreme giftedness, you will occupy high positions in life. Therefore, what you do to others will have great consequences for them.

[Pause]

Primum non nocere – first, do no harm. But if possible, do help. Even more, Desire the Welfare of Others. But the latter is an idea – you can never reach it but only get close to it.

My queue to the grave is getting shorter, especially for the ultra marathons I do in India for the cause of recycling, reducing, and reusing. Therefore, it is my hope that some of you will return as staff and faculty in future to carry the spirit of this camp. It has been said that no one knows how to better run a hotel than its past guest.

So I leave now casting a longing lingering look! May you become an idea!