



Pusat Pengajian Sains Matematik

Talk

By

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Title:

MAKING MATH EASY

Date:

Monday, 25 October 2010

2:30 – 4:30 pm

Venue:

Dewan Persidangan Universiti

Abstract

See next page

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Abstract

Why is math difficult? A unique experiment is on in USM to understand the causes, so as to reverse them and make math easy. Plato thought math and music were alike; but while everyone still likes music, math is now widely disliked. What happened?

“Mathematics” derives from *mathesis* meaning soul-stirring learning.¹ This relation of mathematics to the soul drew it into a religious conflict. In the 4th-6th c., philosophers used math to resist changes in church doctrine, and the church cursed this notion of the soul.² Many centuries later, after the Crusades failed militarily, the church fell back on mathematics as a “universal” tool of persuasion.³ To make it theologically correct, math was modified (made soul-less) and given a false history (e.g. Egyptian sacred geometry was reinterpreted and attributed to a non-existent⁴ Euclid). Arithmetic, algebra,⁵ trigonometry⁶ and calculus⁷ all originated outside Europe. They were all similarly transformed, since they were hard to understand⁸ on native European traditions, which mixed math with theology.⁹ *Western math is difficult just because¹⁰ it is entangled with theological complexities*, of no value to others. Nevertheless, even after colonialism, math teaching continues to blindly imitate the West, and hence reproduces in the classroom the European learning difficulties with math. The experimental course on “calculus without limits”, using computers, aims to demonstrate that de-Westernising math also makes it easy so that students can immediately use it to solve complex practical problems. More details at <http://ckraju.net/usm/making-math-easy-details.html>

About the speaker

After a PhD from the Indian Statistical Institute, C. K. Raju taught at Pune University for several years, before joining C-DAC, to play a key role in building the first Indian supercomputer, Param. Currently a Distinguished Professor at Inmantec, Delhi NCR, he is a Visiting Professor at the School of Mathematical Sciences, USM.

He has authored several books. In *Time: Towards a Consistent Theory* (Kluwer, 1994) he proposed new equations for physics and a new understanding of quantum mechanics. In *The Eleven Pictures of Time* (Sage, 2003) he studied how science, religion and ethics interact through time beliefs, and how Christian theology has penetrated current physics. *Cultural Foundations of Mathematics* (Pearson Longman, 2007) proposed a new philosophy of mathematics, while presenting evidence to show that the calculus was transmitted to Europe. In *Is Science Western in Origin?* (Multiversity, 2009) he summarised how, even before racist and colonial historians, the West fabricated history during the religious fanaticism of the Crusades and the Inquisition. Forthcoming is *Euclid and Jesus*, the story of how mathematics changed across two religious wars.

He received the Telesio-Galilei gold medal for 2010 in Hungary, for correcting a major mathematical mistake made by Einstein.

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- 1 Plato prescribed the teaching of both music and mathematics for the good of the soul. (Plato, *Republic* VII.526, VII.527.) The same point is reiterated by Proclus, 800 years later, when he says that mathematics “leads to the blessed life”. Proclus, *Commentary*, trans. Glen R. Morrow, Princeton University Press, Princeton, New Jersey, 1970, p. 37.
 - 2 See C. K. Raju, “The curse on ‘cyclic’ time”, *The Eleven Pictures of Time* (Sage, 2003), chp. 2, for how and why that notion of the soul was cursed in the 6th c.
 - 3 The aim of the Crusades was to convert Muslims to Christianity by force, just as Europe had earlier been converted to Christianity by force. However, beyond Spain, the Crusades failed militarily. Since Muslims could not be forced, and would not accept the Christian scriptures, but would accept reason, the church was forced to use reason to persuade Muslims, as the Schoolmen advocated. For this purpose, the church first had to change its theology to Christian rational theology, derived from Islamic rational theology or the *aql-i-kalam* (with some modifications). After eliminating the notion of mathesis, mathematics was taught solely as a way to teach reasoning, as a form of persuasive discourse. It was only after 1570 that Clavius introduced practical mathematics in the Jesuit syllabus.
 - 4 C. K. Raju, “Good-Bye Euclid!”, *Bharatiya Samajik Chintan* 7 (4) (New Series) (2009) pp. 255–264, and “Teaching racist history”, *Indian Journal of Secularism* 11(4) (2008) 25–28. Briefly, the only “evidence” for “Euclid” is a passage in a late 16th c. version of Proclus’ commentary. However, Proclus’ commentary of the *Elements* makes it a text on Egyptian sacred geometry (finalised by Hypatia and Theon who preceded him) written at the time of the persecution of pagans in the Roman empire by Christians. Attributing the text to a Euclid made its *origins* theologically correct. This had the advantage, as the church well knew, that any desired teaching can be attributed to a non-existent person. The same interpolated passage also attributes to Euclid a philosophy of geometry aligned with post-Crusade Christian rational theology; this allowed the *contents* of the text to be interpreted in a theologically-correct way.
 - 5 Here “arithmetic” refers to the way arithmetic is done today, using place value and algorithms. Originating in India, this way of doing arithmetic was known in Europe as “algorismus” through translations of al Khwarizmi’s *Hisab al Hind*. Arithmetic algorithms are rather more than “Arabic numerals”, however, and the power of this arithmetic was in sharp contrast to the kindergarten arithmetic of the abacus which was all that the West knew until the 10th c., and to which the Roman and Greek numerals are firmly tied. Algebra, from *al jabr*, refers to another text of al Khwarizmi, and is again of non-Western origin.
 - 6 The non-Western origin of trigonometry is clear from the very names, such as “sine”, from sinus (fold) a bad literal translation of *jaib* (pocket). This name came from the Crusading Toledo translators, and was a misreading of *jiba*, the Arabic form of *jiva*, the vernacular for the Sanskrit *jya*. For a quick refutation of the fantastic Christian-chauvinist claims that there was a Claudius Ptolemy in the 2nd c. who did astronomy using trigonometry, see C. K. Raju, *Is Science Western in Origin?* (Multiversity, 2009). Briefly, the texts of the *Almagest* are all post-Crusade texts, which are manifestly accretive (and accreted trigonometry from the Baghdad House of Wisdom in the 9th c.), after originating in Jundishapur, Iran, in the 6th c. The only thing known about the fictitious Ptolemy is his date which is derived from the dates of 4 supposed observations, which are not observations at all, for they were derived by erroneous back-calculation, and as such are of no use for purposes of dating. This date is clearly false: for the repeated Roman calendar reforms of the 5th-6th c. show no knowledge of the *Almagest* text, or even the length of the year in it, though the Council of Nicea (4th c.) had already decided to consult Alexandrian astronomers for the calendar.
 - 7 For the Indian origins of the calculus and its transmission to Europe, see C. K. Raju, *Cultural Foundations of Mathematics: the Nature of Mathematical Proof and the Transmission of the Calculus from India to Europe in the 16th c.* CE, Pearson Longman, 2007.
 - 8 Perhaps the best example of the initial European difficulties with the calculus is Descartes’ contention that measuring a curved line was beyond the capacity of the human mind, although, in fact, any child can use a piece of string to do so. R. Descartes, *The Geometry*, trans. D. Eugene and M. Latham, Chicago: Encyclopaedia Britannica, 1996, Book 2, p. 544. The argument was repeated by Galileo to Cavalieri, and Newton thought he had resolved the difficulty with his doctrine of fluxions, which required that time must “flow” smoothly, which brought in *the* key mistake in his physics.

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- 9 As clear, for example, from Bishop Berkeley's critique (against an "infidel" mathematician), the key difficulty with the calculus was the issue of infinity (or, equivalently, infinitesimals), which issue had already been confounded by the Christian priest Philoponus in his arguments against the "pagan" Proclus, in the first creationist controversy. It is through this notion of infinity that Christian theology penetrated mathematics. Europeans failed to understand that, in India, as I have explained, the infinite series were "rigorously" summed using what would today be called infinitesimals in a non-Archimedean field.
- 10 The theological difficulties with infinities and infinitesimals in the calculus were supposed to have been resolved with formal real numbers, which require set theory. Now, the simple, but *non-unique*, representation of natural real numbers, $3.1415\dots$, was in use for thousands of years. The non-uniqueness is appropriate with the philosophy of zeroism, and natural real numbers are adequate for *all* practical purposes. However, we now have to say that a (formal) real number *is* an equivalence class of Cauchy sequences of rational numbers, which makes it a mind-boggling, uncountably infinite set. This notion simply cannot be explained to beginning students, and even professors of mathematics in the best institutes in India remain unfamiliar with the postulates of set theory. Thus, the theological difficulties related to the Western misunderstanding of the calculus were "resolved" by set theory in a way which has brought in extreme pedagogical difficulties into mathematics. In fact, set theory did not resolve those difficulties, it (a) just pushed them into a region which Western mathematicians don't care about, and (b) made the mathematician feel powerful with the ability to manipulate infinite processes. There is no reason why we should accept these postulated ways to handle infinity, which are of no practical value in themselves, and are inconsistent, if the double standards between mathematics and metamathematics are eliminated.