The Great Theorems of Mathematics

A Mathematical Journey

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Journey Through Genius
William Dunham
Penguin books, 1991,
vii+300 pages, soft cover,
Rs.310.

A general reader needs to develop an appreciation of mathematics; a student of mathematics needs to develop a mathematical culture by reading books that reveal the exciting, inspirational, and human aspects of mathematics. This is quite different from what the student learns in classroom lectures. Bill Dunham's *Journey Through Genius* succeeds in serving these purposes and provides a better vision of mathematics for the reader. The author presents a personal chronological selection of twelve great theorems (and several not so great ones) from Hippocrates, Euclid, Archimedes, Heron, Cardano, Newton, Johann Bernoulli, Euler and Cantor. He says in the preface of the book that he wants to reach a wide audience. So he sets the historical scene and provides the necessary mathematical background before presenting each great theorem. Next he presents the original proof of that great theorem using modern terminology. He faithfully follows that scheme throughout the *Journey*.

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A college mathematics student can easily follow Dunham's exposition; a college lecturer can use it as a source book for lectures – either in the classroom or on more popular occasions. The presentation is clear and the style engaging. In Chapter 1 he tells us the way Hippocrates succeeded in the quadrature of a particular lune (finding the area of the region enclosed by two circular arcs). But the world had to wait for Archimedes and some two hundred years for the quadrature of the circle. This is discussed in Chapter 4. You are compelled to admire the simplicity and the ingenuity in Euclid's proof of the infinitude of the primes or Georg Cantor's proof of his theorems. Again, you are compelled to notice the creativity and the skill that went into Euler's evaluation of the infinite series $1+1/4+1/9+\ldots\ldots$. In Chapter 6 you will learn of the role played by the mathematical challenges of the time to solve the general cubic and the general quartic in radicals. Heron's proof that the area of the

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triangle with side lengths a, b, c and semi-perimeter s is $\Delta = \sqrt{s(s-a)(s-b)(s-c)}$ is awesome! (Here Heron misses the significance of the construction of a point he started with. A short geometric proof based on the knowledge of geometry of his time is possible (*Samasya*, Vol.3, No.2, 1196)). Pages 53–60 contain a discussion of Euclid's parallel postulate. Dunham tells us how Gauss, Bolyai, Lobachevski, and Riemann arrived at two different geometries differing from Euclid's when the parallel postulate was replaced by two other possibilities. Later on in pages 277–278 he tells us that a similar situation developed when Cantor introduced transfinite numbers.

On the nonmathematical side you will admire the various tactics employed by Archimedes to fight the attacking Roman army. Dunham exhibits remarkable ability, be it in the portrayal of the many–sided personality of Cardano, the calculus controversy involving Newton and Leibniz or the tragic events in Georg Cantor's life. Scholars differ while giving historical accounts and you have to read various scholars before you arrive at your conclusions. Dunham has provided, not a long, but a useful list of references. The student reader is strongly advised to read as many of these as possible.

Since the publication of the *Journey*, Dunham has delivered invited lectures at a number of places. He was interviewed on Australian Radio (Dunham is a professor of mathematics in the USA). The Mathematical Association of America has just released a video tape in which he talks about mathematical contributions of ancient Babylonians, Egyptians, and Greeks. Also, the references below for a list of recently published journal articles on related themes.

For example, a first year college student comments on the *Journey*: "the historical and the biographical details make an interesting reading... the proofs are easy to follow." *Read the Journey, ask your friends to read it, urge the libraries to have a copy of it.*

Finally a request to the publisher: Reduce the price of the book for the purchaser in India!

Suggested Reading

Hazel Perfect, Georg Cantor. 1845-1918 He Transposed Mathematics into a New Key. *Mathematical Spectrum*. **27:25-28. 1994-5.**

G Hossein Behforooz. Thinning out the Harmonic Series. *Mathematics Magazine*. **68:289-293. 1995.**

Lester H Lange. Did Plutarch Get Archimedes' Wishes Right? *College Mathematics Journal*. **26:199-204. 1995.**

Semyon Gindking, The Great Art: The Controversial Origins of "Cardano's Formula". *Quantum*.**May-June:40-45. 1995.**

Vladimir Tikhomirov, Georg Cantor. *Quantum*. **Nov-Dec:48-52. 1995**

Samasya. **3:2 (to appear in Sept.1996).**

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