



SOCIETY OF ACTUARIES

Article From:

# The Actuary

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## MATH ODDITIES: MORE ABOUT $\pi$

In December this column quoted a computer magazine suggesting that  $\pi$  can be closely approximated by the ratio 355/113. Rational approximations to this irrational quantity have been around for centuries. From a recent exhibit of the scientific discoveries from ancient India, we pass on the following:

(1) As early as the 6th century BC, it was known (and written) that the ratio of the circumference of a circle to its diameter is approximately three.

(2) A portion of one of the early Hindu vedas, the Aryabhata I of 499 AD, translates into English as follows:

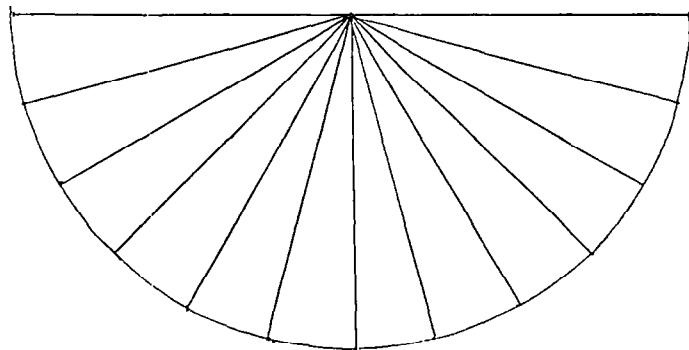
“Add four to one hundred, multiply by eight, add 62000. The result is the circumference of a circle of diameter 20000.”

$\pi$  as so computed is 3.1416.

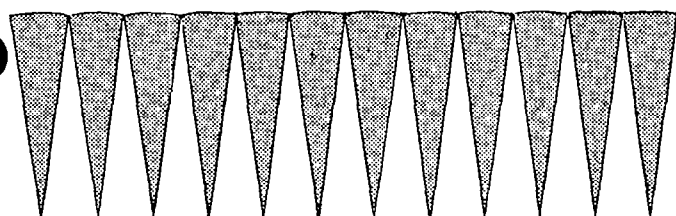
(3) Later Hindu writings, Aryabhata II of 950 AD and Bhashara II of 1114 AD, show the familiar 22/7 approximation, not as accurate as the earlier one, but perhaps more useful.

(4) Very early Hindu scholars discovered that the area of a circle is equal to the semi-circumference times the radius, and hence equal to  $\pi$  times the radius squared. They demonstrated this relationship in an ingenious way, which we attempt to illustrate below.

a. Cut a circle in half, and draw the equally spaced radii dividing the semi-circle into  $n$  identical pie-shaped pieces.



b. Cut along the radii, from the center to (but not through) the circumference. Then pull the circumference to form a nearly-straight line.



## THE 21ST ANNUAL ACTUARIAL RESEARCH CONFERENCE

The 21st Annual Actuarial Research Conference was held Oct. 29, 30, 31 at the Ohio State University in Columbus under the joint sponsorship of the SOA, CAS, AERF, Columbus Actuarial Club, Griffith Foundation for Insurance Education, and the Ohio State University. The general topic of the conference was risk, valuation and surplus. This topic was attractive to a very diverse group, from SOA and CAS members to regulators to academia.

James Hickman and Donald Cody gave surveys of the issues, of current research, and of desirable directions for future research. Regulation was the theme of two presentations, with emphasis on U.S. regulation by John Montgomery and Canadian regulation by Allan Brender. Issues bearing on the C-risks were presented by Peter Deakins, Pilot Gill, Graham Lord, Daniel McCarthy and Michael Tuohy. The research portion of the conference was rounded out by papers on risk theory (John Beekman and Clinton Fuelling), simulation (Allan Brender), and credibility and group insurance pricing (Charles Fuhrer).

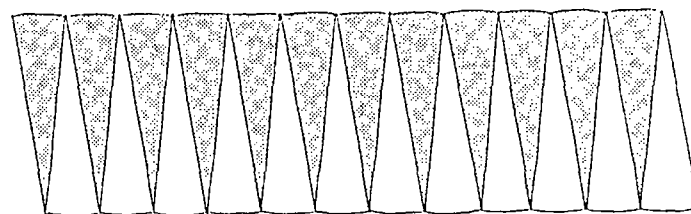
Most of the presentations will appear in a future issue of ARCH. Persons desiring immediate information should write to Charles S. Fuhrer at his *Yearbook* address.

## EXAM PREPARATION SEMINARS

The University of Toronto will hold exam preparation seminars in various locations for the May 1987 Society examinations. There will be seminars for courses 120, 130 and 135 (formerly part 3) and for courses 140 and 150 (formerly part 4).

For information concerning dates and locations, contact Samuel Broverman at his *Yearbook* address.

c. Do the same with the other half-circle, and fit the two areas together.



d. The result is seen to be very close to a rectangle of semi-circumference length and radius width.

e. From this point it takes only a little mental gymnastics to realize that the rectangle is exact, not approximate, as the number  $n$  increases without bounds.