Math 696 – Spring 2004
Document Preparation

Your assignment is to reproduce this document. In it you will learn to make **bold** face, *italic* face, and large type. In addition, you will construct a bulleted list, a footnote, centered text, and type of various point sizes. Finally, you will learn to make some mathematical constructions.

Srinivasa Ramanujan, Indian mathematician whose contributions to the theory of numbers include pioneering discoveries of the properties of the partition function, was born on Dec. 22, 1887 in Erode, India and died on April 26, 1920 in Kumbakonam. When he was 15 years old, he obtained a copy of George Shoobridge Carr's *Synopsis of Elementary Results in Pure and Applied Mathematics*, 2 vol. (1880-86). This collection of some 6,000 theorems (none of the material was newer than 1860) aroused his genius. Having verified the results in Carr's book, Ramanujan went beyond it, developing his own theorems and ideas. In 1903 he secured a scholarship to the University of Madras but lost it the following year because he neglected all other studies in the pursuit of mathematics.

In 1911 Ramanujan published the first of his papers in the Journal of the Indian Mathematical Society. His genius slowly gained recognition, and in 1913 he began a correspondence with the British mathematician Godfrey H. Hardy that led to a special scholarship from the University of Madras and a grant from Trinity College, Cambridge. Overcoming his religious objections, Ramanujan traveled to England in 1914, where Hardy tutored him and collaborated with him in some research.

$$\pi$$

Srinivasa Ramanujan developed methods of calculating pi that were so efficient that they have been incorporated into computer algorithms, permitting expressions of pi in millions of digits. Among his methods was this series.

$$1/\pi = \frac{\sqrt{8}}{9801}\sum_{n=0}^{\infty}\frac{(4n)![1103+26390n]}{(n!)^4\,396^{4n}}.$$

This discovery was phenomenal because prior to that time, π was computed using Machin-like formulae. By the way, **John Machin** (1680-1751), a professor of astronomy at Gresham College in London, obtained 100 places of accuracy for the computation of π using Gregory's formula,

$$\int_0^x \frac{dt}{1+t^2} = \arctan x = x - \frac{x^3}{3} + \frac{x^5}{5} - \frac{x^7}{7} + \ldots$$

The formula developed by Machin was given by

$$\frac{\pi}{4} = 4\arctan\frac{1}{5} - \arctan\frac{1}{239}$$

- 2037 Digits – Eniac (1949) – (von Neumann, et.al.)
- 1,000,000 Digits – CDC 7600 (1973) – (Guilloud and Bouyer)
- 17,000,000 Digits – Symbolics 3670 (1985), (Gosper)
- 29,000,000 Digits – Cray-2 (1986), (Bailey)
- 1-4 Billion Digits – (Chudnovskys)
- 206 Billion Digits[1] – Hitachi's (1999) – (Kanada)

Just Just how big is a number having 206 billion digits? Well, if you were to type it for this assignment, and if each digit was exactly 0.1 inches wide, the number could be expressed in a string 325,000 miles long. This is greater than the distance to the moon or about 12 times around the planet *Earth*.

π
π π
π π
π π
π
π are square?

[1] This is the current record. It's computation uses a different category of formula developed by Peter and Jonathan Borwein. How do you think that accuracy is verified?