SOME PIECES OF PI

For the gala beginning of Mathophiles for the 2000–2001 year, we look at a standard question from the Math Comps:

How would one compute π?

Tim is still writing this talk, but formulas he may discuss include:

$$\frac{\pi}{2} = \frac{2 \cdot 2 \cdot 4 \cdot 4 \cdot 6 \cdot 6 \dots}{1 \cdot 3 \cdot 3 \cdot 5 \cdot 5 \cdot 7 \dots} \quad \text{(Wallis, 1655)}$$

$$\frac{\pi^2}{6} = \sum_{n=1}^{\infty} \frac{1}{n^2} \quad \text{(Euler, 1748)}$$

$$\frac{1}{\pi} = \frac{\sqrt{8}}{9801} \sum_{n=0}^{\infty} \frac{(4n)!}{(n!)^4} \frac{1103 + 26390n}{396^{4n}} \quad \text{(Ramanujan, 1914)}$$

Each additional term in the last sum adds 8 digits' accuracy.

$$\pi \approx \left(\frac{1}{10^5} \sum_{n=-\infty}^{\infty} e^{-\frac{n^2}{10^{10}}} \right)^2$$

is not exact, but is accurate to over 42 billion digits.

$$\pi = \sum_{n=0}^{\infty} \frac{1}{16^n} \left(\frac{4}{8n+1} - \frac{2}{8n+4} - \frac{1}{8n+5} - \frac{1}{8n+6} \right) \quad \text{(Bailey et al, 1996)}$$

lets one find individual hex digits of π without knowing the previous ones.

And do you know how to find π using only a wood floor and toothpicks?

Finally, it would be fun to look at the formula

$$\pi = \lim_{n \to \infty} 2^{n+2} \sqrt{2 - \sqrt{2 + \sqrt{2 + \sqrt{2 + \dots}}}},$$

where the square roots are nested to a depth of n. This formula was found at Earlham by Brian Faye as part of a Calc A lab.

Everyone with an interest in either **MATH** or **FOOD** is welcome!

Mathophiles, Monday, September 4, 4PM, Dennis 231

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