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Image: Taken from the Wikipedia pi article. The caption is, "Srinivasa Ramanujan, working in isolation in India, produced many innovative series for computing π."

Pi as a Continued Fraction thanks to Ramanujan?

This amazing result came to my attention thanks to the November 7, 2016 episode of the show *Star Talk* on cable television on the Nat Geo (National Geographic) channel. The host of this weekly one-hour talk show is the famous astrophysicist Neil deGrasse Tyson, who did such a great job as on-camera host of *Cosmos: A Spacetime Odyssey*. This episode publicized the new movie (a historical drama) *The Man Who Knew Infinity*, about the life and work of Ramanujan, the famous mathematician who died so young in 1920 at the age of 32.

Mathematician Ken Ono was the expert math consultant for the movie. On this television show, he presented this equation for pi; 3 plus a "continued fraction" which is simple to memorize and write.

The numerator of the fraction is 1 (written as one squared, 1^2) and the denominator is:
6 plus a fraction whose numerator is 3^2 and whose denominator is
6 plus a fraction whose numerator is 5^2 and whose denominator is
6 plus a fraction whose numerator is 7^2 and whose denominator is
6 plus a fraction whose numerator is 9^2 and whose denominator is
6 plus …

Image credit: The Wikipedia pi article.

$$\pi = \cfrac{4}{1+\cfrac{1^2}{2+\cfrac{3^2}{2+\cfrac{5^2}{2+\cfrac{7^2}{2+\cfrac{9^2}{2+\ddots}}}}}} = 3 + \cfrac{1^2}{6+\cfrac{3^2}{6+\cfrac{5^2}{6+\cfrac{7^2}{6+\cfrac{9^2}{6+\ddots}}}}} = \cfrac{4}{1+\cfrac{1^2}{3+\cfrac{2^2}{5+\cfrac{3^2}{7+\cfrac{4^2}{9+\ddots}}}}}.$$

I emailed Professor Ono using a found-on-the-internet Emory University email address. I asked for a proof or demonstration since I am a math teacher in Texas public schools for grades 7-12. He answered, "Have a look at part VII of *https://sites.google.com/site/tpiezas/0017*. This is not exactly the continued fraction I offered in the tv show. You can derive that one I gave from it though."

The title for that article is "*Ramanujan's Continued Fractions, Apéry's Constant, and More*," by Tito Piezas III. Change the 0017 to 0016 in that web page address to see the Tito Piezas III article with the title, "*Ramanujan's Pi Formulas with a Twist.*" Change it to 0015 to find the Tito Piezas III article with the title, "*Ramanujan's Continued Fractions and the Platonic Solids*."

I now see that the Wikipedia pi article includes a section about continued fractions, including this one. The Wayback Machine from *archive.org* shows that continued fractions were added to the Wikipedia pi article in April of 2012.

Continuing to search the internet, I found that Wolfram Research lists 13 continued fractions for pi on this web page (http://functions.wolfram.com/Constants/Pi/10/), including this one presented on television by Professor Ono.

I have not yet demonstrated that this expression for pi came from Ramanujan. Who first presented this expression for pi? I would enjoy seeing a derivation I could understand, but I will be patient. [Douglas Yazell, History technical committee Chair. Contact information: *history2016@aiaahouston.org*.]