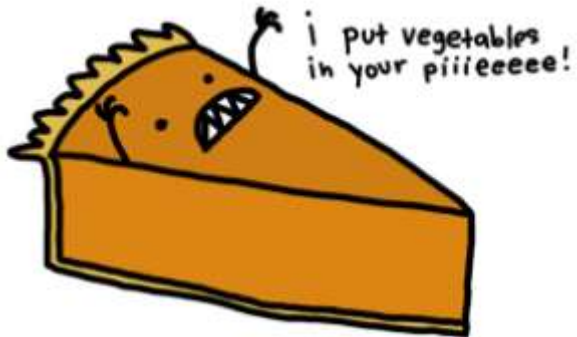
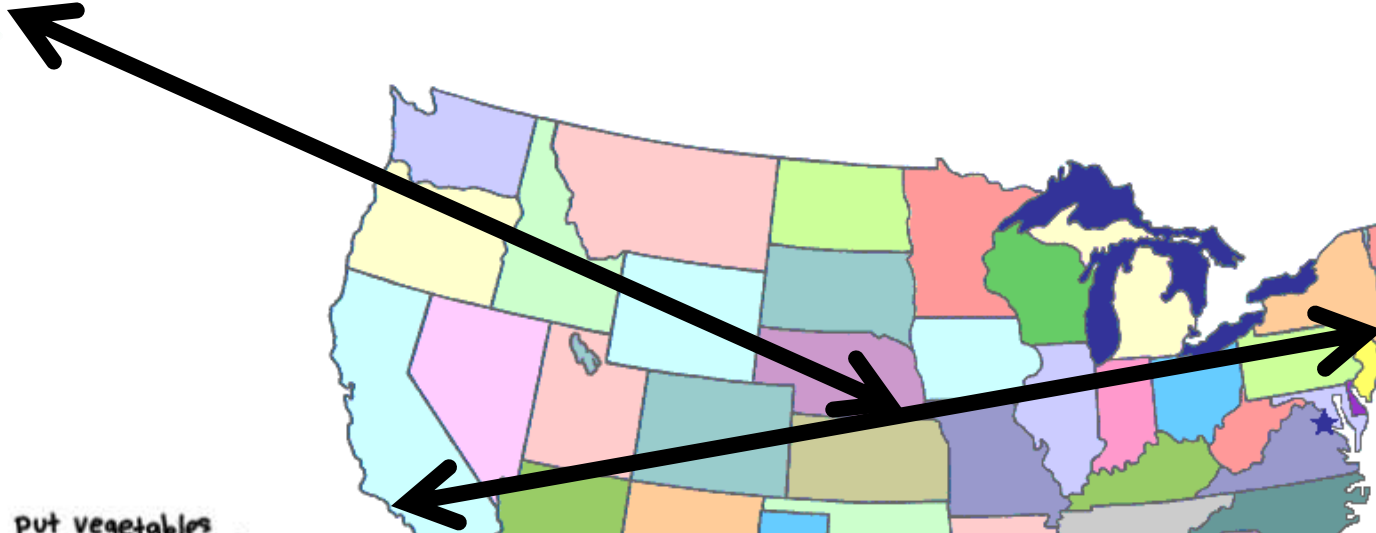


What is π ?

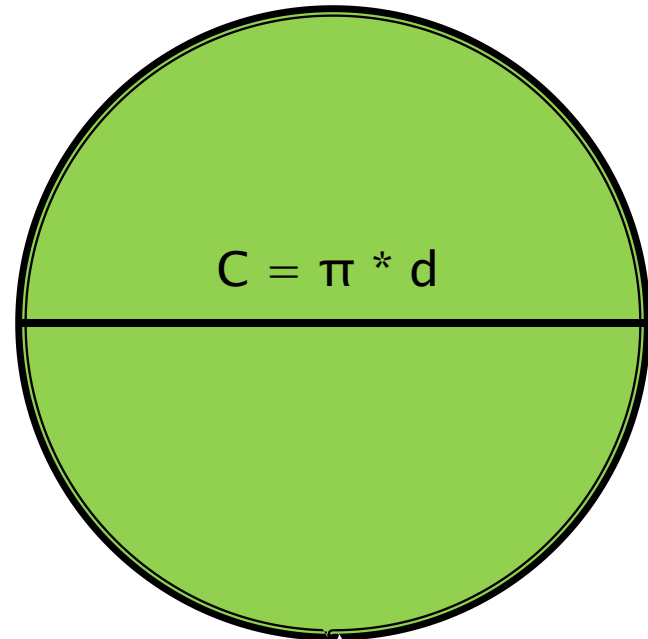
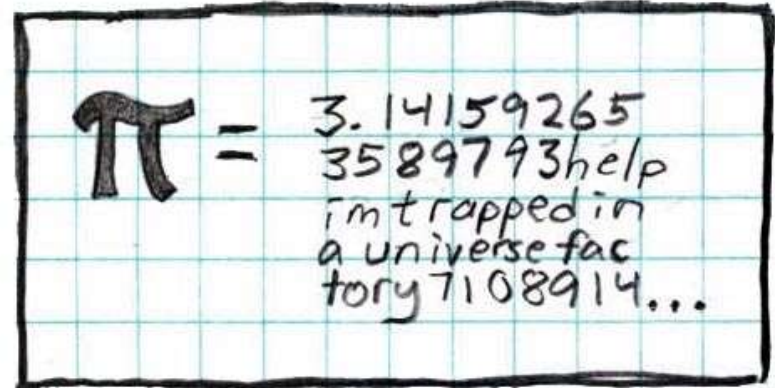
Measuring the Circle: The Story of π

Π is more than just a dessert!



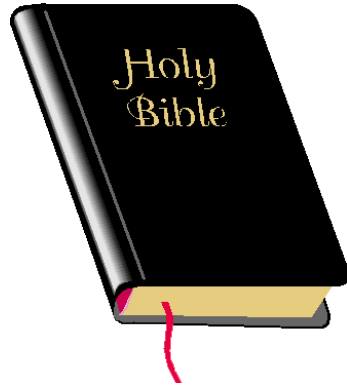
What does π represent?

- ▶ Symbol π did not always represent number
- ▶ π as a mathematical term
 - π is the ratio of a circle's circumference to its diameter



So what exactly is π ?

A Brief History



- ▶ c. 1900 B.C: Babylon $\pi = 3 \frac{1}{8}$
- ▶ c. 1650 B.C: Egypt: Rhind Papyrus $\pi = (1\frac{6}{10})^2$
- ▶ c. 550 B.C: The Bible $\pi = 3$
- ▶ c. 240 B.C: Greece: Archimedes $\pi = 3 \frac{1}{7}$
- ▶ c. 150 A.D: Greece: Ptolemy $\pi = \frac{377}{120}$
- ▶ c. 480 A.D: China: Zu Chongzhi $\pi = \frac{355}{113}$
- ▶ c. 530 A.D: India: Aryabhata $\pi = \frac{62832}{2000}$

π approximation activity

Calculate the circumference of a 1Km diameter lake by using the approximations listed below. Then use your calculator's π to calculate the circumference. Calculate the error of the approximation in Km and cm.

- ▶ Babylon $\pi = 3 \frac{1}{8}$
- ▶ Egypt $\pi = (\frac{16}{9})^2$
- ▶ Greece $\pi = 3 \frac{1}{7}$
- ▶ China $\pi = \frac{355}{113}$
- ▶ India $\pi = \frac{62832}{20000}$

Decimal	Error in Km	Error in cm
3.125	.01659	165.9
3.16049	.01890	189.0
3.142857	.001264	12.4
3.14159	.000000267	.0267
3.1416	.000007346	.7346

So what exactly is π ?

A Brief History

- ▶ Middle Ages Europe
 - 1706: Britain: William Jones
 - 1873: Britain: William Shanks
 - 1882: Germany: Ferdinand von Lindemann

- ▶ Modern Era: computing π with technology
 - ▶ 1949: US: John von Neumann
 - ▶ 1987: Japan: Prof. Kanada
 - ▶ 1991: US: Chudnovsky's
 - ▶ 1999: Japan: Prof. Kanada



If approximations are “close enough” ... why keep trying?

- ▶ Irrational numbers
- ▶ Many questions left unanswered—and which are even worthwhile?
- ▶ How to generate digits promotes technology improvements
- ▶ People are curious about the unknown



Historical Timeline

- ▶ 1900 B.C: Babylon $\pi = 3 \frac{1}{8}$
- ▶ 1650 B.C: Egypt: Rhind Papyrus $\pi = (1\frac{6}{9})^2$
- ▶ 550 B.C: The Bible: $\pi = 3$
- ▶ 240 B.C: Greece: Archimedes $\pi = 3 \frac{1}{7}$
- ▶ 150 A.D: Greece: Ptolemy $\pi = \frac{377}{120}$
- ▶ 480 A.D: China: Zu Chongzhi $\pi = \frac{355}{113}$
- ▶ 530 A.D: India: Aryabhata $\pi = \frac{62832}{2000}$
- ▶ 1706: Britain: William Jones first reference to number as being called π
- ▶ 1873: Britain: William Shanks computed π to 607 places
- ▶ 1882: Germany: Ferdinand von Lindemann proved π is transcendental
- ▶ 1949: US: John von Neumann computed π to 2035 places
- ▶ 1987: Japan: Prof. Kanada computed π to 134,217,000 places
- ▶ 1991: US: Chudnovsky's computed π to 2,260,321,336 places
- ▶ 1999: Japan: Prof. Kanada computed π to 206,158,430,000 places

References

- ▶ Arndt, Jorg and Christoph Haenel. *Pi - Unleashed*. Trans. Catriona and David Lischka. Berlin: Springer, 2001. Google Books. 7 Sept 2009. <<http://books.google.com/>>.
- ▶ Berlinghoff and Gouvea, *Math through the Ages. 2004*.
- ▶ Wikipedia entry on *Pi* (9/7/09) at <<http://en.wikipedia.org/wiki/Pi>>.