wiki**How**
to do anything

How to Calculate Pi

Co-authored by **wikiHow Staff** ✔

Updated: March 29, 2019

Pi (π) is one of the most important and fascinating numbers in mathematics. Roughly 3.14, it is a constant that is used to calculate the circumference of a circle from that circle's radius or diameter.[1] It is also an irrational number, which means that it can be calculated to an infinite number of decimal places without ever slipping into a repeating pattern.[2] This makes it difficult, but not impossible, to calculate precisely.

Explore this Article

- Calculating Pi Using the Measurements of a Circle
- Calculating Pi Using an Infinite Series
- Calculating Pi Using Buffon's Needle Problem
- Show 2 more...
- Article Summary
- Related Articles
- References

Method 1

Calculating Pi Using the Measurements of a Circle

1 Make sure you are using a perfect circle. This method won't work with ellipses, ovals or anything but a real circle. A circle is defined as all the points on a plane that are an equal distance from a single center point. The lids of jars are good household objects to use for this exercise. You should be able to calculate pi roughly because in order to get exact results of pi, you will need to have a very thin lead(or whatever you are using). Even the sharpest pencil graphite could be huge to have exact results.

2 Measure the circumference of a circle as accurately as you can. The circumference is the length that goes around the entire edge of the circle. Since the circumference is round, it can be difficult to measure (that's why pi is so important).

- Lay a string over the circle as closely as you can. Mark the string off where it circles back around, and then measure the string length with a ruler.

3 Measure the diameter of the circle. The diameter runs from one side of the circle to the other through the circle's center point.

4 Use the formula. The circumference of a circle is found with the formula $C = \pi{*}d = 2{*}\pi{*}r$. Thus pi equals a circle's circumference divided by its diameter. Plug your numbers into a calculator: the result should be roughly 3.14.[3]

5 Repeat this process with several different circles, and then average the results. This will give you more accurate results. Your measurements might not be perfect on any given circle, but over time they should average out to a pretty accurate calculation of pi.

Method 2

Calculating Pi Using an Infinite Series

1 Use the Gregory-Leibniz series. Mathematicians have found several different mathematical series that, if carried out infinitely, will accurately calculate pi to a great number of decimal places. Some of these are so complex they require supercomputers to process them. One of the simplest, however, is the Gregory-Leibniz series. Though not very efficient, it will get closer and closer to pi with every iteration, accurately producing pi to five decimal places with 500,000 iterations.[4] Here is the formula to apply.

- *π = (4/1) - (4/3) + (4/5) - (4/7) + (4/9) - (4/11) + (4/13) - (4/15) ...*
- Take 4 and subtract 4 divided by 3. Then add 4 divided by 5. Then subtract 4 divided by 7. Continue alternating between adding and subtracting fractions with a numerator of 4 and a denominator of each subsequent odd number. The more times you do this, the closer you will get to pi.

2 **Try the Nilakantha series.** This is another infinite series to calculate pi that is fairly easy to understand. While somewhat more complicated, it converges on pi much quicker than the Leibniz formula.[5]

- *π = 3 + 4/(2*3*4) - 4/(4*5*6) + 4/(6*7*8) - 4/(8*9*10) + 4/(10*11*12) - 4/(12*13*14) ...*
- For this formula, take three and start alternating between adding and subtracting fractions with numerators of 4 and denominators that are the product of three consecutive integers which increase with every new iteration. Each subsequent fraction begins its set of integers with the highest one used in the previous fraction. Carry this out even a few times and the results get fairly close to pi.

Method 3 **Calculating Pi Using Buffon's Needle Problem**

1 **Try this experiment to calculate pi by throwing hotdogs.** Pi, it turns out, also has a place in an interesting thought experiment called Buffon's Needle Problem,[6] which seeks to determine the likelihood that randomly tossed uniform elongated objects will land either between or crossing a series of parallel lines on the floor. It turns out that if the distance between the lines is the same as the length of the tossed objects, the number of times the objects land across the lines out of a large number of throws can be used to calculate pi. Check out the above WikiHow article link for a fun breakdown of this experiment using thrown food.

- Scientists and mathematicians have not figured out a way to calculate pi exactly, since they have not been able to find a material so thin that it will work to find exact calculations.[7]

Method 4 **Calculating Pi Using a Limit**

1 **Pick a large number.** The bigger the number, the more accurate your calculation will be.

2 **Plug your number, which we'll call x, into this formula to calculate pi: x * sin(180 / x)**. For this to work, make sure your calculator is set to Degrees. The reason this is called a Limit is because the result of it is 'limited' to pi. As you increase your number x, the result will get closer and closer to the value of pi.

Method 5 **Using Arcsine Function/Inverse Sine Function**

1 **Pick any number between -1 and 1.** This is because the Arcsin function is undefined for arguments greater than 1 or less than -1.

2 **Plug your number into the following formula, and the result will be roughly equal to pi.**

- pi = 2 * (Arcsin(sqrt(1 - x^2)) + abs(Arcsin(x))).
  - Arcsin refers to the inverse sine in radians
  - Sqrt is short for square root
  - Abs is short for absolute value
  - x^2 refers to an exponent, in this case, x squared.

Community Q&A

Question

Is twenty two over seven equal to pi?

Community Answer

It is not equal to pi. While it does look like pi at first (3.14285...), pi is 3.14159... Also, we know it cannot be equal to pi because it ends up repeating. Pi is an irrational number, meaning it goes on forever and does not repeat. Remember, irrational numbers are defined as "not being able to be written as a ratio between two numbers" twenty-two over seven is a ratio of two numbers, so it cannot be equal to pi.

Question

How can I figure out pi as a fraction?

Community Answer

You can't. Pi cannot be a fraction because it is irrational. This means that it cannot be expressed as a ratio of two rational numbers. Pi is sometimes expressed as the fraction 22/7, but that is just an approximation.

Question

What does the word irrational mean?

Community Answer

An irrational number is a number that cannot be expressed as a ratio of whole numbers (i.e., as a fraction). The root of the word 'irrational' is 'ratio', and the prefix 'ir' means 'not'. The word can have different meanings outside of math.

Question

How is pi irrational if its equal to C/D?

Community Answer

A rational number is a number that can be expressed as a fraction of two integers. There are no two integers you can plug into C and D that will give pi. Either the circumference or the diameter of the circle (if not both) is always irrational (though, like pi, we would normally round them when doing math to simplify things).

Question

What are the continuous numbers of pi?

Donagan
Top Answerer

3.14159265358979.... (the numbers never end!)

Question

How can I find a series of numbers whose value gets closer to Pi using sin?

Kevin Vega
Community Answer

The formula you are looking for is $\infty*\sin(180/\infty)$.

Question

What is the value of 2 with a Pi constant attached next to it?

Community Answer

$2\pi = 2*\pi = 2*3.14.... = 6.28....$ Sometimes, people call this value τ (tau).

Question

How to calculate value of pi at home so that I can make a world record?

Donagan
Top Answerer

The world record was set by a very high-powered computer. You're not likely to break the record at home.

Question

How do I recite pi without memorization?

Donagan
Top Answerer

Memorization is your only hope. Mathematicians believe that the digits of pi are essentially random (with no pattern).

Question

How do I calculate the sine of any given angle?

Community Answer

Set the calculator to either degree, radian or gradian mode and then press the "sin" which may alternatively also be called the "sin()" button. Put the value of the angle in between the parenthesis and press "=". The answer will be the sine of that angle.

Tips

- Calculating pi can be fun and challenging, but doing so too deeply has diminishing returns. Astrophysicists say they only need to use pi to 39 decimal places in order to do cosmological calculations that are accurate to the size of an atom.

References

1. https://www.mathsisfun.com/definitions/pi.html
2. http://mathworld.wolfram.com/IrrationalNumber.html
3. http://www.mathsisfun.com/numbers/pi.html
4. http://en.wikipedia.org/wiki/Pi
5. http://www.mathscareers.org.uk/article/calculating-pi/
6. https://mste.illinois.edu/activity/buffon/

7. http://mathworld.wolfram.com/BuffonsNeedleProblem.html