

CSCI 116

Project #6: Computing Pi

Purpose: Since everyone else seems to do it when they get a computer, I suppose we have to as well. For this project, we are going to compute the value for π (pi). We aren't going to get as carried away as the supercomputer guys do and compute millions of digits. We are going to be a bit more modest and just compute the first 15 or so digits using doubles.

Program Objective: To compute and print the first 15 digits of π .

Instructions: Write a program to compute and print π . To compute the value of π , we need a formula for it. Let's use the standard formula¹,

$$\pi = 16 \arctan\left(\frac{1}{5}\right) - 4 \arctan\left(\frac{1}{239}\right)$$

This is all well and good, but in order to compute π , we need to compute \arctan now. We could try to use a standard function from `cmath`, but let's write our own function to compute \arctan . Mathematicians tell us an easy formula to use is

$$\arctan(x) = \sum_{n=0}^{\infty} \frac{(-1)^n}{2n+1} x^{2n+1} = x - \frac{x^3}{3} + \frac{x^5}{5} - \frac{x^7}{7} + \frac{x^9}{9} - \dots$$

This shouldn't be too bad since it looks like the computation for e^x that we did in class. We should be able to reuse most of the code we wrote. The only parts that might need some thinking are the alternating signs, and the fact that the exponents and denominators both increment by 2.

Here is a sample output from the program:

Pi = 3.14159265358979
Press any key to continue

NOTE: You are to implement *functions* for arctan, pi, and exponentiation. You are to use the formulas above in your computation. Going on line and finding C++ code that computes π and turning it in as your own is considered **plagiarism**, and will result in a **zero** (0) for the project as well as other consequences!

Have fun!

¹Note: the formulas sometimes don't show up in Chrome. If they don't, try using a different browser, such as Internet Explorer. If none of them work, here is the page as a [pdf](#)