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COMP 115      Robots, Games, and Problem Solving

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Lab #7 (not really a lab, just practice problems)

More practice on loops!

1. Back when I covered `for` loops, I gave an example of a program that calculates the value an investment after a number of years and an interest rate specified by the user. This time, we will go the other way around. We want to calculate how many years it will take before an investment surpasses a given value at a given interest rate. All numbers in this program should be floating-point numbers.
  - (a) Ask the user for the initial value of the investment.
  - (b) Ask the user for the interest rate. This should be a number between 0 and 1.
  - (c) Ask the user for the final value of the investment.
  - (d) Using a loop, determine how many years it will take at the given interest rate for the initial investment to surpass the final value entered by the user.
2. The *powers of 2* are the numbers obtained by repeatedly multiplying the number 1 by 2. The first few powers of 2 are: 1, 2, 4, 8, 16, 32, 64, etc. Write a program that prints on screen all the powers of two that are smaller than an integer given by the user.
3. The following sum can be used to calculate the value of  $\pi$ :

$$\begin{aligned}\pi &= 4 - \frac{4}{3} + \frac{4}{5} - \frac{4}{7} + \frac{4}{9} - \frac{4}{11} + \frac{4}{13} \dots \\ &= \sum_{i=0}^{\infty} \frac{(-1)^i 4}{2 * i + 1}\end{aligned}$$

(the second line is just mathematical notation, ignore it if you don't know what it means), and I showed how to write a `for` loop that summed up the first few terms of this sum.

Write a program that asks the user for a floating point number and determines how many terms of this sum you must add up so that the error between the true value of  $\pi$  (as stored in the math library) and your sum is smaller than the number given by the user (the error is the absolute value of the difference between your sum and the true value – the function `math.abs` will be useful here).