Programming Problem 2a: population.py

Directions: Download the template files I have provided on Blackboard. Then open Spyder, load these template files, and write the following programs. Submit your source code via Gradescope in `.py` format. READ THE INSTRUCTIONS on submitting your work in the Course Documents section of Blackboard.

Specify collaborators/resources or explicitly specify that none were used in the comments at the top of your `.py` file. Failure to include this will result in a zero on the assignment.

Be sure to read the SPECIFICATIONS carefully! And write comments!

Suppose that you are a demographist, who wants to model the growth of the population of a nation over time. A simple model for this growth is the standard exponential model

$$P = P_0 e^{rt}$$

where P_0 is the initial population at time t = 0, r is the relative growth rate in percent per year (expressed as a decimal), t is the time elapsed in years, and P is the population at time t. e, of course, is the base of the natural logarithm ($e \approx 2.718$).

Write a program that prompts the user to enter a value for the initial population. The program should then do the following **three** times: it will ask for a number of years and a relative growth rate; the program will then compute the new population after that many years have elapsed, using the population growth formula provided above. This should be done *cumulatively* – that is, the end population for the first iteration should be used as the initial population for the second iteration, and the end population for the second iteration should be used as the initial population for the third iteration.

So, for example: suppose that the user enters an initial population of 300, a first time period of 4 years, and a first growth rate of 1.2%. Then the population at the end of the first time period would be 314.751, since

$$300 \cdot e^{(0.012)(4)} = 314.751.$$

Suppose then that the second time period was 2.5 years, and the second growth rate is 5%; then the population at the end of the second time period will be

$$314.751 \cdot e^{(0.05)(2.5)} = 356.66.$$

Finally, suppose that the user enters 1 year for the last time period, and 2.1% for the last growth rate; then the population at the end of the last time period will be

$$356.66 \cdot e^{(0.021)(1)} = 364.229.$$

That last number, 364.229, is what the program should display as the final population. (Don't worry about that fact that many of these numbers aren't integers.)

So, when you run your program, it should look something like this:

```
Enter initial population: 300
Enter first time period (in years): 4
Enter first growth rate (in percent): 1.2
Enter second time period (in years): 2.5
Enter second growth rate (in percent): 5
Enter third time period (in years): 1
Enter third growth rate (in percent): 2.1
The final population is 364.2288848868699
```

(The numbers after each `:`, like `300` and `4` and `1.2`, are user entries; the rest should be produced by the program.)

Hints: make sure you try calculating with my sample values by hand before you start programming, to make sure you understand the task! Finally, in case you are tempted to figure out a way to get Python to "repeat itself three times" – don't do that, just write similar code three times over (we'll learn about repetition soon enough).

Specifications: your program must

- clearly ask the user to enter the initial population.
- ask the user three times to enter a number of years, and a growth rate. The program should accept the growth rates input as **percents** (but input without the percent sign – so "3.5%" will be input to the program as just `3.5`).
- compute the **final** population as described above, and clearly display it. You are not required to round this value to an integer.

Challenge*: try to write this program using only three variables.*
