

Unit 2: Input, Output and Functions

Skill Builder 1: A Tale of Two Means

In this lesson, you will write a program that requires a mathematical function that is not part of Python's "built-in" tools.

Objectives:

- Use import for additional functions
- Write a program using the menus
- Examine a mathematical relationship

1. The **arithmetic mean** (average, pronounced "arith**METIC**" of two numbers is:

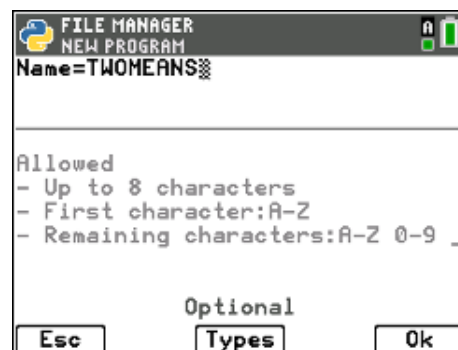
$$am = \frac{a+b}{2}$$

The **geometric** mean is:

$$gm = \sqrt{a \cdot b}$$

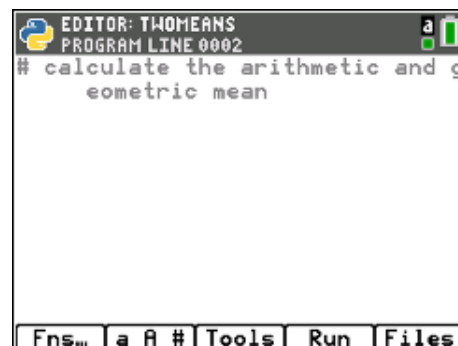
Write a program to calculate and display both means to compare them for several examples.

Begin a new Python program and name it **TWOMEANS**.



2. Start a line with the **#** sign ("pound," "number" or "hashtag") found on **<a A #>**. Highlight the symbol, press **[enter]** and select **<Paste>**. This symbol is used for making a **#comment** which is ignored when the program runs. After the **#** sign, write a sentence explaining the purpose of the program. Comments are useful in two ways:
 - a. They allow the programmer to document the purpose for different chunks of code. This makes longer programs easier to read and debug if there are errors.
 - b. They are useful in debugging because you can "comment out" a line so it does not execute when the code runs. That allows the programmer to systematically isolate where the error occurs.

Note the wraparound feature in the Editor: The remaining part of the line is also indented a bit.



3. This program requires the *square root function* which is *not* part of Python's built-in operations. The square root (**sqrt**) and other mathematics functions are found in the standard Python module called **math**. To use this function, you must import the math module to your code. Select **<Fns...> Modul > math** and select the statement at the top:

from math import *

TI-84 PLUS CE PYTHON

Modules are used to keep Python small and fast: We only *import* stuff that our program will actually use.

The **Math** menu contains lots of mathematics functions and there are separate **Const** and **Trig** sub-menus, too. To use any of these functions the math module must be imported into your program.

*Note: The asterisk (*) means “from math import all.”*

- Use the **input()** function to enter the first number. First type the variable **a** and the = sign ([sto] key).

Recall that **input()** returns a string and we must convert it to a number. Combine those two steps into one by writing:

$$a = \text{float}(\text{input}())$$

First, get **float()** from <Fns...> Type,

Then, with the cursor inside the parentheses, look on <Fns...> I/O for the **input()** function.

For the prompt inside the **input()** parentheses, write “First number?”

The question mark is on the <a A #> screen.

Write a second statement to enter the second number (not shown). This is a good opportunity for you use the <Tools> **Copy Line** and **Paste Line Below** features and then edit the second line.

- After your two input statements, write two assignment statements, one for the **arithmetic** mean and one for the **geometric** mean:

$$\begin{aligned} am &= (a + b) / 2 \\ gm &= \text{sqrt}(a * b) \end{aligned}$$

sqrt() is on <Fns...> Modul math

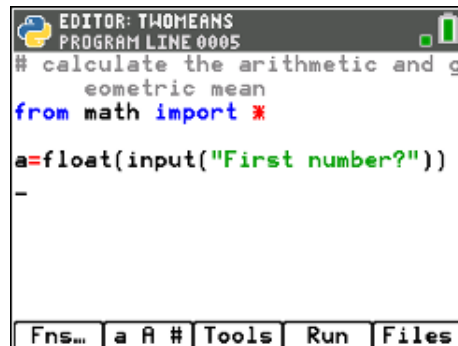
*You can also simply type **sqrt()**.*

STUDENT ACTIVITY



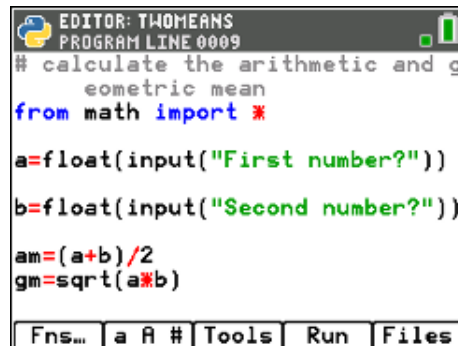
```

EDITOR: TWOMEANS
math module
Math Const Trig
1:from math import *
2:fabs()
3:sqrt()
4:exp()
5:pow(x,y)
6:log(x,base)
7:fmod(x,y)
8:ceil()
9:floor()
0:trunc()
Esc Modul
    
```



```

EDITOR: TWOMEANS
PROGRAM LINE 0005
# calculate the arithmetic and g
# eometric mean
from math import *
a=float(input("First number?"))
-
Fns... a A # Tools Run Files
    
```



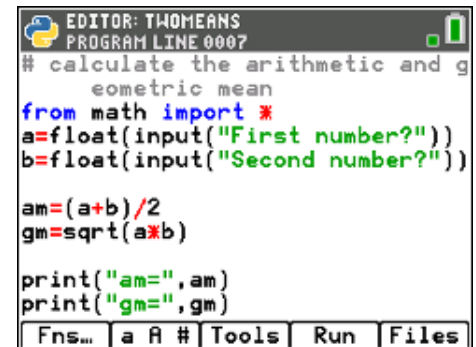
```

EDITOR: TWOMEANS
PROGRAM LINE 0009
# calculate the arithmetic and g
# eometric mean
from math import *
a=float(input("First number?"))
b=float(input("Second number?"))
am=(a+b)/2
gm=sqrt(a*b)
Fns... a A # Tools Run Files
    
```



6. The last task is to write the `print()` statements to display the two calculated values. Use your imagination! A sample is shown here:

```
print( "am = ", am)
print( "gm = ", gm)
```



```
EDITOR: TWOMEANS
PROGRAM LINE 0007
# calculate the arithmetic and g
eometric mean
from math import *
a=float(input("First number?"))
b=float(input("Second number?"))

am=(a+b)/2
gm=sqrt(a*b)

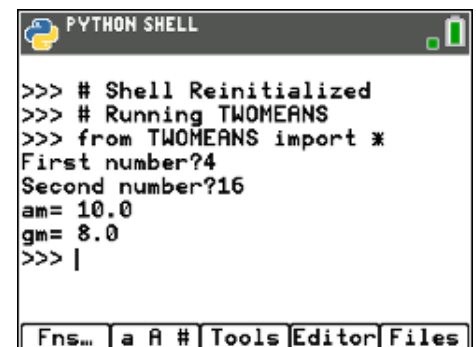
print("am=",am)
print("gm=",gm)
```

7. Run the program and enter two numbers for which you know the answers... TEST, TEST, TEST.

To rerun the last program, select **<tools>** and press **[enter]**.

After trying many examples, do you notice a relationship between the two means? Is one always larger than the other? Are they ever equal? How are they related to the two numbers you enter? Are there any values which cause an error?

Check your guesses with the teacher! Can you prove it?



```
PYTHON SHELL

>>> # Shell Reinitialized
>>> # Running TWOMEANS
>>> from TWOMEANS import *
First number?4
Second number?16
am= 10.0
gm= 8.0
>>> |
```