Unit 2: Input, Output and Functions | **Skill Builder 2: Heron's Formula**

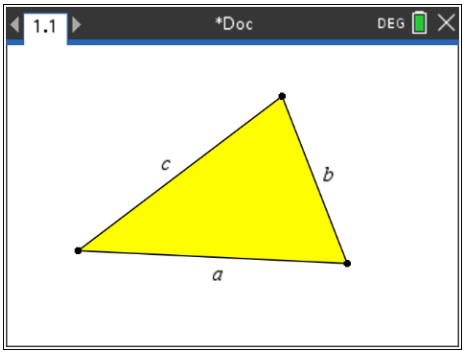
In this lesson, you will use one of the program templates, create a function to evaluate and return a value, and explore the mathematical operators.

Objectives:

- Use a program template (Type:)
- Create a function for Heron's Formula

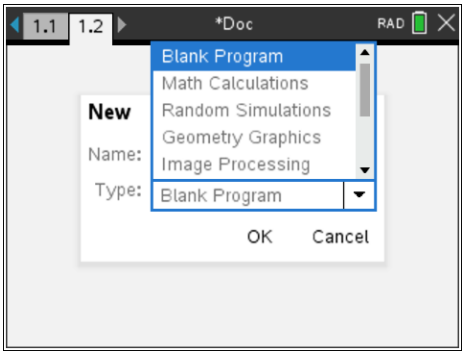
You are given a triangle with only the side measurements. Can you determine the area? YES, using Heron's Formula. ☺

In this lesson you will create a function to determine the area of a triangle using the three side lengths and then complete the program that uses that function.



1. This program, like the last one, requires the sqrt() function. This time we will use one of the included Python 'templates' which pre-loads the most commonly needed functions for the project.
   When you select **Add Python > New** and are entering the name of the Python file (we use 'area' for this name) there is a field under the name labeled 'Type:'. The default type is 'Blank Program'. Clicking on the pop-up arrow on the right exposes the other types of programming projects available (there are many!).

   For this project select the Type: **Math Calculations** and click **OK** or press **enter**.



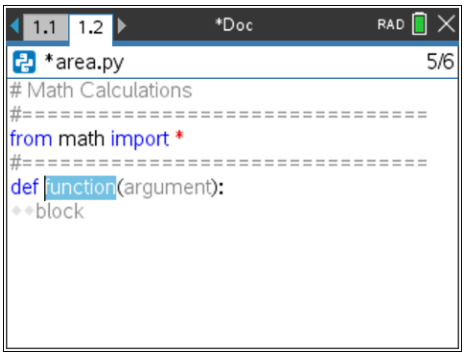
> **Teacher Tip:** The program templates provide *most* of the needed modules and functions, but you are free to add more if you find that you need functions that are not supplied with the project. One of the tricky parts of this system is knowing in which module the needed functions reside. This comes with experience. This modularity is one of Python's biggest assets: lightweight, fast, and efficient.

2. The **Math Calculations** template provides the statement

   from math import *

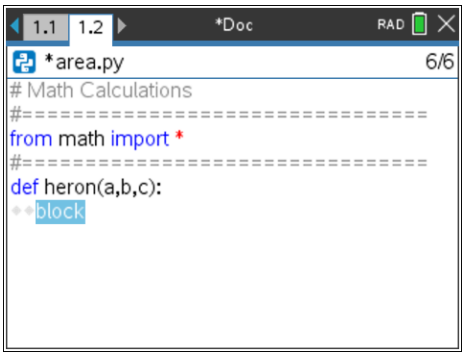
   for you.

   Next get the **def function()** statement from **menu > Built-ins > Function**.



3. Make the name of the function **heron**. There are three arguments, **a**, **b**, and **c**, which represent the three sides of the triangle.

   See the next step for the code for the block.



Teacher Tip: A function can have many arguments (or one) and in Python you can assign the arguments default values which we will not discuss in this course.

4. **Heron's Formula** is a two-step calculation:

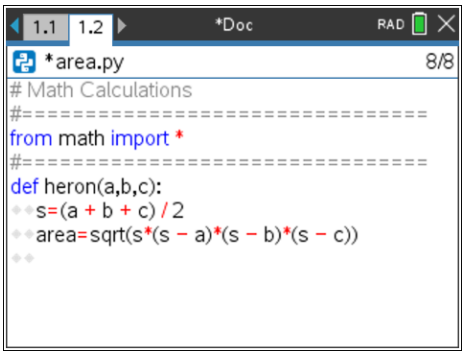
   First, calculate half the perimeter (the semi-perimeter):

   s = (a + b + c) / 2

   Then the area is:

   area = sqrt(s*(s - a)*(s - b)*(s - c))

   Remember that both statements in this function block are indented.



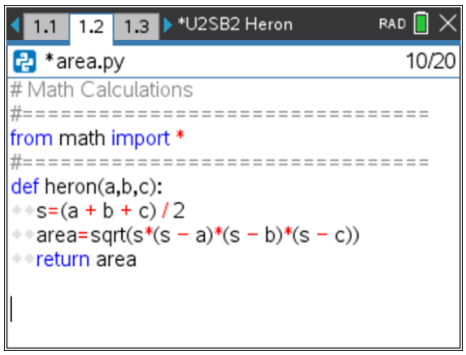
Teacher Tip: Be sure that the entire function block is properly indented!

5. Finish the function by providing the **return** statement

   return area

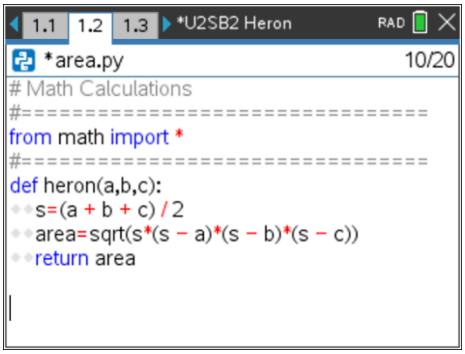
   found on **menu > Built-ins > Function**.

   As in mathematics, functions have arguments and 'produce' a value. The return statement is needed to 'send' the value back to the main program where it can be used.
   Important: Move the insertion cursor back to the *beginning* of a new line using **del** or **shift+tab**. You can also skip one or more lines for clarity.



Teacher Tip: White space in a program has no effect on execution.

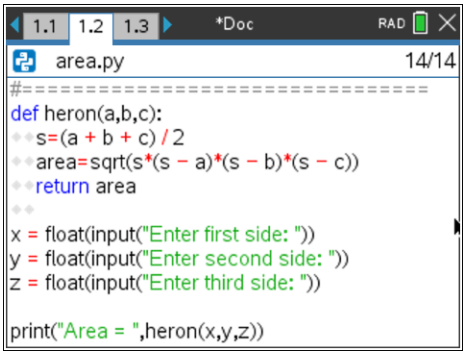
6. Now it's time to write the main program using just the statements:



input() (3 times for the three sides)
print() (to print the area)

Before going to the next step, try writing them yourself.

7. The three **input**() statements request the lengths of the three sides, convert each length to a number, and store the values in three variables. We use x, y, and z.



x = float(input("Enter first side: "))

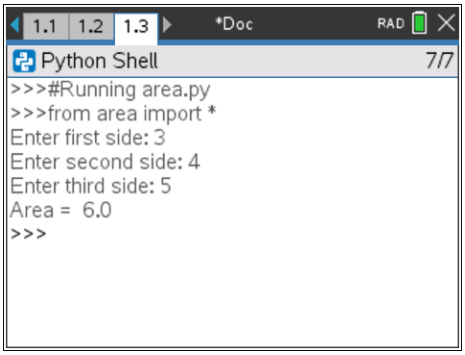
The other two are similar.

The **print**() statement prints the value of the **heron** function with the three variables as arguments:

print("Area = " , heron(x,y,z))

Teacher Tip: Explain the difference between the 'formal' arguments in the function definition (a, b, c) and the 'actual' arguments (x, y, z) in the function call in the print statement. Arguments a, b, and c are 'placeholders' that get their 'actual' values from the variables that are used in the function call.

8. Test your program with numbers for which you know the area, like 3, 4, and 5. Why is the area 6? What other triangles have areas that are easy to compute when given the three sides?



Remember to save your work.

Teacher Tip: For testing, right triangles are easy marks for determining the area, so any Pythagorean triple is a good test case. The areas of equilateral triangles are easy to compute but do not result in 'nice' numeric values.