

GSET - Introduction to Programming with Python - Summer 2023

Conditionals - Tutorial 6 - Triangles and Quadralaterals

Overview :

Scientists and engineers benefit from the understanding of Trigonometry. In this exercise you are going to use the trigonometry tools available with NUMPY to solve a simple geometry problem and the graphing tools in MATPLOTLIB to display the results. You will also use conditional statements to determine the type of geometry of different examples.

System Requirements:

- **Computer:** A computer is required to complete this tutorial. Any OS should work.
- **Python:** An online Python compiler that supports NumPY and MATPLOTLIB is required([Tutorials Point MATPLOTLIB Online](#)) or a Python system of your choice with NumPy and MATPLOTLIB installed.

Area of a Polygon :

You will be calculating the side length and area of a triangle and a quadrilateral (4 sided polygon). You have been given several formulas on the next page.

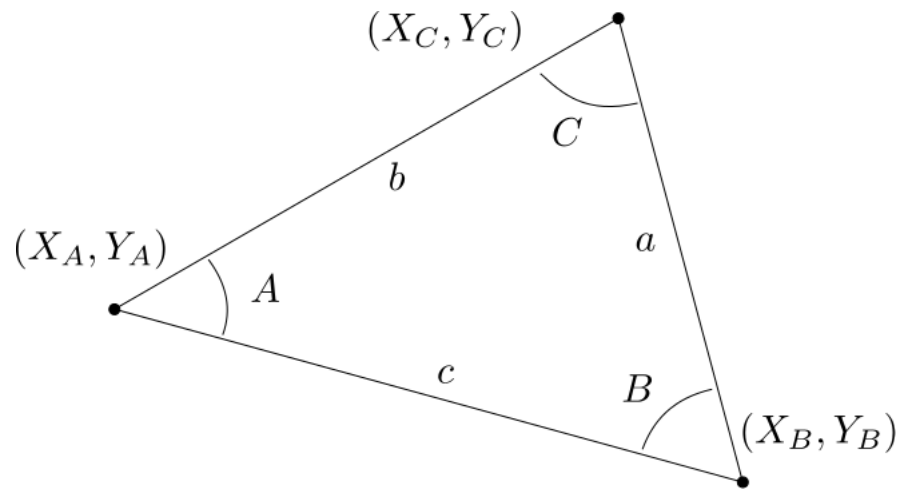
Trigonometric Functions from NumPy :

The trigonometric functions that you need are included in the [NumPy Mathematics functions](#) list. To use NumPy, `import numpy`.

- `numpy.sin(x)` - sine of x
- `numpy.cos(x)` - cosine of x
- `numpy.tan(x)` - tangent of x
- `numpy.asin()` - inverse aka arc-sine
- `numpy.acos()` - inverse aka arc-cosine
- `numpy.atan()` - inverse aka arc-tangent

Equations that you will need :

- **Distance Formula:** $D_{ij} = \sqrt{(x_i - x_j)^2 + (y_i - y_j)^2}$
- **Heron's Formula(Area):** $A = \sqrt{s(s-a)(s-b)(s-c)}$
- **Perimeter Formula:** $p = a + b + c$ and $s = p/2$



- **Law of Cosines:**

$$a^2 = b^2 + c^2 - 2bc \times \cos(A)$$

$$b^2 = a^2 + c^2 - 2ac \times \cos(B)$$

$$c^2 = a^2 + b^2 - 2ab \times \cos(C)$$

Assignment : You are required to write a Python program to complete the problem described below.

Part 1 : Triangle

1. Ask the user to enter the 3 vertices of a triangle using the *input()* function. The data should be stored using lists.
2. Show the vertices and legs of the triangle using MATPLOTLIB.
3. Calculate the length of each side of the triangle. Show these results in the command window with *fprintf()*.
4. Calculate each of the internal angles of the triangle. Show these results in the command window with *fprintf()*.
5. Calculate the area of the triangle. Show this result in the command window with *fprintf()*.
6. Use one or more if statements to determine what type of triangle is formed by the three points. There are six categories shown below. Your program should print category to the command window.
 - Equilateral
 - Right
 - Isosceles
 - Scalene
 - Acute
 - Obtuse

Submission :

- Your program needs a proper *Header* or title block on it (name, date, etc.). Please see this discussion in the notes for details.
- Your script file needs to be named properly. Please see the *naming convention* document on ilearn.
- Submit your file on ilearn in the *Tutorial_6_Triangles and Quadrilaterals*. You can resubmit if needed, but your latest submission will be the only one graded.