SOURCE CODE ACADEMIA

Project #4: Exploring Triangles

Checking Right, Isosceles, or Scalene

Description:

In this project, students will write a Python program that:

- Takes three sides of a triangle as input.
- Checks if the triangle is valid or not.
- Decides whether the triangle is Right-Angled, Isosceles, Equilateral, or Scalene.
- Calculates and displays its Perimeter and Area.
- Demonstrates geometric relationships used in Trigonometry (like right-angled triangles) — but without any angle or trigonometric ratio calculation.

Algorithm:

Step 1: Input

- Ask the user to enter the three sides of a triangle.
- Store them in variables `a`, `b`, and `c`.

Step 2: Validate the Triangle

Check if the triangle can exist using the **Triangle Inequality Rule:**

$$a + b > c, \quad a + c > b, \quad b + c > a$$

If not valid, print `"Not a valid triangle."` and stop.

Step 3: Classify the Triangle

- **Equilateral:** all three sides equal.

- **Isosceles:** any two sides equal.
- **Scalene:** all sides different.
- **Right-Angled:** check if $a^2 + b^2 = c^2$ or permutations thereof.

Step 4: Calculate Area and Perimeter

- **Perimeter:** $P = a + b + c$
- Use **Heron's Formula** to find area:

$$s = \frac{a+b+c}{2}, \quad \text{Area} = \sqrt{s(s-a)(s-b)(s-c)}$$

Step 5: Output

- Display the type of triangle.
- Print perimeter and area neatly.

Pseudocode:

```
BEGIN
IMPORT math

PRINT "Enter the three sides of a triangle:"
INPUT a, b, c

# Step 2: Check triangle validity
IF (a + b > c) AND (a + c > b) AND (b + c > a) THEN
    PRINT "Triangle is valid"

    # Step 3: Type of triangle
    IF a == b AND b == c THEN
        PRINT "Equilateral Triangle"
    ELSE IF a == b OR b == c OR a == c THEN
        PRINT "Isosceles Triangle"
    ELSE
        PRINT "Scalene Triangle"
    END IF

    # Check if Right-angled
    IF a^2 + b^2 == c^2 OR a^2 + c^2 == b^2 OR b^2 + c^2 == a^2 THEN
        PRINT "It is also a Right-Angled Triangle"
    END IF

    # Step 4: Calculate area and perimeter
    s = (a + b + c) / 2
    area = math.sqrt(s * (s - a) * (s - b) * (s - c))
    perimeter = a + b + c

    # Step 5: Output
    PRINT "Perimeter =", perimeter
    PRINT "Area =", area

ELSE
    PRINT "Not a valid triangle"
END IF

END
```

Sample Output:

```
Enter the three sides of a triangle:
Side 1: 3
Side 2: 4
Side 3: 5

Triangle is valid
Scalene Triangle
It is also a Right-Angled Triangle
Perimeter = 12
Area = 6.0


Enter the three sides of a triangle:
Side 1: 5
Side 2: 5
Side 3: 5

Triangle is valid
Equilateral Triangle
Perimeter = 15
Area = 10.825
```

Learning Outcome:

- Understand the relationship between sides of triangles (foundation of trigonometry).
- Learn Heron's Formula and Pythagoras Theorem logically — without using sin, cos, or tan.
- Practice if-else logic, the math module, and geometric validation.