

Geometry Library Documentation

Overview

The `'villaflor_geometry.h'` header file provides a set of functions to perform geometric calculations, including the calculation of areas, perimeters, and distances between points. This documentation describes the purpose, parameters, and return values of each function, and provides guidance on how to use them in your programs.

Including the Header File

To use the functions provided in `'villaflor_geometry.h'`, include the header file at the beginning of your C source file. Ensure that `'villaflor_implementation.c'` is compiled along with your source file.

I. Functions

a) Area Calculations

`'double areaCircle(double radius)'`

- Description: Calculates the area of a circle.
- Formula: $Area = \pi \times radius^2$
- Parameters:
 - `'radius'` (double): The radius of the circle. Should be a non-negative value.
- Returns:
 - The area of the circle (double).

`'double areaRectangle(double length, double width)'`

- Description: Calculates the area of a rectangle.
- Formula: $Area = length \times width$
- Parameters:
 - `'length'` (double): The length of the rectangle. Should be a non-negative value.
 - `'width'` (double): The width of the rectangle. Should be a non-negative value.
- Returns:
 - The area of the rectangle (double).

`double areaTriangle(double base, double height)`

- Description: Calculates the area of a triangle.
- Formula: $Area = 0.5 \times base \times height$
- Parameters:
 - ***`base`*** (double): The base of the triangle. Should be a non-negative value.
 - ***`height`*** (double): The height of the triangle. Should be a non-negative value.
- Returns:
 - The area of the triangle (double).

b) Perimeter Calculations

`double perimeterCircle(double radius)`

- Description: Calculates the perimeter (circumference) of a circle.
- Formula: $Perimeter = 2 \times (length + width)$
- Parameters:
 - ***`radius`*** (double): The radius of the circle. Should be a non-negative value.
- Returns:
 - The perimeter of the circle (double).

`double perimeterRectangle(double length, double width)`

- Description: Calculates the perimeter of a rectangle.
- Formula: $Perimeter = 2 \times (length + width)$
- Parameters:
 - ***`length`*** (double): The length of the rectangle. Should be a non-negative value.
 - ***`width`*** (double): The width of the rectangle. Should be a non-negative value.
- Returns:
 - The perimeter of the rectangle (double).

`double perimeterTriangle(double side1, double side2, double side3)`

- Description: Calculates the perimeter of a triangle.
- Formula: $Perimeter = side1 + side2 + side3$
- Parameters:
 - ***`side1`*** (double): The length of the first side. Should be a non-negative value.

- **`side2`** (double): The length of the second side. Should be a non-negative value.
- **`side3`** (double): The length of the third side. Should be a non-negative value.
- Returns:
 - The perimeter of the triangle (double).

c) Distance Calculation

`double distanceBetweenPoints(double x1, double y1, double x2, double y2)`

- Description: Calculates the distance between two points in a 2D plane using the Euclidean distance formula.
- Formula: $Distance = \sqrt{(x2 - x1)^2 + (y2 - y1)^2}$
- Parameters:
 - **`x1`** (double): The x-coordinate of the first point.
 - **`y1`** (double): The y-coordinate of the first point.
 - **`x2`** (double): The x-coordinate of the second point.
 - **`y2`** (double): The y-coordinate of the second point.
- Returns:
 - The distance between the two points (double).

d) Volume Calculations

`double volumeSphere(double radius)`

- Description: Calculates the volume of a sphere.
- Formula: $Volume = (4/3) \times \pi \times radius^3$
- Parameters:
 - ***radius*** (double): The radius of the sphere. Should be a non-negative value.
- Returns:
 - The volume of the sphere (double).

`double volumeCube (double side)`

- Description: Calculates the volume of a cuboid.
- Formula: $Volume = side \times side \times side$
- Parameters:

- **length** (double): The length of the cuboid. Should be a non-negative value.
- **width** (double): The width of the cuboid. Should be a non-negative value.
- **height** (double): The height of the cuboid. Should be a non-negative value.
- Returns:
 - The volume of the cuboid (double).

`double volumeCylinder(double radius, double height)`

- Description: Calculates the volume of a cylinder.
- Formula: $\text{Volume} = \pi \times \text{radius}^2 \times \text{height}$
- Parameters:
 - **radius** (double): The radius of the cylinder's base. Should be a non-negative value.
 - **height** (double): The height of the cylinder. Should be a non-negative value.
- Returns:
 - The volume of the cylinder (double).

`double volumeCone(double radius, double height)`

- Description: Calculates the volume of a cone.
- Formula: $\text{Volume} = (1/3) \times \pi \times \text{radius}^2 \times \text{height}$
- Parameters:
 - **radius** (double): The radius of the cone's base. Should be a non-negative value.
 - **height** (double): The height of the cone. Should be a non-negative value.
- Returns:
 - The volume of the cone (double).

`double volumePyramid(double baseLength, double baseWidth, double height)`

- Description: Calculates the volume of a rectangular pyramid.
- Formula: $\text{Volume} = (1/3) \times \text{baseLength} \times \text{baseWidth} \times \text{height}$
- Parameters:
 - **baseLength** (double): The length of the pyramid's base. Should be a non-negative value.

- **baseWidth** (double): The width of the pyramid's base. Should be a non-negative value.
- **height** (double): The height of the pyramid. Should be a non-negative value.
- Returns:
 - The volume of the pyramid (double).

e) Surface Area Calculations

`double surfaceAreaSphere(double radius)`

- Description: Calculates the surface area of a sphere.
- Formula: $\text{Surface Area} = 4 \times \pi \times \text{radius}^2$
- Parameters:
 - **radius** (double): The radius of the sphere. Should be a non-negative value.
- Returns:
 - The surface area of the sphere (double).

`double surfaceAreaCube(double side)`

- Description: Calculates the surface area of a cuboid.
- Formula: $\text{Surface Area} = 6 \times \text{side} \times \text{side}$
- Parameters:
 - **length** (double): The length of the cuboid. Should be a non-negative value.
 - **width** (double): The width of the cuboid. Should be a non-negative value.
 - **height** (double): The height of the cuboid. Should be a non-negative value.
- Returns:
 - The surface area of the cuboid (double).

`double surfaceAreaCylinder(double radius, double height)`

- Description: Calculates the surface area of a cylinder.
- Formula: $\text{Surface Area} = 2 \times \pi \times \text{radius} \times (\text{radius} + \text{height})$
- Parameters:
 - **radius** (double): The radius of the cylinder. Should be a non-negative value.
 - **height** (double): The height of the cylinder. Should be a non-negative value.

- Returns:
 - The surface area of the cylinder (double).

`double surfaceAreaCone(double radius, double height)`

- Description: Calculates the surface area of a cone.
- Formula: Surface Area = $\pi \times \text{radius} \times (\text{radius} + \text{slant height})$
- Parameters:
 - ***radius*** (double): The radius of the cone. Should be a non-negative value.
 - ***height*** (double): The height of the cone. Should be a non-negative value.
- Returns:
 - The surface area of the cone (double). The slant height is computed using the sqrt function to find the square root of ($\text{radius}^2 + \text{height}^2$).

`double surfaceAreaPyramid(double baseLength, double baseWidth, double height)`

- Description: Calculates the surface area of a rectangular pyramid.
- Formula: Surface Area = base area + lateral area
 - Base Area = base length \times base width
 - Lateral Area = $0.5 \times \text{perimeter of the base} \times \text{slant height}$
 - Slant Height = $\text{sqrt}((\text{base length}/2)^2 + \text{height}^2)$
- Parameters:
 - ***baseLength*** (double): The length of the base of the pyramid. Should be a non-negative value.
 - ***baseWidth*** (double): The width of the base of the pyramid. Should be a non-negative value.
 - ***height*** (double): The height of the pyramid. Should be a non-negative value.
- Returns:
 - The surface area of the pyramid (double).

II. Helper Functions

`double sqrt(double number)`

- Description: Calculates the square root of a number using an iterative method (Newton's method).
- Purpose: To compute the square root of a given non-negative number without using the standard math library's *sqrt* function.

- Parameters:
 - **`number`** (double): The number for which the square root is to be computed. It should be a non-negative value. If a negative value is provided, the function returns `-1`, indicating an error (as real square roots are not defined for negative numbers in this context).
- Returns:
 - The square root of the number (double). If the number is negative, the function will return `-1`.
- Precision:

The precision of the result is controlled by the small value e (0.00001 in this implementation). Adjusting e can make the approximation more or less precise. Smaller values of e lead to more precise results but may require more iterations.

III. Additional Information

Error Handling

Most functions assume non-negative inputs for geometric dimensions. If negative values are provided, the functions will still compute the result based on the given values but might not represent meaningful geometric properties.

Suggestion: Input validation should be added to check for negative radius values and handle them appropriately (e.g., returning an error code or message). This validation should be written in your *main.c* (or your source file that includes `villaflor_geometry.h`).