

Classes

1. Create a class to represent a three-vector. This class should have a constructor that accepts three arguments, which are the x , y , and z components of the vector. The class should have three public data members that are used to store the x , y and z components separately. Create three member functions to:
 - Return the azimuthal angle (ϕ) between the x and y components.
 - Return the elevation angle (θ) between the x - y plan and the z axis.
 - Return the resultant (r) of the vector.

The azimuthal angle (ϕ) should be returned as zero if x and y is zero. If one of x and y are not zero, then it should be calculated from:

$$\phi = \tan^{-1}(y, x)$$

where \tan^{-1} should be substituted with `math.atan2(y, x)` in Python.

The elevation angle (θ) should be returned as zero if x , y and z are all zero. If one of x , y and z is not zero, then it should be calculated from:

$$\theta = \tan^{-1}(\sqrt{x^2 + y^2}, z)$$

where \tan^{-1} should be substituted with `math.atan2` in Python.

The resultant (r) of the three-vector is defined as:

$$r = \sqrt{x^2 + y^2 + z^2}$$

Test the class by writing a simple program that creates a three-vector object and calls its member functions.

2. Draw a UML representation of the class three-vector, including the attributes, operations and visibility.
3. A house has a solar panel array on it that is controlled by a small computer system that is part of the solar array installation. Define a solar panel class that includes a public data member to hold a serial number as a text string and a public data member to hold the current power produced as a floating point value. Define a solar array class that contains a public data member that is a list of solar panel objects. The solar array class should include public data members `x` and `y` to hold map coordinates of the solar array. It should also include a public member function that returns the total power of the solar array, by looping over the solar panel objects and summing their power values.

Test the classes by writing a simple program that creates a solar array object, with four solar panel objects and calls the total power member function of the solar array object.

4. Draw a UML representation of the solar array and solar panel class, including association, attributes, operations and visibility.