Lab Assignment #8

Objective: This assignment will help you review the `ArrayList` class as a type-safe generic data type.

If you do not know what a "vector" is, read **http://www.math.com/tables/oddsends/vectordefs.htm** first.

Program assignment: *Build an ADT for vectors.*

Your program should have the following header:

A vector **x** consists of *n* real components $[x_1, x_2, \ldots, x_n]$. The operations between two vectors $\mathbf{x} = [x_1, x_2, \ldots, x_n]$ and $\mathbf{y} = [y_1, y_2, \ldots, y_n]$ are defined as follows:

addition $[x_1 + y_1, x_2 + y_2, \ldots, x_n + y_n]$

subtraction $[x_1 - y_1, x_2 - y_2, \ldots, x_n - y_n]$

dot-product $\mathbf{x} \bullet \mathbf{y} = x_1 * y_1 + x_2 * y_2 + \ldots + x_n * y_n$

equivalence $\mathbf{x} == \mathbf{y}$ if $(x_1 = y_1$ **and** $x_2 = y_2$ **and** $\ldots$ **and** $x_n = y_n)$

scalar-product $s * \mathbf{x} = [s * x_1, s * x_2, \ldots, s * x_n]$, where *s* is a real number.

absolute-value $|\mathbf{x}| = \sqrt{(\mathbf{x} \bullet \mathbf{x})}$

1. You should have two constructors:
   a. One constructor, with parameters `(double [ ] initvalues)`, where `initvalues` are the initialization values for the new vector.
   b. The copy constructor.

2. You should have an accessor function for the *k*-th components of a vector.

3. You should have member functions for arithmetic: `plus()` and `minus()` which, for example, would be used as: `x = y.plus(z), where x, y,` and `z` are MyVector objects.

4. You should have a member function for scaling: `scaledBy()` which, for example, would be used as: `x = y.scaledBy(s), where x` and `y` are MyVector objects, and `s` is a real number.

5. You should override the `toString()` method for display on `System.out`

6. You should override the `equals()` method.

7. You should create an *absolute value* function: `abs()`

8. You should build a *dot product* function: `dot()`

Design specifications

- Create a Java project `project8` and a package `package8`
- Call your class `MyVector`. Define a second class containing a main method that exercises the class `MyVector` as an application. That is, a main method that runs through a selection of arithmetic and logical operations and uses `MyVector` output. The two classes should be saved in two different files.
- Your class `MyVector` should keep the vector in an `ArrayList<Double>` abstract data type.

Grading criteria (100 points maximum)

1. Operations of `MyVector` included and functional
    a. Addition ..... /6
    b. Subtraction ..... /6
    c. Dot-Product ..... /6
    d. Equivalence ..... /6
    e. Scalar-Product ..... /6
    f. Absolute-Value ..... /6
    g. toString() is overridden ..... /6

2. `MyVector` constructors
    a. Constructor ..... /6
    b. Copy constructor ..... /6

3. Accessor function implemented ..... /6

4. Creation of `project` . Package should include:
    a. Driver class ..... /10
    b. `MyVector` class ..... /10

5. Naming Conventions ..... /10

6. Style and Comments ..... /10