Day 5 - Programs at Bootcamp

Section B - Functions and Libraries :- Static Functions

1. Create ***MathFunction.java*** class and write following static methods that are done part of week 1
   a. To return an harmonic number
   b. To return a sin of an angle
   c. To return cosine of an angle
   d. To return Binary of a number
2. To ***MathFunction.java*** add a static method sqrt() that takes a double argument and returns the square root of that number. Use Newton's method (see Sqrt.java) to compute the result. Also write overloaded version in which user specifies the error tolerance epsilon. Here are the functions

```
//return the square root of c, computed using Newton's method
public static double sqrt(double c)
//overloaded version in which user specifies the error tolerance epsilon
public static double sqrt(double c, double epsilon)
```

3. To ***MathFunction.java*** add a function isPrime() that takes an integer argument N and returns true or false depending on whether N is prime.
4. To ***MathFunction.java*** add a Static function that takes one integer command line input n and outputs n! = 1 * 2 * ... * n. Write a function that has the following signature:

```
public static long factorial(int n)
```

5. To ***MathFunction.java*** add a static method to return futureValue that computes the amount of money you will have if you invest C dollars today at the compound interest rate of r per period, in T periods. The formula for the future value is given by C*(1 + r)^T.

Day 5 - Programs at Home

Section B - Functions and Libraries :- Static Functions

1. To ***MathFunction.java*** add a static method to return presentValue that computes the amount of money that would have to be invested now, at the compound interest rate r per period, to obtain a cash flow of C in T periods. The formula for the present value is given by C/(1 + r)^T.
2. To ***MathFunction.java*** add a static method minValue to return and maxValue to return max from array of integer values given in a parameter
3. To ***MathFunction.java*** override static method minValue and maxValue to return min and max from array of Strings given in a parameter
4. To ***MathFunction.java*** add static methods checkCollinearUsingSlope & checkCollinearUsingArea to take x1, y1, x2, y2, x3, y3 as three points and return true if three points are collinear else return false. E.g. check A (2, 4), B (4, 6) and C (6, 8) are Collinear

   Slope Formula - Three points are collinear if the slopes formed by three points are equal. Assume point A(x1, y1), B(x2, y2) and c(x3, y3). Then

   Slope AB = (y2-y1)/(x2-x1), Slope BC = (y3-y2)/(x3-x2) and so on

   If Collinear then Slope AB = Slope BC = Slope AC

   Triangle Formula - Three points are collinear if the area of the triangle formed by three points are 0. Area of a triangle is

$$\frac{1}{2}\begin{vmatrix} x_1 - x_2 & x_2 - x_3 \\ y_1 - y_2 & y_2 - y_3 \end{vmatrix}$$

area of triangle formula

$$\text{determinant}\begin{vmatrix} a & b \\ c & d \end{vmatrix} = ad - bc$$

$$\frac{1}{2}\begin{vmatrix} 2-4 & 4-6 \\ 4-6 & 6-8 \end{vmatrix} = \frac{1}{2}\begin{vmatrix} -2 & -2 \\ -2 & -2 \end{vmatrix} = \frac{1}{2}(4-4) = 0$$