Lab Program 1:

Develop a Java program that prints all real solutions to the quadratic equation ax2+bx+c = 0. Read in a, b, c and use the quadratic formula. If the discriminate b2 -4ac is negative, display a message stating that there are no real solutions.

SOURCE CODE:

```java
import java.util.Scanner;
import java.lang.Math;

public class QuadEq {
        public static void main (String ss[]) {
        Scanner x = new Scanner(System.in);
        System.out.print("Enter the value of a: ");
        double a;
        do {
                System.out.println("make sure it is not 0");
                a=x.nextDouble();
        }while(a==0);


        System.out.print("Enter the value of b: ");
        double b=x.nextDouble();
        System.out.print("Enter the value of c: ");
        double c=x.nextDouble();

        double d=b*b-(4*a*c);
        double r1,r2;




        if(d>0) {
                r1=(-b + Math.sqrt(d))/(2*a);
                r2=(-b - Math.sqrt(d))/(2*a);
                System.out.println("Roots are real and distinct");
                System.out.println("Roots are: "+r1+" and "+r2);
        }

        else if(d==0) {
                r1=r2=-b/(2*a);
                System.out.println("Root is real and unique");
                System.out.println("Root is: "+r1);
        }
        else {
                r1=-b/(2*a);
                r2=Math.sqrt(Math.abs(d)/(2*a));
                System.out.println("There are no real solutions");
                System.out.println("Roots are imaginary and distinct");
                System.out.println("Root 1 is: "+r1+" + i"+r2);
                System.out.println("Root 2 is: "+r1+" - i"+r2);
        }


}
}
```

WRITTEN CODE:

LAB-program 1   Quadratic Equation

```java
import java.util.Scanner;
import java.lang.Math;

public class QuadEq {
    public static void main (String ss[]) {
        Scanner x = new Scanner (System.in)
        System.out.println ("Enter value of a: ");
        double a;
        do {
            System.out.println ("make sure it is not 0");
            a = x.nextDouble ();
        } while (a==0);
        System.out.println ("Enter the value of b: ");
        double b = x.nextDouble();
        System.out.println ("Enter the value of c: ");
        double c = x.nextDouble ();
        double d = b*b - (4*a*c);
        double r1, r2;

        if (d>0) {
            r1 = (-b + Math.sqrt (d))/(2*a);
            r2 = (-b - Math.sqrt (d))/(2*a);
            System.out.println ("Roots are Real and Distinct");
            System.out.println ("Roots are: "+r1+ "and "+r2);
        }
    }
}
```

OUTPUT

```
else if (d==0) {
    r1 = r2 = -b/(2*a);
    System.out.println("Roots are Real & distinct");
    System.out.println("Roots are: "+r1+" and "+r2);
}

else {
    r1 = -b/(2*a);
    r2 = Math.sqrt(Math.abs(d)/(2*a));
    System.out.println("there are no real solutions");
    System.out.println("Roots are imaginary & distinct");
    System.out.println("Root 1 is: "+r1+"+i"+r2);
    System.out.println("Root 2 is: "+r1+"-i"+r2);
}
}
}
```

Test cases:

① 1, -2, 1

② 1, 5, 3

③ 3, 1, 4

OUTPUT (including test cases):

```
PS C:\Users\anosh\OneDrive\Desktop\java practice> javac QuadEq.java
PS C:\Users\anosh\OneDrive\Desktop\java practice> java QuadEq
Enter the value of a: make sure it is not 0
0
make sure it is not 0
1
Enter the value of b: -2
Enter the value of c: 1
Root is real and unique
Root is: 1.0
PS C:\Users\anosh\OneDrive\Desktop\java practice> java QuadEq
Enter the value of a: make sure it is not 0
1
Enter the value of b: 5
Enter the value of c: 3
Roots are real and distinct
Roots are: -0.6972243622680054 and -4.302775637731995
PS C:\Users\anosh\OneDrive\Desktop\java practice> java QuadEq
Enter the value of a: make sure it is not 0
3
Enter the value of b: 1
Enter the value of c: 4
There are no real solutions
Roots are imaginary and distinct
Root 1 is: -0.16666666666666666 + i2.798809270624444
Root 2 is: -0.16666666666666666 - i2.798809270624444
PS C:\Users\anosh\OneDrive\Desktop\java practice>
```