

7) Develop a Java program that prints all real solutions to the quadratic equation  $ax^2 + bx + c = 0$ . Read in  $a, b, c$  and use the quadratic formula. If the discriminant  $b^2 - 4ac$  is negative, display a message stating that there are no real solutions.

### Algorithm

Step 1 : Start

Step 2 : Initialize float  $a, b, c, d$  and double  $x_1, x_2$ ;

Step 3 : Print enter the coefficients

Step 4 : Read the values of  $a, b, c$ .

Step 5 : Calculate  $d$  value where  $d = b^2 - 4ac$

Step 6 : If  $d > 0$

calculate  $x_1$  and  $x_2$ , print  $x_1, x_2$

Step 7 : else if  $d = 0$

calculate  $x_1 = x_2 = -b/2a$  print  $x_1, x_2$

Step 8 : else

print roots are imaginary;

calculate  $x_1 = -b/2a$

$x_2 = \sqrt{d}/2a$

print  $x_1$  and  $x_2$

Step 9 : Stop

# Algorithm

## Flowchart

Start

Initialize  $a, b, c, d, x_1, x_2$

Read  $a, b, c$

if  $a=0$

T

print Invalid input

F

$d = b^2 - 4ac$

if  $d > 0$

T

$x_1 = \frac{-b + \sqrt{d}}{2a}, x_2 = \frac{-b - \sqrt{d}}{2a}$

F

print roots are real and distinct and are  $x_1, x_2$

if  $d=0$

T

$x_1 = x_2 = -b/2a$

F

print roots are real and equal and are  $x_1, x_2$

else  $d < 0$

T

print roots are imaginary

$x_1 = -b/2a, x_2 = \frac{\sqrt{abs(d)}}{2a}$

print root 1:  $x_1 + ix_2$   
root 2:  $x_1 - ix_2$

Stop

```

import java.util.Scanner;

code import static java.lang.Math.sqrt;

public class QuadraticEquation {
    public static void main (String [] args) {
        float a, b, c, d;
        double r1, r2;
        Scanner scan = new Scanner (System.in);
        System.out.println ("Enter coefficients");
        a = Scan.nextFloat ();
        b = Scan.nextFloat ();
        c = Scan.nextFloat ();

        if (a == 0)
            System.out.println ("Invalid input");
        else {
            d = b*b - 4*a*c;
            if (d > 0)
            { System.out.println ("Roots are real & distinct");
              r1 = (-b + Math.sqrt(d)) / (2*a);
              r2 = (-b - Math.sqrt(d)) / (2*a);
              System.out.println ("root 1 " + r1 + " root 2 " + r2);
            }
            else if (d == 0)
            { System.out.println ("Roots are real and equal");
              r1 = r2 = -b / (2*a);
              System.out.println ("root 1: " + r1 + " root 2: " + r2);
            }
            else {
                System.out.println ("Roots are imaginary");
                r1 = -b / (2*a);
                r2 = sq(abs)  $\frac{\sqrt{d}}{(2a)}$ ;
                System.out.println ("root 1: " + r1 + "i" + r2 + " root 2: "
                                     + r1 + "-i" + r2);
            }
        }
    }
}

```

Output

① enter coefficients

2 1 1

Roots are imaginary

root 1:  $-0.25 + i0.6614378277$

root 2:  $-0.25 - i0.6614378277$

② enter coefficients

1 2 1

Roots are real and equal

root 1:  $-1.0$

root 2:  $-1.0$

③ enter coefficients

1 3 1

Roots are real and distinct

root 1:  $-0.38196601125$

root 2:  $-2.6180339887$

④ enter coefficients

0 1 1

~~Invalid quadratic equation~~

~~22/12/23~~



C:\Users\STUDENT\Desktop\1bm22cs029>javac QE.java

C:\Users\STUDENT\Desktop\1bm22cs029>java QE

Akshara 1BM22CS029

enter coefficients

2

1

1

Roots are imaginary

root1:-0.25+i0.6614378277661477

root2:-0.25-i0.6614378277661477

C:\Users\STUDENT\Desktop\1bm22cs029>javac QE.java

C:\Users\STUDENT\Desktop\1bm22cs029>java QE

Akshara 1BM22CS029

enter coefficients

1

2

1

Roots are real and equal

root1:-1.0

root2:-1.0

C:\Users\STUDENT\Desktop\1bm22cs029>javac QE.java

C:\Users\STUDENT\Desktop\1bm22cs029>java QE

Akshara 1BM22CS029

enter coefficients

1

3

1

Roots are real and distinct

root1:-0.3819660112501051

root2:-2.618033988749895

C:\Users\STUDENT\Desktop\1bm22cs029>javac QE.java

C:\Users\STUDENT\Desktop\1bm22cs029>java QE

Akshara 1BM22CS029

enter coefficients

0

1

1

Invalid quadratic equation