

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

```
import java.util.Scanner;
```

```
class quadratic
```

```
{
```

```
    int a, b, c;
```

```
    double r1, r2, d;
```

```
    void getd()
```

```
    {
```

```
        Scanner s = new Scanner(System.in);
```

```
        System.out.println("Enter the coefficients of  
                             a, b, c");
```

```
        a = s.nextInt();
```

```
        b = s.nextInt();
```

```
        c = s.nextInt();
```

```
    }
```

```
    void compute()
```

```
    {
```

```
        while(a == 0)
```

```
        {
```

```
            System.out.println("Not a quadratic equation");
```

```
System.out.println("Enter a non-zero value for a");  
Scanner S = new Scanner(System.in);  
a = S.nextInt();
```

```
}  
d = b*b - 4*a*c;  
if(d==0)  
{  
    r1 = (-b)/(2*a);  
    System.out.println("Roots are real and equal");  
    System.out.println("Root 1 = Root 2 = " + r1);  
}
```

```
else if(d>0)  
{  
    r1 = ((-b) + (Math.sqrt(d)))/(double)(2*a);  
    r2 = ((-b) - (Math.sqrt(d)))/(double)(2*a);  
    System.out.println("Roots are real and distinct");  
    System.out.println("Root 1 = " + r1 + "Root 2 = " + r2);  
}
```

```
else if(d<0)  
{  
    System.out.println("Roots are imaginary");  
    r1 = (-b)/(2*a);  
    r2 = (Math.sqrt(-d))/(2*a);  
    System.out.println("Root 1 = " + r1 + " + i " + r2);  
    System.out.println("Root 2 = " + r1 + " - i " + r2);  
}
```

```
}  
} }  
class QuadraticMain  
{
```

```
    public static void main(String args[])  
    {
```

```
        Quadratic q = new Quadratic();  
        q.getd();  
        q.compute();  
    }
```

Output:

(i) Enter the coefficients of a, b, c:
1 2 3

Roots are imaginary

$$\text{Root1} = -1.0 + i1.4142135623730951$$

$$\text{Root2} = -1.0 - i1.4142135623730951$$

(ii) Enter the coefficients of a, b, c:

1 -2 1

Roots are real and equal

$$\text{Root1} = \text{Root2} = 1.0$$

(iii) Enter the coefficients of a, b, c:

1 -3 2

Roots are real and distinct

$$\text{Root1} = 2.0 \quad \text{Root2} = 1.0$$

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