

## Experiment - 2.1.1. Roots of a Quadratic Equation

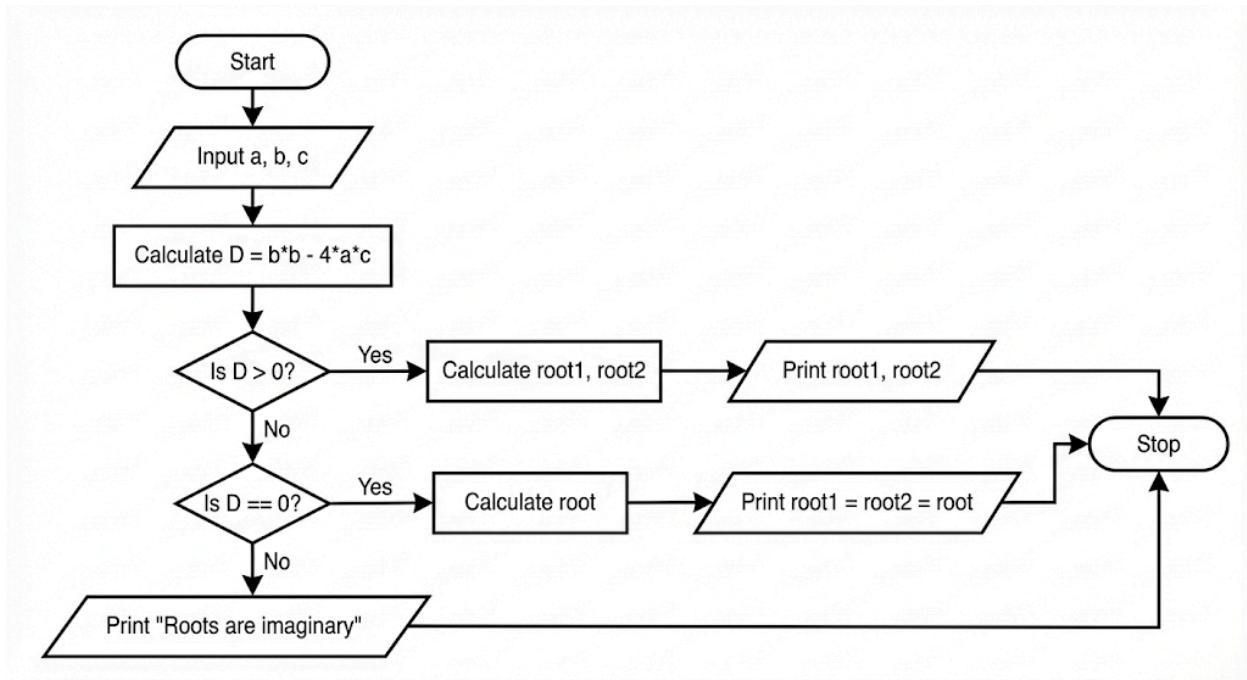
### 1. Aim

To design and implement a Python program that finds the roots of a quadratic equation  $ax^2 + bx + c = 0$  using the quadratic formula. The program determines the nature of the roots (real and distinct, real and equal, or imaginary) based on the discriminant and formats  $D = b^2 - 4ac$  the results to two decimal places.

### 2. Pseudocode

1. **START**
2. **READ** three space-separated integers a, b, and c.
3. **CALCULATE** the discriminant:  $D = b^2 - 4ac$ .
4. **IF**  $D > 0$ :
  - o Calculate  $root1 = \frac{-b+\sqrt{D}}{2a}$
  - o Calculate  $root2 = \frac{-b-\sqrt{D}}{2a}$
  - o **PRINT** "root1 = [value]" and "root2 = [value]" formatted to 2 decimal places.
5. **ELSE IF**  $D == 0$ :
  - o Calculate  $root = \frac{-b}{2a}$
  - o **PRINT** "root1 = root2 = [value]" formatted to 2 decimal places.
6. **ELSE** (if  $D < 0$ ):
  - o **PRINT** "Roots are imaginary".
7. **END**

### 3. Flowchart



## 4. Python Program

```

# Program to find the roots of a quadratic equation
# Input: Space-separated coefficients a, b, and c
# Output: Roots formatted to 2 decimal places or nature of roots

```

```

import math

# Taking coefficients as input
a, b, c = map(int, input().split())

# Calculating the discriminant
D = b*b - 4*a*c

if D > 0:
    # Real and different roots
    sqrt_D = D ** 0.5
    root1 = (-b + sqrt_D) / (2 * a)
    root2 = (-b - sqrt_D) / (2 * a)
    print(f"root1 = {root1:.2f}")
    print(f"root2 = {root2:.2f}")

elif D == 0:

```

```
# Real and same roots
root = -b / (2 * a)
print(f"root1 = root2 = {root:.2f}")
```

else:

```
# Imaginary roots
print("Roots are imaginary")
```

## 5. Experiment Screenshot

The screenshot shows the CodeTantra IDE interface for a challenge titled "2.1. Roots of a Quadratic Equation".

**Problem Statement:**

Write a program to find the roots of a quadratic equation, given its coefficients  $a$ ,  $b$ , and  $c$ . Use the quadratic formula:  $\frac{(-b \pm \sqrt{b^2 - 4ac})}{2a}$

**Discriminant Rule:**

The discriminant  $D = b^2 - 4ac$  determines the nature of the roots:

- If  $D > 0$ : Roots are real and different
- If  $D = 0$ : Roots are real and the same
- If  $D < 0$ : Roots are imaginary

**Input Format:**

- Three space-separated integers representing the coefficients  $a$ ,  $b$ , and  $c$ , respectively.

**Output Format:**

- If roots are real and different, print:

```
root1 = <Root1>
root2 = <Root2>
```

- If roots are the same, print:

```
root1 = root2 = <Root1>
```

- If roots are imaginary, print:

**Sample Test Cases**

**Code Editor:**

```
1 a, b, c = map(int, input().split())
2
3 D = b*b - 4*a*c
4
5 if D > 0:
6     sqrt_D = D ** 0.5
7     root1 = (-b + sqrt_D) / (2 * a)
8     root2 = (-b - sqrt_D) / (2 * a)
9     print(f"root1 = {root1:.2f}")
10    print(f"root2 = {root2:.2f}")
11
12 elif D == 0:
13     root = -b / (2 * a)
```

**Performance Metrics:**

Average time 0.004 s 4.17 ms	Maximum time 0.005 s 5.00 ms
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**Test Results:**

3 out of 3 shown test case(s) passed  
3 out of 3 hidden test case(s) passed

**Test Case 1:**

Expected output:  
1 -5 6  
root1 = -3.00  
root2 = 2.00

Actual output:  
1 -5 6  
root1 = -3.00

**Buttons:**

Debug, Test cases, Terminal, Reset, Submit, Next >, Prev <