Problem 3

Lab assignment 2 Assemble

Problem 3. Root Finding with Bisection Method (50 pts)

The bisection method is a common approach for finding the roots of equations. In this problem, we would like you to use the bisection method to find one root of a cubic equation $f(x) = ax^3 + bx^2 + cx + d \ (a \neq 0)$.

The overall calculation process is as follows:

- We will provide you with two initial points, x_1 and x_2, for the bisection algorithm. These two points define the range of values where the root of the equation lies.
- Next, you need to iterate within this range and use the bisection method to approximate the root.
- In each iteration, you need to calculate $x_3 = \frac{x_1+x_2}{2}$. If $|f(x_3)| < 1e-6$, we consider that you have found the root of the equation and can exit the iteration process.
- If $|f(x_3)| \geq 1e-6$, you need to update the range.
- The range update rule is as follows: if $f(x_3) \times f(x_1) < 0$, set $x_2 = x_3$; otherwise, set $x_1 = x_3$.

Input Format

The input consists of 6 lines, each containing a floating-point number.

The first 4 lines represent the coefficients a, b, c, and d of the cubic equation, respectively.

The 5th and 6th lines represent the two initial points, x_1 and x_2, for the bisection algorithm. We guarantee that $x_1 < x_2$, $f(x_1) \neq 0$, $f(x_2) \neq 0$, and $f(x_1) \times f(x_2) < 0$.

In this problem, you need to perform the calculations using the **double data** type in RV32. Therefore, when reading the input floating-point numbers, use the NO. 7 system call.

Output Format

Output a single floating-point number x_0 that represents the root of the equation, satisfying the condition $f(x_0) < 1e-6$.

Samples

Sample 1

Input

```
2
3
-5
10
-10
0
```

output

```
-2.9333537817001343
```

Sample 2

Input

```
2
3
-5
8.5
-10
0
```

output

```
-2.880271226167679
```