

Python Project for Batch 2 – Module 1

Project Title: Quadratic Factorization into Two Linear Factors

Project Description:

In this project, you will create a Python program that factors a quadratic expression of the form:

$$ax^2 + bx + c$$

into two linear factors:

$$(px + m)(qx + n)$$

Your program should:

1. Ask the user to enter the values of a, b, and c.
2. Find two numbers whose product is $a \times c$ and whose sum is b.
3. Use these numbers to split the middle term and factor the quadratic.
4. Display the factors in the form $(px + q)(rx + s)$.
5. (*Optional*) Handle special cases where the quadratic cannot be factorized into integers.

Example:

If the user enters:

`a = 1, b = 5, c = 6`

The program should display:

```
Step 1: Equation → x2 + 5x + 6
Step 2: Find two numbers that multiply to 6 and add to 5 → 2 and 3
Step 3: Factorize → (x + 2)(x + 3)
```

Objective:

- Understand the process of splitting the middle term for factorization.
- Apply algebraic factorization rules.
- Strengthen Python programming skills for mathematical problem-solving.

Algorithm for Quadratic Factorizer

Step 1: Identify the coefficients a , b , and c from the quadratic expression of the form

$$ax^2 + bx + c$$

Step 2: Multiply a and c to get the product ac .

Step 3: Find two integers whose product is ac and whose sum is b .

Step 4: Split the middle term bx into two terms using the integers found in Step 3.

Step 5: Group the terms into two pairs.

Step 6: Factor out the common term from each pair.

Step 7: Factor out the common binomial factor to get the two linear factors.

Pseudocode for Quadratic Factorization

```
START
    INPUT a, b, c
    product ← a * c
    FOR m FROM -|product| TO |product|
        FOR n FROM -|product| TO |product|
            IF m * n = product AND m + n = b THEN
                middle_term1 ← m
                middle_term2 ← n
                EXIT loops
            ENDIF
        ENDFOR
    ENDFOR
    Split equation: ax^2 + middle_term1*x + middle_term2*x + c
    Group first two terms and last two terms
    Factor out GCF from each group
    Factor out common binomial factor
    OUTPUT two linear factors
END
```