

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 $\rightarrow x^2 + 5x + 6$

Step 2: Find two numbers that multiply to 6 and add to 5 $\rightarrow 2$ and 3

Step 3: Factorize $\rightarrow (x + 2)(x + 3)$

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
```