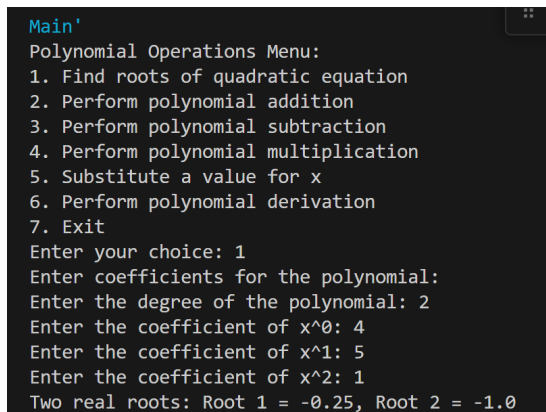# Polynomials Project

The provided Java code constitutes a polynomial operations project aimed at facilitating various operations on polynomials. The project incorporates a menu-driven approach to interactively perform polynomial operations .

Key functionalities include:

- Finding roots of quadratic equations.

- Performing polynomial addition.

- Performing polynomial subtraction.

- Performing polynomial multiplication.

- Substituting a value for 'x' in a polynomial.

- Computing polynomial derivatives.

The program runs continuously, allowing users to perform multiple operations until they choose to exit by selecting the appropriate option from the menu.

1) Quadratic Equation Roots

```
Main'
Polynomial Operations Menu:
1. Find roots of quadratic equation
2. Perform polynomial addition
3. Perform polynomial subtraction
4. Perform polynomial multiplication
5. Substitute a value for x
6. Perform polynomial derivation
7. Exit
Enter your choice: 1
Enter coefficients for the polynomial:
Enter the degree of the polynomial: 2
Enter the coefficient of x^0: 4
Enter the coefficient of x^1: 5
Enter the coefficient of x^2: 1
Two real roots: Root 1 = -0.25, Root 2 = -1.0
```

Figure 1: Output: Quadratic Equation Roots

2) Addition of 2 polynomials

```
Polynomial Operations Menu:
1. Find roots of quadratic equation
2. Perform polynomial addition
3. Perform polynomial subtraction
4. Perform polynomial multiplication
5. Substitute a value for x
6. Perform polynomial derivation
7. Exit
Enter your choice: 2
Enter coefficients for the polynomial:
Enter the degree of the polynomial: 4
Enter the coefficient of x^0: 1
Enter the coefficient of x^1: 2
Enter the coefficient of x^2: 3
Enter the coefficient of x^3: 4
Enter the coefficient of x^4: 5
Enter coefficients for the polynomial:
Enter the degree of the polynomial: 1
Enter the coefficient of x^0: 2
Enter the coefficient of x^1: 5
5x^4 + 4x^3 + 3x^2 + 7x^1 + 3
```

Figure 2: Output: Addition of 2 polynomials

3)Subtraction of 2 polynomials

```
Polynomial Operations Menu:
1. Find roots of quadratic equation
2. Perform polynomial addition
3. Perform polynomial subtraction
4. Perform polynomial multiplication
5. Substitute a value for x
6. Perform polynomial derivation
7. Exit
Enter your choice: 3
Enter coefficients for the polynomial:
Enter the degree of the polynomial: 2
Enter the coefficient of x^0: 4
Enter the coefficient of x^1: 5
Enter the coefficient of x^2: 9
Enter coefficients for the polynomial:
Enter the degree of the polynomial: 3
Enter the coefficient of x^0: 5
Enter the coefficient of x^1: 1
Enter the coefficient of x^2: 0
Enter the coefficient of x^3: 5
-5x^3 + 9x^2 + 4x^1 + -1
```

Figure 3: Output: Subtraction of 2 polynomials

4) Multiplication of 2 polynomials

```
Polynomial Operations Menu:
1. Find roots of quadratic equation
2. Perform polynomial addition
3. Perform polynomial subtraction
4. Perform polynomial multiplication
5. Substitute a value for x
6. Perform polynomial derivation
7. Exit
Enter your choice: 4
Enter coefficients for the polynomial:
Enter the degree of the polynomial: 3
Enter the coefficient of x^0: 2
Enter the coefficient of x^1: 71
Enter the coefficient of x^2: 2
Enter the coefficient of x^3: 1
Enter coefficients for the polynomial:
Enter the degree of the polynomial: 2
Enter the coefficient of x^0: 4
Enter the coefficient of x^1: 7
Enter the coefficient of x^2: 5
5x^5 + 17x^4 + 373x^3 + 515x^2 + 298x^1 + 8
```

Figure 4: Output: Multiplication of 2 polynomials

5) Substituting value of x

```
Polynomial Operations Menu:
1. Find roots of quadratic equation
2. Perform polynomial addition
3. Perform polynomial subtraction
4. Perform polynomial multiplication
5. Substitute a value for x
6. Perform polynomial derivation
7. Exit
Enter your choice: 5
Enter the value for x: 3
Enter coefficients for the polynomial:
Enter the degree of the polynomial: 5
Enter the coefficient of x^0: 1
Enter the coefficient of x^1: 7
Enter the coefficient of x^2: 8
Enter the coefficient of x^3: 2
Enter the coefficient of x^4: 1
Enter the coefficient of x^5: 0
229
```

Figure 5: Output: Substituting value of x

6) Derivation of polynomial

```
Polynomial Operations Menu:
1. Find roots of quadratic equation
2. Perform polynomial addition
3. Perform polynomial subtraction
4. Perform polynomial multiplication
5. Substitute a value for x
6. Perform polynomial derivation
7. Exit
Enter your choice: 6
Enter coefficients for the polynomial:
Enter the degree of the polynomial: 5
Enter the coefficient of x^0: 1
Enter the coefficient of x^1: 2
Enter the coefficient of x^2: 4
Enter the coefficient of x^3: 5
Enter the coefficient of x^4: 7
Enter the coefficient of x^5: 8
40x^4 + 28x^3 + 15x^2 + 8x^1 + 2
```

Figure 6: Output: Derivation of polynomial

7) Exit

```
Polynomial Operations Menu:
1. Find roots of quadratic equation
2. Perform polynomial addition
3. Perform polynomial subtraction
4. Perform polynomial multiplication
5. Substitute a value for x
6. Perform polynomial derivation
7. Exit
Enter your choice: 7
Exiting the program.
```

Figure 7: Output: Exit