CS217 Object Oriented Programming

Instructions

1. Make your own files (2 files for each class). Name of files must be same as class name such that for Point class there are header file (Point.h), Implementation file(Point.cpp).Write only one main function. Main function is only for testing purpose don't submit main.cpp.
2. Please use the macros and pre processor instructions (#ifndef, #de_ne, #endif) in each class header file.
3. Data member names of each class should be the same as per mentioned in each question.
4. Please read the questions carefully, read them twice even thrice to understand them completely.
5. In case of any query, please raise your hands and we will be there to solve your query.
6. Please concentrate, understand and code. Good Luck :)

Question: 1

1) Implementation of Quadratic Polynomial Class

Write a class Polynomial. This class has three private data members

- a: Int that holds the coefficient of X^2
- b: Int that holds the coefficient of X
- c: A double that holds the coefficient of X^0 (Constant term)

The class has the following member functions.

Polynomial	Constructs a new Polynomial object to represent the quadratic Polynomial with all coefficients =0
Polynomial (a,b,c)	Constructs a new Polynomial object to represent the quadratic Polynomial
getters/setters	Write getter/setters for all members e.g. a,b,c
Polynomial(const & Copy)	Copy Constructor
operator =	Overload = operator to assign values
operator ==	Overload == comparison operator
Polynomial p3=p1+p2	Overload + operator which takes two Polynomial object as argument. It preforms the addition and returns the result.
Polynomial p3=p1-p2	Overload - operator which takes two Polynomial object as argument. It preforms the subtraction and returns the result.

Polynomial p2= p1*d	Overload * operator which takes an int as argument. It preforms the scaler multiplication and returns the result.
operator string()	Returns a String representation of Quadratic Polynomial. Example 4X^2 + 3X + 2
operator<<	Outputs the Polynomial (Nonmember Function)
operator>>	Input the Polynomial (Nonmember Function)

2) More Polynomial Methods

Extend the Polynomial class to support the *evaluation* of quadratic polynomials as follows:

- Add a member function named *evaluate* that takes a single int argument representing the '*x*' value and returns the result (type double) of evaluating the polynomial at *x*.

- Add a void member function named roots that will take two *reference* arguments of type Complex (use your Complex class), then compute and provide *both* roots of a quadratic polynomial object. Recall that the roots are given by the quadratic equation:

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

The expression under the radical is referred to as the *discriminant*. If the *discriminant* is negative, the roots must be expressed as imaginary values using Complex numbers as follows:

$$x = \frac{-b}{2a} \pm \frac{\sqrt{4ac - b^2}}{2a} i$$

The roots method should first determine if the roots are real or imaginary based on the value of the *discriminant*. If the roots are *real*, return them as complex values with the imaginary component set to zero, if the roots are *imaginary*, return them in complex form using the absolute value of the *discriminant*.

Question: 2

Write a class Matrix. This class has three private data members

- rows: An integer that holds the numbers of rows for matrix.
- columns: An integer that holds the numbers of columns for matrix.
- matrix: An integer pointer to pointer that points to 2D array (rows x columns).

The class has the following member functions.

Matrix (int r, int c)	Constructs a new Matrix object to represent the given matrix
operator =	Overload = operator to assign values
operator ==	Overload == operator to compare whether matrices are equal or not
d2=d1+1	Overload + operator which takes integer as argument. It preforms scalar addition.
d2=d1-4	Overload - operator which takes integer as argument. It preforms scalar subtraction.
d3=d1+d2	Overload + operator which takes matrix object as argument. It adds two matrixes and returns the result.
d3=d1-d2	Overload - operator which takes matrix object as argument. It subtracts two matrixes and returns the result.
d++	Overload Post-increment Operator
++d	Overload Pre-increment Operator
d--	Overload Post-decrement Operator
--d	Overload Pre-decrement Operator
Matrix d3=d1*d2;	Overload * operator which takes matrix object as argument. It multiplies two matrixes and returns the result.
Matrix d3=d1*2;	Overload * operator which takes matrix object as argument. It preforms scalar multiplication.
Matrix d3=d1/2;	Overload / operator which takes matrix object as argument. It preforms scalar division.
double value= ~d2;	Overload ~ operator which takes matrix object as argument. It gives determinant of matrix. (unary operator)
void setRows(int r)	It sets row of a matrix.
int getRows()const	Returns row of matrix.
void setCol(int c)	It sets column of a matrix.
int getCol()const	Returns column of matrix.

operator string()	Returns a String representation of matrix. Example 2X2 matrix “2X2 1-2 3-4”

Write main function to test all the implemented functionality. (*Do not submit main function*)