```
import java.util.*;
/*
*
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*
*/

public class QuadraticTester
{
  public static void main(String[] args)
  {
    //Create new scanner to retrieve starting values from user
    Scanner userInput = new Scanner(System.in);

    //Allow user to input values for a, b and, c
    System.out.println("Welcome to the quadratic equation solver. Your \n" +
                "equation will be modeled in the form of ax² + bx" +
                " + c.");
    System.out.println("Please enter a value for a: ");
    double a = userInput.nextDouble();
    System.out.println("Please enter a value for b: ");
    double b = userInput.nextDouble();
    System.out.println("Please enter a value for c: ");
    double c = userInput.nextDouble();
    Quadratic quad = new Quadratic(a, b, c);

    //If statement to determine if values form a valid quadratic
    //equation
    if(a == 0)
    {
      System.out.println("Your equation is not quadratic");
      System.exit(0);
    }

    //Else statement to determine if equation has real or
    //complex roots
    else if(quad.realRoots() == false)
    {
      System.out.println("Your equation had a negative discriminant.\n" +
                  "Therefore your equation did not have any real roots. \n" +
                   "Your equation must have complex roots" );
    }

    //If quadratic is valid and has real roots tell user their
```

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    //roots
    else
    {
      double root1 = quad.firstRoot();
      double root2 = quad.secondRoot();
      System.out.println("Your equation was " + a + "x² + " + b + "x + " + c +
                  ", \nyour first root was " + root1 + " and your second\n" +
                  "root was " + root2);
    }

    //Ask user if they would like to calculate a discriminant
    System.out.println("Would you like to compute the value\n" +
                "of the first derivative of the quadratic\n" +
                 "at a specific point?" +
                 "\nPlease enter 1 for yes and 2 for no");
    double input = userInput.nextDouble();

    //If statement for if user would like to calculate
    //derivaive
    if(input == 1)
    {
      //Gather user value for x
      System.out.println("Please enter a value for x: ");
      double x = userInput.nextDouble();
      //Set X to x
      quad.setValue(x);
      //Set deriv to calculated derivative
      double deriv = quad.derivative();
      System.out.println("The derivative of " + a + "x² + " + b
                  + "x + " + c + "\nat point " + x + " was : "
                  + deriv + ".");
    }
    //Statement for if user does not want to calculate derivative
    else
    {
      System.out.println("Goodbye");
    }

  }
}
class Quadratic
{
  //Declare variables
  private double A;
```

```
private double B;
private double C;
private double X;
private double discriminant;

/**
 * Constructor
 * @param A the value of a in the quadratic equation
 * @param B the value of b in the quadratic equation
 * @param C the value of c in the quadratic equation
 */
public Quadratic(double a, double b, double c)
{
  A = a;
  B = b;
  C = c;
  calcDiscriminant();
}

//Setters

/**
* Assigns x to variable X
 */
void setValue(double x)
{
  this.X = x;
}

/**
 * Calculates discriminant and sets it equal to
 * variable discriminant
 */
private void calcDiscriminant()
{
  discriminant = B*B - 4.0*A*C;
}

//Getters

/**
 * @return The first root of the quadratic
 */
public double firstRoot()
```

```
  {
    return (-B + Math.sqrt(discriminant))/(2.0*A);
  }

  /**
   * @return The second root of the quadratic
   */
  public double secondRoot()
  {
    return (-B - Math.sqrt(discriminant))/(2.0*A);
  }

  /**
   * @return Whether or not the quadratic has real roots
   */
  public boolean realRoots()
  {
    if(discriminant < 0) return false;
    else return true;
  }

  /**
   * @return The calculation of the derivative
   */
  public double derivative()
  {
    return ((2.0*A*X) + B);
  }
}

/*=====TESTING==========

Correct Equations (Done with calculator)

2x² + 4x + 2
Roots = (-1, -1)
Discriminant = Positive
Derivative at point x = 2 : f'(2) = 12

0x² + 4x + 2

Not quadratic - N/A

1x² + 2x + 2
```

Roots = Complex
Discriminant = Negative
Derivative at point x = 6 : f'(6) = 14

x^2 - 2x + 1
Roots = (1, 1)
Discriminant = Zero
Derivative at point x = 6 : f'(6) = 10

$15x^2$ - 36x + 16
Roots = (1.81, .58)
Discriminant = Positiveat point x = 15 f'(15) = 414

Output from my code:

$2x^2$ + 4x + 2
Roots = (-1, -1)
Discriminant = Positiveat point x = 2 : f'(2) = 12

$0x^2$ + 4x + 2

Not quadratic - N/A

$1x^2$ + 2x + 2
Roots = Complex
Discriminant = Negative
Derivative at point x = 6 : f'(6) = 14

x^2 - 2x + 1
Roots = (1, 1)= Zero
Derivative at point x = 6 : f'(6) = 10

$15x^2$ - 36x + 16
Roots = (1.81, .58)
Discriminant = Positive
Derivative at point x = 15 f'(15) = 414

*/