CSC108 – Introduction to Programming

Lab09

**Quadratic Equation Class:**

Design a class named **QuadraticEquation** for a quadratic equation ax2 + bx + c = 0. The class contains:

* Private data fields **a, b**, and **c** that represent the coefficients.
* A constructor with arguments (e.g. newA, newB, and newC) for **a, b**, and **c**.
* Three **get** methods **(e.g. getA, getB, getC)** for **a, b**, and **c**.
* A method named **getDiscriminant()** that returns the discriminant, which is b2 - 4ac.
* The methods named **getRoot1()** and **getRoot2()** for returning two roots of the equation:

r1 = and r2 =

These methods are useful only if the discriminant is non-negative. Let these methods return 0 if the discriminant is negative.

Write a test program (**TestQuadraticEquation**) that requests the user to enter three integer coefficients (a, b, and c). Use data type **int** for these local variables and display the results based on the discriminant. If the discriminant is positive, display the two roots. If the discriminant is 0, display the one root. Otherwise, display “The equation has no roots”. Use \u00B2 to display the superscript 2. At the end of your program, use the **Date** class from the **java.util** library that creates a **Date** object and displays the date and time using the **toString()** method.

Example equations: Extract coefficients, then evaluate discriminant (b2 - 4ac) to determine the number of roots.

x2 + 2x + 3 = 0

Discriminant: b2 - 4ac

22-(4\*1\*3)= -8 (0 roots)

(Negative discriminant)

Factoring:

(x + ?)(x + ?)

Cannot factor

No roots

x2 + 0x – 9 = 0

Discriminant: b2 - 4ac

02-(4\*1\*-9)=36 (2 roots)

Factoring:

(x - 3)(x + 3)

x-3=0 x+3=0

x=3 x=-3

Roots are 3,-3

x2 - 2x + 1 = 0

Discriminant: b2 - 4ac

-22-(4\*1\*1)=0 (1 root)

Factoring:

(x - 1)(x - 1)

x-1=0 x-1=0

x=1 x=1

Root is 1

x2 + 5x + 6 = 0

Discriminant: b2 - 4ac

52-(4\*1\*6)=1 (2 roots)

Factoring:

(x + 2)(x + 3)

x+2=0 x+3=0

x=-2 x=-3

Roots are -2,-3

**Sample runs:**

Enter three coefficients:

1 5 6

For: 1x² + 5x + 6 = 0

Roots are -2.0 and -3.0

Sat Apr 18 15:29:00 EDT 2015

Enter three coefficients:

1 2 3

For: 1x² + 2x + 3 = 0

No roots

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Enter three coefficients:

1 -2 1

For: 1x² + -2x + 1 = 0

Root is 1.0

Sat Apr 18 15:30:19 EDT 2015

Enter three coefficients:

1 0 -9

For: 1x² + 0x + -9 = 0

Roots are 3.0 and -3.0

Sat Apr 18 15:29:47 EDT 2015

**Sample Algorithms:**

**TestQuadraticEquation Class:**

1. Get 3 coefficients from the console
2. Create QuadraticEquation object with the 3 coefficients
3. If discriminant is < 0, put “No roots” to the console
4. If discriminant is = 0, call instance method to calculate the root and put it to the console.
5. If discriminant is > 0, call instance methods getRoot1 and getRoot2 to calculate the 2 roots and put them to the console.
6. Create Date object for current date and put it to the console using the toString method.

**QuadraticEquation Class:**

1. Declare private data fields for a,b, and c coefficients.
2. Create QuadraticEquation constructor with 3 args newA, newB, newC.
3. Create getA, getB, and getC methods, which return their respective coefficients.
4. Create getDiscriminant method that returns the discriminant. )
5. Create getRoot1 and getRoot2 methods that return 0 if the discriminant is < 0, root1 if = 0, roots 1 and 2 if > 0.

root1 = and/or root2 =

Zip the Lab09 folder and send it to me as an attachment in Blackboard.

public class QuadraticEquation {  
private int a,b,c;  
public QuadraticEquation(int x,int y,int z)  
{  
a=x;  
b=y;  
c=z;  
}  
public int getA() {  
return a;  
}  
public int getB() {  
return b;  
}  
public int getC() {  
return c;  
}  
public int getDiscriminant()  
{  
return b\*b-4\*a\*c;  
}  
  
public double getRoot1()  
{  
if(getDiscriminant()<0)return 0;  
return (-b-Math.sqrt(getDiscriminant()))/(2\*a);  
}  
public double getRoot2()  
{  
if(getDiscriminant()<0)return 0;  
return (-b+Math.sqrt(getDiscriminant()))/(2\*a);  
}  
}  
class QuadraticTest  
{  
public static void main(String[] args) {  
QuadraticEquation test=new QuadraticEquation(1, 1, -4);//enter what you want here  
if(test.getRoot1()==0 && test.getRoot2()==0)System.out.println("The equation has no roots");  
System.out.println(test.getRoot1()+" "+test.getRoot2());  
}  
}