Solving Quadratic Equations Using C++ Application Program

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Abstract - *This study is used to design the application software using C++ program application. This package was developed by using the C++ programming language .used a complier Dev-C++ to compile, run and for finding the bugs in the program. The CAP_QUAD is a software application package used to develop this solution for the quadratic equations, earlier this was tested by the students in a University of Nigeria. Usually large errors in using mathematical algorithms are treated by using the quadratic equations. Using this application we can outline way of solving this quadratic . Accordingly, the study has also revealed the excellent performance of the students. In the view of the implication of findings, it was recommended that there is a need of design and development of computer educational packages and utilization into classroom study. But this awareness about these requires knowledge in the numerical mathematics.*

***Key Words*: Application Program, Quadratic equation, Development, Technology in Class Room, Constructive Mathematics.**

1. INTRODUCTION

Technological inventions are used for enhancing mathematics, enrich student learning in the areas of richer curricula, enhanced pedagogical and more effective organization structures. Modern technologies in mathematics take the form of computer applications. These technological tools support to the cognitive process reducing the memory load of students and creating awareness to the problem-solving process. These support logical reasoning by testing conjectures easily. These records problem solving process-the fits, start and different pathways children follow-be recording replaying as a window into children's thinking. Classroom studies do factor with a frequency be will during to anyone. Two set of instruments were use for the study, the first was tagged Quadratic Equation Assessment Test (QAT) which was multiple choice objectives items adopted from New General design by the researcher. QAT consisted of 25-Mathematics for Senior Secondary School Two.

1.1 Quadratic Equation

When a polynomial is set equal to a value (whether an integer or another polynomial), the result is an equation. An equation that can be written in the form $ax^2 + bx + c = 0$ is called QUADRATIC EQUATION. You can solve a quadratic equation using the rules of algebra, applying factoring techniques where necessary, and by using the PRINCIPLE OF ZERO PRODUCTS.

1.2 The Principle of Zero Products

The Principle of Zero Products states that if the product of two numbers is 0, then at least one of the factors is 0. (This is not really new).

If $ab = 0$, then either $a = 0$ or $b = 0$, or both a and b are 0.
This property may seem fairly obvious, but it has big implications for solving quadratic equations. If you have a factored polynomial that is equal to 0, you know that at least one of the factors or both factors equal 0.We can use this method to solve quadratic equations.

2. Factoring the Quadratic

Often, the simplest way to solve "ax2 + bx + c = 0" for the value of x is to factor the quadratic, set each factor equal to zero, and then solve each factor. But sometimes the quadratic is too messy, or it doesn't factor at all, or you just don't feel like factoring. While factoring may not always be successful, the Quadratic Formula can always find the solution. The Quadratic Formula uses the "a", "b", and "c" from "ax2 + bx + c", where "a", "b", and "c" are just numbers; they are the "numerical coefficients" of the quadratic equation they have given you to solve. The Quadratic Formula is derived from the process of completing the square, and is formally stated as:

For $ax^2 + bx + c = 0$, the values of x which are the solutions of the equation are given by:

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

Fig -1: Finding roots

For the Quadratic Formula to work, you must have your equation arranged in the form "(quadratic) = 0". Also, the "2*a*" in the denominator of the Formula is underneath everything above, not just the square root. And it's a "2*a*" under there, not just a plain "2". Make sure that you are careful not to drop the square root or the "plus/minus" in the middle of your calculations, or I can guarantee that you will forget to "put them back in" on your test, and you'll mess yourself up. Remember that "b^2" means "the square of ALL of *b*, including its sign", so don't leave b^2 being negative, even if *b* is negative, the square of a negative is a positive.

Here are some examples of how the Quadratic Formula works
$x^2 + 3x - 4 = 0$

This quadratic happens to factor:

$x^2 + 3x - 4 = (x + 4)(x - 1) = 0$

...so we already know that the solutions are $x = -4$ and $x = 1$. How would the solution look in the Quadratic Formula? Using $a = 1$, $b = 3$, and $c = -4$, solution looks like this:

$$x = \frac{-(3) \pm \sqrt{(3)^2 - 4(1)(-4)}}{2(1)}$$

$$= \frac{-3 \pm \sqrt{9+16}}{2} = \frac{-3 \pm \sqrt{25}}{2}$$

$$= \frac{-3 \pm 5}{2} = \frac{-3-5}{2}, \frac{-3+5}{2}$$

$$= \frac{-8}{2}, \frac{2}{2} = -4, 1$$

Fig -2: Solving by factors

Then, as expected, the solution is x=-4, x=1.

2.1 Methods to Solve

The following methods are used to solve quadratic equation.

They are:

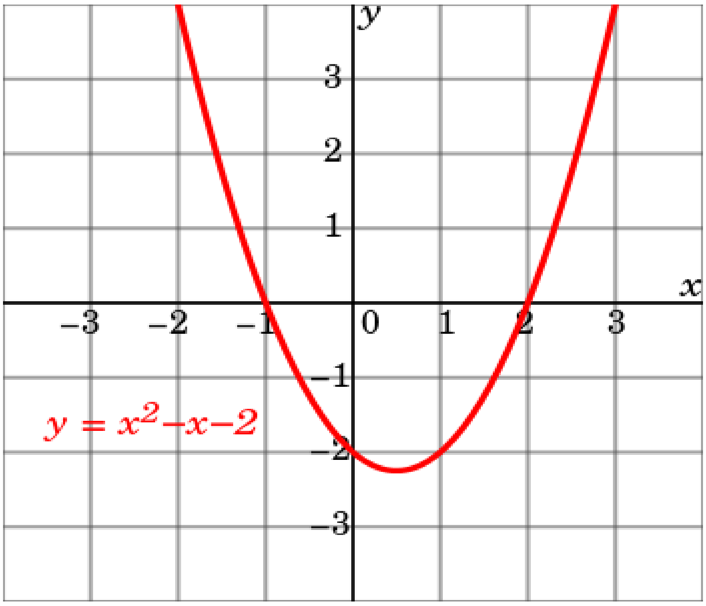
1. Manual factoring
2. Completing the square

2.2 Completing the Square

The process of completing the square makes use of the algebraic identity, which represents a well-defined algorithm that can be used to solve any quadratic equation. Starting with a quadratic equation in standard form, $ax^2 + bx + c = 0$

1. Divide each side by a, the coefficient of the squared term.
2. Subtract the constant term c/a from both sides.
3. Add the square of one-half of b/a, the coefficient of x, to both sides. This "completes the square", converting the left side into a perfect square.
4. Write the left side as a square and simplify the right side if necessary.
5. Produce two linear equations by equating the square root of the left side with the positive and negative square roots of the right side.
6. Solve the two linear equations.

We illustrate use of this algorithm by solving $2x^2 + 4x - 4$



Graph -1: Function on graph for QE

2.3 Algorithm

Algorithm for computing one root x 2, 1 of the quadratic equation ax +bx+c=0.

(i) Compute z = -b.

(ii) Compute y = b2.

(iii) Compute w = 4a .

(iv) Compute v = w l c .

(v) Compute u = y - v .

(vi) Compute t =fi

(vii) Compute s = z +'t

(viii) Compute r = 2a

(ix) Compute x1 = s/r .

1. For simplicity we here assume that u = b2 - 4ac is not negative, to avoid having to deal with imaginary numbers like Jr--1.

2. An algorithm for computing x2 requires the replacement of steps (vii) and (ix) by

(vii)' Compute s' = z - t .

(ix)' Compute x2 = s'/r .

2.4. Flowchart

Flowchart to calculate the roots of quadratic equation is shown below

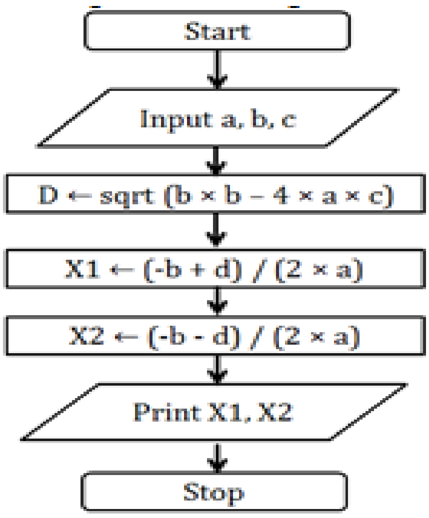


Fig -3: Flowchart for QE algorithm

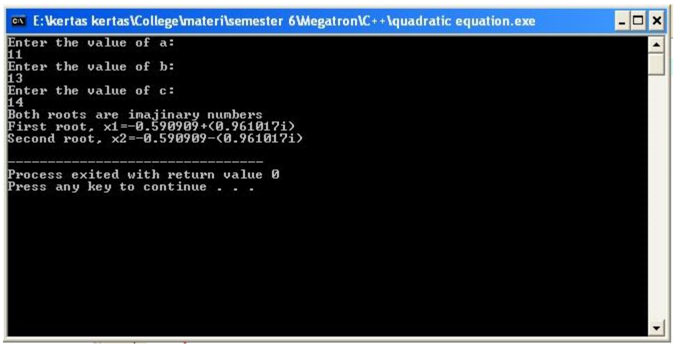
2.5 Program

```
#include <iostream>
using namespace std;
int main ()
{
   float a, b, c, OneSolution, Solution1, Solution2,
determinant;

   cout<<"Quadratic Equation Form ax^2 + bx + c \n";
   cout<<"Enter Integer for a: ";
   cin>>a;
   cout<<"Enter Integer for b: ";
   cin>>b;
   cout<<"Enter Integer for c: ";
   cin>>c;

   if (a == 0)
      if (b == 0)
         if (c == 0)
            cout<<"All Solutions";
<<endl;
         else
            cout<<"NO Solutions" <<endl;
      else
      {
         OneSolution = -c/b;
         cout<<"Solution for "<<a<<"x^2 + " <<b <<"x +" <<c
<<"\nx = " <<OneSolution                    <<endl;
      }
   else
   {
      determinant = b * b - 4 * a * c;
      if (determinant < 0)
         cout<<"Solution for "<<a<<"x^2 + " <<b <<"x +" <<c
<<"\nNo Solution" <<endl;
      else if (determinant == 0)
      {
         cout<<"Solution for "<<a<<"x^2 + " <<b <<"x +" <<c
<<"\nDuplicate Solution"                <<endl;
         OneSolution = (-b/2) * a;
         cout<<OneSolution<<endl;
      }
      else
      {
         cout<<"two solutions" <<endl;
         Solution1 = (-b + sqrt(determinant)) / 2 * a;
         Solution2 = (-b - sqrt(determinant)) / 2 * a;
         cout<<"Solution for "<<a<<"x^2 + " <<b <<"x +" <<c
<<"\nx1 = " << Solution1                <<endl<< "x2 = "
<<Solution2 <<endl;
      }
   }
   system("pause");
}
```

Output:



Examples Results Works
0x^2 + 0x + 0 = 0 Answer = "All Solutions"
0x^2 + 0x + 1 = 0 Answer = "No Solutions"
0x^2 + 2x + 1 = 0 Answer = -1/2
1x^2 + 2x + 1 = 0 Answer = "Duplicate Solution" = -1
1x^2 + 4x + 1 = 0 Answer = "two solutions" = d = 3.464 1st root = -0.267 | 2nd root = -3.73

2.5 (A) Field Testing

The results of this study and usage of application C++ program for quadratic equation solving showed the average or mean scores of the students out of a maximum score of 25 is20.7.This translates 82.8% to make a conclusion about the performance level of students in quadratic equation exposed to CAP_QUAD package. The mean percentage of the student is 82.8% as shown in table. The conclusion therefore is that application programming for solving the quadratic equation results in excellent performance level.

Table -1: Performance level of students when exposed to used CAP-QAUD

S.NO	SCORES	PERCENTAGE
1	20	80
2	21	84
3	20	80
4	19	76
5	18	72

6	20	80
7	24	96
8	23	92
9	19	76
10	17	68
11	21	86
12	22	88
13	22	88
14	24	96
15	23	92
16	18	72
17	20	80
18	23	92
19	20	80
20	20	80
MEAN	20.7	82.8

2.5 (B) Advantages using Application software

1. Immediate feedback as the software allows the users or students to know immediately if the problem is accurate or not.
2. Motivation to practice the computations.
3. Assists students to work in their own space.

3. CONCLUSIONS

1. Even though the technologies have been developed rapidly these days, it operation has to be implemented in the classroom studies.
2. Use of an application for solving the mathematical computation make the future generation more independent.
3. Properly used technology to enhance the learning boundaries and potential to positively improve students.
4. As this quadratic equation is commonly used in applied mathematics, its actual use be excepted to be one of the best understood of computer algorithms.
5. Even in the elementary problem we are working at frontiers of common computing knowledge.
6. There is a necessity of concentrating on the robustness of these formulas for the quadratic equations.
7. There is a necessity of concentrating on the robustness of these equations.
8. It can be used in computer based algorithm understanding and also implementing this using application program has to be taken to the classrooms.

4. REFERENCES

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