Quadratic Equation Solver Tutorial
Introduction

We will be making an app to solve 2\textsuperscript{nd} level polynomials like ax\textsuperscript{2}+bx+c. We will model our app upon the quadratic equation.

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

Ex. \(1\times x^2+4x+4 \Rightarrow \frac{-4 \pm \sqrt{4^2 - 4\times1\times4}}{2\times1} = -2,-2\)
Goals

• Examine Math Functions
  – Call sqrt
• Examine Order of Operations
• Review Components
  – Textboxes
  – Buttons
  – Labels
• Review Screen Arrangement
• Review Function Calling
Step 1: Change Title of Screen

Change the title of Screen1 to “Quadratic Equation Solver”.

![Diagram showing screen properties]
Step 2: Vertical Layout

1. Drag a VerticalArrangement onto Screen.
2. Set Width to Fill Parent and Height to 300 pixels
Step 3: Horizontal Layouts

1. Add 2 HorizontalArrangements into the “Vertical Arrangement1”.
2. Set both their Widths to fill parent.
3. Name the top one “LabelArrangement” and the bottom one “TextBoxArrangement”.

![Diagram of horizontal layouts with components and properties table]
1. Add 3 Labels to “LabelArrangement”.
2. Rename them variableA-C. Set each Label’s Font to bold and size 18.
3. Set Text to Variable (respective letter).
4. Set TextAlignment to center.
5. Set Width to 94 pixels and Height 25 pixels for each Label.
Step 5: Textboxes

1. Add 3 TextBox(es) to the “TextBoxArrangement”.
2. Rename each to TextBox(respective letter).
3. Check the FontBold box and set the FontSize to 30 on each TextBox.
4. Make the Hint “Enter Variable (respective letter) Value” for each.
5. Check NumbersOnly box on each TextBox.
6. Set Text Alignment to center for each.
7. Set Width to 94 pixels and Height to 50 pixels for each.
Step 6: Solve Button

1. Add a HorizontalArrangement to “VerticalArrangement1” and name it “ButtonArrangement”.
2. Add a HorizontalArrangement to “ButtonArrangement” and name it “Filler”.
3. Set Width to 84 pixels and Height to 75 pixels.
4. Add a Button to ButtonArrangement and rename it SolverButton.
5. Set FontSize to 40.
6. Check FontBold box.
7. Set Text to “Solve”.
8. Leave Width and Height on Automatic.
Step 7: Answer Label

1. Add a Label to VerticalArrangement.
2. Rename it “AnswerLabel”.
3. Check boxes FontBold and FontItalic.
4. Set FontSize to 40.
5. Set Text to “$x=?$”.
6. Set TextAlignment to center.
7. Set Width & Height to Fill parent.
Step 8: Set Variables

1. Open Blocks Editor.
2. Create 6 variables. Click Definition. Drag out 6 “Define variable as pieces”. Set names of variables to a, b, c, positiveX, negativeX, & squareRoot.
3. Set each variable’s type to number. Click Math and connect a “number 123” to each variable.
Step 9: Getting Numbers in Textboxes

1. Click “My Blocks”. Click on “SolveButton”. Drag out a “when SolveButton.Click do”.

2. Click “My Blocks”. Click “My Definitions”. Drag a “set global a to” into the “do” slot of the “when SolveButton.Click do” block.

3. Connect a “TextBoxA.Text” to the “to” slot of “set global a to” block.

4. Repeats steps 1 & 2 for variables b & c being set to “TextBoxB.Text” & “TextBoxC.Text” respectively.
Let’s Examine the Quadratic Equation

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

**Important Considerations**

1. What is the order of operations?
2. How should we deal with the + or -?
3. What happens if \( b^2 - 4ac \) is negative?

**Decisions**

1. \( b^2 - 4ac \) under the square root must be solved first. Then we want to do the addition/subtraction above the fraction. Then divide by 2a.
2. The + and – should be calculated in separate functions and set to 2 different variables. The sqaeroot should also be a separate function with a result set to a variable because both the + and – functions need that result.
3. The “sqrt” function built into handles square roots of negatives just fine with imaginary numbers (i).
Blocks Equation Practice

Convert Block Equation to Math Equation

- \( 6 \times (7-4) + 9 \)
- \( \frac{100}{(9 \times 6+6)} \)
- \( 8 \pm \sqrt{8^2 - 4 \times 2 \times -3} \)

Convert Math Equation to Block Equation
Step 10: SquareRoot Function

1. Click Definition. Drag a “to Procedure arg” block on. Name it “quadraticSquareRoot”.
2. Click “My Blocks”. Click “My definitions”. Drag “set global squareRoot to” into the “quadraticSquareRoot” block.
3. Click “Math” Connect a “call sqrt” to the “to” slot of “set global squareRoot to”.
4. Click “Math”. Connect a “-” to the right of the “cal sqrt” block.
5. Click “Math”. Drag a “x” to the left slot of the “-” block.
6. Click “My Blocks”. Click “My definitions”. Drag a “global b” into the left and right slots of the “x” block.
7. Drag a “x” into the right slot of the “-” block. Drag a “number 123” into the left slot of the “x” block and another “x” into the right slot.” Set the “number 123” to “4”.
8. Click “My Blocks”. Click “My definitions”. Drag a “global a” into the left slot and a “global c” into the right slot of the inner most “x” block.
Step 11: Positive/Negative Functions

1. Click Definition. Drag a “to Procedure arg” block on. Name it “calculatePositiveX”.
2. Click “My Blocks”. Click “My definitions”. Drag “set global positiveX to” into the “calculatePositiveX” block.
3. Click “Math”. Connect a “/” to the “to” slot of “set global positiveX to” block.
4. Click “Math”. Drag a “+” into the left slot and a “x” into the right slot of the “/”.
5. Drag a “x” into the left slot of the “+” block. Click “My Blocks”. Click “My Definitions”. Drag a “global squareRoot” into the right slot of the “+” block.
6. Drag a “global b” into the left and a “number 123” into the right of the “x” block. Set the “number 123” to “-1”.
7. Drag a “x” into the right slot of the “/” block.
8. Drag a “number 123” into the left slot and a “global a” into the right slot of the “x” block.
9. Repeat steps 1-8 except rename the “to Procedure arg” to “calculateNegativeX” of step 1, change the “set global positiveX to” to “set global negativeX to” of step 2, and change the “+” of step 4 to “-”. (Recommend copy and paste here to save time)
Step 12: Call Our Functions and Display Answer

1. Click “My Blocks”. Click “My definitions”. Drag “call quadraticSquareRoot” into the “do” slot of the “when SolveButton do”. Click do” block under the “set global c to”.
2. Repeat step 1 for “call calculatePositiveX” and “call calculateNegativeX”.
3. Drag a “set AnswerLabel.Text to” into the “do” slot of the “when SolveButton do”. under function calls from steps 1 & 2.
4. Click “Text”. Connect a “Join” to the “to” slot of the “set AnswerLabel.Text to” block.
5. Drag a “text text” into the left slot and another “join” into the right slot of the first “join”. Set text of “text text” to “x= “.
6. Click “My Blocks”. Click “My Definitions”. Drag “global positiveX” into the left slot and another “join” into the right slot of the last “join” block added.
7. Click “My Blocks”. Click “My Definitions”. Drag “global negativeX” into the right slot and “text text” into the left slot of the last “join” block added. Set text of “text text” to “, “.
Review

• Used the “+”, “−”, “×”, “/” and “call sqrt” functions from “Math” in blocks editor.
• Converted Block Equations to Mathematical Equations and vice versa
Challenges

• Check for and handle blank checkboxes.
• Return only 1 answer if “positiveX” and “negativeX” are the same.
• Improve the phone interface.
• Create other math formula solvers
  – Tip Calculator
  – Shape Info. Solver i.e. Circle Solver given radius
  – Factorial(!) - 5! = 5 X 4 X 3 X 2 X 1
  – Your own math formulas, even fake ones as jokes.