

A step-by-step guide to using all the features of the MATLAB advanced calculator:

1. Basic Operations

Purpose: Perform standard arithmetic and advanced mathematical operations.

Logic:

- The script offers a variety of basic mathematical operations including addition, subtraction, multiplication, division, exponentiation, square root, logarithms, and trigonometric functions.
- Depending on the user's choice, the script prompts for input values and performs the selected operation.
- For example, addition involves simply adding two numbers, while operations like logarithms and trigonometric functions involve more specialized calculations.

Steps:

1. **Run the Script:** Type `advanced_calculator_with_graphing_v2` in the MATLAB command window and press Enter.
2. **Select Operation:** When prompted, enter 1 for Basic Operations.

Key Steps:

1. **Prompt User:** Ask which operation to perform.
2. **Input Values:** Request numbers from the user.
3. **Perform Calculation:** Apply the chosen mathematical operation.
4. **Display Result:** Output the result to the user.

Examples:

- **Addition:**
 - Choose option 1 for Addition.
 - Input 5 when asked for the first number.
 - Input 3 when asked for the second number.
 - Result: 8
- **Square Root:**

- Choose option 6 for Square Root.
- Input 16 when asked for the number.
- Result: 4
- **Sine (in degrees):**
 - Choose option 9 for Sine.
 - Input 30 when asked for the angle.
 - Result: 0.5

2. Solve an Equation

Purpose: Solve a symbolic equation for its roots.

Logic:

- This feature uses MATLAB's Symbolic Math Toolbox to handle symbolic equations.
- The user inputs an equation as a string, which is then converted to a symbolic expression.
- MATLAB's solve function is used to find the roots of the equation.
- The roots are displayed as solutions to the equation.

Steps:

1. **Run the Script:** Type `advanced_calculator_with_graphing_v2` in the MATLAB command window and press Enter.
2. **Select Operation:** When prompted, enter 2 for Solve an Equation.
3. **Input Equation:** Enter the equation in symbolic form. For example, " $x^2 - 5x + 6 = 0$ ".

Key Steps:

1. **Input Equation:** Convert the user's input string to a symbolic expression.
2. **Solve:** Use the solve function to find the roots of the equation.
3. **Display Solutions:** Output the solutions.

Example:

- **Solve:**
 - Input $x^2 - 5x + 6 = 0$.
 - MATLAB will output the solutions: $x = 2$ and $x = 3$.

3. Plot an Equation

Purpose: Plot a function over a specified range.

Logic:

- This feature allows plotting a user-defined function over a specified range.
- The equation is converted to a MATLAB function using `matlabFunction`.
- A range of x values is generated, and corresponding y values are computed.
- The plot function is used to visualize the function.

Steps:

1. **Run the Script:** Type `advanced_calculator_with_graphing_v2` in the MATLAB command window and press Enter.
2. **Select Operation:** When prompted, enter 3 for Plot an Equation.
3. **Input Function:** Enter the function to plot. For example, `"sin(x)"`.

Key Steps:

1. **Input Function:** Convert the symbolic expression to a MATLAB function.
2. **Generate Data:** Compute y values for a range of x values.
3. **Plot:** Create a plot of the function using `plot`.

Example:

- **Plot:**
 - Input `sin(x)`.
 - MATLAB will generate a plot of the sine function over the range `[-10, 10]`.

4. Solve and Plot an Equation

Purpose: Solve an equation and plot it with the solutions marked.

Logic:

- Combines features of both solving an equation and plotting.
- The script first solves the equation to find its roots.

- Then, it plots the function over a range, highlighting the solutions on the graph.

Steps:

1. **Run the Script:** Type `advanced_calculator_with_graphing_v2` in the MATLAB command window and press Enter.
2. **Select Operation:** When prompted, enter 4 for Solve and Plot.
3. **Input Equation:** Enter the equation to solve and plot. For example, " $x^2 - 4$ ".

Key Steps:

1. **Input Equation:** Convert the equation to a symbolic expression.
2. **Solve:** Find the roots of the equation.
3. **Generate Data:** Compute y values for a range of x values.
4. **Plot:** Create a plot of the function, marking the solutions.

Example:

- **Solve and Plot:**
 - Input $x^2 - 4$.
 - MATLAB will display the solutions: $x = -2$ and $x = 2$.
 - It will also generate a plot of the function $x^2 - 4$ over a range, with the solutions marked on the graph.

5. Exit

Purpose: Exit the calculator program.

Logic:

- Ends the script execution.

Steps:

1. **Run the Script:** Type `advanced_calculator_with_graphing_v2` in the MATLAB command window and press Enter.
2. **Select Operation:** When prompted, enter 5 to exit the calculator.

Key Steps:

1. **Select Exit Option:** The user selects the exit option.
2. **Terminate Script:** The script displays a message and terminates.

Detailed Logic Example for Each Feature

1. **Basic Operations Example:**
 - **Addition:** If the user chooses addition, the script will prompt for two numbers, say 5 and 3. The script computes $5 + 3$ which results in 8.
2. **Solve an Equation Example:**
 - **Equation:** For $x^2 - 5x + 6 = 0$, the script converts this to a symbolic form and uses solve to find $x = 2$ and $x = 3$.
3. **Plot an Equation Example:**
 - **Function:** For $\sin(x)$, the script computes y values over x in the range $[-10, 10]$ and plots the sine curve.
4. **Solve and Plot an Equation Example:**

Equation: For $x^2 - 4$, the script finds solutions $x = 2$ and $x = -2$, then plots the quadratic function, marking these solutions on the graph

Example Workflow

Here's how you might use the script in a real session:

1. **Basic Calculation:**
 - Run the script and choose 1 for Basic Operations.
 - Select option 1 for Addition.
 - Input 7 and 8.
 - MATLAB displays Result: 15.
2. **Solve Equation:**
 - Run the script and choose 2 for Solve an Equation.
 - Input $x^2 - 2x - 8 = 0$.
 - MATLAB shows solutions $x = 4$ and $x = -2$.
3. **Plot Function:**
 - Run the script and choose 3 for Plot an Equation.

- Input $\cos(x)$.
 - MATLAB displays a plot of $\cos(x)$.
4. **Solve and Plot:**
- Run the script and choose 4 for Solve and Plot.
 - Input $x^3 - 3x + 2 = 0$.
 - MATLAB shows solutions $x = 1$ and $x = -1$ and plots the function with these solutions marked.
5. **Exit:**
- Run the script and choose 5 to exit.

This guide will help you effectively use the advanced calculator script, taking advantage of its capabilities for both solving and visualizing mathematical functions.