

Screenshots Module 6: Root Solver

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CSC505: Principles of Programming

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Screenshots Module 6: Root Solver

This document contains a screenshot of the Root Solver script user interactions and outputs

Figure 1

Project Outputs on Terminal – User Flow

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Windows PowerShell
PS P:\CSU-projects\CSC-505-Programs\CTA-Module-6> uv run python root_solver.py
[Root Resolver]

Main Menu
1. Solve a root
2. How to write a transcendental equation
3. Exit

Enter a choice (1, 2, or 3): 2
[How to Write a Transcendental Equation]

What is a transcendental equation?
An equation involving transcendental functions such as exp, log, sin, cos, tan, sqrt, or x^x.

Syntax tips:
- Use 'x' as the variable.
- Use '^' or '**' for exponents (e.g., x^3, x^(1/2), x^x).
- Use pow(x,y) for exponents (e.g., pow(x,3), pow(x,1/3)).
- Use log(x) for logarithmic functions.
- Use sin(x) for sine functions.
- Use cos(x) for cosine functions.
- Use tan(x) for tangent functions.
- Use abs(x) for absolute value functions.
- Use pi and e for mathematical constants.

Examples:
- x^2-x
- x^x-2
- sqrt(x)-1
- pow(x,3)-8
- x^(1/3)-2

Press Enter to continue...

Main Menu
1. Solve a root
2. How to write a transcendental equation
3. Exit

Enter a choice (1, 2, or 3): 1
[Select Method]

1. Bisection
2. Newton-Raphson

Enter a choice (1, or 2): 1
[Bisection Method]

Requires a sign change on [a, b]; repeatedly halves the interval.
You will enter:
- Tolerance (stopping threshold)
- Max iterations
- Interval start (a)
- Interval end (b)

Parameter notes:
- Tolerance: stop when |f(x)| <= tol or interval width <= tol.
- Max iterations: safety cap on loop count.
- Interval start/end: [a, b] must bracket a sign change (f(a)*f(b) < 0).

Enter tolerance (>0): 1e-6
Enter max iterations (>=1): 100
Enter interval start a: 0
Enter interval end b: 1

Equation: cos(x)-x
Method: Bisection
Iterations: 20
Root: 0.7390851974
Residual: 1.675e-07
Status: CONVERGED
Converged by tolerance.

Main Menu
1. Solve a root
2. How to write a transcendental equation
3. Exit

Enter a choice (1, 2, or 3): 1
[Select Method]

1. Bisection
2. Newton-Raphson

Enter a choice (1, or 2): 2
[Newton-Raphson Method]

Uses derivative to refine an initial guess x0.
You will enter:
- Tolerance (stopping threshold)
- Max iterations
- Initial guess x0
- Derivative step h (e.g., 1e-6)

Parameter notes:
- Tolerance: stop when residual or step size is below tol.
- Max iterations: safety cap on loop count.
- Initial guess: well-chosen initial guesses converge faster.
- Derivative step h: finite-difference step; too small may be unstable.

Enter tolerance (>0): 1e-6
Enter max iterations (>=1): 20
Enter initial guess x0: 1.5
Enter derivative step h (e.g., 1e-6): 1e-6

Equation: x^3-x-2
Method: Newton
Iterations: 10
Root: 1.37998060
Residual: 5.894e-07
Status: CONVERGED
Converged by residual tolerance.

Main Menu
1. Solve a root
2. How to write a transcendental equation
3. Exit

Enter a choice (1, 2, or 3): 3
Are you sure you want to quit? [Y/N]: y
Goodbye!
PS P:\CSU-projects\CSC-505-Programs\CTA-Module-6>

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Figure 2*Project Outputs on Terminal – Input Validation*

The screenshot shows a Windows PowerShell window titled "Windows PowerShell" with the command "PS P:\CSU-projects\CSC-505-Programs\CTA-Module-6> uv run python root_solver.py" entered. The terminal displays a series of user inputs and system responses related to root solving and transcendental equation writing.

```

PS P:\CSU-projects\CSC-505-Programs\CTA-Module-6> uv run python root_solver.py
[Root Resolver]

Main Menu
1. Solve a root
2. How to write a transcendental equation
3. Exit

Enter a choice (1, 2, or 3): ww
Invalid input. Please enter a nonzero positive integer (e.g., 2).
Enter a choice (1, 2, or 3): -1
Invalid input. Please enter a nonzero positive integer (e.g., 2).
Enter a choice (1, 2, or 3): 4
Please select a valid option.
Enter a choice (1, 2, or 3): 2.2
Invalid input. Please enter a nonzero positive integer (e.g., 2).
Enter a choice (1, 2, or 3): 1

Enter transcendental equation in x (e.g., cos(x)-x): cos(y)-x
Invalid expression syntax: unmatched <unknown> line 1
Enter transcendental equation in x (e.g., cos(x)-x): cos(y)-x
Only variable 'x' and approved math names are allowed.
Enter transcendental equation in x (e.g., cos(x)-x): ccas(x)-tag(x)
Only approved math functions are allowed.
Enter transcendental equation in x (e.g., cos(x)-x): cos(x)-tag(x)
Only approved math functions are allowed.
Enter transcendental equation in x (e.g., cos(x)-x): cos(x)-tan(x)

Select Method
1. Bisection
2. Newton-Raphson

Enter a choice (1, or 2): 1

Bisection Method

Requires a sign change on [a, b]; repeatedly halves the interval.
You will enter:
- Tolerance (Stopping threshold)
- Max iterations
- Interval start (a)
- Interval end (b)

Parameter notes:
- Tolerance: stop when |f(a)| <= tol or interval width <= tol.
- Max iterations: safety cap on loop count.
- Interval start/end: [a, b] must bracket a sign change (f(a)+f(b) < 0).

Enter tolerance (>0): -2
Invalid input. Please enter a nonzero positive float (e.g., 12.99).
Enter tolerance (>0): 3.3
Enter max iterations (>=1): 0
Invalid input. Please enter a nonzero positive integer (e.g., 2).
Enter max iterations (>=1): 2.2
Invalid input. Please enter a nonzero positive integer (e.g., 2).
Enter max iterations (>=1): 10
Enter interval start a: 1
Enter interval end b: -1
Require a < b.
Enter interval start a: 1
Enter interval end b: 100

Equation: cos(x)-tan(x)
Method: Bisection
Iterations: 1
Root: 50.500000000
Residual: 7.337e-01
Status: CONVERGED.
Converged by tolerance.

Main Menu
1. Solve a root
2. How to write a transcendental equation
3. Exit

Enter a choice (1, 2, or 3): 2

How to Write a Transcendental Equation

What is a transcendental equation?
An equation involving transcendental functions such as exp, log, sin, cos, tan, sqrt, or x^x.

Syntax tips:
- Use 'x' or 'x' as the variable.
- Use '^' or '**' for exponents (e.g., x^3, x^(1/2), x^x).
- Use pow(x,y) for exponents (e.g., pow(x,3), pow(x,1/3)).
- Use log(x) for logarithmic functions.
- Use sin(x) for sine functions.
- Use cos(x) for cosine functions.
- Use tan(x) for tangent functions.
- Use abs(x) for absolute value functions.
- Use pi and e for mathematical constants.

Examples:
- cos(x)-x
- x^x-2
- sqrt(x)-1
- pow(x,3)-8
- x^(1/3)-2

Press Enter to continue...

Main Menu
1. Solve a root
2. How to write a transcendental equation
3. Exit

Enter a choice (1, 2, or 3): 1

Enter transcendental equation in x (e.g., cos(x)-x): cos(x)-x

Select Method
1. Bisection
2. Newton-Raphson

Enter a choice (1, or 2): 2

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Continue next page

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Newton-Raphson Method

Uses derivative to refine an initial guess x0.
You will enter:
- Tolerance (stopping threshold)
- Max iterations
- Initial guess x0
- Derivative step h (e.g., 1e-6)

Parameter notes:
- Tolerance: stop when residual or step size is below tol.
- Max iterations: safety cap on loop count.
- Initial guess x0: starting point; better guesses converge faster.
- Derivative step h: finite-difference step; too small may be unstable.

Enter tolerance (>0): 1
Enter max iterations (>=1): 100
Enter initial guess x0: tt
Invalid input. Please enter a valid float (e.g., 12.99).
Enter initial guess x0: -12.99
Enter derivative step h (e.g., 1e-6): 1s-6
Invalid input. Please enter a nonzero positive float (e.g., 12.99).
Enter derivative step h (e.g., 1e-6): 22e-10

Equation: cos(x)-x
Method: Newton
Iterations: 40
Root: N/A
Residual: 2.198e+07
Status: FAILED_SAFELY
Derivative too small; failing safely.

Main Menu

1. Solve a root
2. How to write a transcendental equation
3. Exit

Enter a choice (1, 2, or 3): 3
Are you sure you want to quit? [Y/N]: 3
Invalid input. Please enter 'Y' or 'N'.
Are you sure you want to quit? [Y/N]: w
Invalid input. Please enter 'Y' or 'N'.
Are you sure you want to quit? [Y/N]: n

Main Menu

1. Solve a root
2. How to write a transcendental equation
3. Exit

Enter a choice (1, 2, or 3): 3
Are you sure you want to quit? [Y/N]: y
Goodbye!
PS P:\CSU-projects\CSC-505-Programs\CTA-Module-6> |
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ch  9:03 AM
12/22/2025