Finding Roots of Nonlinear Functions using Bisection

Write a program that finds a root of a nonlinear function $f(x)$. The program should:

- Read the function parameters from a spreadsheet.
- Read guesses for the low and high values of $x$ from the spreadsheet.
- Read the required accuracy for the root from the spreadsheet.
- Define the nonlinear function as a separate subroutine.
- Check that there is a root of the function between the low and high values of $x$. Use the function subroutine to evaluate the function at each point.
  - If there is no root between these bounds, stop and provide an error message.
- Determine the best accuracy (the smaller error) of the two roots.
- Begin a WHILE loop that continues until the smaller error term is less than the required accuracy. Inside the loop:
  - Calculate the $x$-value halfway between the two bounds.
  - Calculate the value of the function at the midpoint $x$.
  - If the root is between the lower value of $x$ and the midpoint value of $x$,
    - Make the midpoint value of $x$ the new high value of $x$.
    - Make the midpoint value of the function the new high value of the function.
    - Calculate the smaller error of the two roots.
  - If the root is between the midpoint value of $x$ and the high value of $x$,
    - Make the midpoint value of $x$ the new low value of $x$,
    - Make the midpoint value of the function the new low value of the function, and
    - Calculate the smaller error of the two roots.
- End the loop.
- Output the value of $x$ that provides the smaller error value, and output the value of the function for that value of $x$ to the spreadsheet.

For this assignment, the nonlinear function should be the secant formula we used in lecture and lab with $E = 30,000,000$ psi, $L/r = 150$, $ec/r^2 = 0.75$, and find the value of average stress $P/A$ that creates a maximum stress (allowable stress) that is equal to 30,000 psi (similar to what we did in class, but with a higher grade steel providing a higher allowable stress).