Using the TI83+ to solve equations

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The purpose of this document is to walk you through the solution of a nonlinear equation using a TI83+ calculator. Specifically, we will be solving the equation that arises in section 9.3 of my textbook, *A Life Scientist's Guide to Physical Chemistry*, after equation (9.11) on page 197:

$$s - \frac{1.14 \times 10^{-3}\,\text{mol/L}}{e^{-4.025\sqrt{s}}} = 0.$$

1. Press the $\boxed{\text{MATH}}$ key, then scroll down and select `0:Solver...`. Press $\boxed{\text{ENTER}}$. You should see

   ```
   EQUATION SOLVER
   eqn:0=
   ```

2. Enter the left-hand side of the above equation next to the equal sign. Use the $\boxed{\text{ALPHA}}$ key when you need a variable name (perhaps `S` in this case). Your screen should look like this:

   ```
   EQUATION SOLVER
   eqn:0=S-1.14E-3/
   e^(-4.025*√(S))
   ```

3. Press $\boxed{\text{ENTER}}$. You should see a line that says `S=0`. This is where you need to enter a guess for the solution. The text suggests 1.14×10^{-3}, but really, anything reasonably close to this will do. Even zero works sometimes, although not reliably. In this case, I enter

   ```
   S=1E-3
   ```

4. You can also set the bounds in the line following this one. This is useful when an equation has multiple solutions and the calculator is finding the wrong one (usually only a problem if your initial guess is bad). We're just going to leave that alone.

5. With the cursor still on the `S=1E-3` line, press ALPHA SOLVE. The calculator will think about it for a second or two, and should produce the following output.

```
S-1.14E-3/e^(...=0
S=.00131947608...
bound={-1E99,1...
left-rt=0
```

The last line is important because it tells you the calculator actually found a solution. You can read the value of s off the screen. It is also stored in the variable `S` of your calculator.