Guess, Check, and Improve

In this activity, you will use the HP 39gs graphing calculator to help you solve a complicated equation using the Guess-Check-and-Improve strategy. Your equation is:

$$\frac{3n+5}{2} = \frac{5n+3}{3}$$

Using the Aplet

Your teacher will send an Aplet to your HP 39gs called *Guess-Check-Improve*. Once you get the Aplet, press the APLET key, highlight the Aplet name (Figure 1), and press the START menu key to see the Aplet's Note. Read the note; then press the SYMB key to enter the Symbolic view (Figure 2).
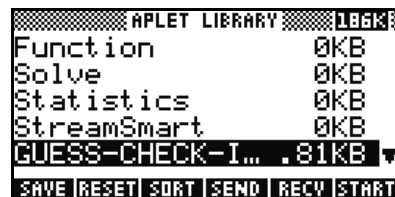

Figure 1

In the Symbolic View, you will see a list of equations named F1(X), F2(X), etc. Notice that F1(X) contains the left side of the equation above, F2(X) contains the right side, and F3(X) contains their difference. Note that the HP 39gs uses X for the independent variable; so x replaces n in the equation (Figure 2).
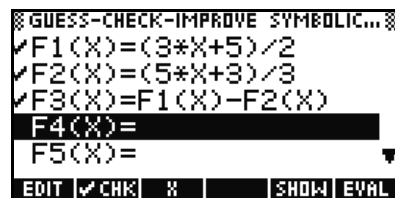

Figure 2

Press the **NUM** key to see Figure 3. Your table of values has 4 columns: X, F1, F2, and F3. You can enter any value you like in the X-column and the HP 39gs will use that value to calculate values for the left side of the equation (F1), the right side of the equation (F2), and the difference between the two sides (F3). Your goal is to find a solution to the equation; that is, a value for X that makes F1 and F2 equal.

Figure 3

Exercises

Record your answers to the following questions in the space provided.

Figure 4

1. F3(X) calculates the difference between the left side of the equation (F1) and the right side (F2). How do you think Sonia will use F3 to make her next guess?

Check: Enter the first two values for X shown in Figure 4 to make sure you get the same answers with your HP 39gs. Your display should look like Figure 4.

<u>Try It Out</u>

2. Enter a first guess for the value of X that makes the two sides of the equation equal to each other. Then enter a second guess. Use the guess-check-and-improve strategy to improve your guesses until you find the solution to the equation. Record your guesses and the final solution in the table below.

Test Variable x	Left Side $(3x+5)/2$	Right Side $(5x+3)/3$	Difference

Leave F1(X), F2(X), and F3(X) as they are; we will come back to them later. For now uncheck those three equations so that they do not show up in the table. Highlight F1(X) as in Figure 5 and press the ■CHK menu key. This is a toggle that will turn any equation on or off to include it in the table or not. Once you press this menu key, the check mark to the left of the equation should disappear. Figure 6 shows all three de-activated and F4(X) ready for entry.
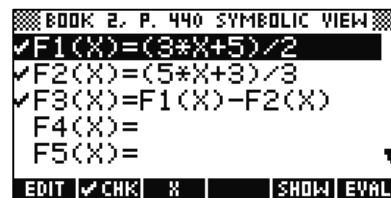
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BOOK 2, P. 440 SYMBOLIC VIEW
✓F1(X)=(3*X+5)/2
✓F2(X)=(5*X+3)/3
✓F3(X)=F1(X)-F2(X)
 F4(X)=
 F5(X)=
EDIT ✓CHK  X       SHOW EVAL
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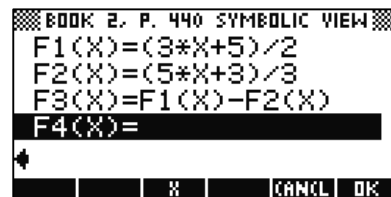Figure 5

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BOOK 2, P. 440 SYMBOLIC VIEW
 F1(X)=(3*X+5)/2
 F2(X)=(5*X+3)/3
 F3(X)=F1(X)-F2(X)
 F4(X)=

          X     CANCL OK
```
Figure 6

3. Use your Aplet to solve each equation below.

Use F4(X), F5(X), and F6(X) for exercise a. Just remember that F4(X) is the left side of the equation and F5(X) is the right side. Remember to use x as the independent variable. Also remember that F6(X) = F4(X) − F5(X).

a. $4x - 70 = 18x$

Now use F7(X), F8(X), and F9(X) for exercise b. Remember to uncheck F4(X), F5(X), and F6(X).

b. $4x - 1 = \dfrac{3x + 8}{2}$

4. Examine the tables and think about how you made your choices for x. What strategies did you use to help you improve your guesses?

<u>Try It Again</u>

Instead of guessing one *x*-value at a time, the HP 39gs can display a table of values all at once. You can even zoom in on a specific value. Suppose we want to see a table of values for our first equation that has *X* starting at zero and increasing by 1.

Re-activate F1(*X*) through F3(*X*) using the ✓CHK menu key, and delete the other equations using the **DEL** key. Figure 7 shows the result.
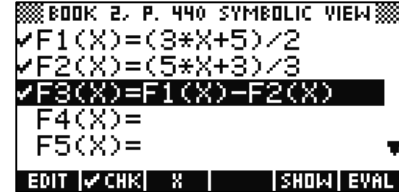

Figure 7

Press the **SHIFT** of the **NUM** key (Num Setup) to see the Numeric Setup. Check that NUMSTART is set to 0, NUMSTEP is set to 1, and NUMZOOM is set to 10, as in Figure 8.
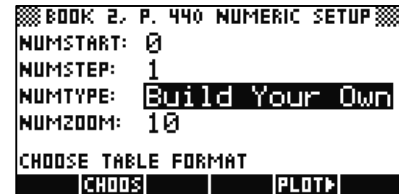
Highlight NUMTYPE, press the CHOOS menu key, and select the AUTOMATIC option shown in Figure 9. Then press the OK menu key. The final setup is shown in Figure 10.
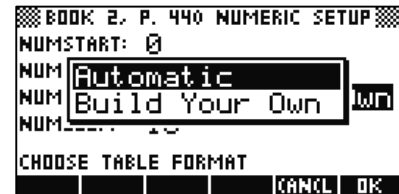

Figure 8

To see the table, press the **NUM** key and scroll through the table using the direction keys.

5. How will you know which value of *X* gives a correct answer? Where is the solution in the table?
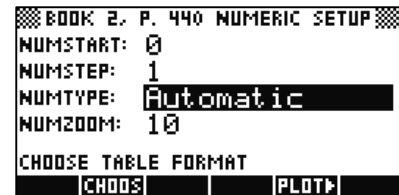

Figure 9

Figure 10

Use Your HP 39gs

Not every equation has a solution that is an integer between 0 and 19.

6. Try to solve the equation $\dfrac{8x+3}{3} = x+3$ using the Automatic table option. Use F1(X) for the left side and F2(X) for the right side of the equation. You can leave F3(X) as it is. Remember that you can scroll up past the top of the table and do wn past the bottom of the table. You can also type any value into the X-column and the table will re-configure instantly.

a. Does 0 ever appear in column F3? If not, where does it look like the solution to this equation should be?

b. To refine your guesses, highlight the value of X closest to the solution and pre ss the ZOOM menu key. From the list of options, highlight IN to zoom in on the table. Right now, the values in the X-column increase by 1. Since we set NUMZOOM to 10, zooming in will make the values in the X-column increase by 0.1. Press the OK menu key to zoom in and then return to the table to see if any of the new values of X cause 0 to appear in F3. What is the solution to this equation?

To return the table to integer values of X, simply press the ZOOM menu key again and select the OUT option to zoom back out. Use your HP 39gs to solve the equations below. Some solutions may not be positive and may not be integers. If you use the Automatic table method, you may need to scroll around the table or zoom in or out to find the solution.

7. $15x + 32 = 3x - 16$

8. $\dfrac{7x+34}{3} = \dfrac{13x-4}{2}$

What Did You Learn?

9. When you solve equations with the HP 39gs, what strategies can you use to improve your guesses? Be sure to consider how to find negative and decimal solutions as well as positive integers.
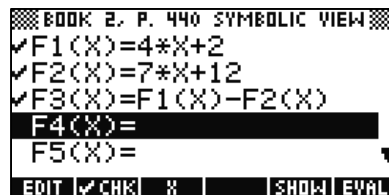
10. What equation is being solve d in Figure 11?

Figure 11