Investigating the Graph and Table Functionality and Features

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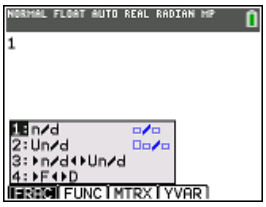
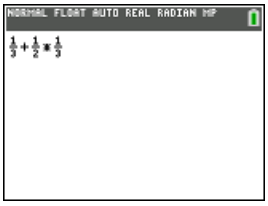
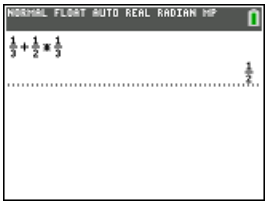
1. On the Home screen, press [1].
2. Press [ALPHA] [F1] to get to the shortcut FRAC menu.
3. Press [ENTER] or [1] to select n/d .



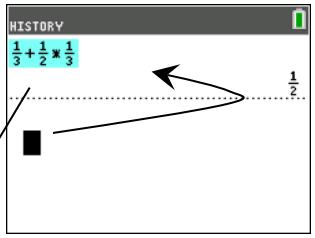
4. Press [3] [▸] [+] [1] [ALPHA] [F1] [ENTER] [2] [▸] [x] [1] [ALPHA] [F1] [ENTER] [3] [▸]



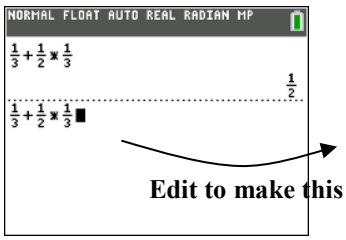
5. Press [ENTER] (to say "please").

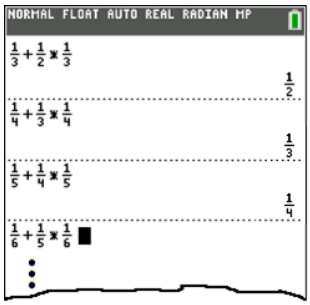


6. Press the [▲] key twice to climb up the tree and highlight the expression. Press [ENTER] to "pluck the fruit off the tree."



7. Press [2nd] [◂] to go to the beginning of the line (H). Change the expression to increase each denominator by 1. Press [ENTER].



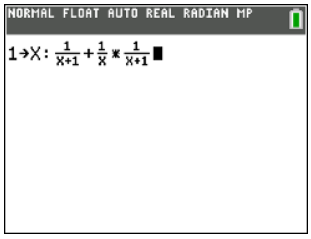


We have create a table on the home screen.

Questions:

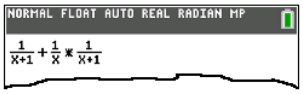
1. What pattern do you notice? Will it always work?
2. If you entered $\frac{1}{100}+\frac{1}{99}*\frac{1}{100}$ what would you expect? Confirm your guess.
3. Explore $\frac{1}{x+1}+\frac{1}{x}\cdot\frac{1}{x+1}$ on the home screen for values of x of your choice.

   Store a number in x: [1] [STO▸] [X,T,θ,n] [ALPHA] [:] , then "climb the tree" by pressing the [▲] key twice, press [ENTER] to pluck the fruit, and replace numbers with variable expressions, creating a table this way.

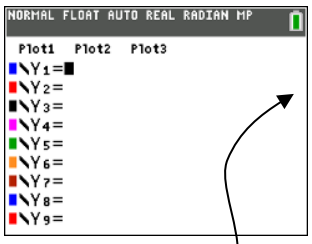


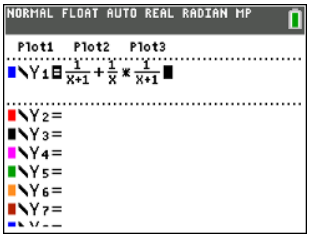
4. Replay, using [2nd] [◂] to go to the beginning of the line (H) and make x any nondecimal value you wish. What do you observe?

5. Replay, use the delete key so only you have $\frac{1}{x+1}+\frac{1}{x}\cdot\frac{1}{x+1}$ on the entry line, and press [ENTER].



Press Y=, position your cursor in Y1,

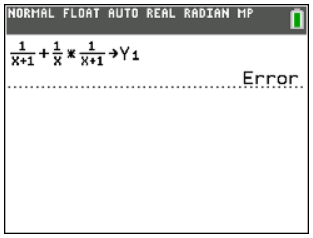


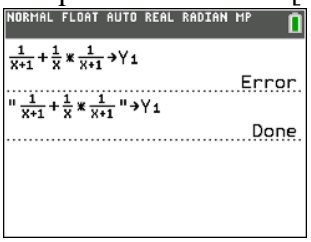


and press [2nd] [ENTER]
to "beam the expression up" into Y1.
Note: After the evaluation of an expression on the home screen, the input expression is stored in [2nd] [entry] (above the [ENTER] key). [2nd] [ENTER] overwrites the entire line. It is a way to copy and paste.

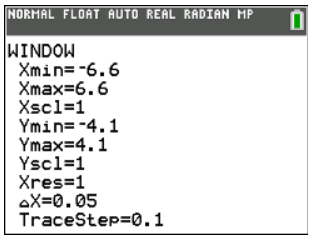
Alternate Approach:

You can also do the above from the home screen but must use quotes. Use [ALPHA] [F4] [ENTER] to get Y1.

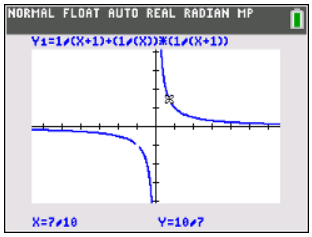




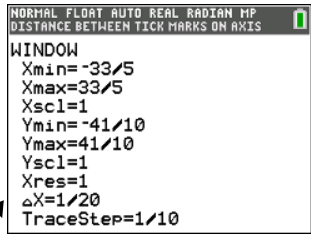
6. Press [ZOOM] [4] to graph in a pre-set "Decimal" window.
Press [TRACE], and use the left and right arrow keys.
Press [WINDOW] to see the value of the graphing increment TraceStep.
Values of Xmin and Xmax will depend on the pixel resolution for each calculator model in the TI-84 Plus Family.



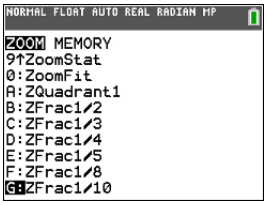
7. Explore the pre-set fractional window. Press [ZOOM], press the [▲] key, and select ZFrac1/10 to graph in a pre-set "$\frac{1}{10}$" window.
Note: ZFrac1/10 sets the window variables so that you can trace in increments of $\frac{1}{10}$, if possible, and sets ΔX and ΔY to $\frac{1}{10}$.
Compare the graph coordinate values as you trace.
What do you notice? What do you wonder?



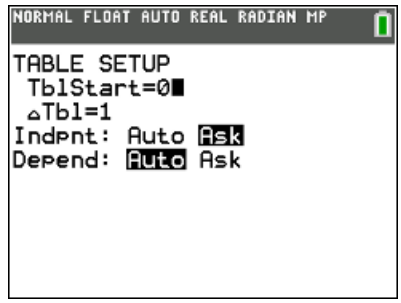
Press [WINDOW] to compare the value of the graphing increment TraceStep with the TraceStep above from ZDecimal.



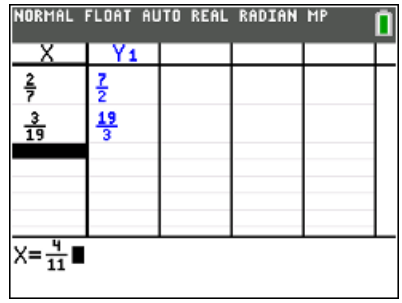
Explore other Fractional pre-set windows.
(ZFrac1/*n* sets TraceStep to 1/*n*)



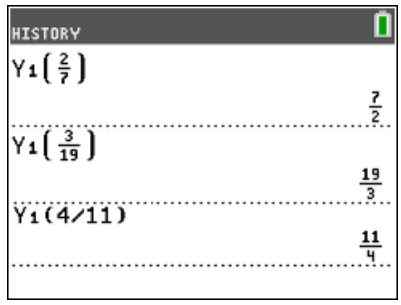
8. Change the settings for the table using [2nd] [WINDOW] so you can **Ask** for any independent variable.



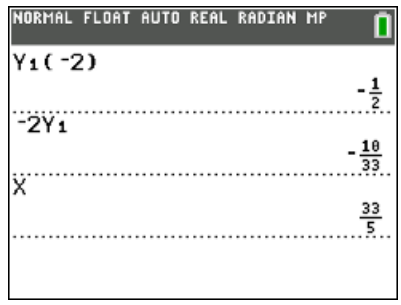
Use the stacked fraction template to explore the value of y for different inputs of the form $\frac{a}{b}$.
Use [ALPHA] [F1] [ENTER] to select **n/d** or [ALPHA] [X, T, θ, n].



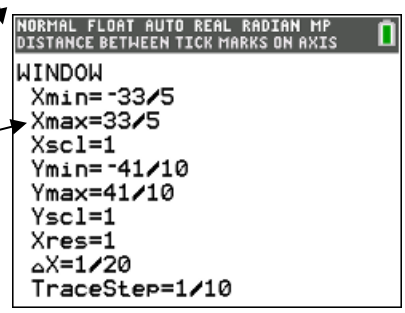
Because the expression $\frac{1}{x+1}+\frac{1}{x}\cdot\frac{1}{x+1}$ is in Y1,
we can use function notation on the home screen to create a table.
Use [ALPHA] [F4] [ENTER] to select Y1.



Division with the [÷] key appears as **thin bar** fractions.
On a single line, stacked fractions appear as **thick bar** fractions.
They also appear as thick bar fractions in Classic mode.

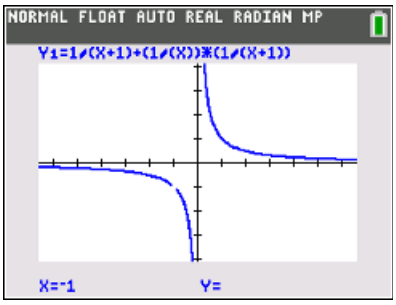


Common Error:
In the Y= Editor, if you enter the function –2Y1 or (–2)Y1, you will graph a reflection and vertical stretch of the function stored in Y1.
If you were to type Y1(–2), you have the function Y1 evaluated at x = –2, which, if defined, is a horizontal line.
(Here it would be the line $y = -\frac{1}{2}$.)
On the home screen, –2Y1 = –2·Y1(X). This is –2 multiplied by the output of Y1 when it is evaluated at whatever the current value of X happens to be.



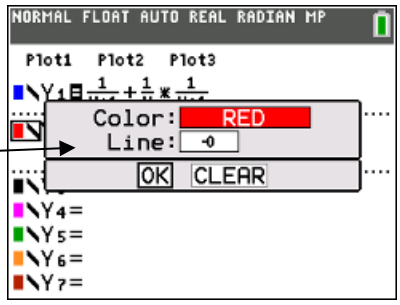
Often that value of X will be Xmax if you just produced a graph.
Do not store anything in X that you want saved, since it is used by the calculator behind the scenes.

9. What is happening when $x = -1$?
Press GRAPH to liberate the cursor from the curve and observe the "screen coordinates" in this window.

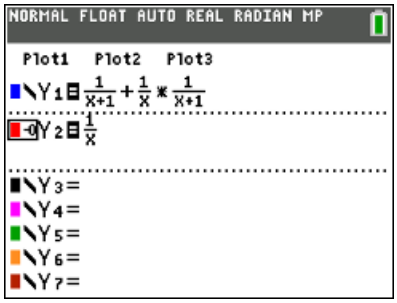


10. Smart Trace – While tracing, enter a value to jump to that point! Similarly for Intersection, Minimum, and Maximum.
(Must be on TRACE and the value you type must be in the interval [Xmin, Xmax].)

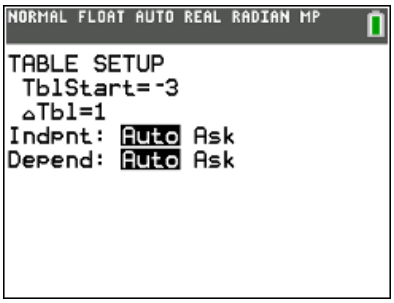
11. Enter the reciprocal function in Y2.
Press ◄ until your cursor is before Y2.
Press ENTER to open the spinner.
Change the line style to "animated path."
(For the 84CE, press ►. For the 84, press ENTER.)
On the spinner, highlight OK and press ENTER.
Graph both functions.

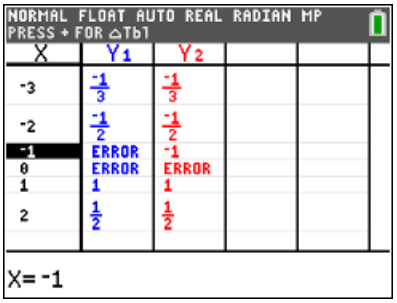


Press TRACE and type −1.
Use ▼ to see the value for the other function



Explore a table.
If necessary, set both to Auto.



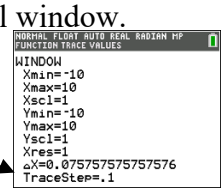


12. Press Y = and deselect Y2 by highlighting the equals sign and pressing ENTER.
Press ZStandard. Why is there no longer a hole showing at $x = -1$?

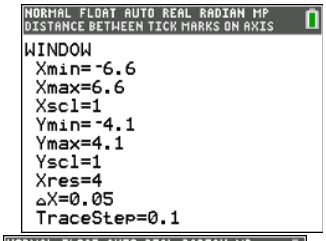
For the TI-84 Plus CE, TraceStep $= \dfrac{\text{Xmax} - \text{Xmin}}{132}$.

For the TI-84 Plus, TraceStep $= \dfrac{\text{Xmax} - \text{Xmin}}{94}$.

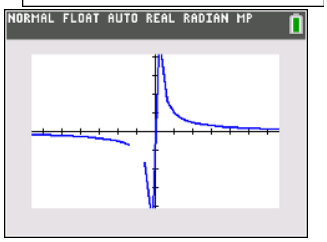
No need to memorize. Just double the value of Xmax after creating a pre-set decimal window.
After a ZStandard, press WINDOW to and change TraceStep to 0.1.
Notice the window is not centered.
Alternatively, double Xmin and Xmax after setting a ZDecimal Window.



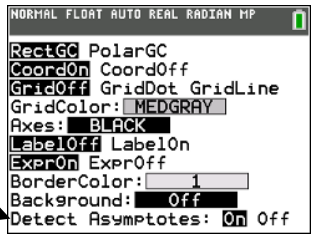
13. Press TRACE. Observe what [2nd] [◄] (⏮) and [2nd] [►] (⏭) do here.
The cursor jumps every 5 pixels.



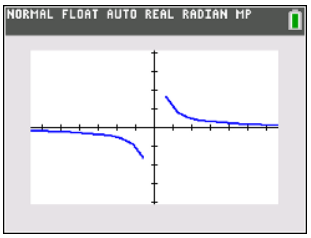
14. Press [ZOOM] [4] to return to pre-set "Decimal" window.
Press [WINDOW] and change Xres to 4. Every 4 pixels are graphed.
The false "asymptote" appears.



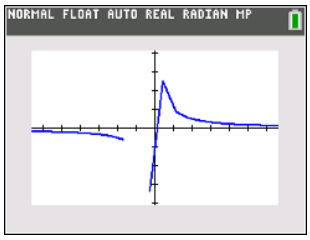
Detect Asymptotes is turned on by default but is ignored if Xres $\neq 1$.
(You can speed up graphing if you press [2nd] [format] above TRACE and select Off for Detect Asymptotes.)



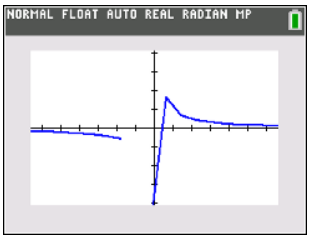
Change Xres to 6.
(Graph every 6 pixels.)



Change Xres to 7.
(Graph every 7 pixels.)



Change Xres to 8.
(Graph every 8 pixels.)



You can think of Xres as the caffeine level of the little person inside the calculator doing the graphing. The maximum value of Xres is 8. One purpose for Xres is when it is computationally demanding to compute an output for every pixel, like a definite integral with an upper limit of x.

15. Use algebra to show $\frac{1}{x+1} + \frac{1}{x} \cdot \frac{1}{x+1}$ and $\frac{1}{x}$ are equivalent when $x \neq -1$.
Model the home screen investigation on page 1 instead with $\frac{1}{x} + \frac{1}{x-1} \cdot \frac{1}{x}$.
What is the hole? Any asymptotes?
You will need to press [2nd] [format] above TRACE and turn off the axes to see the hole.