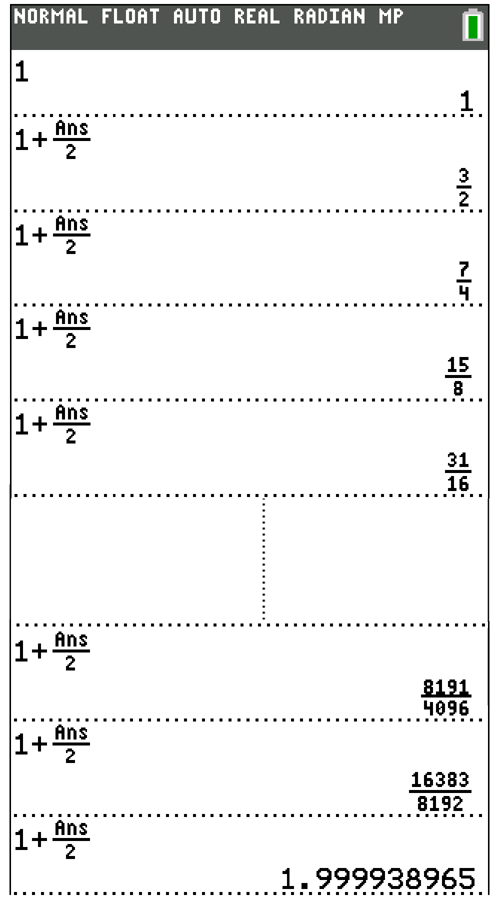
A gift that keeps on giving!

Reset the defaults on your calculator. (These are calculator settings it has when it first comes out of the box.) Press [2nd] [MEM] 7:Reset… 2:Defaults… 2:Reset



1. Clear the home screen.
   Press the number 1 followed by [ENTER].
   This number will be the initial seed.

2. Next build the expression $1+\frac{\text{Ans}}{2}$
   For the shortcut FRAC menu, press [ALPHA] [F1] and use n/d for stacked fractions instead of the division key.

3. Once you build the expression, continue pressing [ENTER] to create the screen to the right. Describe any patterns.

4. Conjecture what three expressions will come next.

   $1, \frac{3}{2}, \frac{7}{4}, \frac{15}{8}, \frac{31}{16}$, ______ , ______ , ______

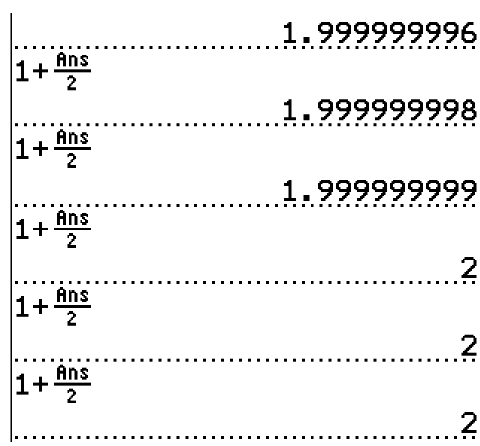
5. After pressing [ENTER] many, many times, the TI-84 Plus will eventually stop displaying a number as a stacked fraction. (It resigns from duty once the number's denominator exceeds 4 digits. Alas, using ▸Frac on 1.999938965 will not help.)

   a. If we were write the number which comes after $\frac{16383}{8192}$ as a stacked fraction, what would be its denominator?

   b. What would be its numerator?

   c. Verify your claim by entering your fraction on the home screen.

   d. A student had pressed the [ENTER] key 5 times to reach the number $\frac{31}{16}$. What is the least number of times they would have pressed [ENTER] to reach 1.999938965? Create a formula for the *n*th term.



6. Eventually the expression $1+\frac{\text{Ans}}{2}$ will converge to 2.
   This means when Ans = 2, then $1+\frac{\text{Ans}}{2} = \text{Ans}$.

   a. Solve the equation $1+\frac{x}{2}=x$ to show that $x = 2$ is the one and only value to which this expression converges.
   b. Conjecture what would happen if the initial seed were 2.
   c. Repeat the above with a seed of -1.
      After pressing [ENTER] 5 times, can you predict three more?
   d. Precalculus: Show your formula in 5d is equivalent to $2-\frac{1}{2^{n-1}}$.
      Then show why $2-\frac{1}{2^{n-1}} \to 2$ as $n \to \infty$.