

Introduction to Infinite Series

Name _____

Adding the terms of a sequence $\{a_n\}_{n=1}^{\infty}$ gives us an **infinite series**

$$a_1 + a_2 + a_3 + \dots + a_n + \dots$$

which can be denoted $\sum_{i=1}^{\infty} a_i$. In general, the sum of the first n terms of a sequence is denoted $\sum_{i=1}^n a_i$

Example 1

If we start to add the terms of the sequence $\left\{\frac{1}{2^n}\right\}$ we get.

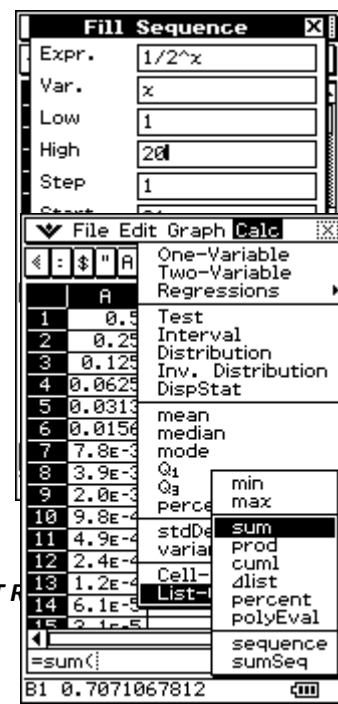
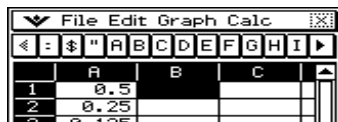
$$\begin{aligned} \sum_{i=1}^1 \frac{1}{2^i} &= \frac{1}{2} = .5; & \sum_{i=1}^2 \frac{1}{2^i} &= \frac{1}{2} + \frac{1}{4} = .75; & \sum_{i=1}^3 \frac{1}{2^i} &= \frac{1}{2} + \frac{1}{4} + \frac{1}{8} = .875; \\ \sum_{i=1}^4 \frac{1}{2^i} &= \frac{1}{2} + \frac{1}{4} + \frac{1}{8} + \frac{1}{16} = .9375 \end{aligned}$$

So what will $\sum_{i=1}^{\infty} \frac{1}{2^i}$ equal?

To find out, let's use the Spreadsheet Application!

From the Menu Application \mathbb{M} open the Spreadsheet Application \mathbb{R} . We are going to list the terms of our sequence $\left\{\frac{1}{2^n}\right\}$ in column A and the partial sums in column B.

- Go to Edit in the tool bar and select Fill Sequence. We want to have Column A be the terms of our sequence. Fill in the dialog box as it is in the screenshot to the right. Tap OK.
- Tap in Cell B1 to select it. It should be the only solid black cell. Push the = button on the calculator to start a formula. This will bring up a new toolbar.
- We want to enter a formula that adds all of the terms up



to our current row. We want to use the “sum” function. Tap Calc in the menu bar. To find the sum command, tap on List-Calculation as demonstrated in the screenshot to the right.

- 4) You should have at the bottom of your screen a text box with “=sum(“ in it.

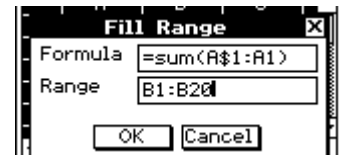


Enter the formula =sum(A\$1:A1) and tap EXE. (The \$ locks the row so that we always start our sum at the first row.)

- 5) Select B1 again to make it solid black with white numbers (should be 0.5).

- 6) Select Edit from the menu bar and select Fill Range.

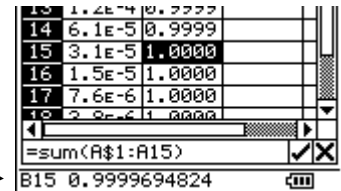
- 7) A Fill Range dialog box should open up with your formula in it. You want to change the range to go from B1 all the way to B20. To do this in the Range text box enter B1:B20 then tap OK.



Notice the first four entries are the same as we calculated above at the beginning of Example 1!

As we add more and more (smaller and smaller) terms the total sum gets closer to 1.

At B15 it says 1.0000, but if you select that cell you see at the very bottom of the screen that the cell just rounded up from the value 0.9999694824.



Example 2

Use the method above to find $\sum_{i=1}^{\infty} \frac{1}{3^i}$.