

SERIES ON THE GRAPHING CALCULATOR

You may graph the sequence of partial sums for an infinite series by using parametric mode with a T-step of 1 or by using sequence mode. With parametric mode, the steps for entering the sequence of partial sums is the same, no matter what calculator is used. With sequence mode, the steps are different depending on which type of calculator is being used.

Example: Find the sum of the terms generated by $a_n = \frac{1}{n}$

Parametric Mode on the TI-83, TI-89, etc.:

You will be using the "sum" and the "sequence" commands to do this.

TI-83: "sum" is 2nd Stat Math 5

TI-89: "sum" is 2nd Math List 6

"seq" is 2nd Stat Ops 5

"seq" is 2nd Math List 1

Let $X_{T1} = T$

Window: $T : [1, 20]$

$$Y_{T1} = \text{sum} \left(\text{seq} \left(\frac{1}{T}, T, 1, T \right) \right)$$

Tstep = 1

$X : [-1, 20]$

$Y : [-1, 20]$

Press "graph" and then "trace" to see the sequence of partial sums.

You will need to set your calculator to "dot" mode so that the dots are not connected.

Sequence Mode on the TI-83:

Press "y=" and let nMin = 1

Window: nMin = 1

$$u(n) = u(n-1) + \frac{1}{n}$$

nMax = 20

$$u(n\text{Min}) = 1$$

PlotStart = 1

PlotStep = 1

$X : [-1, 20]$

$Y : [-1, 20]$

Note: Press 2nd 7 to get "u" and the "x,t,θ,n" key to get "n."

Press "graph" and then press "trace" to see the sequence of partial sums.

Depending on the operating system of your TI-83, you may need to set it to "dot" mode so that dots on the graph are not connected.

Sequence Mode on the TI-89:

Press "y=" and let $u1 = \sum \left(\frac{1}{n}, n, 1, n \right)$

Window: nMin = 1

$$u1 = 1$$

nMax = 20

PlotStart = 1

PlotStep = 1

$X : [-1, 20]$

$Y : [-1, 20]$

Note: Press Alpha 6 to get "n." You can get the \sum by looking in the catalog toward the end of the "S" commands for \sum (sum) or by pressing Math, A: Calculus, 4 \sum (.).

Sequence mode on the TI-89 should automatically graph in dots without setting the calculator to be in "dot" mode.

Press "graph" and then "trace" to see the sequence of partial sums.

Convergence and Divergence of a Series

What does it mean for a series to converge? To diverge? Let's look at a couple of geometric series.

Given the series $\sum_{n=1}^{\infty} \frac{3}{2^n} = \frac{3}{2} + \frac{3}{4} + \frac{3}{8} + \frac{3}{16} + \frac{3}{32} + \frac{3}{64} + \frac{3}{128} + \frac{3}{256} + \frac{3}{512} + \frac{3}{1024} + \dots$

Find the first **ten** terms of the sequence of partial sums, and list them below.

(To do this on the TI-89, you can just add the numbers or you can use the Σ command found under F3 or in the catalog. For example, if you wanted to find the sum of the first four terms, you would type $\Sigma(3 \div (2^n), n, 1, 4)$. The last number in the command represents the number of terms you are adding.)

What do you notice about the results? What does the formula for the sum of an infinite geometric series $\left(S = \frac{a_1}{1-r} \text{ if } |r| < 1, \text{ where } a_1 \text{ is the first term and } r \text{ is the common ratio} \right)$ tell you about this series?

Given the series $\sum_{n=1}^{\infty} \left(\frac{3}{2}\right)^n = \frac{3}{2} + \frac{9}{4} + \frac{27}{8} + \frac{81}{16} + \frac{243}{32} + \dots$

Find the first **five** terms of the sequence of partial sums, and list them below.

What do you notice about the results? What formula for the sum of an infinite geometric series tell you about this series?