23. SERIES

A. Constant Term Series

This is an excellent application of the calculator. The ability to generate partial sums of series quickly and easily is a big advantage in studying series. The easiest way to compute partial sums is the \texttt{sum seq} command. The commands \texttt{sum} and \texttt{seq} are on the \texttt{MATH/MISC} menu.

To compute a partial sum for the series \( \sum_{n=1}^{10} \frac{1}{2^n} \), enter: \texttt{sum seq(1/2}, \texttt{ N N, 0, 10, 1) ENTER}.

To see another, recall the last command by pressing \texttt{ENTRY} (\texttt{2nd/ENTER}). Change 10 to 20 (or whatever) and press \texttt{ENTER}.

With just a little practice, this is almost too easy. I think that the following two methods are more instructive. They display the partial sums one after the other and allow one to "see" the convergence or divergence (for most series).

\begin{verbatim}
0 STO N:1/2^n STO S ENTER
N+1 STO N:S+1/2^n STO S ENTER
\end{verbatim}

Continuing to press \texttt{ENTER} displays the partial sums.

In the method above, you have to keep count if you want to know which partial sum is displayed. The following keeps count for you. Here \( S \) is a 2-vector whose first entry is \( N \) and whose second in the \( N \)th partial sum.

\begin{verbatim}
0 STO N:[N,1/2^n] STO S ENTER
N+1 STO N:[1,1/2^n]+S STO S ENTER
\end{verbatim}

The limitations of the calculator can be demonstrated by series which either diverge very slowly like the harmonic series or converge very slowly. For the series \( \sum_{n=1}^{\infty} \frac{1}{n^{1.01}} \), for example, the calculator can't even come close without permanent batteries, an indestructible calculator and an immortal button-pusher.