Infinite Series
Demonstration Activity

1) Open the Series Demonstration located at
http://demonstrations.wolfram.com/SeriesAFewExamples/

2) First get familiar with the various options. Choose a term. Adjust the slider for k.

3) Let the term be n. Does it converge or diverge? Explain why.

4) Let the term be $\frac{1}{n}$. Does it converge or diverge? Explain why.

5) Let the term be $\frac{1}{n^2}$. Does it converge or diverge? Explain why.

6) Let the term be $\frac{(-1)^n}{n}$. Does it converge or diverge? Explain why.

7) List $S_1, S_2, \ldots, S_{10}$ for $\frac{1}{n}$ and $\frac{1}{n^2}$.

$\frac{1}{n}$:

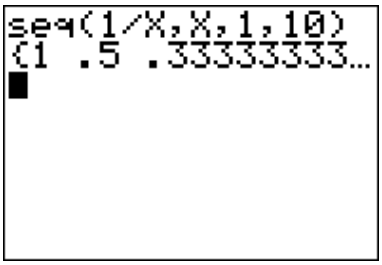
$\frac{1}{n^2}$:

8) Graphically $\frac{1}{n}$ is slowing down yet is not converging. Graphically $\frac{1}{n^2}$ is also slowing down and does converge. What is the difference? Explain.

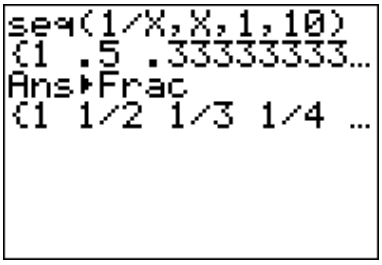
9) How come $\frac{1}{n}$ diverges but $\frac{(-1)^n}{n}$ converges? What convinces you?

10) You can compute partial sums using the sequence and sum commands on your graphing calculator. We will practice this for the harmonic series $\frac{1}{n}$.

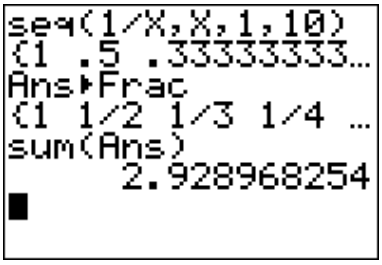
a) On the home screen, enter **seq(1/x,x,1,10).**
The **seq** command can be found in either the **CATALOG** or in the **LIST** menu under **OPS**.



b) To convert the entries in the list into fraction form, select **MATH**, then **FRAC**.



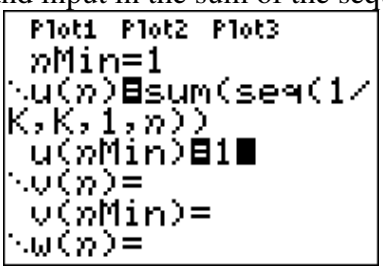
c) Use the **sum** command to find the sum of the ten terms in the list.
The **sum** command can be found in either **CATALOG** or in the **LIST** menu under **MATH**.



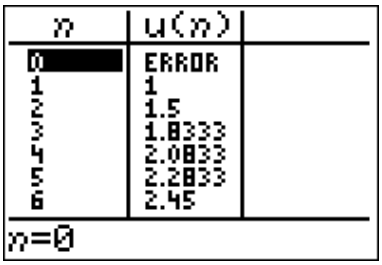
This sum represents the 10th partial sum of the series: $\sum_{n=1}^{10} \frac{1}{n}$

d) Press **MODE** and change to **Seq MODE**.

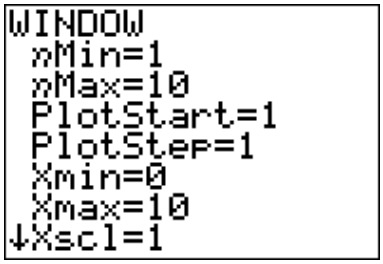
e) Select **Y=** and input in the sum of the sequence as shown below:

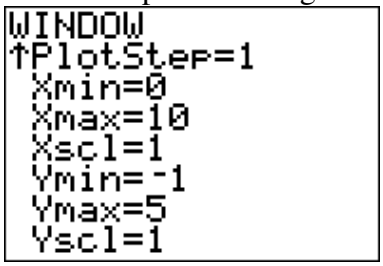


f) View the **TABLE** to see a list of the results for the partial sums for different values of n.

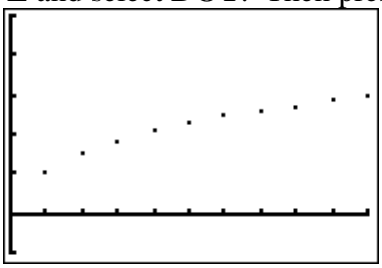


g) To see these results graphically (with values of n on the horizontal axis), first check the **FORMAT** menu to make sure that **Time** is selected. Then set up the viewing window parameters as shown.





h) Press **MODE** and select **DOT**. Then press **GRAPH** to see the partial sums plotted.



11) Try to replicate the calculator keystrokes above, but applied to the sequence $\frac{1}{2^n}$.

a) List the first 10 terms (as fractions) given to you by your calculator for $\frac{1}{2^n}$.

b) Find the 10th partial sum for this series.

c) Give a rough plot of the partial sums.

d) Does this series converge? If so, to what?