MAT1575 Module 5 – Graphing sequences and series using Desmos.

Objectives: Study sequences and series numerically and graphically using Desmos.

1. In Desmos we can create a list of numbers using square brackets. For example `[1,2,...,10]` creates the list of numbers from 1 to 10. You can also make a list that starts at any other number, or that skips several numbers at a time, for example `[3,4,...,7]` or `[2,4,...,12]`. The important thing is that you specify a starting value, a "step" value, and an ending value. The ending value can even be a variable if you want to create a list whose length you can change with a slider.

2. If you set a list equal to a variable, like `N=[1,2,...,10]`, you can use that list to create new lists. Try the following:

   ```
   N=[1,2,...,10]
   a_N = 1-1/N
   ```

   This should create a list of the values $1 - \frac{1}{N}$ from $N = 1$ to $N = 10$. We can now plot the sequence $a_N = 1 - \frac{1}{N}$ is Desmos using the following notation:

   ```
   (N,a_N)
   ```

   This plots the set of **pairs** where the first entry comes from N and the second entry comes from the matching pair in a_N.

3. To plot the **series** obtained from `a_N`, use the following notation

   $$\left(N, \sum_{n=1}^{N} a_N[k]\right)$$

   You can get the $\sum$ symbol by typing the word `sum` into Desmos. Here $a_N[k]$ means the k^{th} term of the list a_N.

4. Plot the following sequences and series using Desmos and guess whether or not they converge. If they converge, determine their limit.:

   (a) $a_n = 3n + 2$

   (b) $a_n = \frac{n^k}{e^n}$ for $k = 2, 3$

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

(d) $a_n = \frac{n+1}{n+2}$

(e) $a_n = \left(1 + \frac{1}{n}\right)^n$

(f) $\sum_{n=0}^{m} 3n + 2$

(g) $\sum_{n=0}^{m} \frac{x^n}{e^n}$ for $x = 2, 3$

(h) $\sum_{n=0}^{m} \frac{-1}{n^2 + 1}$

(i) $\sum_{n=0}^{m} \frac{n+1}{n+2}$

(j) $\sum_{n=0}^{m} (-1)^n$