3.4: Other Applications of Mclaurin and Taylor series

So far we have discussed how we can use power series to approximate more complex functions around a particular value. This is very common in physical chemistry, and you will apply it frequently in future courses. There are other useful applications of Taylor series in the physical sciences. Sometimes, we may use relationships to derive equations or prove relationships. Example *[Math Processing Error]* illustrates this last point.

Example *[Math Processing Error]*

Calculate the following sum (*[Math Processing Error]* is a positive constant)

[Math Processing Error]

Solution

Let's 'spell out' the sum:

[Math Processing Error]

The sum within the brackets is exactly *[Math Processing Error]*. This is exact, and not an approximation, because we have all infinite terms.

Therefore,

[Math Processing Error]

This would require that you recognize the term within brackets as the Maclaurin series of the exponential function. One simpler version of the problem would be to ask you to prove that the sum equals 1.

There are more ways we can use Taylor series in the physical sciences. We will see another type of application when we study differential equations. In fact, power series are extremely important in finding the solutions of a large number of equations that arise in quantum mechanics. The description of atomic orbitals, for example, require that we solve differential equations that involve expressing functions as power series.