**Power / Taylor Series**

*Part 3: By Advanced Algebra*

We have a few basic power series at our disposal and we have learned some tricks to find more series. There are more advanced techniques such as ‘long multiplication’ and ‘long division’ to find power series:

Find the first three non-zero terms of the power series for

We know that and . Thus

Of course, we could have also computed the various derivatives:

 so that and

 so that and

 so that and

 so that and

 so that and

 so that and

which gives the same answer (of course)

Find the first two non-zero terms in the power series for :

As before, we know that and . Thus:

so that

In this case it would have been simpler to compute the derivatives, but they do get more and more complicated:

 so that and

 so that and

 so that and

 so that and

Find the power series for

Since we have:

Of course we could have also noted that

which goes tp show, once again, that there are usually many paths to the right answer.

**Exercises:**

Find the first four terms of the power series for by long multiplication. Verify your answer by taking derivatives.

Find the first two terms of the power series for . Verify your answer by writing and using long multiplication. Finally, verify your answer by taking derivatives.

Find the power series for by long division. Verify your answer by writing and finding its power series.