

# Math 2565 - Tutorial 8

## Power Series

You will work in your groups via the Zoom breakout rooms to answer the following 2 questions. Try to use the collaboration spaces on OneNote, so your progress can be monitored throughout the session and everyone can contribute. You will only need to submit your answers your answers to questions 1 and 2. You may need to use the fundamental limit  $\lim_{n \rightarrow \infty} \sqrt[n]{n} = 1$  and the integral  $\int \frac{1}{1+x^2} dx = \arctan(x)$  somewhere in your answers.

Solutions to the problems will be uploaded directly after the 2nd tutorial session.

### 1 (Interval of Convergence)

Find the interval of convergences for the following series.

(a)  $\sum_{n=1}^{\infty} \left(\frac{x+1}{3}\right)^n$

(b)  $\sum_{n=1}^{\infty} \frac{2^n}{n} (4x-8)^n$

(c)  $\sum_{n=1}^{\infty} 2^{n^2} (x-3)^n$

### 2 (Deriving Power Series)

Recall that the geometric series  $f(x) = \sum_{n=0}^{\infty} x^n = \frac{1}{1-x}$  for  $|x| < 1$ . Use this series to derive a power series representation for the following functions using either differentiation, integration, substitution or a combination of them.

(a)  $g(y) = \frac{1}{1+5y}$

(b)  $h(x) = \frac{1}{(1-x)^2}$

(c)  $i(x) = \arctan(x)$