Math 31 – Workshop #26

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1. Determine the interval of convergence for each of the following series.

   (a) $\displaystyle\sum_{n=3}^{\infty} \frac{x^n}{5^n \ln n}$

   (b) $\displaystyle\sum_{n=1}^{\infty} \frac{n(x-3)^n}{n+1}$

2. (a) The sum of a certain geometric series is $\frac{3}{4}$. What might the series be?

   (b) The sum of a certain geometric series is $\dfrac{5}{1-2x}$. What might the series be?

   (c) Looking at the series you got from part 2b, let $p_4(x)$ represent the polynomial you get if you remove all terms with degree greater than 4. What is $p_4(x)$?

   (d) Consider the function $f(x) = \dfrac{5}{1-2x}$. Graph $f(x)$ and $p_4(x)$ on the same screen of your calculator. On what interval would you say $p_4(x)$ is a good approximation of $f(x)$?

3. (a) Find a series whose sum is $\dfrac{1}{1+3x}$.

   (b) Use your series above, and your knowledge of calculus, to find a series whose sum is $\ln|1+3x|$.

   (c) Let $p_3(x)$ be the polynomial you get if you remove all the terms from the above series with degree greater than 3. What is $p_3(x)$.

   (d) Graph $f(x) = \ln|1+3x|$ and $p_3(x)$ on the same screen of your calculator. On what interval would you say $p_3(x)$ is a good approximation of $f(x)$?

4. Recall that the Maclaurin series for e^x is as follows.

$$e^x = 1 + x + \frac{x^2}{2!} + \frac{x^3}{3!} + \frac{x^4}{4!} + \cdots$$

   (a) Use the Maclaurin series for e^x to find the Maclaurin series for $\cosh x = \dfrac{e^x + e^{-x}}{2}$.

   (b) Use your result from above to find the Maclaurin series for $\sinh x = \dfrac{e^x - e^{-x}}{2}$.