From Yesterday

1. Without consulting your notes, organize a table that shows

   - the function
   - the first 4 non-zero terms of the Maclaurin series
   - the radius of convergence
   - a column to be used later.

   for these functions:

Function	Maclaurin series	radius of convergence	one more column
e^x			
$\sin(x)$			
$\cos(x)$			
$\frac{1}{1-x}$			
$\frac{1}{1+x}$			
$\ln(1+x)$			
$\frac{1}{1+x^2}$			
$\arctan(x)$			

2. These are converging Maclaurin series. For each series:

   - Identify the function.
   - Identify the value of x.
   - Find the sum.

   (a) $1+1+\frac{1}{2!}+\frac{1}{3!}+\frac{1}{4!}+\ldots$

   (b) $1-\frac{1}{3}+\frac{1}{3^2}-\frac{1}{3^3}+\ldots$

   (c) $\frac{1}{2!}-\frac{1}{3!}+\frac{1}{4!}-\frac{1}{5!}+\ldots$

   (d) $1-\frac{1}{2}+\frac{1}{3}-\frac{1}{4}+\ldots$

   (e) $1-\frac{1}{3!}+\frac{1}{5!}-\frac{1}{7!}+\ldots$

   (f) $1-\frac{1}{3}+\frac{1}{5}-\frac{1}{7}+\ldots$

3. For what values of x does this power series

$$\sum_{k=1}^{\infty} \frac{kx^k}{3^k}$$

converge. Explain your reasoning.

4. How many terms of the Maclaurin series for $\ln(1+x)$ are needed to estimate $\ln(1.5)$ to within 0.0001? [No calculators...]

5. Add a column to your table in question 1 to show sigma notation for each function. For example the series for e^x would be:

$$\sum_{k=0}^{\infty} \frac{x^k}{k!}$$

Note that *zero factorial* has a defined value of 1.

New Questions

6. Find the Taylor series for $f(x) = \ln(x)$ when $a = 1$.
   (a) Demonstrate how to do this by *brute force*, taking the derivatives of $\ln(x)$ at $x = 1$.
   (b) Demonstrate how to do this starting with the relationship of $f(x) = \dfrac{1}{1-x}$ and a simple converging geometric series.

7. If $f(x)$ is an odd function then $\displaystyle\int_{-a}^{a} f(x)\,dx = 0$.
   (a) Draw a graph and explain why.
   (b) Use the algebraic definition of an odd function to explain why.
   Hint: Consider $G(x) = \displaystyle\int_{0}^{x} f(t)\,dt$. What do you need to show about $G(x)$?

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