Math 156 Applied Honors Calculus II Fall 2009

hw11 , due: Wednesday, December 9

section 12.8 (power series) page 789 / 4 , 7 , 10 , 29 , 32

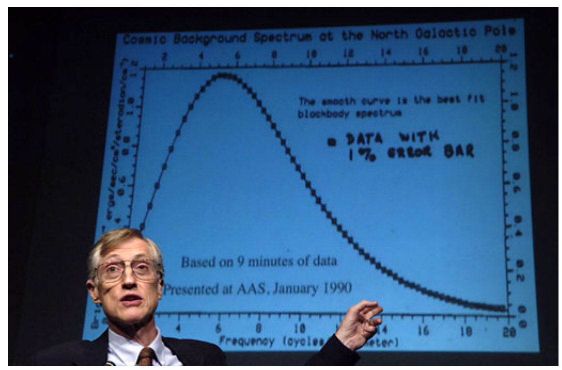
(hint: for 789/32, use $n = 0, 1, 2, 3$; sketch the functions on the interval $-2 \le x \le 2$; you may check your sketch by plotting the functions with Maple or a graphing calculator)

section 12.9 (series representations) page 795 / 3 , 30 , 32 , 37

(note: in 795/3, the power series should be centered at $a = 0$)

section 12.12 (applications of series; applied project) page 821 / 1 , 2 , 3

(hint: for 821/2, use the 1st order Taylor approximation $e^x \approx 1 + x$; for 821/3, sketch the functions for $\lambda \ge 0$; you may check your sketch using Maple or a graphing calculator)



This exercise concerns the formula for the energy density of blackbody radiation, $f(\lambda)$. As stated in the text, the 19th century Rayleigh-Jeans formula was corrected by Max Planck in 1900 (the story is explained in the article, "Max Planck: the Reluctant Revolutionary"; to find the article, Google the title). In 2006, John Mather and George Smoot shared the Nobel Prize in Physics "for their discovery of the blackbody form and anisotropy of the cosmic microwave background radiation" which confirms the big bang theory of the origin of the Universe. The photo shows John Mather with a plot of the experimental data for $f(\lambda)$; the data compares well with Planck's formula, which you are asked to sketch in problem 821/3.

1. For each series given below, make a table with three columns. column 1: n, column 2: s_n, column 3: $|s - s_n|$, where s is the sum of the series, s_n is the nth partial sum, and $|s - s_n|$ is the error. Fill in the table for $n = 0, 1, 2, 3, 4, 5$. Which series converges most rapidly?

a) $\displaystyle\sum_{n=0}^{\infty} \frac{1}{n!}$ b) $\displaystyle\sum_{n=0}^{\infty} \frac{(-1)^n}{n!}$ c) $\displaystyle\sum_{n=0}^{\infty} \frac{2^n}{n!}$

2. Let $f(x) = \sqrt{x}$. We know that $f(9) = \sqrt{9} = 3$. Find an approximate value for $\sqrt{10}$ by evaluating $T_1(10)$, where $T_1(x)$ is the 1st degree Taylor polynomial for $f(x) = \sqrt{x}$ about $x = 9$. Repeat for the 2nd and 3rd degree Taylor polynomials. Also find $\sqrt{10}$ using a calculator. Do the Taylor approximations become more accurate as the order increases?

announcements

1. The online teaching evaluations will be available from Friday Dec 4 to Tuesday Dec 15. Please complete the evaluations - they provide valuable feedback from students to instructors.

2. The final exam is on Thursday, December 17, 8-10am, in room 140 Lorch. The exam will cover the entire course. The review sheet will be distributed one week before the exam. Calculators are not allowed on the exam. You may use two sheets of notes (e.g. two sides of one page). We will supply the exam booklets.