Goal Evaluate more complicated sums with the aid of known Taylor series. Evaluate limits using Taylor series.

Problems to hand in

Find the **sum** of each of the following series (which do converge). Simplify.

1. $1-\frac{1}{3}+\frac{1}{5}-\frac{1}{7}+\frac{1}{9}-\dots$
2. $\sum_{n=0}^{\infty}\frac{(-1)^n\ \pi^{2n+1}}{9^n\ (2n)!}$
3. $-\frac{\pi^3}{3!}+\frac{\pi^5}{5!}-\frac{\pi^7}{7!}+\frac{\pi^9}{9!}-\dots$
4. $-\frac{1}{3}+\frac{1}{5}-\frac{1}{7}+\frac{1}{9}-\dots$
5. $-1+\frac{1}{2}-\frac{1}{3}+\frac{1}{4}-\frac{1}{5}+\frac{1}{6}-\dots$
6. $\sum_{n=0}^{\infty}\frac{(-1)^n\,(\ln 8)^n}{3^{n+1}\ n!}$
7. $\sum_{n=0}^{\infty}\frac{(-1)^n\ \pi^{2n}}{(36)^n\ (2n+1)!}$
8. $\frac{1}{6}-\frac{1}{2(6)^2}+\frac{1}{3(6)^3}-\frac{1}{4(6)^4}+\dots$
9. $1-e+\frac{e^2}{2!}-\frac{e^3}{3!}+\frac{e^4}{4!}-\frac{e^5}{5!}+\dots$
10. $-\frac{\pi^2}{2!}+\frac{\pi^4}{4!}-\frac{\pi^6}{6!}+\frac{\pi^8}{8!}-\dots$
11. $\sum_{n=0}^{\infty}\frac{(-1)^n\ \pi^{2n}}{(2n)!}$
12. $\sum_{n=0}^{\infty}\frac{1}{e^n}$
13. $\sum_{n=0}^{\infty}\frac{(-1)^{n+1}\ 2^{n+1}\ (\ln 9)^n}{n!}$
14. $4-\frac{4}{3}+\frac{4}{5}-\frac{4}{7}+\frac{4}{9}-\dots$
15. $\sum_{n=0}^{\infty}\frac{e^6\ (x-6)^n}{n!}$ (answer will be in x)
16. $\sum_{n=0}^{\infty}\frac{(-1)^{n+1}\ \pi^{2n+1}}{9\ (2n)!}$
17. $\sum_{n=0}^{\infty}\frac{1}{3!\ \pi^n}$
18. $-\pi+\frac{\pi^3}{3!}-\frac{\pi^5}{5!}+\dots$
19. $1+1-\frac{1}{3}+\frac{1}{5}-\frac{1}{7}+\dots$
20. $2-1+\frac{2}{3}-\frac{2}{4}+\frac{2}{5}-\dots$
21. $\frac{1}{2!}-\frac{1}{3!}+\frac{1}{4!}-\frac{1}{5!}+\dots$
22. $\sum_{n=0}^{\infty}\frac{(-1)^n\pi^{2n+1}}{\left(\sqrt{2}\right)^{4n}(2n)!}$

23. Use Series to Compute $\lim_{x\to 0}\frac{xe^x-\arctan x}{\ln(1+5x)-5x}$. Check your answer using L'Hôpital's Rule.