1. Compute
$$\sum_{n=0}^{\infty} \frac{\pi^n}{4^n}$$

2. Compute
$$\sum_{n=0}^{\infty} (-1)^n \frac{1}{5^n}$$

3. Compute
$$\sum_{n=1}^{\infty} \frac{4}{(4n-3)(4n+1)}$$

4. Determine if the series converges or diverges. Justify carefully.
$$\sum_{n=1}^{\infty} 1.000001^n$$

5. Determine if the series converges or diverges. Justify carefully.
$$\sum_{n=1}^{\infty} \frac{1}{n\sqrt{n}+n+\sqrt{n}}$$

6. Determine if the series converges or diverges. Justify carefully.
$$\sum_{n=1}^{\infty} \frac{1}{3n+7}$$

7. Determine if the series converges or diverges. Justify carefully.
$$\sum_{n=1}^{\infty} \frac{n^2+2n+1}{10n^3+3n^2+4n-1}$$

8. Determine if the series converges or diverges. Justify carefully.
$$\sum_{n=1}^{\infty} (2n!)e^{-n/2}$$

9. Determine if the series converges or diverges. Justify carefully.
$$\sum_{n=1}^{\infty} \frac{3}{\sqrt{n^2+n+3}}$$

10. Determine if the series converges or diverges. Justify carefully.
$$\sum_{n=1}^{\infty} \frac{(n!)^2}{(2n+1)!}$$

11. Determine if the series converges or diverges. Justify carefully.
$$\sum_{n=1}^{\infty} \tan(\frac{1}{n^2})$$

12. Determine if the series converges absolutely, converges, or diverges. Justify carefully.
$$\sum_{n=1}^{\infty} (-1)^n \frac{n^3}{3^n}$$

13. Determine if the series converges absolutely, converges, or diverges. Justify carefully.
$$\sum_{n=1}^{\infty} (-1)^n (\sqrt[3]{n+1} - \sqrt[3]{n})$$

14. Determine if the series converges absolutely, converges, or diverges. Justify carefully.
$$\sum_{n=1}^{\infty} \frac{\cos(\frac{n\pi}{2})}{n}$$

15. Determine if the series converges absolutely, converges, or diverges. Justify carefully.
$$\sum_{n=1}^{\infty} \frac{\sin n}{n^2}$$

16. How many terms do you need to add to get a number that is within 0.0001 of the infinite sum for
$$\sum_{n=0}^{\infty} \frac{(-1)^n}{(4n+3)^3}$$

17. How many terms do you need to add to get a number that is within 0.01 of the infinite sum for
$$\sum_{n=0}^{\infty} \frac{(-1)^n}{n^2+7}$$

18. How many terms do you need to add to get a number that is within 0.0001 of the infinite sum for
$$\sum_{n=0}^{\infty} \frac{1}{3n+1}$$
Explain your answer.

19. Find the interval of convergence and the radius of convergence for
$$\sum_{n=0}^{\infty} \frac{\sqrt{n}x^n}{5^n}$$

20. Find the interval of convergence and the radius of convergence for
$$\sum_{n=0}^{\infty} \frac{(-1)^n}{(2n)!} x^{2n}$$

21. Find the interval of convergence and the radius of convergence for
$$\sum_{n=0}^{\infty} n^2 x^n$$

22. Find the interval of convergence and the radius of convergence for
$$\sum_{n=0}^{\infty} \frac{(x-2)^n}{n+1}$$

23. Find the interval of convergence and the radius of convergence for
$$\sum_{n=0}^{\infty} n! x^n$$

24. Find the interval of convergence and the radius of convergence for
$$\sum_{n=0}^{\infty} \frac{2n+1}{2^n+3^n}(x-1)^n$$

25. Compute the derivative of the power series and compare the intervals of convergence of the series and its derivative.
$$\sum_{n=1}^{\infty} \frac{(x-2)^n}{n}$$

26. Compute the derivative of the power series and compare the intervals of convergence of the series and its derivative.
$$\sum_{n=0}^{\infty} \frac{x^n}{n!}$$

27. Find the power series for the function $\sqrt[3]{(1+x)^4}$ expanded about $x = 0$.

28. Find the power series for the function $\sqrt[5]{(1+x)^6}$ expanded about $x = 0$.

29. Find the power series for the function $\left(\frac{1}{x+2}\right)^3$ expanded about $x = 0$.

30. Find the third degree Maclaurin polynomial for the function $f(x) = \tan x$.

31. Find the fourth degree Taylor polynomial for the function $\ln x$ expanded about $x = 1$.

32. Devire the Taylor series for $\sin x$ expanded about $x = 0$.

33. Derive the Maclaurin series for e^x.

34. Use the error term for the the Maclaurin series for e^x to estimate how close $1+x+x^2/2$ is to e^x if $-0.1 \le x \le 0.1$.

35. What degree Maclaurin polynomial does one need in order to approximate $\cos x$ to within 0.00005 for $0 \le x \le 0.5$?

36. What degree Maclaurin polynomial does one need in order to approximate e^x to within 0.000005 for $-1 \le x \le 1$?

37. Derive the power series for $\tan x$ (expand about $x = 0$). Use this to compute the sum of the series
$$1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + \dots$$

38. Derive the Maclaurin series for $\ln(1+x)$. Use this to compute the sum of the series
$$1 - \frac{1}{2} + \frac{1}{3} - \frac{1}{4} + \dots$$