1. Determine if the following sequence is convergent \( \{ \frac{ln(2 + e^n)}{3n} \} \).

2. Determine if the following sequence is convergent \( \{ \frac{(-3)^n}{n!} \} \).

3. Determine if the following sequence is convergent \( \{ \frac{n^3}{n!} \} \).

4. Determine if the following sequence is convergent \( \{ \frac{1 \cdot 3 \cdot 5 \cdots (2n-1)}{(2n)^n} \} \).

5. Determine if the following sequence is convergent. If so, find its limit.

6. The Fibonacci sequence is defined by \( f_1 = 1, \ f_2 = 1, \ f_n = f_{n-1} + f_{n-2} \ for \ n \geq 3 \). Let \( a_n = \frac{f_{n+1}}{f_n} \) and show \( a_{n-1} = 1 + \frac{1}{a_{n-2}} \). Assuming that \( a_n \) is convergent, find its limit.

7. Show that the sequence \( a_1 = 2, \ a_{n+1} = \frac{1}{3 - a_n} \ for \ n \geq 1 \), satisfies \( 0 < a_n \leq 2 \) and is decreasing. Deduce that the sequence is convergent, and find its limit.

8. A sequence is defined recursively by \( a_1 = 1, \ a_{n+1} = 1 + \frac{1}{1 + a_n} \ for \ n \geq 1 \). Find the first eight terms of the sequence. What do you notice about the odd terms and even terms? By considering the odd and even terms separately, show that \( a_n \) is convergent and find its limit.

9. Determine the sum of the series \( \sum_{n=1}^{\infty} \left( \frac{1}{\sqrt{n}} - \frac{1}{\sqrt{n+1}} \right) \).

10. Let \( a_n = \frac{2n}{3n+1} \). Determine whether \( \{a_n\} \) is convergent. Determine whether \( \sum_{n=1}^{\infty} a_n \) is convergent.

11. Determine whether the series \( 4 + \frac{8}{5} + \frac{16}{25} + \frac{32}{125} + \cdots \) is convergent or divergent. If it is convergent, find its sum.

12. Determine whether the series \( \sum_{n=1}^{\infty} \left( \frac{1}{e^{2n}} \right) \) is convergent or divergent. If it is convergent, find its sum.

13. Determine whether the series \( \sum_{n=1}^{\infty} [2(0.1)^n + (0.2)^n] \) is convergent or divergent. If it is convergent, find its sum.

14. Determine whether the series \( \sum_{n=1}^{\infty} \frac{n^2}{3(n+1)(n+2)} \) is convergent or divergent. If it is convergent, find its sum.

15. Determine whether the series \( \sum_{n=1}^{\infty} \frac{1}{n(n+2)} \) is convergent or divergent. If it is convergent, find its sum.

16. Determine whether the series \( \sum_{n=1}^{\infty} \frac{1}{4n^2 - 1} \) is convergent or divergent. If it is convergent, find its sum.

17. Determine whether the series \( \sum_{n=1}^{\infty} \frac{n}{\sqrt{1+n^2}} \) is convergent or divergent. If it is convergent, find its sum.
18. Determine whether the series $\sum_{n=1}^{\infty} \frac{1}{1+2^{-n}}$ is convergent or divergent. If it is convergent, find its sum.

19. Find the values for $x$ such that the series $\sum_{n=1}^{\infty} (x-3)^n$ is convergent. Find the sum for those values of $x$.

20. Find the values for $x$ such that the series $\sum_{n=1}^{\infty} \frac{1}{x^n}$ is convergent. Find the sum for those values of $x$.

21. Find the values for $x$ such that the series $\sum_{n=1}^{\infty} \tan^n x$ is convergent. Find the sum for those values of $x$.

22. Find the sum of the series $\sum_{n=1}^{\infty} \frac{1}{1 + (4n-1)(4n-3)}$.

23. Find the sum of the series $\sum_{n=1}^{\infty} \frac{n^2 + 3n + 1}{(n^2 + n)^2}$.

24. If the $n$th partial sum of a series $\sum_{n=1}^{\infty} a_n$ is $s_n = \frac{n-1}{n+1}$ find $a_n$ and $\sum_{n=1}^{\infty} a_n$.

25. If the $n$th partial sum of a series $\sum_{n=1}^{\infty} a_n$ is $s_n = 3 - n2^{-n}$ find $a_n$ and $\sum_{n=1}^{\infty} a_n$.

26. What is the value for $c$ if $\sum_{n=1}^{\infty} (1 + c)^{-n}$.

27. Suppose that $\sum_{n=1}^{\infty} a_n$, $a_n \neq 0$, is known to be convergent. Prove that $\sum_{n=1}^{\infty} \frac{1}{a_n}$ is divergent.

28. Write out the partial fraction decomposition of the function $\frac{x^4 + x^2 + 1}{(x^2 + 1)(x^2 + 4)^2}$. Do not determine the numerical values of the coefficients.

29. Write out the partial fraction decomposition of the function $\frac{19x}{(x-1)^3(4x^2 + 5x + 3)^2}$. Do not determine the numerical values of the coefficients.

30. Write out the partial fraction decomposition of the function $\frac{x^3 + x^2 + 1}{x^3 + x^2 + 2x^2}$. Do not determine the numerical values of the coefficients.

31. Evaluate the integral $\int \frac{18 - 2x - 4x^2}{x^3 + 4x^2 + x - 6} \, dx$.

32. Evaluate the integral $\int \frac{x^4}{x^4 - 1} \, dx$.

33. Evaluate the integral $\int \frac{x^3 - 2x^2 + x + 1}{x^4 + 5x^2 + 4} \, dx$. 

34. Evaluate the integral \( \int_0^4 \frac{1}{x^2 + x - 6} \, dx \).

35. Evaluate the integral \( \int_{-2}^{2} \frac{1}{x^2 - 1} \, dx \).

36. Evaluate the integral \( \int_0^\infty \frac{1}{\sqrt{x}(1 + x)} \, dx \).

37. If the infinite curve \( y = e^{-x} \), \( x \geq 0 \), is rotated about the \( x - axis \), find the area of the resulting surface.

38. Find the area of the surface obtained by rotating the curve \( x = acos^3(\theta), y = asin^3(\theta) \), \( 0 \leq \theta \leq \pi/2 \) about the \( x - axis \).

39. Set up the integral giving the surface area of the ellipsoid obtained by rotating the ellipse \( x = acos(\theta), y = bsin(\theta), a \geq b \), about the \( y - axis \).