9.2 Q's

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9.2 Exercises

See CalcChat.com for tutorial help and worked-out solutions to odd-numbered exercises.

Finding Partial Sums In Exercises 1–6, find the sequence of partial sums S_1, S_2, S_3, S_4, and S_5.

1. $1 + \frac{1}{4} + \frac{1}{9} + \frac{1}{16} + \frac{1}{25} + \cdots$
2. $\frac{1}{2 \cdot 3} + \frac{2}{3 \cdot 4} + \frac{3}{4 \cdot 5} + \frac{4}{5 \cdot 6} + \frac{5}{6 \cdot 7} + \cdots$
3. $3 - \frac{9}{2} + \frac{27}{4} - \frac{81}{8} + \frac{243}{16} - \cdots$
4. $1 + \frac{1}{2} + \frac{1}{4} + \frac{1}{6} + \frac{1}{8} + \frac{1}{10} + \cdots$
5. $\sum_{n=1}^{\infty} \frac{3}{2^{n-1}}$
6. $\sum_{n=1}^{\infty} \frac{(-1)^{n+1}}{n!}$

Verifying Divergence In Exercises 7–14, verify that the infinite series diverges.

7. $\sum_{n=0}^{\infty} \left(\frac{7}{6}\right)^n$
8. $\sum_{n=0}^{\infty} 4(-1.05)^n$
9. $\sum_{n=1}^{\infty} \frac{n}{n+1}$
10. $\sum_{n=1}^{\infty} \frac{n}{2n+3}$
11. $\sum_{n=1}^{\infty} \frac{n^2}{n^2+1}$
12. $\sum_{n=1}^{\infty} \frac{n}{\sqrt{n^2+1}}$
13. $\sum_{n=1}^{\infty} \frac{2^n+1}{2^{n+1}}$
14. $\sum_{n=1}^{\infty} \frac{n!}{2^n}$

Verifying Convergence In Exercises 15–20, verify that the infinite series converges.

15. $\sum_{n=0}^{\infty} \left(\frac{5}{6}\right)^n$
16. $\sum_{n=1}^{\infty} 2\left(-\frac{1}{2}\right)^n$
17. $\sum_{n=0}^{\infty} (0.9)^n = 1 + 0.9 + 0.81 + 0.729 + \cdots$
18. $\sum_{n=0}^{\infty} (-0.6)^n = 1 - 0.6 + 0.36 - 0.216 + \cdots$
19. $\sum_{n=1}^{\infty} \frac{1}{n(n+1)}$ (*Hint*: Use partial fractions.)
20. $\sum_{n=1}^{\infty} \frac{1}{n(n+2)}$ (*Hint*: Use partial fractions.)

Numerical, Graphical, and Analytic Analysis In Exercises 21–24, (a) find the sum of the series, (b) use a graphing utility to find the indicated partial sum S_n and complete the table, (c) use a graphing utility to graph the first 10 terms of the sequence of partial sums and a horizontal line representing the sum, and (d) explain the relationship between the magnitudes of the terms of the series and the rate at which the sequence of partial sums approaches the sum of the series.

n	5	10	20	50	100
S_n					

21. $\sum_{n=1}^{\infty} \frac{6}{n(n+3)}$
22. $\sum_{n=1}^{\infty} \frac{4}{n(n+4)}$
23. $\sum_{n=1}^{\infty} 2(0.9)^{n-1}$
24. $\sum_{n=1}^{\infty} 10\left(-\frac{1}{4}\right)^{n-1}$

Finding the Sum of a Convergent Series In Exercises 25–34, find the sum of the convergent series.

25. $\sum_{n=0}^{\infty} 5\left(\frac{2}{3}\right)^n$
26. $\sum_{n=0}^{\infty} \left(-\frac{1}{5}\right)^n$
27. $\sum_{n=1}^{\infty} \frac{4}{n(n+2)}$
28. $\sum_{n=1}^{\infty} \frac{1}{(2n+1)(2n+3)}$
29. $8 + 6 + \frac{9}{2} + \frac{27}{8} + \cdots$
30. $9 - 3 + 1 - \frac{1}{3} + \cdots$
31. $\sum_{n=0}^{\infty} \left(\frac{1}{2^n} - \frac{1}{3^n}\right)$
32. $\sum_{n=0}^{\infty} [(0.3)^n + (0.8)^n]$
33. $\sum_{n=1}^{\infty} (\sin 1)^n$
34. $\sum_{n=1}^{\infty} \frac{1}{9n^2+3n-2}$

Using a Geometric Series In Exercises 35–40, (a) write the repeating decimal as a geometric series, and (b) write its sum as the ratio of two integers.

35. $0.\overline{4}$
36. $0.\overline{36}$
37. $0.\overline{81}$
38. $0.\overline{01}$
39. $0.0\overline{75}$
40. $0.2\overline{15}$

Determining Convergence or Divergence In Exercises 41–54, determine the convergence or divergence of the series.

41. $\sum_{n=0}^{\infty} (1.075)^n$
42. $\sum_{n=0}^{\infty} \frac{3^n}{1000}$
43. $\sum_{n=1}^{\infty} \frac{n+10}{10n+1}$
44. $\sum_{n=1}^{\infty} \frac{4n+1}{3n-1}$
45. $\sum_{n=1}^{\infty} \left(\frac{1}{n} - \frac{1}{n+2}\right)$
46. $\sum_{n=1}^{\infty} \left(\frac{1}{n+1} - \frac{1}{n+2}\right)$
47. $\sum_{n=1}^{\infty} \frac{3^n}{n^3}$
48. $\sum_{n=0}^{\infty} \frac{3}{5^n}$
49. $\sum_{n=2}^{\infty} \frac{n}{\ln n}$
50. $\sum_{n=1}^{\infty} \ln\frac{1}{n}$
51. $\sum_{n=1}^{\infty} \left(1 + \frac{k}{n}\right)^n$
52. $\sum_{n=1}^{\infty} e^{-n}$
53. $\sum_{n=1}^{\infty} \arctan n$
54. $\sum_{n=1}^{\infty} \ln\left(\frac{n+1}{n}\right)$

WRITING ABOUT CONCEPTS

55. **Series** State the definitions of convergent and divergent series.
56. **Sequence and Series** Describe the difference between $\lim_{n\to\infty} a_n = 5$ and $\sum_{n=1}^{\infty} a_n = 5$.