AP Calculus BC
Spring 2014

Name: _____

Unit 5: Sequences and Series

Day 1 - Factorial Practice

Simplify and evaluate. No calculators!

1. $6!$
2. $\frac{5!}{3!}$
3. $\frac{6!}{4!}$
4. $\frac{6!}{4!2!}$
5. $\frac{5!}{2!2!}$
6. $\frac{7!}{3!2!}$
7. $\frac{6!}{(5-3)!3!}$
8. $\frac{7!}{(7-4)!4!}$
9. $\frac{4!}{(4-1)!0!}$

Simplify. (There should be no more factorials left)

10. $\frac{n!}{(n-2)!}$
11. $\frac{n!}{(n+1)!}$
12. $\frac{n!}{(n-3)!}$
13. $\frac{(2n)!}{(2n+1)!}$
14. $\frac{(2n+1)!}{(2n+3)!}$
15. $\frac{[2(n+1)]!}{(2n)!}$

Evaluate the limit.

16. $\lim_{n\to\infty}\frac{n!}{(n+1)!}$
17. $\lim_{n\to\infty}\frac{(2n+1)!}{(2n-1)!}$
18. $\lim_{n\to\infty}\frac{x^n}{n!}$

Find the derivative. No calculators. You may use factorials in your answer.

19. f^{10} of x^{10}
20. f^{15} of $3x^{15}$
21. f^{40} of $5x^{40}$

Day 2 – Sequences

1. (a) What is a sequence?
   (b) What does it mean to say that $\lim_{n\to\infty} \to a_n = 8$?
   (c) What does it mean to say that $\lim_{n\to\infty} a_n = \infty$?
2. (a) What is a convergent sequence? Give two examples.
   (b) What is a divergent sequence? Give two examples.

List the first five terms of the sequence.

3. $a_n = 1-(0.2)^n$
4. $a_n = \dfrac{n+1}{3n-1}$
5. $a_n = \dfrac{3(-1)^n}{n!}$
6. $\{2\cdot 4\cdot 6\cdot\cdots\cdots\cdot(2n)\}$
7. $a_1 = 3,\ a_{n+1} = 2a_n - 1$
8. $a_1 = 4,\ a_{n+1} = \dfrac{a_n}{a_n - 1}$

Find a formula for the general term a_n of the sequence, assuming that the pattern of the first few terms continues.

9. $\left\{\frac{1}{2},\frac{1}{4},\frac{1}{8},\frac{1}{16},\ldots\right\}$
10. $\left\{\frac{1}{2},\frac{1}{4},\frac{1}{6},\frac{1}{8},\ldots\right\}$
11. $\{2,7,12,17,\ldots\}$
12. $\left\{-\frac{1}{4},\frac{2}{9},-\frac{3}{16},\frac{4}{25},\ldots\right\}$
13. $\left\{1,-\frac{2}{3},\frac{4}{9},-\frac{8}{27},\ldots\right\}$
14. $\{5,1,5,1,5,1,\ldots\}$

Determine whether the sequence converges or diverges. If it converges, find the limit.

15. $a_n = n(n-1)$
16. $a_n = \dfrac{n+1}{3n-1}$
17. $a_n = \dfrac{3+5n^2}{n+n^2}$
18. $a_n = \dfrac{\sqrt{n}}{1+\sqrt{n}}$
19. $a_n = \dfrac{2^n}{3^{n+1}}$
20. $a_n = \dfrac{n}{1+\sqrt{n}}$
21. $a_n = \dfrac{(-1)^{n-1}n}{n^2+1}$
22. $a_n = \dfrac{(-1)^n n^3}{n^3+2n^2+1}$
23. $a_n = \cos\left(n/2\right)$
24. $a_n = \cos\left(2/n\right)$
25. $\left\{\dfrac{(2n-1)!}{(2n+1)!}\right\}$
26. $\{\arctan 2n\}$
27. $\left\{\dfrac{e^n+e^{-n}}{e^{2n}-1}\right\}$
28. $\left\{\dfrac{\ln n}{\ln 2n}\right\}$
29. $\{n^2 e^{-n}\}$
30. $\{n\cos n\pi\}$
31. $a_n = \dfrac{\cos^2 n}{2^n}$
32. $a_n = \ln(n+1) - \ln n$
33. $a_n = n\sin\left(1/n\right)$
34. $a_n = \sqrt{n} - \sqrt{n^2-1}$
35. $a_n = \left(1+\dfrac{2}{n}\right)^{1/n}$
36. $a_n = \dfrac{\sin 2n}{1+\sqrt{n}}$
37. $\{0,1,0,0,1,0,0,0,1,\ldots\}$
38. $\left\{\frac{1}{1},\frac{1}{3},\frac{1}{2},\frac{1}{4},\frac{1}{3},\frac{1}{5},\frac{1}{4},\frac{1}{6},\ldots\right\}$
39. $a_n = \dfrac{n!}{2^n}$
40. $a_n = \dfrac{(-3)^n}{n!}$

Day 3 – Series

1. (a) What is the difference between a sequence and a series?

   (b) What is a convergent series? What is a divergent series?

2. Explain what it means to say that $\sum_{n=1}^{\infty} a_n = 5$.

3. Let $a_n = \dfrac{2n}{3n+1}$

   (a) Determine whether $\{a_n\}$ is convergent

   (b) Determine whether $\sum_{n=1}^{\infty} a_n$ is convergent.

Determine whether the series is convergent or divergent. If it is convergent, find its sum.

4. $3+2+\dfrac{4}{3}+\dfrac{8}{9}+\ldots$

5. $\dfrac{1}{8}-\dfrac{1}{4}+\dfrac{1}{2}-1+\ldots$

6. $-2+\dfrac{5}{2}-\dfrac{25}{8}+\dfrac{125}{32}-\ldots$

7. $1+0.4+0.16+0.064+\ldots$

8. $\sum_{n=1}^{\infty} 5\left(\dfrac{2}{3}\right)^{n-1}$

9. $\sum_{n=1}^{\infty} \dfrac{(-6)^{n-1}}{5^{n-1}}$

10. $\sum_{n=1}^{\infty} \dfrac{(-3)^{n-1}}{4^n}$

11. $\sum_{n=0}^{\infty} \dfrac{1}{\left(\sqrt{2}\right)^n}$

12. $\sum_{n=0}^{\infty} \dfrac{\pi^n}{3^{n+1}}$

13. $\sum_{n=1}^{\infty} \dfrac{e^n}{3^{n-1}}$

14. $\sum_{n=1}^{\infty} \dfrac{n}{n+5}$

15. $\sum_{n=1}^{\infty} \dfrac{3}{n}$

16. $\sum_{n=2}^{\infty} \dfrac{2}{n^2-1}$

17. $\sum_{n=1}^{\infty} \dfrac{(n+1)^2}{n(n+2)}$

18. $\sum_{n=2}^{\infty} \dfrac{n^2}{n^2-1}$

19. $\sum_{n=1}^{\infty} \dfrac{2}{n^2+4n+3}$

20. $\sum_{n=1}^{\infty} \dfrac{3^n+2^n}{6^n}$

21. $\sum_{n=1}^{\infty} \left[(0.8)^{n-1}-(0.3)^n\right]$

22. $\sum_{n=1}^{\infty} \sqrt[n]{2}$

23. $\sum_{n=1}^{\infty} \ln\left(\dfrac{n}{2n+5}\right)$

24. $\sum_{n=1}^{\infty} \arctan n$

25. $\sum_{n=1}^{\infty} (\cos 1)^n$

26. $\sum_{n=1}^{\infty} \left(\dfrac{3}{n(n+3)}+\dfrac{5}{4^n}\right)$

27. $\sum_{n=1}^{\infty} \left(\dfrac{3}{5^n}+\dfrac{2}{n}\right)$

Day 4 - Integral/P-Series Test

1. Draw a picture to show that

$$\sum_{n=2}^{\infty}\frac{1}{n^{13}} < \int_{1}^{\infty}\frac{1}{x^{13}}\,dx$$

What can you conclude about the series?

2. Suppose *f* is a continuous positive decreasing function for $x \geq 1$ and $a_n = f(n)$. By drawing a picture, rank the following three quantities in increasing order:

$$\int_{1}^{6} f(x)dx \qquad \sum_{i=1}^{5} a_i \qquad \sum_{i=2}^{6} a_i$$

Use the Integral Test to determine whether the series is convergent or divergent.

3. $\sum_{n=1}^{\infty}\frac{1}{n^4}$

4. $\sum_{n=1}^{\infty}\frac{1}{\sqrt[4]{n}}$

5. $\sum_{n=1}^{\infty}\frac{1}{3n+1}$

6. $\sum_{n=1}^{\infty}e^{-n}$

7. $\sum_{n=1}^{\infty}ne^{-n}$

8. $\sum_{n=1}^{\infty}\frac{n+2}{n+1}$

Determine whether the series is convergent or divergent.

9. $\sum_{n=1}^{\infty}\frac{2}{n^{0.85}}$

10. $\sum_{n=1}^{\infty}\left(n^{-1.4}+3n^{-1.2}\right)$

11. $1+\frac{1}{8}+\frac{1}{27}+\frac{1}{64}+\frac{1}{125}+\ldots$

12. $1+\frac{1}{2\sqrt{2}}+\frac{1}{3\sqrt{3}}+\frac{1}{4\sqrt{4}}+\frac{1}{5\sqrt{5}}+\ldots$

13. $\sum_{n=1}^{\infty}\frac{5-2\sqrt{n}}{n^3}$

14. $\sum_{n=3}^{\infty}\frac{5}{n-2}$

15. $\sum_{n=1}^{\infty}\frac{1}{n^2+4}$

16. $\sum_{n=1}^{\infty}\frac{3n+2}{n(n+1)}$

17. $\sum_{n=1}^{\infty}\frac{n}{n^2+1}$

18. $\sum_{n=1}^{\infty}\frac{1}{n^2-4n+5}$

19. $\sum_{n=1}^{\infty}ne^{-n^2}$

20. $\sum_{n=1}^{\infty}\frac{\ln n}{n^2}$

21. $\sum_{n=2}^{\infty}\frac{1}{n\ln n}$

22. $\sum_{n=1}^{\infty}\frac{n}{n^4+1}$

BONUS (THESE ARE HARD!!)

23. $\sum_{n=1}^{\infty}\frac{1}{n^3+n}$ (use non-linear partial fractions)

24. $\sum_{n=3}^{\infty}\frac{1}{n\ln n\ln(\ln n)}$

25-26: Find the values of *p* for which the series is convergent.

25. $\sum_{n=2}^{\infty}\frac{1}{n(\ln n)^p}$

26. $\sum_{n=1}^{\infty}\frac{1}{n\ln n[\ln(\ln n)]^p}$

Day 5 - Review for Quick Quiz 1

Sequences, Geometric Series, Test for Divergence, Telescoping, Integral and P-Series Tests

I. Sequences – Find the limit of the sequence or explain why it does not exist.

1. $a_k = \left(\frac{-3}{2}\right)^k$ 2. $a_k = \left(\frac{\sqrt{26}}{17}\right)^k$ 3. $\left\{\frac{k^2}{k^2+1}\right\}$ 4. $\left\{\frac{k!}{(k+1)!}\right\}$ 5. $a_k = \ln\left(\frac{k}{k+1}\right)$

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II. Series – Do the following converge or diverge? WHY – what test or logic did you use?

6. $\sum_{n=0}^{\infty} \frac{n+1}{2n+1}$ 7. $\sum_{j=0}^{\infty} (\ln 2)^j$ 8. $\sum_{n=2}^{\infty} \frac{2}{n^2-1}$ 9. $\frac{1}{100} + \frac{1}{200} + \frac{1}{300} + \ldots$

CV / DV CV / DV CV / DV CV / DV

Why? _____ Why? _____ Why? _____ Why? _____

_____ _____ _____ _____

10. $\sum_{k=1}^{\infty} k^{-11/10}$ 11. $\sum_{k=2}^{\infty} \frac{2}{k \ln k}$ 12. $\sum_{k=1}^{\infty} \frac{\tan^{-1} k}{1+k^2}$ 13. $\sum_{k=1}^{\infty} \frac{9}{k(k+3)}$

CV / DV CV / DV CV / DV CV / DV

Why? _____ Why? _____ Why? _____ Why? _____

_____ _____ _____ _____

14. What is the sum of the series $\frac{3}{2}-\frac{3}{8}+\frac{3}{32}-\frac{3}{128}+\ldots$?

$(A)\ \frac{6}{7}$ $(B)\frac{9}{8}$ $(C)\frac{6}{5}$ $(D)\frac{15}{8}$ $(E)\,2$

15.

$$\sum_{k=0}^{\infty}\left(\sin\left(\frac{\pi}{6}\right)\right)^{k} =$$

$(A)\ 1$ $(B)\,2$ $(C)\frac{1}{1-\frac{\sqrt{3}}{2}}$ $(D)\frac{\frac{\sqrt{3}}{2}}{1-\frac{\sqrt{3}}{2}}$ (E)*Does not converge*

16.

$$\sum_{n=1}^{\infty}\left(\frac{1}{2}\right)^{2n} =$$

$(A)\frac{1}{3}$ $(B)\frac{1}{2}$ $(C)1$ $(D)\,2$ $(E)\infty$

17. Which of the following series are convergent?

(A) I only
(B) II only
(C) I and II only
(D) II and III only
(E) I, II, and III

I. $1+\frac{1}{2\sqrt{2}}+\frac{1}{3\sqrt{3}}+\ldots$

II. $\frac{1}{1\bullet 2}+\frac{1}{2\bullet 3}+\frac{1}{3\bullet 4}+\ldots$

III. $1+\frac{1}{2}+\frac{1}{3}+\frac{1}{4}+\ldots$

18.

$$\sum_{k=0}^{\infty}\left(\frac{-\pi}{3}\right)^{k} =$$

$(A)\frac{1}{1-\frac{\pi}{3}}$ $(B)\ \frac{\frac{\pi}{3}}{1-\frac{\pi}{3}}$ $(C)\frac{3}{3+\pi}$ $(D)\frac{\pi}{3+\pi}$ $(E)\,$*Does not converge*

Remember, the only two that tell you what the sum IS are geometric and telescoping (partial fractions)…the others only indicate CV or DV!

Determine whether the series converges of diverges. There may be more than one correct way to determine convergence or divergence of a given series.

1. $\sum_{n=1}^{\infty} \frac{5}{n+1}$

2. $\sum_{n=1}^{\infty} \frac{3}{\sqrt{n}}$

3. $\sum_{n=2}^{\infty} \frac{\ln n}{n}$

4. $\sum_{n=1}^{\infty} \frac{1}{2n-1}$

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

6. $\sum_{n=1}^{\infty} \frac{1}{(\ln 3)^n}$

7. $\sum_{n=1}^{\infty} n \sin\left(\frac{1}{n}\right)$

Find the sum of the telescoping series.

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

9. $\sum_{n=1}^{\infty} \frac{6}{(2n-1)(2n+1)}$

10. $\sum_{n=1}^{\infty} \left(\frac{1}{\sqrt{n}} - \frac{1}{\sqrt{n+1}}\right)$

Day 6 - Direct and Limit Comparison Tests

1. Suppose $\sum a_n$ and $\sum b_n$ are series with positive terms and $\sum b_n$ is known to be convergent.
   (a) If $a_n > b_n$ for all *n*, what can you say about $\sum a_n$? Why?
   (b) If $a_n < b_n$ for all *n*, what can you say about $\sum a_n$? Why?
2. Suppose $\sum a_n$ and $\sum b_n$ are series with positive terms and $\sum b_n$ is known to be divergent.
   (a) If $a_n > b_n$ for all *n*, what can you say about $\sum a_n$? Why?
   (b) If $a_n < b_n$ for all *n*, what can you say about $\sum a_n$? Why?

Determine whether the series converges or diverges.

3. $\sum_{n=1}^{\infty} \frac{1}{n^2+n+1}$
4. $\sum_{n=1}^{\infty} \frac{2}{n^3+4}$
5. $\sum_{n=1}^{\infty} \frac{5}{2+3^n}$
6. $\sum_{n=1}^{\infty} \frac{1}{n-\sqrt{n}}$
7. $\sum_{n=1}^{\infty} \frac{n+1}{n^2}$
8. $\sum_{n=1}^{\infty} \frac{4+3^n}{2^n}$
9. $\sum_{n=1}^{\infty} \frac{\cos^2 n}{n^2+1}$
10. $\sum_{n=1}^{\infty} \frac{n^2-1}{3n^4+1}$
11. $\sum_{n=1}^{\infty} \frac{n^2+1}{n^3-1}$
12. $\sum_{n=0}^{\infty} \frac{1+\sin n}{10^n}$
13. $\sum_{n=1}^{\infty} \frac{n-1}{n4^n}$
14. $\sum_{n=1}^{\infty} \frac{\sqrt{n}}{n-1}$
15. $\sum_{n=1}^{\infty} \frac{2+(-1)^n}{n\sqrt{n}}$
16. $\sum_{n=1}^{\infty} \frac{1}{\sqrt{n^3+1}}$
17. $\sum_{n=1}^{\infty} \frac{1}{\sqrt{n^2+1}}$
18. $\sum_{n=1}^{\infty} \frac{1}{2n+3}$
19. $\sum_{n=1}^{\infty} \frac{2^n}{1+3^n}$
20. $\sum_{n=1}^{\infty} \frac{1+2^n}{1+3^n}$
21. $\sum_{n=1}^{\infty} \frac{1}{1+\sqrt{n}}$
22. $\sum_{n=1}^{\infty} \frac{n+2}{(n+1)^3}$
23. $\sum_{n=1}^{\infty} \frac{5+2n}{(1+n^2)^2}$
24. $\sum_{n=1}^{\infty} \frac{n^2-5n}{n^3+n+1}$
25. $\sum_{n=1}^{\infty} \frac{1+n+n^2}{\sqrt{1+n^2+n^6}}$
26. $\sum_{n=1}^{\infty} \frac{n+5}{\sqrt[3]{n^7+n^2}}$
27. $\sum_{n=1}^{\infty} \left(1+\frac{1}{n}\right)^2 e^{-n}$
28. $\sum_{n=1}^{\infty} \frac{2n^2+7n}{3^n\left(n^2+5n-1\right)}$
29. $\sum_{n=1}^{\infty} \frac{1}{n!}$
30. $\sum_{n=1}^{\infty} \frac{n!}{n^n}$
31. $\sum_{n=1}^{\infty} \sin\frac{1}{n}$
32. $\sum_{n=1}^{\infty} \frac{1}{n^{1+1/n}}$

Day 7 - Alternating Series

1. (a) What is an alternating series?
   (b) Under what conditions does an alternating series converge?
   (c) If these conditions are satisfied, what can you say about the remainder after n terms?

Test the series for convergence or divergence.

2. $-\frac{1}{3}+\frac{2}{4}-\frac{3}{5}+\frac{4}{6}-\frac{5}{7}+\ldots$

3. $\frac{4}{7}-\frac{4}{8}+\frac{4}{9}-\frac{4}{10}+\frac{4}{11}-\ldots$

4. $\frac{1}{\ln 2}-\frac{1}{\ln 3}+\frac{1}{\ln 4}-\frac{1}{\ln 5}+\frac{1}{\ln 6}-\ldots$

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

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

7. $\sum_{n=1}^{\infty}(-1)^n\frac{3n-1}{2n+1}$

8. $\sum_{n=1}^{\infty}(-1)^n\frac{2n}{4n^2+1}$

9. $\sum_{n=1}^{\infty}\frac{(-1)^{n+1}}{4n^2+1}$

10. $\sum_{n=1}^{\infty}(-1)^n\frac{\sqrt{n}}{1+2\sqrt{n}}$

11. $\sum_{n=1}^{\infty}(-1)^n\frac{n^2}{n^3+4}$

12. $\sum_{n=1}^{\infty}(-1)^n\frac{e^{1/n}}{n}$

13. $\sum_{n=1}^{\infty}(-1)^n\frac{n}{\ln n}$

14. $\sum_{n=1}^{\infty}(-1)^{n-1}\frac{\ln n}{n}$

15. $\sum_{n=1}^{\infty}\frac{\cos n\pi}{n^{3/4}}$

16. $\sum_{n=1}^{\infty}\frac{\sin\left(n\pi/2\right)}{n!}$

17. $\sum_{n=1}^{\infty}(-1)^n\sin\left(\frac{\pi}{n}\right)$

18. $\sum_{n=1}^{\infty}(-1)^n\cos\left(\frac{\pi}{n}\right)$

19. $\sum_{n=1}^{\infty}(-1)^n\frac{n^n}{n!}$

20. $\sum_{n=1}^{\infty}\left(-\frac{n}{5}\right)^n$

Day 8 - Absolute and Conditional Convergence

1. What can you say about the series $\sum a_n$ in each of the following cases?

(a) $\lim_{n\to\infty}\left|\frac{a_{n+1}}{a_n}\right| = 8$ (b) $\lim_{n\to\infty}\left|\frac{a_{n+1}}{a_n}\right| = 0.8$ (c) $\lim_{n\to\infty}\left|\frac{a_{n+1}}{a_n}\right| = 1$

Determine whether the series is absolutely convergent, conditionally convergent, or divergent.

2. $\sum_{n=1}^{\infty}\frac{n^2}{2^n}$

3. $\sum_{n=1}^{\infty}\frac{(-10)^n}{n!}$

4. $\sum_{n=1}^{\infty}(-1)^{n-1}\frac{2^n}{n^4}$

5. $\sum_{n=1}^{\infty}\frac{(-1)^{n+1}}{\sqrt[4]{n}}$

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

7. $\sum_{n=1}^{\infty}(-1)^n\frac{n}{5+n}$

8. $\sum_{n=1}^{\infty}(-1)^{n-1}\frac{n}{n^2+1}$

9. $\sum_{n=1}^{\infty}\frac{1}{(2n)!}$

10. $\sum_{n=1}^{\infty}e^{-n}n!$

11. $\sum_{n=1}^{\infty}\frac{(-1)^n e^{1/n}}{n^3}$

12. $\sum_{n=1}^{\infty}\frac{\sin 4n}{4^n}$

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

14. $\sum_{n=1}^{\infty}(-1)^{n+1}\frac{n^2 2^n}{n!}$

15. $\sum_{n=1}^{\infty}\left(\frac{10^n}{(n+1)4^{2n+1}}\right)$

16. $\sum_{n=1}^{\infty}\frac{3-\cos n}{n^{\frac{2}{3}}-2}$

17. $\sum_{n=2}^{\infty}\frac{(-1)^n}{\ln n}$

18. $\sum_{n=1}^{\infty}\frac{n!}{n^n}$

19. $\sum_{n=1}^{\infty}\frac{\cos(n\pi/3)}{n!}$

20. $\sum_{n=2}^{\infty}\frac{(-1)^n}{(\ln n)^n}$

21. $\sum_{n=1}^{\infty}\frac{n^n}{3^{1+3n}}$

22. $\sum_{n=2}^{\infty}\frac{(-1)^n}{n\ln n}$

23. $\sum_{n=1}^{\infty}\left(\frac{n^2+1}{2n^2+1}\right)^n$

Day 9 - All Types of Tests Mixed Up!

Test the series for convergence or divergence.

1. $\sum_{n=1}^{\infty} \frac{n^2-1}{n^2+n}$

2. $\sum_{n=1}^{\infty} \frac{n-1}{n^2+n}$

3. $\sum_{n=1}^{\infty} \frac{1}{n^2+n}$

4. $\sum_{n=1}^{\infty} (-1)^{n-1} \frac{n-1}{n^2+n}$

5. $\sum_{n=1}^{\infty} \frac{(-3)^{n+1}}{2^{3n}}$

6. $\sum_{n=1}^{\infty} \left(\frac{3n}{1+8n}\right)^n$

7. $\sum_{n=2}^{\infty} \frac{1}{n\sqrt{\ln n}}$

8. $\sum_{k=1}^{\infty} \frac{2^k k!}{(k+2)!}$

9. $\sum_{k=1}^{\infty} k^2 e^{-k}$

10. $\sum_{n=1}^{\infty} n^2 e^{-n^3}$

11. $\sum_{n=2}^{\infty} \frac{(-1)^{n+1}}{n \ln n}$

12. $\sum_{n=1}^{\infty} (-1)^n \frac{n}{n^2+25}$

13. $\sum_{n=1}^{\infty} \frac{3^n n^2}{n!}$

14. $\sum_{n=1}^{\infty} \sin n$

15. $\sum_{n=0}^{\infty} \frac{n!}{2 \cdot 5 \cdot 8 \cdot \cdots \cdot (3n+2)}$

16. $\sum_{n=1}^{\infty} \frac{n^2+1}{n^3+1}$

17. $\sum_{n=1}^{\infty} (-1)^n 2^{1/n}$

18. $\sum_{n=2}^{\infty} \frac{(-1)^{n-1}}{\sqrt{n}-1}$

19. $\sum_{n=1}^{\infty} (-1)^n \frac{\ln n}{\sqrt{n}}$

20. $\sum_{k=1}^{\infty} \frac{k+5}{5^k}$

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

22. $\sum_{n=1}^{\infty} \frac{\sqrt{n^2-1}}{n^3+2n^n+5}$

23. $\sum_{n=1}^{\infty} \tan\left(1/n\right)$

24. $\sum_{n=1}^{\infty} \frac{\cos(n/2)}{n^2+4n}$

25. $\sum_{n=1}^{\infty} \frac{n!}{e^{n^2}}$

26. $\sum_{n=1}^{\infty} \frac{n^2+1}{5^n}$

27. $\sum_{n=1}^{\infty} \frac{k \ln k}{(k+1)^3}$

28. $\sum_{n=1}^{\infty} \frac{e^{1/n}}{n^2}$

29. $\sum_{n=1}^{\infty} \frac{\tan^{-1} n}{n\sqrt{n}}$

30. $\sum_{j=1}^{\infty} (-1)^j \frac{\sqrt{j}}{j+5}$

31. $\sum_{k=1}^{\infty} \frac{5^k}{3^k+4^k}$

32. $\sum_{n=1}^{\infty} \frac{(2n)^n}{n^{2n}}$

33. $\sum_{n=1}^{\infty} \frac{\sin\left(1/n\right)}{\sqrt{n}}$

34. $\sum_{n=1}^{\infty} \frac{1}{n+n\cos^2 n}$

35. $\sum_{n=1}^{\infty} \left(\frac{n}{n+1}\right)^{n^2}$

36. $\sum_{n=1}^{\infty} \frac{1}{(\ln n)^{\ln n}}$

37. $\sum_{n=1}^{\infty} \left(\sqrt[n]{2}-1\right)^n$

38. $\sum_{n=1}^{\infty} \left(\sqrt[n]{2}-1\right)$