SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

Solve the problem.

1) What is the volume of the solid obtained by rotating the region bounded by $y = xe^x$, $y = 0$, $x = 0$, and $x = 1$ about the x–axis?

2) Evaluate $\int 2xe^x \, dx$.

3) Evaluate $\int_0^1 (xe^x)^2 \, dx$.

4) Find the area of the region R that is bounded by the curves $y = x^4$ and $y = 4^x$ for $2 \le x \le 4$.

5) Use trigonometric substitution to evaluate $\int \frac{x}{\sqrt{1 - x^2}} \, dx$.

6) Use trigonometric substitution to evaluate $\int \frac{4x^2}{x^4 - 1} \, dx$.

7) Use trigonometric substitution to evaluate $\int \frac{x}{\sqrt{x^2 + 9}} \, dx$.

8) Evaluate $\int \frac{2x^3 - 12x - 15}{x^4 + 4x^3 + 5x^2} \, dx$.

9) Evaluate $\int \frac{3x + 5}{x^4 + x^2} \, dx$.

10) Evaluate $\int \frac{x^5 + 1}{x^2} \, dx$.

11) Given $\int \frac{x - 2}{x^3 - x^2 - 4} \, dx$, factor the denominator by noting a root r and then employing long division by $x - r$. Then use the method of partial fractions to aid in finding the antiderivative.

12) Determine whether $\int_{-1}^{\infty} e^{-x} \, dx$ converges or diverges. If it does converge, evaluate the integral.

13) Determine whether $\int_0^8 \frac{1}{2x\sqrt{x}} \, dx$ converges or diverges. If it does converge, evaluate the integral.

14) Determine whether $\int_0^2 \frac{x}{\sqrt{4 - x^2}} \, dx$ converges or diverges. If it converges, evaluate the integral.

15) Determine whether $\int_0^2 \frac{1}{(x-1)^{4/5}}\,dx$ converges or diverges. If it converges, evaluate the integral.

16) Find the area between the x–axis and the graph of $y = (x + 1)^{-3}$ for $x \geq 2$.

17) Write out the first five terms (beginning with n = 1) of the sequence $\{a_n\}$ where $a_1 = 1$ and $a_n = (a_{n-1})^2 - 4$ for $n \geq 2$.

18) Write out the first five terms (beginning with n = 1) of the sequence $a_n = n[9 + 8(-1)^n]$.

19) Compute the limit of the convergent sequence $\left\{\frac{3n + 5}{2n - 4}\right\}$.

20) Compute the limit of the convergent sequence $\left\{\left[1 + \frac{4}{n}\right]^n\right\}$.

21) Compute the limit of the convergent sequence $\{3^{5/n}\}$.

22) Determine whether the following series converges or diverges. If it converges, find its sum.

$$\sum_{k=1}^{\infty} 6 \cdot (0.7)^k$$

23) Determine whether the infinite series $1 + \frac{1}{2} + \frac{1}{4} + \frac{1}{2^n} + \ldots$ converges or diverges. If it converges, find its sum.

24) Determine whether the infinite series $\sum_{n=0}^{\infty} \cos^n 2$ converges or diverges. If it converges, find its sum.

25) Express the nth partial sum of the infinite series $\sum_{n=2}^{\infty} \frac{1}{n(n-1)}$ as a telescoping sum and thereby find the sum of the series if it converges.

26) A person sweeps up 1 pound of dirt from a walkway onto a shovel and drops 80% of it while carrying it over to a dumpster. She sweeps up what fell, again onto a shovel, and drops 80% of that on the way to the dumpster. This pattern continues. How many pounds of dirt will have been swept onto the shovel assuming an infinite number of sweepings?

27) Use the p–series test to determine whether the series converges or diverges. Indicate the value of p.

$$\sum_{k=1}^{\infty} \frac{35}{2k\sqrt{k}}$$

28) Use the integral test to test the series $\sum_{n=1}^{\infty} \sin\frac{1}{n}$ for convergence.

29) Use the integral test to test the series $\sum_{n=1}^{\infty} \left(\frac{1}{n} - \frac{1}{n^2}\right)$ for convergence.

30) Test the series for convergence: $\sum_{k=1}^{\infty} \frac{\sqrt{k!}}{3^k}$.

31) Test the series for convergence: $\sum_{k=1}^{\infty} \frac{2\ln k}{k}$.

32) Test the series for convergence: $\sum_{k=1}^{\infty} \frac{|\sin 2k|}{k^2}$.

33) Test the series for convergence: $\sum_{k=1}^{\infty} \frac{3k}{e^k}$.

34) Test the series for convergence: $\sum_{k=1}^{\infty} \frac{k^3}{3^k}$.

35) Test for convergence. State what convergence test you use.

(a) $\sum_{n=1}^{\infty} \frac{2^n}{n!}$ (b) $\sum_{n=1}^{\infty} 2^{-1/n}$ (c) $\sum_{n=1}^{\infty} \frac{10}{(n+1)^{3/2}}$

36) Determine whether the series $\sum_{n=1}^{\infty} \frac{n!}{(5n)!}$ converges or diverges.

1) Answer: $\frac{\pi}{4}(e^2 - 1)$
2) Answer: $2e^x(x - 1) + C$
3) Answer: $\frac{(e^2 - 1)}{4}$
4) Answer: $A \approx 25.2766$;
5) Answer: $-\sqrt{1 - x^2} + C$
6) Answer: $2\arctan x + \ln|x - 1| - \ln|x + 1| + C$
7) Answer: $\sqrt{x^2 + 9} + C$
8) Answer: $\ln|x^2 + 4x + 5| - \arctan(2 + x) + \frac{3}{x} + C$
9) Answer: $\frac{3}{2}\ln\left|\frac{x^2}{x^2 + 1}\right| - 5\arctan x - \frac{5}{x} + C$
10) Answer: $\frac{x^4}{4} - \frac{1}{x} + C$
11) Answer: $\frac{2\sqrt{7}}{7}\tan^{-1}\left(\frac{\sqrt{7}}{7}(2x + 1)\right) + C$
12) Answer: converges to e
13) Answer: diverges to ∞
14) Answer: converges to 2
15) Answer: converges to 10
16) Answer: $\frac{1}{18}$
17) Answer: 1, –3, 5, 21, 437
18) Answer: 1, 34, 3, 68, 5
19) Answer: $\frac{3}{2}$
20) Answer: e^4
21) Answer: 1
22) Answer: converges to 14
23) Answer: converges; sum is 2
24) Answer: converges; sum is $\frac{1}{1 - \cos 2}$
25) Answer: $S_n = -\frac{1}{n + 1} + 1$; 1
26) Answer: 5 pounds
27) Answer: p = 3/2; converges
28) Answer: diverges
29) Answer: diverges
30) Answer: diverges by the divergence test
31) Answer: diverges by direct comparison

32) Answer: converges by direct comparison to the p–series $\sum_{k=1}^{\infty} \frac{1}{k^2}$

33) Answer: converges by the ratio test ($L = \frac{1}{e}$)

34) Answer: converges by ratio test ($L = \frac{1}{3}$)

35) Answer: (a) converges, ratio test (b) diverges, test for divergence
(c) converges, comparison test with a p–series

36) Answer: converges