1. The limit $\lim_{n\to\infty} \sum_{i=1}^{n} \frac{\pi}{n} e^{-i\frac{\pi}{n}} \sin\left(i\,\frac{\pi}{n}\right)$ is equal to

(a) $\int_0^{\pi} e^{-x} \sin x\, dx.$

(b) $\int_0^{\pi} e^{x} \sin x\, dx.$

(c) $\int_{-\pi}^{0} e^{x} \sin x\, dx.$

(d) $\int_0^{1} e^{-x} \sin x\, dx.$

(e) $\int_0^{1} e^{x} \sin x\, dx.$

2. If $\int (\ln x)^2\, dx = x(\ln x)^2 + 2x(k - \ln x) + C$, where k and C are constants, then $k=$

(a) 1

(b) 2

(c) -1

(d) -2

(e) $\frac{1}{2}$

3. If $f(x) = \int_{\sqrt{x}}^{1} \cos(t^2)\, dt$, then $f'(x) =$

(a) $\dfrac{-\cos x}{2\sqrt{x}}$

(b) $\dfrac{-\cos x}{2x}$

(c) $\dfrac{-\sqrt{x}\,\cos x}{2}$

(d) $-\dfrac{\cos(x\,\sqrt{x})}{2\sqrt{x}}$

(e) $\dfrac{-\cos x}{x}$

4. If the velocity of a particle moving along a line is $v(t) = |t^2 - 1|$ in m/s, then the total distance travelled by the particle during the time interval $[0, 2]$ is

(a) $-\int_0^1 (t^2 - 1)\, dt + \int_1^2 (t^2 - 1)\, dt$

(b) $\int_0^1 (t^2 - 1) dt + \int_1^2 (t^2 - 1)\, dt$

(c) $\int_0^2 (t^2 - 1)\, dt$

(d) $\int_0^1 (t^2 - 1)\, dt - \int_1^2 (t^2 - 1)\, dt$

(e) $-\int_0^1 (t^2 - 1)\, dt - \int_1^2 (t^2 - 1)\, dt$

5. $\int_3^7 \frac{x}{x^2-4}\,dx =$

(a) $\ln 3$

(b) $3\ln 3$

(c) $\ln \frac{1}{3}$

(d) $3\ln \frac{1}{3}$

(e) $\frac{1}{2}\ln 3$

6. If $F(x) = \int_1^x \frac{\sin t}{t}\,dt, \qquad x > 0,$

then $\int_1^5 \frac{\sin 2t}{t}\,dt$ is

(a) $F(10) - F(2)$

(b) $F(10) - F(1)$

(c) $F(5) - F(1)$

(d) $2F(5) - F(1)$

(e) $2F(10) - 2F(1)$

7. Find the area of the region bounded by the curves

$$y = \sin x \quad \text{and} \quad y = \cos x \;\; \text{over} \;\; [0, \pi].$$

(a) $2\sqrt{2}$

(b) $\sqrt{2} + 3$

(c) $2 - \sqrt{2}$

(d) $3 + 2\sqrt{2}$

(e) $\sqrt{2} + 1$

8. Find the volume of the solid obtained by rotating the region bounded by the curves

$$y = 1 - x^2, \quad x = 0, \quad y = 0, \;\; x \geq 0\,,$$

about the line $x = 1$.

(a) $\dfrac{5\pi}{6}$

(b) $\dfrac{3\pi}{2}$

(c) $\dfrac{4\pi}{3}$

(d) $\dfrac{6\pi}{5}$

(e) $\dfrac{3\pi}{5}$

9. The average value of $f(x) = \ln x$ over the interval $[e, e^2]$ is

(a) $\dfrac{e}{e-1}$

(b) $\dfrac{e}{e+2}$

(c) $e+1$

(d) $e-1$

(e) e^2-1

10. $\int x^3 \sqrt{x^2-1}\, dx =$

(a) $\frac{1}{3}\sqrt{(x^2-1)^3} + \frac{1}{5}\sqrt{(x^2-1)^5} + C$

(b) $\frac{1}{2}x\sqrt{x^2-1} + \frac{1}{3}x\sqrt{x^2-1} + C$

(c) $\frac{1}{2}\sqrt{x^2-1} + \frac{1}{5}x^2\sqrt{x^2-1} + C$

(d) $\frac{1}{2}x\sqrt{x^2-1} + \frac{1}{5}x^2\sqrt{x^2-1} + C$

(e) $\sqrt{(x^2-1)^5} + \sqrt{(x^2-1)^7} + C$

11. $\displaystyle\int_{\ln 3}^{\ln 4} \frac{e^x}{e^{2x} - 3e^x + 2}\, dx =$

(a) $2 \ln 2 - \ln 3$

(b) $3 \ln 2 - \ln 5$

(c) $4 \ln 2 - \ln 7$

(d) $5 \ln 2 - \ln 3$

(e) $3 \ln + \ln 5$

12. The area between the curves

$$y = \frac{1}{x^2+1} \text{ and } y = \frac{-1}{x^2+1}$$

is equal to

(a) 2π

(b) $\frac{\pi}{2}$

(c) $\frac{\pi}{4}$

(d) π^2

(e) ∞

13. $\int_2^6 (x-1)\sqrt{x-2}\,dx =$

(a) $\frac{272}{15}$

(b) $\frac{28}{25}$

(c) $\frac{24}{11}$

(d) $\frac{64}{25}$

(e) $\frac{128}{15}$

14. The arc length of the curve

$$s(t) = 3 - \cosh t, \qquad -1 \le t \le 1,$$

is equal to

(a) $e - e^{-1}$

(b) $\frac{e + e^{-1}}{2}$

(c) 0

(d) 6

(e) $5\,e$

15. The sequence $\left\{\frac{e^n + n}{e^n - n}\right\}_{n\geq 1}$ is

(a) convergent and its limit is 1.

(b) convergent and its limit is 0.

(c) convergent and its limit is -1.

(d) divergent and its limit is ∞.

(e) divergent and its limit is $-\infty$.

16. The series $\sum_{n=1}^{\infty} \frac{e^{n+1} - e^n}{e^{2n+1}}$ is

(a) convergent and its sum is $\frac{1}{e}$.

(b) convergent and its sum is e.

(c) convergent and its sum is 0.

(d) convergent and its sum is $\frac{1}{e^2}$.

(e) divergent

17. What is the minimum number of **Terms** needed to estimate the sum $\sum_{n=1}^{\infty} \frac{1}{n^3}$ with an error of at most 0.0002?

(a) 50 terms

(b) 101 terms

(c) 26 terms

(d) 1001 terms

(e) 22 terms

18. Which one of the following statements is TRUE for the series $\sum_{n=1}^{\infty} \frac{1 + \ln n}{n}$ and $f(x) = \frac{1 + \ln x}{x}$?

(a) The series diverges by the Integral Test.

(b) The series converges by the Integral Test.

(c) The Integral Test is not applicable because f is increasing.

(d) The Integral Test is not applicable because f is negative.

(e) The Integral Test is not applicable because f is discontinuous.

19. The series $\sum_{n=1}^{\infty} \frac{\tan^{-1} n}{n\sqrt{n}}$ is convergent by the Comparison Test. The comparison series used is

(a) $\sum_{n=1}^{\infty} \frac{\pi}{2n\sqrt{n}}$

(b) $\sum_{n=1}^{\infty} \frac{\pi}{4n\sqrt{n}}$

(c) $\frac{\pi}{2} \sum_{n=1}^{\infty} \frac{1}{n^2}$

(d) $\sum_{n=1}^{\infty} \frac{\pi}{4n^3}$

(e) $\sum_{n=1}^{\infty} \frac{1}{\sqrt{n}}$

20. $\sum_{n=1}^{\infty} n^{-\pi}$ is

(a) a convergent, $p-$ series.

(b) a divergent, $p-$ series.

(c) a convergent, geometric series.

(d) a divergent, geometric series.

(e) a convergent, alternating series.

21. The series

$$\frac{\pi}{2}\sum_{n=0}^{\infty}\frac{(-\pi^2)^n}{4^n(2n+1)!} =$$

(Hint: Use the Maclaurin series for $\sin x$).

(a) 1

(b) -1

(c) $\frac{-\pi}{2}$

(d) $\frac{\pi}{2}$

(e) $\frac{\pi}{4}$

22. The series $\sum_{n=0}^{\infty}\frac{\cos n\pi}{n-\pi}$ is

(a) convergent.

(b) divergent by the Test for Divergence.

(c) absolutely convergent.

(d) divergent by the Ratio Test.

(e) divergent by the Alternating Series Test.

23. The series $\sum_{k=1}^{\infty} \left[\ln(2k^4+1) - \ln(k^4+1)\right]$ is

(a) divergent by the Test for Divergence.

(b) convergent.

(c) absolutely convergent.

(d) convergent by the Comparison Test.

(e) convergent by the Alternating Series Test.

24. The series $\sum_{n=1}^{\infty} \left(\frac{1-n}{1+2n}\right)^n$ is

(a) absolutely convergent.

(b) conditionally convergent.

(c) divergent by the Integral Test.

(d) divergent by the Comparison Test.

(e) divergent by the Root Test.

25. The interval of convergence of the series $\sum_{n=0}^{\infty} \frac{(x-1)^n}{n^3+1}$ is

(a) $[0, 2]$.

(b) $[0, 2)$.

(c) $(0, 2]$.

(d) $(0, 2)$.

(e) $[1, 2]$.

26. If $f^{(n)}(1) = \frac{n!}{2^n}$, $n = 0, 1, \ldots$, then $f(x) =$

(a) $\sum_{n=0}^{\infty} 2^{-n}\,(x-1)^n$

(b) $\sum_{n=0}^{\infty} 2^n\,n!\,(x-1)^n$

(c) $\sum_{n=0}^{\infty} \left(\frac{2}{x-1}\right)^n$

(d) $\sum_{n=0}^{\infty} \left(\frac{x}{2}\right)^n$

(e) $\sum_{n=0}^{\infty} \left(\frac{2}{x}\right)^n$

27. The value of $\int_0^1 e^{x^5}\,dx$ is equal to

(a) $\sum_{n=0}^{\infty} \frac{1}{(5n+1)\ n!}$

(b) $\sum_{n=0}^{\infty} \frac{5}{(5n+1)\ n!}$

(c) $\sum_{n=0}^{\infty} \frac{25}{(5n+1)\ n!}$

(d) $\sum_{n=0}^{\infty} \frac{1}{(5n+1)^6}$

(e) $\sum_{n=0}^{\infty} \frac{1}{(5n+1)!}$

28. If $e^{2x}\cos 3x = a+bx+cx^2+\ldots$, for all x, then $a+b+2c=$

(a) -2

(b) -1

(c) -3

(d) -4

(e) -5