1. $\lim_{n\to\infty} \sum_{i=1}^{n} \frac{5}{2n}\left(9+\frac{4i}{n}\right)^{1/2} =$

(a) $\frac{5}{12}\,(13\sqrt{13}-27)$

(b) $\frac{5}{12}\,(\sqrt{13}-3\sqrt{3})$

(c) $\frac{1}{12}\,(\sqrt{13}-3\sqrt{3})$

(d) $\frac{5}{12}\,(\sqrt{13}-1)$

(e) $\frac{1}{12}(1-3\sqrt{3})$

2. $\int_1^2 \frac{x^2+1}{3x-x^2}\,dx =$

(a) $-1+\frac{11}{3}\ln 2$

(b) $-3+\ln 2$

(c) $-11+\ln\frac{3}{2}$

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

(e) $2-\ln 5$

3. If $f(x) = \int_1^{e^x} (\ln t)^2 \, dt$, then $f'(\ln x) =$

(a) $x\,(\ln x)^2$

(b) $(\ln x)^2$

(c) $(x \ln x)^2$

(d) $x^2 \ln x$

(e) $\ln(x^2)$

4. $\displaystyle\int \frac{dx}{9\sqrt{x-1} + (x-1)^{3/2}} =$

(a) $\dfrac{2}{3}\tan^{-1}\left(\dfrac{\sqrt{x-1}}{3}\right) + C$

(b) $\dfrac{1}{3}\tan^{-1}\left(\sqrt{\dfrac{x}{3}}\right) + C$

(c) $\dfrac{2}{3}\tan^{-1}\left(\dfrac{\sqrt{x^2+x}}{3}\right) + C$

(d) $\dfrac{2}{3}\tan^{-1}\left(\sqrt{\dfrac{x^2-1}{3}}\right) + C$

(e) $\dfrac{1}{3}\tan^{-1}\left(\dfrac{\sqrt{x^2-1}}{3}\right) + C$

5. $\int \frac{x-1}{\sqrt{1-x^2}}\,dx =$

(a) $-\sqrt{1-x^2} - \sin^{-1} x + C$

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

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

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

(e) $-(1-x^2) - \sin^{-1} x + C$

6. The volume of the solid obtained by rotating the region enclosed by the curves $y = x^2$ and $y = -x$ about the $y-$ axis is

(a) $\frac{\pi}{6}$

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

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

(d) $\frac{2\pi}{3}$

(e) $\frac{\pi}{3}$

7. The area of the region in the first quadrant bounded on the left by the y-axis, below by the line $y = \frac{x}{4}$, above left by the curve $y = 1 + \sqrt{x}$, and above right by the curve $y = \frac{2}{\sqrt{x}}$ is:

(a) $\frac{11}{3}$

(b) 2

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

(d) $\frac{5}{3}$

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

8. A region bounded by the triangle with vertices $(0, 1)$, $(1, 0)$, and $(2, 0)$ is revolved about the x-axis. Then the volume of the resulting solid is

(a) $\frac{\pi}{3}$

(b) $\frac{\pi}{6}$

(c) $\frac{2\pi}{3}$

(d) $\pi - 1$

(e) $\pi - 2$

9. $\int_0^{\pi/4} \sec^4 x \, \tan^2 x \, dx =$

(a) $\dfrac{8}{15}$

(b) $\dfrac{2}{5}$

(c) $\dfrac{7}{15}$

(d) $\dfrac{4}{15}$

(e) $\dfrac{16}{15}$

10. $\int \dfrac{x^5}{\sqrt{1-x^4}} \, dx =$

(a) $\dfrac{\sin^{-1}(x^2)}{4} - \dfrac{x^2\sqrt{1-x^4}}{4} + C$

(b) $x^2 \sin^{-1}(x^2) - \dfrac{\sqrt{1-x^4}}{4} + C$

(c) $\sin^{-1}(x^2) + \dfrac{1}{2x^5}\sqrt{1-x^4} + C$

(d) $\sin^{-1}(x^4) - \sqrt{1-x^4} + C$

(e) $\dfrac{\sin^{-1}(x^2)}{4} - \dfrac{x^2}{4} + C$

11. $\int_0^1 \ln(x^2+1)\,dx =$

(a) $-2 + \frac{\pi}{2} + \ln\, 2$

(b) $-1 + \frac{\pi}{4} + \ln\, 2$

(c) $-1 + \frac{\pi}{3} + \ln\, 2$

(d) $-2 + \pi + \ln\, 2$

(e) $-2 + \ln\, 2$

12. The improper integral $\int_{-\infty}^0 x\,e^{4x}\,dx$

(a) converges to $-\frac{1}{16}$

(b) converges to $-\frac{1}{4}$

(c) diverges

(d) converges to $\frac{1}{4}$

(e) converges to 0

13. The limit of the n^{th} term of a sequence, given by

$$a_n = \frac{1}{n}\sin\left(\frac{n\pi}{4}\right) + \frac{3n^3 + 6n^2 + 1}{n^3 + n^2 + 4}, \text{ is equal to}$$

(a) 3

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

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

(d) $\sqrt{3}$

(e) 9

14. The sum of $\sum_{n=2}^{\infty} 2^{n+1} \cdot 9^{\frac{1-n}{2}}$ is

(a) 8

(b) 1

(c) $\frac{2}{3}$

(d) $\frac{4}{3}$

(e) $\frac{2}{9}$

15. The number of terms of the series $\sum_{n=2}^{\infty} \frac{1}{n(\ln n)^2}$, we need to add to ensure that the sum is accurate to within 0.01 is n bigger than

(a) e^{100}

(b) e^{10}

(c) 100

(d) 10

(e) ln 10

16. The series $\sum_{n=1}^{\infty} \left(\frac{1}{3}\right)^{\frac{1}{n^3}}$ is

(a) divergent

(b) convergent

(c) convergent by alternating series test

(d) convergent and its sum is $\frac{1}{3}$

(e) conditionally convergent

17. The series $\sum_{n=1}^{\infty} \frac{1}{n^{1+\frac{100}{n}}}$ is

(a) divergent by the limit comparison test

(b) convergent by the limit comparison test

(c) convergent and its sum is $\frac{1}{100}$

(d) divergent by the divergent series test

(e) convergent by the integral test.

18. The series $\sum_{n=1}^{\infty} (-1)^{n-1} \frac{e^{\frac{1}{n}}}{n}$ is

(a) convergent by alternating series test

(b) divergent by the integral test

(c) divergent by the ratio test

(d) convergent by the root test

(e) divergent by alternating series test

19. By applying the ratio test to the series

$$\sum_{n=0}^{\infty} \frac{n!}{\alpha(\alpha+1)(\alpha+2)\ldots(\alpha+n-1)}, \quad \alpha > 0,$$

(a) the test fails

(b) the series convergent, but not absolutely convergent

(c) the series converges

(d) the series diverges

(e) the series converges absolutely

20. Which of the following statements is **TRUE**?

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

(b) $\sum_{n=2}^{\infty} (-1)^n \frac{1}{n \ln n}$ converges absolutely

(c) If a series $\sum_{n=1}^{\infty} a_n$ converges, then $\sum_{n=1}^{\infty} \frac{a_n}{n}$ converges absolutely

(d) If $\sum_{n=1}^{\infty} (a_n + b_n)$ converges absolutely, then both $\sum_{n=1}^{\infty} a_n$ and $\sum_{n=1}^{\infty} b_n$ are convergent

(e) $\sum_{n=1}^{\infty} (-1)^n \frac{\sin\left(\frac{1}{n}\right)}{n}$ converges conditionally

21. The radius of convergence R and the interval of convergence I of the power series $\sum_{n=0}^{\infty} \frac{3^n}{(n+1)^2}(2x-1)^n$ are

(a) $R = \frac{1}{6}, \quad I = \left[\frac{1}{3}, \frac{2}{3}\right]$

(b) $R = \frac{1}{6}, \quad I = \left[\frac{1}{3}, \frac{2}{3}\right)$

(c) $R = \frac{1}{6}, \quad I = \left(\frac{1}{3}, \frac{2}{3}\right)$

(d) $R = \frac{1}{3}, \quad I = \left[\frac{1}{6}, \frac{5}{6}\right]$

(e) $R = \frac{1}{3}, \quad I = \left[\frac{1}{6}, \frac{5}{6}\right)$

22. $\sum_{n=2}^{\infty} n\left(\frac{1}{3}\right)^n =$

(a) $\frac{5}{12}$

(b) $\frac{3}{4}$

(c) 2

(d) $\frac{23}{12}$

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

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

(a) 1

(b) 0

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

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

(e) -1

24. Let $f(x)=x\,\cos(x^2)$. Then $f^{(17)}(0)=$

(a) $\frac{17!}{8!}$

(b) $\frac{1}{8!}$

(c) $\frac{1}{10!}$

(d) $\frac{16!}{9!}$

(e) $\frac{16!}{4!}$

25. The arc length along the curve $y = x^2 - \frac{1}{8} \ln x$ from $(1, 1)$ to $\left(e, e^2 - \frac{1}{8}\right)$ is

(a) $e^2 - \frac{7}{8}$

(b) $e - \frac{7}{8}$

(c) $e^2 - 1$

(d) $e^2 - \frac{1}{8}$

(e) $e^2 - 7$

26. The area of the surface obtained by rotating the curve $y = \sqrt{x}$, $2 \le x \le 3$ about the x-axis is

(a) $\frac{\pi}{6}(13\sqrt{13} - 27)$

(b) $\frac{\pi}{6}(13\sqrt{13} - 3\sqrt{3})$

(c) $\frac{\pi}{6}(\sqrt{13} - 27)$

(d) $\frac{\pi}{6}(\sqrt{13} - 3\sqrt{3})$

(e) $\frac{\pi}{6}(\sqrt{13} - 9\sqrt{3})$

27. The series $\sum_{n=1}^{\infty} \frac{n}{e^{n^2}}$

(a) converges by the integral test

(b) converges by the alternating series test

(c) diverges by the divergence test

(d) diverges by the ratio test

(e) converges as a $p-$ series

28. The series $\sum_{n=1}^{\infty} \frac{1}{(n^2+n)^p}$ is convergent if

(a) $p > \frac{1}{2}$

(b) $p = \frac{1}{2}$

(c) $p < \frac{1}{2}$

(d) $p = \frac{1}{4}$

(e) $p < \frac{1}{4}$