+3 LE-B SC-MATHEMATICS

1. If an equivalence relation R on $A = \{1,2,3,4,5\}$ partitions A as $\{1\} \cup \{2\} \cup \{3,4,5\}$ then total number of elements in R is
   A. 3
   B. 6
   C. 8
   D. 11

2. Let $\mathbb{Z}$ be the set of all integers and for any integer $n > 1, H = \{0, \pm n, \pm 2n, \pm 3n, \ldots\}$. Then total number of left cosets of H in $(\mathbb{Z}, +)$ is
   A. 1
   B. n
   C. 2n
   D. infinity

3. Total number of elements x in a integral domain D which satisfy $x^2 = x$ is
   A. 2
   B. 1
   C. 0
   D. infinity

4. If A and B are symmetric matrices, then which of the following is certainly symmetric?
   A. AB
   B. ABA
   C. $(A + B)(A - B)$
   D. $ABAB$

5. Which of the following is true for the system: $2x - 2y + 3z + 4w = -1$, $-x + y + 2z + 5w = 2, -z - 2w = 3, x - y + 2z + 3w = 0$.
   A. consistent and has finite number of solutions
   B. consistent and has infinite number of solutions
   C. has unique solution.
   D. inconsistent

6. General solution of the differential equation $(x^2 - 4xy - 2y^2)dx + (y^2 - 4xy - 2x^2)dy = 0$ is
   A. $y^3 + 6xy^2 + 6x^2y + x^3 = c$
   B. $y^3 - 6xy^2 - 6x^2y + x^3 = c$
   C. $y^3 - 6xy^2 - 6x^2y - x^3 = c$
   D. $y^3 - 6xy^2 + 6x^2y - x^3 = c$

7. The differential equation $y \sin 2x\, dx - (1 + y^2 + \cos^2 x)dy = 0$ is
   A. exact
   B. not exact
   C. separable

D. homogenous

8. General solution of the differential equation $\frac{d^2y}{dx^2} + 9\frac{dy}{dx} + 20y = 0$ is
   A. $y = c_1e^{-4x} + c_2e^{-5x}$
   B. $y = c_1e^{x} + c_2e^{-x}$
   C. $y = c_1e^{-4x} + c_2e^{5x}$
   D. $y = c_1e^{x} + c_2e^{-x}$
9. The value of $\lim_{x\to 1} \frac{2x-2}{\sqrt[3]{26+x}-3}$ is
   A. 1
   B. ∞
   C. 24
   D. 54
10. The function $f(x) = \frac{x^3+1}{x+1}$
   A. is continuous anywhere on the real line
   B. not continuous anywhere on the real line
   C. is discontinuous at $x = -1$ and is not a removable discontinuity
   D. has removable discontinuity at $x = -1$
11. Which of the following is an asymptote of the curve $= xe^{\frac{1}{x}}$?
   A. $y = x - 1$
   B. $y = x$
   C. $y = x + 1$
   D. $y = 2$
12. The value of $\int \ln\left(\sqrt{1-x} + \sqrt{1+x}\right)\, dx$ is
   A. $x\ \ln\left(\sqrt{1-x} + \sqrt{1+x}\right) + \frac{1}{2}\,x + \frac{1}{2}\sin^{-1}\mathrm{x} + \mathrm{c}$
   B. $x\ \ln\left(\sqrt{1-x} + \sqrt{1+x}\right) - \frac{1}{2}\,x + \frac{1}{2}\sin^{-1}\mathrm{x} + \mathrm{c}$
   C. $x\ \ln\left(\sqrt{1-x} + \sqrt{1+x}\right) + \frac{1}{2}\,x - \frac{1}{2}\sin^{-1}\mathrm{x} + \mathrm{c}$
   D. $x\ \ln\left(\sqrt{1-x} + \sqrt{1+x}\right) - \frac{1}{2}\,x - \frac{1}{2}\sin^{-1}\mathrm{x} + \mathrm{c}$
13. The area of the region bounded by the curves $y = (x-4)^2, y = 16 - x^2$ and the x-axis is
   A. $\frac{64}{3}$
   B. $\frac{32}{3}$
   C. $\frac{16}{3}$
   D. $\frac{8}{3}$
14. The directional derivative of $f = xyz$ at $P = (-1,1,3)$ in the direction of the vector $\vec{a} = \hat{\imath} - 2\hat{\jmath} + 2\hat{k}$ is
   A. $\frac{1}{3}$
   B. $\frac{5}{3}$
   C. $\frac{7}{3}$

D. $\frac{10}{3}$

15. If $v = yz\hat{\imath} + 3zx\hat{\jmath} + z\hat{k}$ then curl v with respect to right handed cartesian coordinates is
    A. $3x\hat{\imath} - y\hat{\jmath} + 2z\hat{k}$
    B. $-3x\hat{\imath} + y\hat{\jmath} - 2z\hat{k}$
    C. $-3x\hat{\imath} + y\hat{\jmath} + 2z\hat{k}$
    D. $3x\hat{\imath} + y\hat{\jmath} + 2z\hat{k}$

16. $\lim_{x\to 0} \frac{1-\cos x+\cos 2x}{x^2}$ is equal to
    A. 1
    B. -1
    C. 0
    D. 2

17. If $f(x,y) = \begin{cases} \frac{x^2-xy}{x+y}, & for\ (x,y) \neq (0,0) \\ 0, & for\ (x,y) = (0,0) \end{cases}$ then $f_y(0,0)$ is equal to
    A. 1
    B. 0
    C. -1
    D. does not exist

18. The function $xy - x^2 - y^2 - 2x - 2y$ has
    A. maximum at $(2,2)$
    B. minimum at $(2,2)$
    C. minimum at $(-2,-2)$
    D. maximum at $(-2,-2)$

19. Value of the beta function $B\left(\frac{1}{3},\frac{2}{3}\right)$ is equal to
    A. $\frac{2\pi}{\sqrt{3}}$
    B. $-\frac{2\pi}{\sqrt{3}}$
    C. $\frac{\pi}{\sqrt{3}}$
    D. $-\frac{\pi}{\sqrt{3}}$,

20. Which of the following sequences $\{a_n\}$ diverges ?
    A. $a_n = \left(\frac{3n+1}{3n-1}\right)^n$
    B. $a_n = \left(\frac{1}{3}\right)^n + \frac{1}{\sqrt{2^n}}$

C. $a_n = \frac{n!}{10^{6n}}$

D. $a_n = \frac{3^n 6^n}{2^{-n} n!}$

21. Laplace transform of $t^2 \cos t$ is equal to

A. $\frac{2s^3-6s}{(s^2+1)^3}$

B. $\frac{2s^3+6s}{(s^2+1)^3}$

C. $\frac{2s^3-6s}{(s^2-1)^3}$

D. $\frac{2s^3+6s}{(s^2-1)^3}$

22. If $L\left(\frac{d^2Y}{dt^2}\right) + L\left(\frac{dY}{dt}\right) = \frac{1}{s^2}$, where L stands for Laplace transform, then which of the following values of y is true

A. $y = L^{-1}\left(\frac{1}{s^2} + \frac{s+3}{s^2+1}\right)$

B. $y = L^{-1}\left(\frac{1}{s^2} - \frac{s+3}{s^2+1}\right)$

C. $y = L^{-1}\left(\frac{1}{s^2} + \frac{s-3}{s^2+1}\right)$

D. $y = L^{-1}\left(\frac{1}{s^2} + \frac{s+3}{s^2-1}\right)$

23. Dimension of the vector space of all 3×3 real symmetric matrices with usual matrix addition and scalar multiplication, is

A. 4

B. 6

C. 9

D. 3

24. Inverse of the linear transformation $T(x, y) = (x + y, 2x - y)$ is

A. $T^{-1}(u, v) = \frac{1}{3}(u - v, 2u - v)$

B. $T^{-1}(u, v) = \frac{1}{3}(u - v, 2u + v)$

C. $T^{-1}(u, v) = \frac{1}{3}(u + v, 2u - v)$

D. $T^{-1}(u, v) = \frac{1}{3}(2u - v, u + v)$

25. Nullity of the linear transformation $T: \mathbb{R}^3 \to \mathbb{R}^2$ defined by $T(x, y, z) = (x + y, y + z)$ is

A. 2

B. 3

C. 0

D. 1

26. If $\{x_n\}$ is the sequence of Secant's iterates to compute $\sqrt[3]{7}$ if then x_{n+1} is equal to

A. $x_n x_{n-1}(x_n - x_{n-1}) - 7$

B. $x_n x_{n-1}(x_n - x_{n-1}) + 7$

C. $x_n x_{n-1}(x_n + x_{n-1}) + 7$

D. $x_n x_{n-1}(x_n + x_{n-1}) - 7$

27. If $ax^2 + bx + c$ is the Lagrange polynomial which interpolates the data

	0	1	-1
	0	1	1

then $a + b + c$ is equal to

A. 0
B. 1
C. 2
D. 3

28. Value of $\int_0^1 \left(\int_0^1 \frac{x-y}{(x+y)^3} dy\right) dx$ is equal to

A. 1
B. 2
C. 0
D. $\frac{1}{2}$

29. Equation of the line passing through $(1,2,3)$ and parallel to the line, which is the intersection of the planes $x - y + 2z = 5, 3x + y + z = 6,$ is

A. $\frac{x-1}{-3} = \frac{y-2}{5} = \frac{z-3}{4}$
B. $\frac{x+1}{-3} = \frac{y+2}{5} = \frac{z-3}{4}$
C. $\frac{x-1}{3} = \frac{y-2}{5} = \frac{z-3}{4}$
D. $\frac{x+1}{3} = \frac{y+2}{5} = \frac{z=3}{4}$

30. If the chord of hyperbola $x^2 - y^2 = a^2$ touches the parabola $y^2 = 4ax$ then locus of their mid point is

A. $y^2(x + a) = x^3$
B. $y^2(a - x) = x^3$
C. $y^2(x - a) = x^3$
D. $x^2(x + a) = y^3$

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KEY

Q.1	Q.2	Q.3	Q.4	Q.5	Q.6	Q.7	Q.8	Q.9	Q.10
D	B	A	B	D	B	A	A	D	D
Q.11	Q.12	Q.13	Q.14	Q.15	Q.16	Q.17	Q.18	Q.19	Q.20
C	B	A	C	C	B	B	D	A	C
Q.21	Q.22	Q.23	Q.24	Q.25	Q.26	Q.27	Q.28	Q.29	Q. 30
A	C	B	C	D	D	B	D	A	C