MATHEMATICS

1. If $\overline{A}$, $\overline{B}$ denote the conjugate matrices of A, B respectively, then which of the following is *false* ?

(A) $\overline{(kA)} = \overline{k}.\overline{A}$, where k is any complex number.

(B) $\overline{(A+B)} = \overline{A} + \overline{B}$ where A, B being conformable for addition.

(C) $\overline{(AB)} = \overline{B} \cdot \overline{A}$, where A, B being conformable for multiplication.

(D) None of the above

2. The rank of the matrix $\begin{bmatrix} 1 & 2 & 1 \\ -3 & -6 & -3 \\ 5 & 10 & 5 \end{bmatrix}$ is :

(A) 1 (B) 2

(C) 3 (D) None of these

3. The characteristic equation of the matrix $A = \begin{bmatrix} 2 & -1 & 1 \\ 1 & 2 & 3 \\ -2 & 1 & 2 \end{bmatrix}$ is :

(A) $\lambda^3 + 6\lambda^2 + 12\lambda + 15 = 0$ (B) $\lambda^3 + 6\lambda^2 - 12\lambda - 15 = 0$

(C) $\lambda^3 - 6\lambda^2 + 12\lambda - 15 = 0$ (D) None of these

4. The eigen values of the matrix $\begin{bmatrix} 1 & 2 & 3 \\ 0 & -4 & 2 \\ 0 & 0 & 7 \end{bmatrix}$ are :

(A) – 3, 2, 5 (B) – 2, 3, 4

(C) – 1, 1, 4 (D) – 4, 1, 7

5. The system of equations $x+2y-z=6;\ 3x-y-2z=3;\ 4x+3y+z=9$ has :

(A) no solution (B) a unique solution

(C) infinite solutions (D) None of these

6. What is the remainder when $4x^4-3x^3-2x^2-37$ is divided by $x + 3$?

(A) 127 (B) 152

(C) 284 (D) 350

7. If the roots of the equation $32x^3-48x^2+22x-3=0$ are in A.P., then roots are :

(A) $\frac{1}{4}, \frac{1}{2}, \frac{3}{4}$ (B) $-\frac{3}{2}, -1, -\frac{1}{2}$

(C) 1, 2, 4 (D) 1, 4, 7

8. The transformed equation whose roots are twice the reciprocals of the roots of the equation $x^4+3x^3-6x^2+2x-4=0$, is :

(A) $x^4+x^3+6x^2-6x-4=0$ (B) $x^4-x^3+6x^2+6x-4=0$

(C) $x^4-x^3+6x^2-6x-4=0$ (D) None of these

9. The equation $x^7-3x^4+2x^3-1=0$ has :

(A) all real roots

(B) at least four imaginary roots

(C) at least six imaginary roots

(D) None of the above

10. If $f(x)=2+\cos 3x;\ -\frac{\pi}{6}\le x\le\frac{\pi}{6}$, then the range of the function $f(x)$, is :

(A) [2, 3] (B) [– 1, 3]

(C) [– 2, 3] (D) [1, 3]

11. Let A = {1, 2, 3, 4} and R = {(1, 1), (2, 2), (3, 3), (4, 4), (1, 2), (2, 1), (2, 3), (3, 2)} be the relation defined on A, then the relation R is :

(A) reflexive, symmetric and transitive

(B) reflexive, symmetric but not transitive

(C) reflexive but not symmetric and not transitive

(D) None of the above

12. What is the least positive integer (mod 11) to which 335 is congruent ?

(A) 17 (B) 13

(C) 11 (D) 5

13. Let G = {1, 2, 3, 4, 5, 6} be a group under the binary operation 'multiplication modulo 7', then the order of element 4, is :

(A) 1 (B) 2

(C) 3 (D) 6

14. The number of generators of a cyclic group G of order 8 are :

(A) 4 (B) 2

(C) 1 (D) None of these

15. Which one of the following statements is *false* ?

(A) The intersection of two subgroups, each of finite index, is again a subgroup of finite index.

(B) A finite group can be expressed as the union of two its proper subgroups.

(C) Any group of prime order can have no proper subgroups.

(D) None of the above

16. The theorem "Every finite group is isomorphic to a permutation group", is known as :

(A) Fundamental theorem on homomorphism of groups

(B) Lagrange's theorem

(C) Cayley's theorem

(D) Sylow's theorem

17. Let $f = \begin{pmatrix} 1 & 2 & 3 & 4 & 5 \\ 2 & 3 & 1 & 5 & 4 \end{pmatrix}$ be the permutation, then its inverse is given by :

(A) $\begin{pmatrix} 1 & 2 & 3 & 4 & 5 \\ 3 & 1 & 5 & 2 & 4 \end{pmatrix}$ (B) $\begin{pmatrix} 1 & 2 & 3 & 4 & 5 \\ 3 & 1 & 2 & 5 & 4 \end{pmatrix}$

(C) $\begin{pmatrix} 1 & 2 & 3 & 4 & 5 \\ 4 & 1 & 5 & 2 & 3 \end{pmatrix}$ (D) None of these

18. Let G be a group of order 20449. Then :

(A) G has no normal Sylow 11-subgroup.

(B) G has only one normal Sylow 11-subgroup.

(C) G has two normal Sylow 11-subgroups.

(D) None of the above

19. Which of the following statements is *true* ?

(A) The ring of integers is a subring of the ring of rationals as well as an ideal of the ring of rationals.

(B) Let R be a commutative ring with unity, then every maximal ideal of R is not a prime ideal.

(C) Every homomorphic image of a ring R is isomorphic to some quotient ring.

(D) None of the above

20. Let Z [x] be the ring of polynomials over the ring of integers. Then :

(A) the ideal $< x >$ is a prime ideal as well as a maximal ideal.

(B) the ideal $< x >$ is neither a prime ideal nor a maximal ideal.

(C) the ideal $< x >$ is not a prime ideal but a maximal ideal.

(D) the ideal $< x >$ is a prime ideal but not a maximal ideal.

21. Let V be a vector space over R^3. Which one of the following is *not* a subspace of V ?

(A) $\{(x, y, z) : xy = 0;\ x, y, z \in R\}$

(B) $\{(x, y, z) : x + y + z = 0;\ x, y, z \in R\}$

(C) $\{(x, y, z) : x = z;\ x, y, z \in R\}$

(D) None of the above

22. The dimension of the subspace W of R^4 generated by

$\{(3, 8, -3, -5), (1, -2, 5, -3), (2, 3, 1, -4)\}$ is :

(A) 1 (B) 2

(C) 3 (D) None of these

23. Which of the following is *not* a linear transformation ?

(A) $T(x, y) = (x + y, x - y, y)$ for all $(x, y) \in R^2$

(B) $T(x, y) = (x + 2y, 3x - 5y, y)$ for all $(x, y) \in R^2$

(C) $T(x, y) = (2x - y, x - y, -2x)$ for all $(x, y) \in R^2$

(D) $T(x, y) = (x + 1, 2y, x + y)$ for all $(x, y) \in R^2$

24. Let $T : R^3 \to R^3$ be the transformation defined by T(X) = AX, where $A = \begin{bmatrix} 1 & 1 & 2 \\ 1 & 2 & 5 \\ 1 & 3 & 3 \end{bmatrix}$. Then the image of X = (2, 0, 5) is :

(A) (12, 27, 17)

(B) (3, 8, 12)

(C) (9, 12, 16)

(D) None of the above

25. The quadratic form corresponding to the matrix $\begin{bmatrix} 2 & 1 & 2 \\ -3 & -3 & -1 \\ 4 & 1 & 3 \end{bmatrix}$ is :

(A) $2x^2 + 3y^2 + 3z^2 + 2xy + 6xz$ (B) $2x^2 + 3y^2 - 3z^2 - 2xy - 6xz$

(C) $2x^2 - 3y^2 + 3z^2 - 2xy + 6xz$ (D) None of these

26. The norm of the vector $u = (2, -3, 6)$ is :

(A) 7 (B) $\sqrt{5}$

(C) 9 (D) $\sqrt{11}$

27. If $x = a\cos\theta$, $y = b\sin\theta$, then $\frac{d^2y}{dx^2}$ is equal to :

(A) $\frac{b\sec^3\theta}{a^2}$ (B) $-\frac{b\,\text{cosec}^3\theta}{a^2}$

(C) $-\frac{b\tan^3\theta}{a^2}$ (D) None of these

28. The nth derivative of $\frac{1}{(3-2x)^3}$ is :

(A) $\frac{(n-2)!\,2^{n-1}}{(3-2x)^{n+2}}$ (B) $\frac{(n+2)!\,2^{n-1}}{(3-2x)^{n+3}}$

(C) $\frac{(n+2)!\,2^{n+1}}{(3-2x)^{n+1}}$ (D) None of these

29. The asymptotes parallel to y-axis of the curve

$x^3+x^2y-2x^2-3xy+3x+2y+1=0$ are :

(A) $x=-1,\ x=2$ (B) $x=1,\ x=-2$

(C) $x=-1,\ x=-2$ (D) $x=1,\ x=2$

30. The radius of curvature of the curve $y=4\sin x-\sin 2x$ at the point $x=\frac{\pi}{2}$, is given by :

(A) $\frac{5\sqrt{5}}{4}$ (B) $\frac{3\sqrt{5}}{4}$

(C) $\frac{\sqrt{5}}{4}$ (D) None of these

31. Which of the following sequences is divergent ?

(A) $a_n=1+\frac{2}{n}$ (B) $b_n=\frac{3n-1}{1+2n}$

(C) $c_n=1+\frac{(-1)^n}{n}$ (D) $d_n=\sin n$

32. The series $\frac{1}{2}+\frac{1.3}{2.5}+\frac{1.3.5}{2.5.8}+\ldots\ldots\ldots$ is :

(A) Convergent (B) Divergent

(C) Oscillatory (D) None of these

33. The series $\frac{1}{\sqrt{2}+1}-\frac{1}{\sqrt{3}+1}+\frac{1}{\sqrt{4}+1}-\ldots\ldots\ldots$ is :

(A) Absolutely convergent

(B) Conditionally convergent

(C) Oscillatory

(D) None of the above

34. Consider the function $f(x)=\begin{cases}\frac{|x|}{x}; & x\neq 0\\ 1; & x=0\end{cases}$. Then at the point $x = 0$, the function $f(x)$ has a :

(A) infinite discontinuity

(B) removable discontinuity

(C) discontinuity of first kind

(D) discontinuity of second kind

35. Rolle's theorem is *not* applicable to the function :

(A) $f(x)=\cos 2x$ in $[-\pi/4,\ \pi/4]$

(B) $f(x)=\frac{\sin x}{e^x}$ in $[0,\ \pi]$

(C) $f(x)=x^3-6x^2+11x-6$ in $[1,\ 3]$

(D) $f(x)=|x|$ in $[-1,\ 1]$

36. If $u = \log\left(\frac{x^4 + y^4}{x - y}\right)$, then $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y}$ is equal to :

(A) 1 (B) 2

(C) 3 (D) None of these

37. The function $f(x, y) = x^4 + x^2y + y^2$ has a minimum value at the extreme point :

(A) (0, 0) (B) (1, 0)

(C) (– 2, 0) (D) (– 3, 0)

38. The value of $\lim_{x \to 0}\left(\frac{1 - \cos x}{3x^2}\right)$ is :

(A) 1/2 (B) 1/6

(C) 1/8 (D) None of these

39. The value of integral $\int_0^1 x^3\left(1 - x^2\right)^{3/2} dx$ is equal to :

(A) $\frac{1}{2}B\left(4, \frac{5}{8}\right)$ (B) $\frac{1}{2}B\left(3, \frac{5}{4}\right)$

(C) $\frac{1}{2}B\left(2, \frac{5}{2}\right)$ (D) None of these

40. The value of integral $\int\int_R \left(x^2 + y^2\right)^{7/2} dx\, dy$, where R is the interior of circle $x^2 + y^2 = 1$, is :

(A) $\frac{2\pi}{9}$ (B) $\frac{3\pi}{4}$

(C) $\frac{\pi}{2}$ (D) None of these

41. Which of the following statements is *false* ?

(A) A continuous function f on $[a, b]$ is Riemann integrable on $[a, b]$.

(B) A bounded function f having a finite number of points of discontinuity on $[a, b]$ is Riemann integrable on $[a, b]$.

(C) A bounded function f is Riemann integrable on $[a, b]$, if the set of its points of discontinuity has only one limit point.

(D) None of the above

42. The value of $\lim_{n\to\infty}\left[\frac{1}{n}+\frac{n^2}{(n+1)^3}+\frac{n^2}{(n+2)^3}+.....+\frac{1}{8n}\right]$ is :

(A) 1 (B) $\frac{3}{8}$

(C) $\frac{1}{2}$ (D) $\frac{2}{3}$

43. Which of the following improper integrals is *not* convergent ?

(A) $\int_{-\infty}^{\infty}\frac{x}{1+x^2}dx$ (B) $\int_{1}^{\infty}xe^{-x}\,dx$

(C) $\int_{1}^{\infty}\frac{\tan^{-1}x}{x^2}dx$ (D) $\int_{0}^{1}\log x\,dx$

44. If $\sum_{n=1}^{\infty}a_n$ is convergent and the sequence $\langle b_n\rangle$ is monotonic and bounded, then $\sum_{n=1}^{\infty}a_n b_n$ is convergent. This statement refers to :

(A) Cauchy's theorem (B) Dirichlet's test

(C) Abel's test (D) None of these

45. The Fourier coefficient a_0 for the function $f(x) = x - x^2$ in $[-\pi, \pi]$ is :

(A) π^2 (B) $\frac{\pi^2}{4}$

(C) $-\frac{\pi^2}{2}$ (D) $-\frac{\pi^2}{3}$

46. Consider the function $f(x, y) = \begin{cases} \frac{x^2 y^2}{x^2 + y^2}, & (x, y) \neq (0, 0) \\ 0; & (x, y) = (0, 0) \end{cases}$ such that $f_{xy}(0, 0) = f_{yx}(0, 0)$. Then which of the following statements is *true* ?

(A) The conditions of Schwarz's theorem and also of Young's theorem are satisfied.

(B) The conditions of Schwarz's theorem and also of Young's theorem are not satisfied.

(C) The conditions of Schwarz's theorem are satisfied but the conditions of Young's theorem are not satisfied.

(D) The conditions of Schwarz's theorem are not satisfied but the conditions of Young's theorem are satisfied.

47. If $f(z) = u + iv$ is an analytic function, where $u = y^3 - 3x^2 y$, then harmonic conjugate (v) of u is :

(A) $v = x^3 - 3xy^2 + c$ (B) $v = 2x^3 + xy^2 + c$

(C) $v = 3x^3 - 2xy^2 + c$ (D) None of these

48. The fixed points of the Mobius transformation $w = -\left(\frac{2z+4i}{iz+1}\right)$ are :

(A) 1, 3 (B) 0, 2

(C) $4i, -i$ (D) $-3i, i$

49. The unit circle in the w-plane corresponds to a.....in the z-plane under the transformation $w+1=\frac{4}{z^2}$.

(A) cardiod (B) ellipse

(C) parabola (D) hyperbola

50. In the metric space (0, 1] with usual metric $d(x, y)=|x-y|$, the sequence $\langle a_n \rangle$, where $a_n = \frac{1}{n}$, is :

(A) not a Cauchy sequence

(B) a Cauchy sequence but does not converge in (0, 1]

(C) a Cauchy sequence that is convergent in (0, 1]

(D) None of the above

51. Which of the following statements is *false* ?

(A) Every compact metric space is sequentially compact.

(B) Every sequentially compact metric space is countably compact.

(C) A countably compact metric space has Bolzano-Weierstrass Property.

(D) None of the above

52. Consider the following statements :

(i) The set of real numbers with usual metric is a connected space.

(ii) A subset of the real line is connected iff it is not an interval.

Then which of the following is *true* ?

(A) Only (i) (B) Only (ii)

(C) Both (i) and (ii) (D) Neither (i) nor (ii)

53. Consider the differential equation $(x-1)(x+2)\frac{d^2y}{dx^2}+x^2\frac{dy}{dx}+xy=0$. Then :

(A) Both – 2 and 1 are ordinary points.

(B) Both – 2 and 1 are regular singular points.

(C) 1 is an ordinary point and – 2 is a regular singular point.

(D) – 2 is a regular singular point and 1 is a irregular singular point.

54. The solution of the differential equation $\left(x^2+y^2+e^x\right)dx+2xy\,dy=0$ is given by :

(A) $x^3+xy^2-e^x=c$, where c is constant

(B) $x^3-xy^2+e^x=c$, where c is constant

(C) $\frac{1}{3}x^3-xy^2-e^x=c$, where c is constant

(D) $\frac{1}{3}x^3+xy^2+e^x=c$, where c is constant

55. The solution of the differential equation $p^2-7p+12=0$, where $p=\frac{dy}{dx}$ is given by :

(A) $(y-3x-c)(y-2x+c)=0$, where c is constant

(B) $(y-4x-c)(y-3x-c)=0$, where c is constant

(C) $(y-6x+c)(y-3x-c)=0$, where c is constant

(D) None of the above

56. The particular integral of the differential equation $2\frac{d^3y}{dx^3}-3\frac{d^2y}{dx^2}+y=e^x+1$, is given by :

(A) xe^x+1 (B) $\frac{1}{2}xe^x+1$

(C) $\frac{1}{3}x^2e^x+2$ (D) $\frac{1}{6}x^2e^x+1$

57. Which of the following is *incorrect* ?

(A) $J_0'(x) = -J_1(x)$

(B) $J_0''(x) = \frac{1}{2}[J_2(x) - J_0(x)]$

(C) $J_1''(x) = \frac{1}{x}J_2(x) + J_1(x)$

(D) None of the above

58. The polynomial $x^4 - 3x^2 + x$ is expressed in terms of Legendre's polynomials as :

(A) $8P_4(x) - \frac{4}{3}P_2(x) + 2P_1(x) - \frac{3}{5}P_0(x)$

(B) $\frac{8}{5}P_4(x) - \frac{2}{5}P_2(x) - 3P_1(x) + \frac{7}{3}P_0(x)$

(C) $\frac{8}{35}P_4(x) - \frac{10}{7}P_2(x) + P_1(x) - \frac{4}{5}P_0(x)$

(D) None of the above

59. The Hypergeometric function xF (1, 1, 2, – x), is equal to :

(A) $\log(1+x)$ (B) $\log(1-x)$

(C) $\log\left(\frac{1+x}{1-x}\right)$ (D) None of these

60. The Laplace transform of $f(t) = te^{-2t}\sin 2t$ is :

(A) $\frac{s-8}{\left(s^2+4s+8\right)^2}$ (B) $\frac{4s+8}{\left(s^2+4s+8\right)^2}$

(C) $\frac{6s+4}{\left(s^2+4s+8\right)^2}$ (D) None of these

61. The inverse Laplace transform of $\frac{1}{s^2(s+2)}$ is :

(A) $2t+e^{-2t}+1$

(B) $\frac{1}{2}\left(2t-e^{-2t}+1\right)$

(C) $\frac{1}{3}\left(2t+e^{-2t}+1\right)$

(D) $\frac{1}{4}\left(2t+e^{-2t}-1\right)$

62. The Fourier sine transform of the function $f(x)=x$, is :

(A) 0

(B) $\frac{e^{-s}}{s}$

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

(D) None of these

63. The solution of the partial differential equation $(y+xz)p-(x+yz)q=x^2-y^2$ is :

(A) $f\left(xyz,\ x^2+y^2-z^2\right)=0$

(B) $f\left(xy/z,\ x^2+y^2+z^2\right)=0$

(C) $f\left(xy+z,\ x^2+y^2-z^2\right)=0$

(D) None of the above

64. The solution of the differential equation $\left(D^2-2DD'+D'^2\right)z=\sin x$ is :

(A) $z=\phi_1(y+x)+x\phi_2(y+x)-\sin x$

(B) $z=\phi_1(y+x)+\phi_2(y-x)+\frac{1}{7}\sin x$

(C) $z=\phi_1(y-x)+x\ \phi_2(y-x)-\frac{2}{5}\sin x$

(D) None of the above

65. The particular integral of the differential equation $\left(D^2 - D'^2 + D - D'\right)z = e^{2x+3y}$ is :

(A) $\frac{1}{9}e^{2x+3y}$ (B) $-\frac{1}{6}e^{2x+3y}$

(C) $-\frac{1}{4}e^{2x+3y}$ (D) $\frac{1}{3}e^{2x+3y}$

66. The conic $x^2 + 2x - y^2 + 5 = 0$ represents :

(A) ellipse (B) parabola

(C) hyperbola (D) circle

67. The equation of the plane which cuts the paraboloid $x^2 - 2y^2 = z$ in a conic with centre $\left(2, \frac{3}{2}, 4\right)$, is given by :

(A) $2x + y - 5z + 3 = 0$ (B) $x + 5y + 3z - 10 = 0$

(C) $x - 2y - 3z + 2 = 0$ (D) $4x - 6y - z + 5 = 0$

68. The nature of surface given by equation $(3x - 4y + z)^2 + 9x - 12y + 3z - 10 = 0$, represents :

(A) a pair of parallel planes

(B) a parabolic cylinder

(C) a cone

(D) None of these

69. The centre of the sphere $x^2 + y^2 + z^2 - 2x - 4y - 6z - 2 = 0$ is :

(A) $(-1, -2, -3)$ (B) $(1, 2, 3)$

(C) $(1, 4, 9)$ (D) None of these

70. The equation of the right circular cone whose vertex is the origin, axis the z-axis and the semi-vertical angle α is :

(A) $x^2 + y^2 = z^2 \tan^2 \alpha$ (B) $\left(x^2 + y^2\right)\tan^2 \alpha = z^2$

(C) $\left(x^2 + y^2\right)z^2 = \tan^2 \alpha$ (D) None of these

71. The equation of the cylinder whose generators are parallel to the line $\frac{x}{1} = \frac{y}{-2} = \frac{z}{3}$ and whose guiding curve is the ellipse $x^2 + 2y^2 = 1,\ z = 0$ is given by :

(A) $(3z - x)^2 + 2(2z + 3y)^2 = 9$

(B) $(3x + z)^2 + 2(3y - 2z)^2 = 9$

(C) $(3x - z)^2 + 2(3y + 2z)^2 = 9$

(D) None of the above

72. Which is not *correct* ? (where symbols have their usual meanings)

(A) $\vec{r}', \vec{r}'' = 0$

(B) $\vec{r}' \cdot \vec{r}''' = \kappa^2$

(C) $\vec{r}'' \cdot \vec{r}''' = \kappa\kappa'$

(D) None of the above

73. Which is not *correct* ? (where symbols have their usual meanings)

(A) $\frac{d\vec{b}}{ds} = \tau\vec{n}$ (B) $\frac{d\vec{t}}{ds} = \kappa\vec{n}$

(C) $\frac{d\vec{n}}{ds} = \tau\vec{b} - \kappa\vec{t}$ (D) None of these

74. A heavy uniform rod is in equilibrium with one end resting against a smooth vertical wall and the other against a smooth plane inclined to the wall at an angle θ. If α is the inclination of the rod to the horizontal, then :

(A) $\tan\alpha = \tan\theta$ (B) $\tan\alpha = 2\tan\theta$

(C) $2\tan\alpha = \tan\theta$ (D) None of these

75. Suppose a system of forces is reduced to a single force $\vec{R}$ and a couple of moment $\vec{K}$ whose axis coincides with the direction of the acting force, then $\vec{R}$ and $\vec{K}$ taken together are known as.....of the system.

(A) null line (B) wrench

(C) pitch (D) None of these

76. If a cone is placed with its slant side in contact with the plane, then it is in .....equilibrium.

(A) stable (B) unstable

(C) neutral (D) None of these

77. The radial component of acceleration is given by :

(A) $\ddot{r} - \dot{r}\,\dot{\theta}^2$ (B) $\ddot{r} - r\,\dot{\theta}^2$

(C) $2\dot{r}\,\dot{\theta} + r\,\ddot{\theta}$ (D) None of these

78. The acceleration of a particle, moving with S.H.M. is 2m/sec^2 when its distance from the mean position is 0.5 m. The time of an oscillation is :

(A) $\frac{\pi}{\sqrt{2}}\text{sec}$ (B) $\frac{\pi}{2}\text{sec}$

(C) πsec (D) $\pi\sqrt{2}\,\text{sec}$

79. A heavy particle slides down a smooth cycloid starting from rest at the cusp, the axis being vertical and vertex downwards. Then :

(A) the magnitude of the acceleration is equal to g.

(B) the magnitude of the acceleration is less than g.

(C) the magnitude of the acceleration is greater than g.

(D) None of the above

80. According to Kepler's first law of planetary motion, every planet revolves round the sun in.....orbit with Sun at one of its foci.

(A) a circular (B) a parabolic

(C) an elliptic (D) a hyperbolic

81. If v is the velocity of a particle P along a plane curve at time t and ρ is the radius of curvature, then the normal component of acceleration towards the centre of curvature is given by :

(A) $\frac{v^2}{\rho}$ (B) $\frac{v}{\rho}$

(C) $\frac{2v^2}{\rho}$ (D) None of these

82. Given that :

x	1	2	3	4	5	6	7	8
$f(x)$	1	8	27	64	125	216	343	512

The value of $\nabla^2 f(8)$ is :

(A) 28 (B) 33

(C) 42 (D) 61

83. Given :

x	0	1	2	3	4
y	4	8	15	7	6

Using Newton's forward interpolation formula, the value of $y'(0)$ is :

(A) – 13.5 (B) – 4.7

(C) 6.6 (D) 10.3

84. Given :

x	0	0.25	0.50	0.75	1.00
y	1	0.9412	0.8	0.64	0.5

Using Simpson's one-third rule, the value of $\int_0^1 y\,dx$ is :

(A) 0.9538 (B) 0.7854

(C) 0.3152 (D) 0.2145

85. Using Jacobi's method, the first iteration solution of the following system of equations $5x+2y+z=12$, $x+4y+2z=15$, $x+2y+5z=20$, is :

(A) $x=2.4,\ y=3.75,\ z=4.0$

(B) $x=0.85,\ y=0.9,\ z=1.25$

(C) $x=1.13,\ y=2.42,\ z=3.23$

(D) None of the above

86. The Newton iterative formula for cube root of number N, is :

(A) $x_{i+1} = \frac{1}{3}\left[x_i + \frac{N}{x_i^2}\right]$ (B) $x_{i+1} = \frac{1}{3}\left[x_i + 2\frac{N}{x_i^2}\right]$

(C) $x_{i+1} = \frac{1}{3}\left[2x_i - \frac{N}{x_i^2}\right]$ (D) $x_{i+1} = \frac{1}{3}\left[2x_i + \frac{N}{x_i^2}\right]$

87. Given $\frac{dy}{dx} = y - x$ with $y(0) = 2$. Then using Euler's method, the value of y (0.1) by taking step size h = 0.1, is :

(A) 3.5 (B) 2.2

(C) 1.3 (D) None of these

88. The format identifier '%*s*' is used for.....data type.

(A) int (B) float

(C) char (D) string

89. Which of the following is a valid statement in C ?

(A) *y* = sqrt (100)

(B) int = 3.14652*100

(C) 3.14 * *r* ** *r* = area

(D) *x* = *y* = *z* = 10.5, 82.0, – 10

90. Which of the following is an exit controlled loop ?

(A) while loop (B) do-while loop

(C) for loop (D) None of these

91. The directive #endif belongs to :

(A) File inclusion directives

(B) Macro substitution directives

(C) Conditional compilation directives

(D) None of the above

92. The three non-parallel and non-zero vectors $\vec{A}, \vec{B}, \vec{C}$ are coplanar, if the value of scalar triple product of vectors $\vec{A}, \vec{B}, \vec{C}$ is :

(A) 0 (B) 1

(C) 2 (D) None of these

93. A force $\vec{F} = 5\hat{i} + 10\hat{j} + 15\hat{k}$ acts on a particle and displaces it from the point A (3, – 1, – 6) to the point B (1, 0, 3). Then the work done by the force is equal to :

(A) 155 (B) 145

(C) 135 (D) None of these

94. If $\phi(x, y, z) = xy^2 + yz^3$, then grad ϕ at the point (2, – 1, 1) is :

(A) $\hat{i} - 3\hat{j} - 3\hat{k}$

(B) $2\hat{i} - 3\hat{j} + \hat{k}$

(C) $3\hat{i} - 2\hat{j} + \hat{k}$

(D) None of the above

95. The value of λ so that the vector $\vec{F} = (x + 3y)\hat{i} + (y - 2z)\hat{j} + (x + \lambda z)\hat{k}$ is a solenoidal vector, is :

(A) 2 (B) 3

(C) – 1 (D) – 2

96. Gauss divergence theorem is a relation between :

(A) line and surface integrals

(B) surface and volume integrals

(C) line and volume integrals

(D) None of the above

97. The value of $\left(\frac{\cos\theta + i\sin\theta}{\cos\theta - i\sin\theta}\right)^4$ is :

(A) 1 (B) $\cos 8\theta + i\sin 8\theta$

(C) $\cos 4\theta - i\sin 4\theta$ (D) None of these

98. Expansion of $\sin^m\theta\cos^n\theta$ is a series of cosines of multiples of θ when m is :

(A) odd (B) 1

(C) even (D) None of these

99. Sum of the series $1-\frac{1}{3^2}+\frac{1}{5.3^2}-\frac{1}{7.3^3}+.....\infty$ is :

(A) π (B) $\frac{\pi}{\sqrt{3}}$

(C) $\frac{2\pi}{\sqrt{3}}$ (D) $\frac{\pi}{2\sqrt{3}}$

100. Sum of the series $\cosh\alpha-\frac{1}{2}\cosh 2\alpha+\frac{1}{3}\cosh 3\alpha-.....\infty$ is :

(A) $\log\left(2\cosh\frac{\alpha}{2}\right)$ (B) $2\log(\cosh\alpha)$

(C) $\log(\cosh\alpha)$ (D) None of these

GENERAL APTITUDE

101. Direction : Study the following information carefully and answer the question given below :

It has been given that :

A is + from point B states B is to the NORTH of A.

A is = from point B states B is to the SOUTH of A.

A is || from point B states A is to the East of B.

A is * from point B states A is to the WEST of B.

Now, S is = 20 m from point P. Point Q is = 15 m from point R. Point U is + 15 m from Point V. Point T is || 20 m from point V. Point U is ||16 m from point Q. Point R is ||30 m from point P.

Z is a point which at a distance of 46 m from point U towards West. Then what is the distance between point S and point Z and in which direction with respect to S ?

(A) 4 m North

(B) 5 m South

(C) 7 m East

(D) 6 m West

102. Complete the series :

508 53 212 29 60 ?

(A) 13 (B) 15

(C) 19 (D) 23

103. Direction : Study the following information carefully and answer the questions given below :

There are two couples in a family. K has two children. M is wife of O, who is brother of B. F is daughter of K. U is sister of S, who is son of O. T is son of B, who is a male.

How is M related to K ?

(A) Sister (B) Sister-in-law

(C) Brother (D) Can't be determined

104. Direction : Read the following information carefully and answer the question given below :

In a certain code language,

'speak nicely to all' is coded as "ka cu ma he"

'all are like us' is coded as "si fo he to"

'teach us lesson nicely' is coded as "po ma fo re"

'lesson like all humans' is coded as "he re gu si"

What would be the code for 'nicely' ?

(A) he (B) ma

(C) si (D) fo

105. Exemption : Rule ::

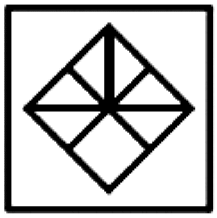
(A) Exile : Nation

(B) Forgiveness: Crime

(C) Immunity : Disease

(D) Debarment : Prevention

106. Find out the number of triangles in the given figure :



(A) 7

(B) 8

(C) 9

(D) 10

107. Direction : Read the following information carefully and answer the question given below :

Eight friends P, Q, R, S, T, U, V and W are standing in a straight line facing north, but not necessarily in the same order.

R and W are immediate neighbours of S. V is immediate neighbour of U and W. T and Q are immediate neighbours of P. Neither T nor R is at the extreme ends of the line. U is on the right of T.

Who among the following are immediate neighbours ?

(A) Q, T

(B) T, R

(C) S, U

(D) P, R

108. In this question, there is a statement followed by two arguments I and II. Read carefully and choose the right option from the given possible answers :

Given answers :

(a) Only argument I is strong

(b) Only argument II is strong

(c) Either I or II is strong

(d) Neither I nor II is strong

Statement : Should there be only one type of schools up to matriculation in the entire country ?

Arguments :

I. Yes, this exists in some of the western countries.

II. No, schools in rural and urban areas need to be different.

(A) a

(B) b

(C) c

(D) d

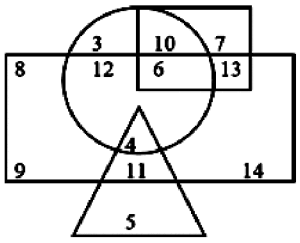
109. In the following figure :

Rectangle represents males

Triangle represents educated

Circle represents urban

Square represents civil servants



Who among the following is neither a civil servant nor educated but is urban and not a male ?

(A) 10

(B) 6

(C) 3

(D) 2

110. Arrange the words given below in a meaningful sequence :

1. Country 2. Furniture 3. Forest 4. Wood 5. Trees

(A) 1, 3, 5, 4, 2

(B) 1, 4, 3, 2, 5

(C) 2, 4, 3, 1, 5

(D) 5, 2, 3, 1, 4

GENERAL ENGLISH

111. Direction : Which of the phrases given below should replace the phrase given in bold in the following sentence to make the sentence grammatically correct ?

Many people believe that voluntary bodies as they are today should **not entrusted with** this national responsibility.

(A) be entrust not with
(B) not be entrust with
(C) not being entrusted for
(D) not be entrusted with

112. The four sentences (labelled 1, 2, 3, 4) below, when properly sequenced would yield a coherent paragraph. Decide on the proper sequencing of the order of the sentences and key in the sequence of the four numbers as your answer :

1. Man has used poisons for assassination purposes ever since the dawn of civilization, against individual enemies but also occasionally against armies.
2. These dangers were soon recognized, and resulted in two international declarations–in 1874 in Brussels and in 1899 in The Hague–that prohibited the use of poisoned weapons.
3. The foundation of microbiology by Louis Pasteur and Robert Koch offered new prospects for those interested in biological weapons because it allowed agents to be chosen and designed on a rational basis.
4. Though treaties were all made in good faith, they contained no means of control, and so failed to prevent interested parties from developing and using biological weapons.

(A) 1 4 3 2
(B) 1 2 3 4
(C) 1 3 2 4
(D) 1 2 4 3

113. Fill in the blank :

A preface ..... a book introduces the book.

(A) by (B) to

(C) over (D) with

114. Direction : Select the option which contains the part of the sentence which has an error (spelling, grammatical or contextual) :

More men than (A)/ women are likely to (B)/ suffer head and neck cancer (C)/ in today's era. (D)

(A) More men than

(B) women are likely to

(C) suffer head and neck cancer

(D) in today's era.

115. Direction : The following question has two blanks, each blank indicating that something has been omitted. Choose the set of words for each blank that best fits in the context of the sentence :

The short-term priority is to remove.....clauses in policies and.....coverage to as many people as possible.

(A) defamatory, exempt

(B) discriminatory, expand

(C) enriching, withheld

(D) degrading, magnifies

116. Find the correctly spelt word :

(A) Relenquish (B) Relinquish

(C) Relinqeush (D) Relinquesh

117. In the following question, out of the four alternatives, select the alternative which best expresses the meaning of the idiom/phrase.

By the skin of one's teeth

(A) to hurt someone

(B) teeth show health of an animal or a person

(C) dental hygiene is critical for good health

(D) a very narrow margin

118. Out of the four alternatives choose the one which can be substituted for the given words/sentence in the question :

A branch of medical science that deal with nose and its disease.

(A) Phrenology (B) Cheiloscopy

(C) Osteoarthritis (D) Pulmonology

119. Find the antonym of WINSOME :

(A) Dour (B) Attractive

(C) Clever (D) Mysterious

120. Find the synonym of PICAYUNE :

(A) Petty (B) Spicy

(C) Paltry (D) Southern