1. $A=\{a, b, c\}$ and $R=\{(a,a),(a,b),(b,c),(b,b),(c,c),(c,a)\}$ is binary relation on A then, which one of the following is correct?

   (A) R is reflexive and symmetric but not transitive

   (B) R is reflexive and transitive but not symmetric

   (C) R is reflexive, but neither symmetric nor transitive

   (D) R is reflexive, symmetric and transitive

2. The total number of subsets of a finite set A has 56 more elements, then the total number of subsets of another finite set B. What is the number of elements in the set A?

   (A) 5 (B) 6

   (C) 7 (D) 8

3. Consider the following statement.

   I. Parallelism of lines is an equivalence relation.

   II. xRy, if x is a father of y, is an equivalence relation.

   Which of the statement given above is/are correct?

   (A) I only (B) II only

   (C) both I and II (D) Neither I nor II

4. If A and B are disjoint sets, then $A\cap(A'\cup B)$ is equal to which one of the following?

   (A) ϕ (B) A

   (C) $A\cup B$ (D) $A-B'$

5. The function $f(x)=e^x, x\in R$ is

   (A) onto but not one-one (B) one-one onto

   (C) one-one but not onto (D) neither one-one nor onto

6. If $A=P\{1,2\}$ where P denotes the power set, then which one of the following is correct?

   (A) $\{1, 2\}\subset A$ (B) $1\in A$

   (C) $\phi\notin A$ (D) $\{1, 2\}\in A$

7. If $n(A)=115, n(B)=326, n(A-B)=47$, then what is $n(A\cup B)$ equal to ?

   (A) 373 (B) 165

   (C) 370 (D) 394

8. The set of all limit points of the set $S = \left\{\frac{1}{n}; n \in N\right\}$ is

(A) ϕ (B) {0}

(C) N (D) None of these

9. For real numbers x and y, we write $xRy \Leftrightarrow x - y + \sqrt{2}$ is an irrational number. Then the relation R is

(A) reflexive (B) symmetric

(C) transitive (D) None of these

10. The set of intelligent students in a class is

(A) a null set (B) a singleton set

(C) a finite set (D) not a well defined collection

11. The order of a set A is 3 and that of a set B is 2. What is the number of relations from A to B?

(A) 4 (B) 6

(C) 32 (D) 64

12. In an examination out of 100 students, 75 passed in English, 60 passed in Mathematics and 45 passed in both English and Mathematics. What is the number of students passed in exactly one of the two subjects?

(A) 45 (B) 60

(C) 75 (D) 90

13. What is the number of proper subset of a given finite set with n elements?

(A) $2n-1$ (B) $2n-2$

(C) $2^n - 1$ (D) $2^n - 2$

14. The union of a finite or countable collection of countable set is

(A) Countable (B) Uncountable

(C) Infinite (D) None of these

15. If $\frac{4+3i}{3-4i} = x + iy$, then $\frac{x}{y}$ is equal to

(A) 0 (B) 1

(C) $\frac{4}{3}$ (D) $\frac{4}{5}$

16. If $|z| = |z-1|$, then

(A) $\text{Re}(z) = 1$ (B) $\text{Re}(z) = \frac{1}{2}$

(C) $\text{Im}(z) = 1$ (D) $\text{Im}(z) = \frac{1}{2}$

17. For complex number z, $|z+5|^2 + |z-5|^2 = 75$, represents

(A) a circle (B) an ellipse
(C) a triangle (D) a straight line

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

(A) 1 (B) 0
(C) $\cos 4\theta - i\sin 4\theta$ (D) $\cos 8\theta + i\sin 8\theta$

19. If $1, \omega, \omega^2$ are the cube roots of units, then the roots of $(x-1)^3 + 8 = 0$ are

(A) –1, –1, –1 (B) $-1, 1+2\omega, 1+2\omega^2$

(C) $1, \omega, 2\omega$ (D) $-1, 1-2\omega, 1-2\omega^2$

20. The complex numbers $z_1 = 1+2i$, $z_2 = 4-2i$ and $z_3 = 1-6i$ form the vertices of a

(A) Right angled triangle (B) Isosceles triangle
(C) equilateral triangle (D) None of these

21. Let $G = \{f_1, f_2, f_3, f_4\}$ with respect to composition of mapping be a group, where

$f_1(x) = x$, $f_2(x) = -x$, $f_3(x) = \frac{1}{x}$, $f_4(x) = \frac{1}{4}$, then inverse of f_3 is

(A) f_1 (B) f_2
(C) f_4 (D) self invertible

22. In the group $U(15)$, the order of 7 is

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

23. Let A be a $m \times n$ matrix having row rank = r = column rank. The dimension of the space of solutions of the system of linear equations $AX = 0$ is

(A) r (B) $n-r$
(C) $m-r$ (D) None of these

24. If H_1 and H_2 are two subgroups of G, then following is also a subgroup of G

(A) $H_1 \cap H_2$ (B) $H_1 \cup H_2$
(C) $H_1 H_2$ (D) None of these

25. If G is a group such that $a^2 = e, \forall\, a \in G$, then G is

(A) abelian group (B) non-abelian group
(C) ring (D) field

26. If G is a group, then for all $a, b \in G$

(A) $(ab)^{-1} = a^{-1}\, b^{-1}$ (B) $(ab)^{-1} = b^{-1}\, a^{-1}$
(C) $(ab)^{-1} = ab$ (D) $(ab)^{-1} = ba$

27. Check the correct statement

(A) The identity of a subgroup is same as that of a group
(B) The inverse of any element of a subgroup is the same as the inverse of the same regarded as an element of the group
(C) The order of any element of a subgroup is the same as the order of the element regarded as a member of the group
(D) All of the above

28. Four fourth roots of unity namely $1, -1, i, -i$ form a group with respect to

(A) addition (B) subtraction
(C) multiplication (D) division

29. The idempotent element in a group are

(A) inverse element of the group (B) identity element of the group
(C) any element of the group (D) none of these

30. The order of the group S_4 (symmetric group) is

(A) 24 (B) 12
(C) 16 (D) 20

31. For which value of x will the matrix $\begin{bmatrix} 8 & x & 0 \\ 4 & 0 & 2 \\ 12 & 6 & 0 \end{bmatrix}$ become singular?

(A) 4 (B) 6
(C) 8 (D) 2

32. If the eigen value of the matrix $S=\begin{bmatrix}3 & 2\\ 2 & 3\end{bmatrix}$ are 5 and 1. What is the eigen value of the matrix S^2?

(A) 2 and 10 (B) 6 and 4

(C) 1 and 25 (D) 5 and 1

33. If $A=\begin{bmatrix}3 & -2\\ 4 & -2\end{bmatrix}$ satisfies the matrix equation $A^2-kA+2I=0$, then what is the value of k?

(A) 0 (B) 1

(C) 2 (D) 3

34. If A and B are symmetric matrices of the same order then, then which one of the following is not correct?

(A) $A+B$ is a symmetric matrix (B) $AB-BA$ is a symmetric matrix

(C) $AB+BA$ is a symmetric matrix (D) None of these

35. What is the dimension of the vector space formed by the solution of the system of the following equations : $\begin{aligned}x+y+z&=0\\ x+2y&=0\\ y-z&=0\end{aligned}$?

(A) 1 (B) 2

(C) 3 (D) 0

36. The value of α for which the system of equations $\begin{aligned}x+y+z&=0\\ y+2z&=0\\ \alpha x+z&=0\end{aligned}$ has more than one solution is

(A) –1 (B) 0

(C) 1/2 (D) 1

37. Let $M=\begin{bmatrix}1 & 1 & 0\\ -1 & 1 & 2\\ 2 & 2 & 0\\ -1 & 0 & 1\end{bmatrix}$. Then the rank of M is equal to

(A) 3 (B) 4

(C) 2 (D) 1

38. Let A be an $n\times n$ matrix which is both Hermitian and unitary. Then

(A) $A^2=I$ (B) A is real

(C) eigen values are 0, 1,–1 (D) None of these

39. The eigen values of a skew-symmetric matrix are

(A) always zero (B) always pure imaginary

(C) either zero or pure imaginary (D) always real

40. Let the characteristics equation of a matrix M be $\lambda^2 - \lambda - 1 = 0$ then

(A) M^{-1} does not exist

(B) $M^{-1} = M + 1$

(C) M^{-1} exists but cannot be determined from the data

(D) $M^{-1} = M - 1$

41. The function $f(x) = x^3 - 6x^2 + 9x + 25$ has

(A) a maxima at $x = 1$ and a minima at $x = 3$

(B) a maxima at $x = 3$ and a minima at $x = 1$

(C) no maxima, but a minima at $x = 1$

(D) a maxima at $x = 1$, but no minima

42. Let W_1 and W_2 be finite dimensional subspaces of a vector space V. If $\dim W_1 = 2, \dim W_2 = 2, \dim (W_1 + W_2) = 3$, then $\dim (W_1 \cap W_2)$ is

(A) 1 (B) 2

(C) 3 (D) 4

43. Let A be a non-zero upper triangular matrix all of whose eigen values are 0. Then $I + A$ is

(A) Invertible (B) Singular

(C) Idempotent (D) Nilpotent

44. If $\dim \frac{V}{W} = 8$ and $\dim W = 3$, then $\dim V$ is

(A) 11 (B) 5

(C) 10 (D) 1

45. If V_1, V_2, V_3 be three non-zero vectors in R^n are linearly dependent, then

(A) V_3 must be a linear combination of V_1 and V_2

(B) V_2 must be a linear combination of V_1 and V_3

(C) V_1 must be a linear combination of V_2 and V_3

(D) None of the above

46. Let V and W be subspaces of R^n. Then

(A) $\dim(V+W)=\dim V+\dim W$ (B) $\dim(V+W)>\dim V+\dim W$

(C) $\dim(V+W)<\min(\dim V, \dim W)$ (D) $\dim(V+W)=\dim V+\dim W-\dim(V\cap W)$

47. The dimension of the vector space $C(R)$ is

(A) 1 (B) 2

(C) 4 (D) 0

48. If M is a 7×5 matrix of rank 3 and N is a 5×7 matrix of rank 5, then rank (MN) is

(A) 5 (B) 2

(C) 3 (D) 1

49. Let M be the real 5×5 matrix having all of its entries equal to 1. Then

(A) M is not diagonalizable (B) M is idempotent

(C) M is nilpotent (D) None of these

50. The square matrix A of order n over R has rank n. Which one of the following statement is not correct?

(A) A^T has rank n (B) A is non singular

(C) A is singular (D) A has n linearly independent columns

51. Matrix has a value. This statement is

(A) Always true (B) Depends on the matrices

(C) False (D) None of these

52. A square matrix A is called orthogonal if

(A) $A=A^2$ (B) $AA^{-1}=I$

(C) $A'=A^{-1}$ (D) None of these

53. The sum and product of the eigen values of the matrix $\begin{bmatrix} 2 & -3 \\ 4 & -2 \end{bmatrix}$ are

(A) 0, 8 (B) 0, –4

(C) 1, 2 (D) 1, –4

54. To multiply a matrix by scalar *k*, multiply

(A) any row by *k* (B) every element by *k*

(C) any column by *k* (D) None of these

55. Two square matrices *A* and *B* are similar if

(A) $A = B$ (B) $B = P^{-1}AP$

(C) $A' = B'$ (D) $A^{-1} = B^{-1}$

56. If the rank of a matrix *A* is 2, then the rank of A' is

(A) 2 (B) more than 2

(C) less than 2 (D) zero

57. The number of elements of order 5 in the symmetric group S_5 is

(A) 5 (B) 24

(C) 20 (D) 12

58. The dimension of the vector space of all 3×3 real symmetric matrices is

(A) 3 (B) 0

(C) 6 (D) 9

59. Let $M = \begin{bmatrix} 1 & 3 & 2 \\ 0 & 4 & 5 \\ 0 & 0 & 9 \end{bmatrix}$, then

(A) *M* is diagonalizable but not M^2 (B) M^2 is diagonalizable but not *M*

(C) Both *M* and M^2 are diagonalizable (D) Neither *M* nor M^2 is diagonalizable

60. Let X and Y be normal spaces. Every linear map $T: X \to Y$ is continuous if

(A) $\dim(X) < \infty$ (B) $\dim(Y) < \infty$

(C) $\dim(Y) = 1$ (D) None of these

61. The sequence $\left\{\frac{n}{n+1}\right\}$ is

(A) Increasing sequence (B) Decreasing sequence

(C) Unbounded (D) None of these

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

(A) Convergent (B) Divergent

(C) Unbounded (D) None of these

63. If $f: N \to R$ is a sequence, what is f(x) for each $x \in n$?

(A) $f(x)$ is a natural number (B) $f(x)$ is a real number

(C) $f(x)$ is a complex number (D) None of these

64. The series $\frac{1}{1\cdot 3}+\frac{1}{2\cdot 4}+\frac{1}{3\cdot 5}+\cdots$ is

(A) decreasing (B) divergent

(C) convergent (D) none of these

65. The sequence $\{x_n\}$, where $x_n = \left(1+\frac{1}{n}\right)^{2n}$ converges to

(A) e (B) e^2

(C) $e^{1/2}$ (D) None of these

66. The function $f(x) = |x|$ at $x = 0$ is

(A) continuous and differentiable (B) continuous but not differentiable

(C) not continuous but differentiable (D) neither continuous nor differentiable

67. $\lim_{x\to\infty} x \sin\frac{1}{x}$ equals to

(A) 0 (B) 1

(C) –1 (D) ∞

68. Let $f : [0,1] \to [0,1]$ be a continuous function, then

(A) f need not to have any fixed points
(B) f has atleast nine fixed points
(C) f has atleast one fixed point
(D) None of these

69. Statement [A] : f is continuous

Statement [B] : f is differentiable

(A) If [A] is true, then [B] is true
(B) If [A] is false, then [B] is false
(C) If [B] is true, then [A] is true
(D) If [B] is true, then [A] is false

70. The value 'c' of Lagrange's mean value theorem for the function $f(x) = x(x-1)$ in [1, 2] is given by

(A) 3/2
(B) 1/2
(C) 5/4
(D) 7/4

71. If $f'(x) = 0, \forall x \in (a,b)$ then

(A) $f(x)$ is zero in (a,b)
(B) $f(x)$ is constant in (a,b)
(C) $f(x)$ is greater than 0 in (a,b)
(D) None of these

72. If $f(x)$ is continuous in $[a, a+h]$, derivable in $(a, a+h)$ then $f(a+h) = f(a) + hf'(a+\theta h)$, where

(A) θ is any real number
(B) $\theta > 1$
(C) $0 < \theta < 1$
(D) θ is an integer

73. Lagrange's mean value theorem is obtained from Cauchy's mean value theorem for the function $f(x)$ and $g(x)$ by putting $g(x)$ as

(A) x
(B) 0
(C) 1
(D) None of these

74. The expansion of $\tan^{-1} x$ in infinite series is valid on

(A) (–1, 1)
(B) [–1, 1]
(C) (–1, 1]
(D) [–1, 1)

75. An integral $\int_a^\infty f(x)dx$ is convergent then its value is

(A) Finite (B) Infinite
(C) Oscillatory (D) None of these

76. The improper integral $\int_a^\infty \frac{dx}{x^n}\,(a>0)$ converges if and only if

(A) $n<1$ (B) $n=1$
(C) $n>1$ (D) None of these

77. The value of the integral is $\int_0^\infty e^{-5x}\,dx$ is

(A) $\frac{1}{5}$ (B) $-\frac{1}{5}$
(C) 0 (D) 1

78. An integral over a three dimensional domain is called

(A) Line Integral (B) Surface Integral
(C) Volume Integral (D) Double Integral

79. Integration of function is same as the

(A) Joining many small entities to create a large entity
(B) Indefinitely small difference of a function
(C) Multiplication of two function with very small change in value
(D) Point where function neither have maximum nor minimum value

80. The derivative of the function $f(x)=\sin nx$ is

(A) odd (B) constant
(C) zero (D) even

81. A function $F(x)=f(x)g(x)$ have derivatives at x_0 if

(A) $f(x)$ has derivative at x_0 but $g(x)$ has not
(B) $g(x)$ has derivative at x_0 but $f(x)$ has not
(C) $f(x)$ and $g(x)$ both have derivative at x_0
(D) None of the above

82. The points of maxima and minima for the function $f(x) = 2x^3 - 9x^2 + 12x - 5$ in [0, 3] are

(A) 3,0 (B) –1, 3

(C) 0, –2 (D) 1, 2

83. It is given that at $x = 1$ the function $f(x) = x^4 - 62x^2 + ax + 9$ attains its maximum value in the interval [0, 2]. Find the value of a.

(A) 12 (B) 120

(C) 100 (D) 20

84. The radius of curvature for the curve $x^3 + y^3 - 2x^2 + 6y = 0$ at the origin is

(A) 1/2 (B) 0

(C) 3/2 (D) –1/2

85. An asymptote of a curve is a straight line that tends to touch the curve at

(A) Origin (B) x-axis

(C) y-axis (D) infinity

86. The asymptotes of the curve $x^2y^2 - x^2y - xy^2 + x + y + 1 = 0$ are

(A) $x = 0, 1$ and $y = 0, 1$ (B) $x = \pm 1$ and $y = \pm 1$

(C) No parallel asymptotes exist (D) None of these

87. The area bounded by the parabola $y^2 = 4ax$ and its latus rectum $x = a$ is

(A) $\frac{4a^2}{3}$ (B) $\frac{8a^2}{3}$

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

88. The length of the arc of the curve $y = f(x)$, between the points $x = a$ and $x = b$ is

(A) $\int_a^b y\,dx$ (B) $\int_a^b x\,dy$

(C) $\int_a^b \sqrt{\left[1 + \left(\frac{dy}{dx}\right)^2\right]}\,dx$ (D) zero

89. The volume of the solid generated by the revolution about the *x*-axis, of the area bounded by the curve $y = f(x)$, the *x*-axis and the ordinates $x = a$, $x = b$ is

(A) $\int_a^b \pi y^2 \, dx$ (B) $\int_a^b \pi x^2 \, dy$

(C) $\int_a^b y \, dx$ (D) None of these

90. The surface area of the solid generated by the revolution about *y*-axis, of the curve $x = f(y)$ from $y = a$ to $y = b$ is

(A) $\int_a^b 2\pi \, yds$ (B) $\int_a^b 2\pi \, xds$

(C) $\int_a^b xdy$ (D) None of these

91. The solution of ordinary differential equation of n order contains

(A) no-arbitrary constants (B) more than *n*-arbitrary constants

(C) *n*-arbitrary constants (D) None of these

92. Which one of the following is the solution of a differential equation?

(A) node (B) locus

(C) cusp (D) envelope

93. The order and degree of the differential equation $\left[1 + \left(\frac{dy}{dx}\right)^2\right]^3 = \frac{d^2y}{dx^2}$ is

(A) 1, 1 (B) 1, 2

(C) 2, 2 (D) 2, 1

94. The equation $\frac{dy}{dx} + Py = Q$ is a linear differential equation of first order if

(A) *P, Q* are functions of *x* only (B) *P, Q* are functions of *y* only

(C) *P, Q* are functions of *x* and *y* (D) None of these

95. A solution of a differential equation which contains no arbitrary constants is

(A) general solution (B) particular solution

(C) primitive (D) none of these

96. The general solution of $2\frac{d^2y}{dx^2}+5\frac{dy}{dx}+2y=0$ is

(A) $y=Ae^{-2x}$ (B) $y=Be^{\frac{x}{2}}$

(C) $y=Ae^{-2x}+Be^{-\frac{x}{2}}$ (D) None of these

97. In linear differential equation, the dependent variable and its differential coefficients are not multiplied together and occurs only in

(A) first degree (B) second degree

(C) third degree (D) fourth degree

98. The necessary condition for the equation $M(x,y)dx+N(x,\ y)dy=0$ to be exact is

(A) $\frac{\partial N}{\partial y}=\frac{\partial M}{\partial x}$ (B) $\frac{\partial N}{\partial y}=-\frac{\partial M}{\partial x}$

(C) $\frac{\partial M}{\partial y}=\frac{\partial N}{\partial x}$ (D) $\frac{\partial M}{\partial y}=-\frac{\partial N}{\partial x}$

99. A differential equation of first order and first degree is homogeneous, if

(A) $\frac{dy}{dx}=\phi(x)$ (B) $\frac{dy}{dx}=\phi\left(\frac{y}{x}\right)$

(C) $\frac{dy}{dx}=$constant (D) None of these

100. The equation $ydx+xdy=0$ is

(A) Exact differential equation (B) Non-exact differential equation

(C) Partial differential equation (D) None of these

101. The complementary function of $(D^2-a^2)y=0$ is

(A) $y=c_1\cos ax+c_2\sin ax$ (B) $y=c_1e^{ax}+c_2e^{-ax}$

(C) $y=(c_1+c_2x)e^{ax}$ (D) None of these

102. For $(D^2+4)y=\tan 2x$ solving by variation of parameters. The value of Wroskian W is

(A) 1 (B) 2

(C) 3 (D) 4

103. The particular integral of the differential equation $\frac{d^2y}{dx^2} + \frac{dy}{dx} = x^2 + 2x + 4$ is

(A) $\frac{x^2}{3} + 4x$ (B) $\frac{x^3}{3} + 4$

(C) $\frac{x^3}{3} + 4x$ (D) $\frac{x^3}{3} + 4x^2$

104. A general solution of a linear differential equation with constant coefficient is

(A) sum of particular solution and complementary function
(B) product of particular solution and complementary function
(C) quotient of particular solution and complementary function
(D) None of these

105. The equation $y = Ae^{3x} + Be^{5x}$ can be represented as

(A) $y'' + 8y' = 0$ (B) $y'' - 8y' + 15y = 0$

(C) $y'' + 8y' + 15y = 0$ (D) $y' + 8y = 0$

106. The equation $x = A\cos(pt - \alpha)$ can be expressed as

(A) $\frac{d^2x}{dt^2} = x$ (B) $\frac{d^2x}{dt^2} = 0$

(C) $\frac{d^2x}{dt^2} = -p^2x$ (D) None of these

107. The differential equation $\frac{dy}{dx} + Py = Q$, P and Q are functions of x only, have the integrating Factor

(A) $e^{\int Qdx}$ (B) $e^{\int Qdy}$

(C) $e^{\int Pdy}$ (D) $e^{\int Pdx}$

108. If an equation $M(x, y)dx + N(x, y)dy = 0$ is not exact, let $F(x, y)$ be such that $FM(x, y)dx + FN(x, y)dy = 0$ is exact, then the function $F(x, y)$ is called

(A) Differentiable function (B) Arbitrary function
(C) Integrating factor (D) None of these

109. The differential equation $y'' + 6y' + 9y = 50e^{2x}$ have particular integral as

(A) $\frac{2}{3}e^{2x}$ (B) $2e^{2x}$

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

110. The linearity principle for ordinary differential equation holds for

(A) non-homogeneous equation (B) non-linear equation
(C) linear differential equation (D) none of these

111. For the equation $\frac{dy}{dx} + 3y = e^{2x}$, the integrating factor is

(A) e^{3x} (B) e^{2x}
(C) e^{-2x} (D) e^{-3x}

112. Given $\frac{dy}{dx} = 2xy$, the solution of the equation is

(A) $y = x^2$ (B) $\log y = x^2 + \log a$
(C) $\log y = x + \log a$ (D) $\log y = x$

113. The solution of the differential equation $(D-1)^2 y = 0$ is

(A) $y = c_1 e^x + c_2 e^{-x}$ (B) $y = A\cos x + B\sin x$
(C) $y = (c_1 + c_2 x)e^x$ (D) None of these

114. The points $A(7, 0, 10)$, $B(6, -1, 6)$ and $C(9, -4, 6)$ are co-ordinates of

(A) Collinear (B) Equilateral triangle
(C) Isosceles triangle (D) None of these

115. Find the ratio in which the line joining the points (4, 4, –10) and (–2, 2, 4) is divided by *YZ* plane.

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

116. Find the coordinates of the points which divides the line joining the points (1,3,7), (6,3,2) in the ratio 2:3.

(A) (1,2,5) (B) (2,2,5)
(C) (1,3,5) (D) (3,3,5)

117. If *l*, *m*, *n* are direction cosines of a line then,

(A) $l + m + n = 0$ (B) $l^2 + m^2 + n^2 = 1$
(C) $l + m + n = 1$ (D) None of these

118. If the direction ratios of a line are 1, –2, 2, then find its direction cosines.

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

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

119. Find the equation to the plane through (1,2,3) parallel to the plane $4x+5y-3z+7=0$.

(A) $x+5y-3z+2=0$ (B) $4x+y-3z+2=0$

(C) $x+y-z+7=0$ (D) $4x+5y-3z-5=0$

120. The length of the perpendicular from the origin to the plane $ax+by+cz+d=0$ is

(A) $\frac{d}{\sqrt{a^2+b^2+c^2}}$ (B) $\frac{a}{\sqrt{a^2+b^2+c^2}}$

(C) $\frac{b}{\sqrt{a^2+b^2+c^2}}$ (D) $\frac{c}{\sqrt{a^2+b^2+c^2}}$

121. Find the equation of the plane passing through the intersection of the planes $3x-y+2z=4$ and $x+y+z=2$ and passing through the point (2, 2, 1)

(A) $3x+y+2z=1$ (B) $7x-5y+4z=8$

(C) $3x-2y+2z=1$ (D) $x-2y+3z=2$

122. The point where the line joining the points (2, –3, 1) and (3, –4, –5) cuts the plane $2x+y+z=7$ is

(A) (1, 1, 7) (B) (1, 2, 1)

(C) (1, –2, 7) (D) None of these

123. The angle between the straight lines $\frac{x-1}{4}=\frac{y+1}{3}=\frac{z-1}{1}$ and $\frac{x-2}{3}=\frac{y+4}{1}=\frac{z-4}{5}$ is

(A) $\sin^{-1}\left(\frac{20}{\sqrt{26}}\right)$ (B) $\sin^{-1}\left(\frac{20}{\sqrt{35}}\right)$

(C) $\cos^{-1}\left(\frac{20}{\sqrt{26}\sqrt{35}}\right)$ (D) None of these

124. The equation of the sphere whose centre is (7, 4, –3) and radius 6 is

(A) $x^2+y^2+z^2-14x-8y+6z+38=0$

(B) $x^2+y^2+z^2-2x-2y+3z+3=0$

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

(D) $x^2+y^2+z^2-9=0$

125. The centre of the sphere $2x^2 + 2y^2 + 2z^2 - 4x + 16y + 8z + 20 = 0$ is

(A) (1, 2, 4) (B) (1, –4, –2)
(C) (1, 4, 2) (D) None of these

126. The radius of the sphere $x^2 + y^2 + z^2 + 12x - 2y - 6z + 30 = 0$ is

(A) 3 (B) 2
(C) 5 (D) 4

127. Two spheres are said to cut each other orthogonally if the tangent planes at a point of intersection are

(A) same (B) at $45°$
(C) at $90°$ (D) None of these

128. The semi vertical angle of the cone generated by revolving the line $x + y = 0$ about the x-axis is

(A) $45°$ (B) $90°$
(C) $30°$ (D) None of these

129. The equation $2(x^2 + y^2 + z^2) - 2xy + 2yz + 2zx = 3a^2$ represents a

(A) pair of lines (B) sphere
(C) right circular cylinder (D) none of these

130. The radius of a great circle of sphere is

(A) greater than the radius of the sphere (B) less than the radius of the sphere
(C) equal to the radius of the sphere (D) None of these

131. The section of a sphere by a plane is

(A) circle (B) ellipse
(C) parabola (D) None of these

132. A line makes angle α, β, γ with the co-ordinate axes, then $\cos 2\alpha + \cos 2\beta + \cos 2\gamma$ is equal to

(A) 1 (B) –1
(C) –2 (D) 2

133. If $\overrightarrow{OP} = 2\vec{i} + 3\vec{j} - \vec{k}$ and $\overrightarrow{OQ} = 3\vec{i} - 4\vec{j} + 2\vec{k}$, then $\overrightarrow{PQ}$ is

(A) $\vec{i} - 7\vec{j} + 3\vec{k}$ (B) $\vec{i} - \vec{j} + 2\vec{k}$

(C) $2\vec{i} - \vec{j} + 2\vec{k}$ (D) None of these

134. The cosine of the angle between the vectors $2\vec{i} + 2\vec{j} - \vec{k}$ and $6\vec{i} - 3\vec{j} + 2\vec{k}$ is

(A) $\frac{1}{21}$ (B) $\frac{4}{3}$

(C) $\frac{4}{21}$ (D) None of these

135. The value of α such that the vectors $2\vec{i} - \vec{j} + \vec{k}$ and $\vec{i} - 3\vec{j} + \alpha\vec{k}$ are at right angle is

(A) –5 (B) 5

(C) 2 (D) None of these

136. Find the unit vector perpendicular to each of the vectors $\vec{a} = 3\vec{i} + \vec{j} + 2\vec{k}$ and $\vec{b} = 2\vec{i} - 2\vec{j} + 4\vec{k}$.

(A) $\vec{i} - \vec{j} - \vec{k}$ (B) $\frac{\vec{i} - \vec{j} - \vec{k}}{\sqrt{3}}$

(C) $\frac{2\vec{i} - \vec{j} - \vec{k}}{\sqrt{5}}$ (D) None of these

137. A vector, 5 units from the origin, along the *X* axis, is added to vector 2 units from the origin along the *Y* axis, then the resultant vector is

(A) $2\vec{i} + 5\vec{j}$ (B) $2\vec{i} - \vec{j}$

(C) $\vec{i} - 2\vec{j}$ (D) $5\vec{i} + 2\vec{j}$

138. When two vectors in the same direction are added, the magnitude of resulting vector is equal to

(A) Sum of magnitudes of the vectors (B) Difference of magnitudes of the vectors

(C) Product of magnitudes of the vectors (D) Sum of the roots of magnitudes of vectors

139. The position of a body, moving in a plane, changes from origin to $12\vec{i} + 6\vec{j}$ in 20s. What is the velocity of the body?

(A) $2\vec{i} + \vec{j}$ (B) $1.2\vec{i} + 0.6\vec{j}$

(C) $0.6\vec{i} + 0.3\vec{j}$ (D) None of these

140. Two forces *P* and *Q* are acting at an angle θ, their resultant (*R*) is given by

(A) $R = \sqrt{P^2 + Q^2 + 2AB\sin 2\theta}$ (B) $R = \sqrt{P^2 + Q^2 + 2AB\cos 2\theta}$

(C) $R = \sqrt{P^2 + Q^2 + 2AB\cos\theta}$ (D) $R = \sqrt{P^2 + Q^2 - 2AB\cos\theta}$

141. The forces which do not meet at a point are called

(A) non-coplanar forces (B) coplanar forces

(C) concurrent forces (D) non- concurrent forces

142. The forces whose lines of action do not lie in the same plane, are called

(A) non-coplanar forces (B) coplanar forces

(C) non-concurrent forces (D) none of the above

143. Coplanar concurrent forces means the lines of action of forces

(A) lie in the same plane

(B) lie in the same plane but the forces are not meeting at one point

(C) lie in the same plane and forces are meeting at one point

(D) none of the above

144. The statement—if three forces acting at a point can be represented in magnitude and direction by the sides of a triangle taken in order, the forces are in equilibrium—is known as

(A) Lami's theorem (B) Law of polygon of forces

(C) Newton's law of forces (D) Law of triangle of forces

145. The statement—the algebraic sum of the moments taken about any point in the plane of forces is zero—is known as

(A) Law of polygon of forces (B) Lami's theorem

(C) Newton's law of forces (D) Law of moments

146. Two forces *A* and *B* are acting at an angle θ and their resultant *B* makes an angle α with the force *A*, then

(A) $\tan\alpha = \frac{B\sin\theta}{B + A\cos\theta}$ (B) $\tan\alpha = \frac{A\sin\theta}{A + B\cos\theta}$

(C) $\tan\alpha = \frac{B\sin\theta}{A + B\cos\theta}$ (D) None of these

147. Limiting force of friction is defined as the frictional force which exists when a body

(A) is moving with maximum velocity (B) is stationary

(C) just begins to slide over the surface (D) none of the above

148. The force of friction which exists when the body is in motion is called

(A) static friction (B) dynamic friction

(C) limiting friction (D) none of the above

149. A body of weight *W* is resting on a horizontal plane. A force *P* is applied parallel to the plane to move the body. The value of *P*, necessary to move the body against the resistance of friction is(ϕ is the angle of friction)

(A) $W / \tan\phi$ (B) $W \sin\phi$

(C) $W \cos\phi$ (D) $W \tan\phi$

150. The minimum force *P*, applied at an angle θ with the horizontal plane, on which a body of weight *W* is placed, to move the body is (see Fig. 1)

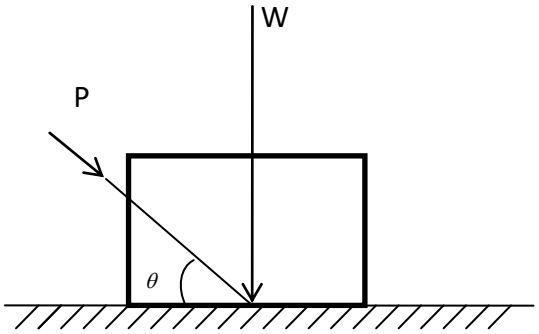


Fig. 1

(A) $W \sin\phi$ (B) $W \cos\phi$

(C) $W \tan\phi$ (D) $W / \tan\phi$

151. Refer to Fig. 1, the force *P* will be minimum when

(A) $\theta = 2\phi$ (B) $\theta = \phi$

(C) $\theta = 90 - \phi$ (D) $\theta = 90 - 2\phi$

152. A horizontal force of 400 N is applied on a body of weight 1200 N, placed on a horizontal plane. If the body is just on the point of motion, the angle of friction would be

(A) 20° (B) $18^\circ 26'$

(C) 10° (D) 25°

153. A body of weight *W* is placed on an inclined plane. The angle made by the inclined plane with horizontal, when the body is on the point of moving down is called

(A) angle of repose (B) angle of inclination

(C) angle of friction (D) angle of limiting friction

154. The number of members (n) and number of joints (j) in a perfect frame is given by

(A) $n = (3j - 2)$ (B) $n = (2j - 3)$

(C) $j = (2n - 3)$ (D) $j = (3n - 2)$

155. The resultant of two forces each equal to $\frac{P}{4}$ and acting at right angles is

(A) $\frac{P}{2}$ (B) $\sqrt{2P}$

(C) $\frac{P}{2\sqrt{2}}$ (D) $\frac{P}{\sqrt{2}}$

156. The C.G. of a triangle lies at the point of concurrence of

(A) the right bisectors of the angle of the triangle

(B) the medians of the triangle

(C) the altitudes from the vertices on the opposite side

(D) none of the above

157. The C.G. of a thin hollow hemisphere is at a distance of

(A) $\frac{r}{2}$ from base (B) $\frac{r}{3}$ from base

(C) $\frac{r}{4}$ from base (D) none of these

158. The units of moment of inertia of area are

(A) kg-m^3 (B) kg-m^2

(C) m^4 (D) None of these

159. If a body is moving in a straight line, the motion of the body is called

(A) rectilinear (B) rotational

(C) curvilinear (D) none of these

160. The product of mass and velocity of a body is called

(A) acceleration (B) velocity

(C) momentum (D) none of these

161. If a body is moving with a uniform acceleration (a), then the distance travelled by a body after time 't' is equal to

(A) $ut + \frac{1}{2}at^2$ (B) $u + at$

(C) $u^2 + 2av$ (D) None of these

162. Rate of change of angular velocity is called

(A) acceleration (B) angular acceleration

(C) kinetic energy (D) none of these

163. The expression $\frac{1}{2}mV^2$ denotes

(A) centrifugal force (B) potential energy

(C) kinetic energy (D) none of these

164. When two bodies of mass (m and $2m$) are connected by a light inextensible string and pass over a smooth pulley, then acceleration of one body is

(A) equal to the acceleration of the other body

(B) two time the acceleration of the other body

(C) half the acceleration of the other body

(D) none of the above

165. The maximum height attained by a ball (to weight 500 N) which is thrown vertically upwards with a velocity 4.9 m/s is equal to

(A) 100 cm (B) 245 cm

(C) 122.5 cm (D) 980 cm

166. A body is moving with a velocity of 2 m/s. If the velocity of body becomes 5 m/s after 4 seconds, the acceleration of the body would be

(A) 1 m/s^2 (B) 0.75 m/s^2

(C) 1.5 m/s^2 (D) 0.375 m/s^2

167. A light string passes over a smooth, weightless pulley and has weights 40 N and 60 N attached to its end as shown in Fig. 2. The tension in string will be

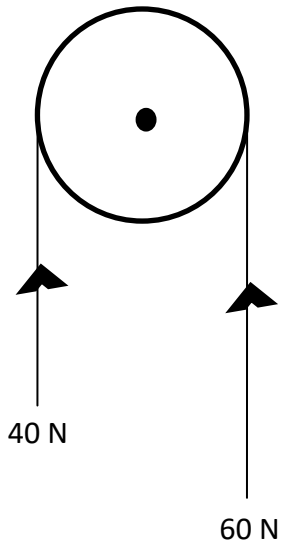


Fig. 2

(A) 60 N (B) 50 N

(C) 48 N (D) 20 N

168. Refer to Fig. 2, the acceleration, with which the weight 60 N descends, is

(A) $\frac{g}{5}$ (B) $\frac{g}{4}$

(C) $\frac{g}{2}$ (D) $5g$

169. With elastic limit in a loaded material, stress is

(A) inversely proportional to strain (B) directly proportional to strain

(C) equal to strain (D) none of the above

170. The ratio of shear stress to shear strain is called

(A) Poisson's ratio (B) Bulk modulus

(C) Modulus of rigidity (D) Modulus of elasticity

171. The binary equivalent of the decimal number 10 is

(A) 0010 (B) 10

(C) 1010 (D) 010

172. The octal equivalent of 1100101.001010 is

(A) 624.12 (B) 145.12

(C) 154.12 (D) 145.21

173. The binary number 111 in octal format is

(A) 6 (B) 7

(C) 8 (D) 5

174. The number $(5401)_8$ into hexadecimal form can be expressed as

(A) A01 (B) A02

(C) B01 (D) C01

175. What is the addition of the binary numbers 101101 and 011011?

(A) 011010 (B) 1010100

(C) 101110 (D) 1001000

176. What does the symbol C represent in a hexadecimal number system?

(A) 8 (B) 16

(C) 13 (D) 14

177. The number $(52)_{16}$ into its decimal equivalent can be written as

(A) 82 (B) 83

(C) 80 (D) 28

178. The entities whose values can be changed called as

(A) Constants (B) Variables

(C) Modules (D) Tokens

179. Which of the following is not a basic data type in C language?

(A) float (B) integer

(C) real (D) none of these

180. Which of the following is not a type of computer code?

(A) EBCDIC (B) BCD
(C) ASCII (D) EDIC

181. The hex representation for G is

(A) C6 (B) C5
(C) D6 (D) D1

182. Which of the following character is available in EBCDIC but not in ASCII?

(A) cent sign (B) dollar sign
(C) comma (D) punctuation

183. What does MBR stand for?

(A) Main Buffer Register (B) Memory Buffer Routine
(C) Main Buffer Routine (D) Memory Buffer Register

184. Which of the following holds the last instruction fetched?

(A) PC (B) IR
(C) MAR (D) MBR

185. What kind of a flag is the sign flag?

(A) General Purpose (B) Address
(C) Status (D) Instruction

186. The transfer between CPU and Cache is known as

(A) Block transfer (B) Word transfer
(C) Set transfer (D) Associative transfer

187. Which function reduces a file's size so that it uses less storage space?

(A) File synthesizing (B) File defragmenting
(C) File scanning (D) File compression

188. Which of the following memory is used in digital camera?

(A) Virtual memory (B) Flash memory

(C) Main memory (D) Cache memory

189. Which of the following memory is considered as the largest unit?

(A) Peta byte (PB) (B) Exa byte (EB)

(C) Zetta byte (ZB) (D) Yotta byte (YB)

190. The theorem which deals with NOR and NAND gates are

(A) Demorgan's theorem (B) Baye's theorem

(C) Boolean's theorem (D) Booth's theorem

191. The following gates are designated as universal gates

(A) NOT, OR, AND (B) XOR, OR, AND

(C) XNOR, NOR, NAND (D) NOR, NAND

192. Given the truth table relating *Y* to *A, B*

A	0	0	1	1
B	0	1	0	1
Y	1	1	1	0

then *Y* is given by

(A) $A + B$ (B) $\overline{A \cdot B}$

(C) $\overline{A + B}$ (D) $A \cdot B$

193. Which of the following logic gates provide output as 0 when both inputs are same (either 0 or 1)?

(A) XNOR (B) NAND

(C) NOR (D) XOR

194. XOR circuit can be constructed using

(A) OR gates only (B) AND, OR gates

(C) AND, NOT gates (D) AND, NOT and OR gates

195. An algorithm represented in the form of programming languages is

(A) Flow chart (B) Pseudo code

(C) Program (D) None of these

196. The pictorial representation of an algorithm is known as

(A) Flow chart (B) Program

(C) Pseudo code (D) None of these

197. Kite box in flow chart is used for

(A) connector (B) decision

(C) statement (D) all

198. Goto statement is used for

(A) jump the control of the program

(B) user defined iteration

(C) same as switch case statement

(D) none of the above

199. A measurement which on repetition givens same or nearly same result is called as

(A) accurate measurement (B) average measurement

(C) precise measurement (D) estimated measurement

200. Computer is free from tiresome and boredom. We call it

(A) Accuracy (B) Reliability

(C) Versatility (D) Diligence

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