1. A relation $R$ is defined on the set $Z$ of integers as follows:
$\mathbf{m R n} \Leftrightarrow m+$ nisodd.
Which of the following statements is/are true for $R$ ?
2. $R$ is reflexive
3. $R$ is symmetric
4. $R$ is transitive

Select the correct answer using the code given below:
a) 2 only
b) 2 and 3
c) 1 and 2
d) 1 and 3
2. The maximum three digit integer in the decimal system will be represented in the binary system by which one of the following?
a) 1111110001
b) 1111111110
c) 1111100111
d) 1111000111
3. Let $\mathrm{f}:[-100 \pi, 100 \pi] \rightarrow[-1,1]$ be defined by $\mathrm{f}(\theta$ $\mathbf{J}=\sin \theta$. Then what is the number of values of $\theta$ $\in[-100 \pi, 1000 \pi]$ for which $\mathbf{f}(\theta)=\mathbf{0}$ ?
a) 1000
b) 1101
c) 1100
d) 1110
4. What does the shaded region in the Venn diagram given below represent?

a) $C \cap(A \cap B)$
b) $\quad C \cup(C \cap A \cap B)$
c) $C \cup(C \cap A) \cup(C \cap B)$
d) $C \cup(A / B)$
5. The difference of two numbers 10001100 and 1101101 in binary system is expressed in decimal system by which one of the following?
a) 27
b) 29
c) 31
d) 33
6. If $A$ and $B$ are subsets of a set $X$, then what is $\{A \cap(X-B)\} \cup B$ equal to ?
a) $A \cup B$
b) $A \cap B$
c) A
d) $B$
7. The number 0.0011 in binary system represents a) rational number $3 / 8$ in decimal system b) rational number $1 / 8$ in decimal system
c) rational number $3 / 16$ in decimal system
d) rational number 5/16 in decimal system
8. If $A=P(\{1,2\})$ where $\mathbf{P}$ denotes the power set, then which of the following is correct?
a) $\quad\{1,2\} \subset A$
b) b) $1 \in A$
c) $\phi \notin A$
d) $\{1,2\} \in A$
9. If $A=\{1,2,5,6\}$ and $B=\{1,2,3\}$ then what is $(A \times B) \cap(B \times A)$ equal to?
a) $\{(1,1),(2,1),(6,1),(3,2)\}$
b) $\{(1,1),(1,2),(2,1),(2,2)\}$
c) $\{(1,1),(2,2)\}$
d) $\{(1,1),(1,2),(2,5),(2,6)\}$
10. Out of 500 first year students, 260 passed in the first semester and 210 passed in the second semester. If $\mathbf{1 7 0}$ did not pass in either semester, how many passed in both semesters?
a) 30
b) 40
c) 70
d) 140
11. Let $A=\{x \in W$, the set of whole numbers and $\mathrm{x}<3\}$
$\mathbf{B}=\{x \in N$, the set of natural numbers and $2 \leq \mathrm{x}<4\}$ and $C=\{3,4\}$, then how many elements will $(A \cup B) \times C$ contain?
a) 6
b) 8
c) 10
d) 12
12. If $\sin \theta$ and $\cos \theta$ are roots of $a x^{2}+b x+c=0$, then constants $a, b, c$ will satisfy which one of the following conditions?
a) $a^{2}+b^{2}+2 a c=0$
b) $\mathrm{a}^{2}+\mathrm{b}^{2}-2 \mathrm{ac}=0$
c) $\quad a^{2}-b^{2}+2 a c=0$
$-a^{2}+b^{2}+2 a c=0$
13. How many real values of x satisfy the equation $|x|+|x-1|=1$ ?
a) 1
b) 2
c) Infinite
d) No value of $x$
14. What is the value of $\sqrt{5 \sqrt{5 \sqrt{5 \sqrt{\ldots \infty \infty}}}}$ ?
a) 5
b) $\sqrt{5}$
c) 1
d) $(5)^{1 / 4}$
15. If $(x+a)$ is a factor of both the quadratic polynomials $x^{2}+p x+q$ and $x^{2}+l x+m$ where $p, q$, and $m$ are constants, then which 1 of the following is correct?
a) $\quad a=(m-q) /(l-p)(l \neq p)$
b) $\quad a=(m+q) /(l+p)(l \neq-p)$
c) $\quad l=(m-q) /(a-p)(a \neq p)$
d) $\quad p=(m-q) /(a-l)(a \neq l)$
16. Consider the equation $(x-p)(x-6)+1=0$ having integral coefficients. If the equation has integral roots, then what values can $p$ have?
a) 4 or 8
b) 5 or 10
c) 6 or 12
d) 3 or 6
17. If $p, q$ and $r$ are rational numbers, then the roots of the equation $x^{2}-2 p x+p^{2}-q^{2}+2 q r-r^{2}=0$ are
a) complex
b) pure imaginary
c) irrational
d) rational
18. If the roots of the equation $x^{2}-4 x-\log _{3} N=0$ are real, then what is the minimum value of $N$ ?
a) $1 / 256$
b) $1 / 27$
c) $1 / 64$
d) $1 / 81$
19. A bag contains balls of tow colors, 3 black and 3 whitej. What is the smallest number of balls which must be drawn from the bag, without looking, so that among these three are two of the same colour?
a) 2
b) 3
c) 4
d) 5
20. If $p$ th term of an $A P$ is $q$, and its qthterm is $p$, then what is the common difference?
a) -1
b) 0
c) 2
d) 1
21. If the points with the coordinates ( $\mathrm{a}, \mathrm{ma}$ ), $\{\mathrm{b},(\mathrm{m}$ $+1) b\},\{c,(m+2) c\}$ are collinear, then which one of the following is correct?
a) $a, b, c$ are in arithmetic progression for all $m$
b) $\quad \mathrm{a}, \mathrm{b}, \mathrm{c}$ are in geometric progression for all m
c) $a, b, c$ are in harmonic progression for all $m$
d) $\mathrm{a}, \mathrm{b}, \mathrm{c}$ are in arithmetic progression only for m = 1
22. If $a, 2 a+2,3 a+3$ are in GP, then what is the fourth term of the GP?
a) -13.5
b) 13.5
c) -27
d) 27
23. Let $\mathbf{a}, \mathrm{b}, \mathrm{c}$ be in AP. Consider the following statements:

1. $\frac{1}{a b}, \frac{1}{c a}$ and $\frac{1}{b c}$ are in AP.
2. $\frac{1}{\sqrt{b}+\sqrt{c}}, \frac{1}{\sqrt{c+\sqrt{a}}}$ and $\frac{1}{\sqrt{a}+\sqrt{b}}$ are in AP.

Which of the statements given above is/are correct?
a) 1 only
b) 2 only
c) Both 1 and 2
d) Neither 1 nor 2
24. If $\log 102, \log 10\left(2^{x}-1\right), \log 10\left(2^{x}+3\right)$ are three consecutive terms of an AP, then which one of the following is correct?
a) $x=0$
b) $x=1$
c) $x=\log 25$
d) $x=\log 52$
25. The sum of first 10 terms and 20 terms of an AP are 120 and 440 respectively. What is the common difference?
a) 1
b) 2
c) 3
d) 4
26. Which one of the following is correct? If $z$ and $w$ are complex number a $\bar{w}$ denotes the conjugate of $w$, then $|z+w|-|z-w|$ holds only, if
a) $\mathrm{z}=0$ or $\mathrm{w}=0$
b) $\mathrm{z}=0$ and $\mathrm{w}=0$
c) Z. $\bar{W}$ is purely real $\bar{W}$ is purely imaginary
27. What is the value of $\left(\frac{i+\sqrt{3}}{-i+\sqrt{3}}\right)^{200}+\left(\frac{i+\sqrt{3}}{i+\sqrt{3}}\right)^{200}+1 ?$
a) -1
b) 0
c) 1
d) 2

28 If $z=1+i \tan \alpha$ where $\pi<\alpha<\frac{3 \pi}{2}$, then what is $|\mathbf{z}|$ equal to ?
a) $\sec \alpha$
b) $-\sec \alpha$
c) $\sec 2 \alpha$
d) $-\sec 2 \alpha$
29. For any positive integer $n$, if $4 n-3 n$ is divided by 9 , then what is the remainder?
a) 8
b) 6
c) 4
d) 1
30. What is the number of terms in the expansion of $(a+b+c)^{n}, n \in N$ ?
a) $\mathrm{n}+1$
b) $\mathrm{n}+2$
c) $n(n+1)$
d) $\frac{(n+1)(n+2)}{2}$
31. In how many ways can be letters of the word 'CABLE' be arranged so that the vowels should always occupy odd positions?
a) 12
b) 18
c) 24
d) 36
32. In a football championship 153 matches were played. Every team played one match with each other team. How many teams participated in the championship?
a) 21
b) 18
c) $\quad 17$
d) 15
33. What is the value of $\sum_{r=1}^{n} \frac{P(n, r)}{r!}$ ?
a) $2^{n}-1$
b) $2^{n}$
c) $\quad 2^{n}-1$
d) $2^{n}+1$
34. The straight line $a x+b y+c=0$ and the coordinate axes form an isosceles triangle under which one of the following conditions?
a) $\quad|a|=|b|$
b) $\quad|a|=|c|$
c) $\quad|b|=|c|$
d) none of these
35. The middle point of the segment of the straight line joining the points $(p, q)$ and $(q,-p)$ is $(r / 2$, $s / 2$ ). What is the length of the segment?
a) $\left[\left(s^{2}+r^{2}\right)^{1 / 2}\right] / 2$
b) $\left[\left(s^{2}+r^{2}\right)^{1 / 2}\right] / 4$
c) $\quad\left(s^{2}+r^{2}\right)^{1 / 2}$
d) $\mathrm{s}+\mathrm{r}$
36. What is the locus of the point which is at a distance 8 units to the left of Y -axis?
a) $X=8$
b) $Y=8$
c) $X=-8$
d) $Y=-8$
37. The line making an angle ( $-120^{\circ}$ ) with $x$-axis is situated in the:
a) first quadrant
b) second quadrant
c) third quadrant
d) fourth quadrant
38. Two straight line paths are represented by the equation $2 x-y=2$ and $-4 x+2 y=6$. Then the paths will
a) cross each other at one point
b) not cross each other
c) cross each other at two points
d) cross each other at infinitely many points
39. What is the equation of circle which touches the lines $x=0, y=0$ and $x=2$ ?
a) $x^{2}+y^{2}+2 x+2 y+1=0$
b) $x^{2}+y^{2}-4 x-4 y+1=0$
c) $x^{2}+y^{2}-2 x-2 y+1=0$
d) None of these
40. $P(2,2)$ is a point on the parabola $y 2=2 x$ and $A$ is its vertex. $Q$ is another point on the parabola such that $P Q$ is perpendicular to $A P$. What is the length of PQ ?
a) $\sqrt{2}$
b) $2 \sqrt{ } 2$
c) $4 \sqrt{ } 2$
d) $6 \sqrt{ } 2$
41. If $(4,0)$ and $(-4,0)$ are the foci of an ellipse and the semimnor axis is 3 , then the ellipse passes through which one of the following points?
a) $(2,0)$
b) $(0,5)$
c) $(0,0)$
d) $(5,0)$
42. The equation of the ellipse whose vertices are $( \pm$ $5,0)$ and foci at $( \pm 4,0)$ is
a) $\frac{x^{2}}{25}+\frac{y^{2}}{9}=1$
b) $\frac{x^{2}}{9}+\frac{y^{2}}{25}=1$
c) $\frac{x^{2}}{16}+\frac{y^{2}}{25}=1$
d) $\frac{x^{2}}{25}+\frac{y^{2}}{16}=1$
43. Given that $p=\tan \alpha+\tan \beta$, and $q=\cot \alpha+\cot \beta$; then what is $(1 / p-1 / q)$ equal to?
a) $\cot (\alpha-\beta)$
b) $\quad \tan (\alpha-\beta)$
c) $\tan (\alpha+\beta)$
d) $\cot (\alpha+\beta)$
44. Let $A B C D$ be a square and let $P$ be a point on $A B$ such that AP: $\mathrm{PB}=1: 2$. If $\angle \mathrm{APD}=\boldsymbol{\theta}$, then what is the value of $\cos \theta$ ?
a) $1 / \sqrt{ } 10$
b) $1 / \sqrt{5}$
c) $2 / \sqrt{ } 10$
d) $2 / \sqrt{ } 5$
45. What is the correct sequence of the following values?

$$
\begin{aligned}
& \text { 1. } \sin \left(\frac{\pi}{12}\right) \text { 2. } \cos \left(\frac{\pi}{12}\right) \\
& \text { 3. } \cot \left(\frac{\pi}{12}\right)
\end{aligned}
$$

What is the correct sequence of the following values?
a) $3>2>1$
b) $1>2>3$
c) $1>3>2$
d) $3>1>2$
46. If $\sin ^{4} x-\cos ^{4} x=p$, then which one of the following is correct?
a) $\mathrm{p}=1$
b) $\mathrm{p}=0$
c) $\quad|p|>1$
d) $|p| \leq 1$
47. What is the value of $\cos (\pi / 9)+\cos (\pi / 3)+\cos$ $(5 \pi / 9)+\cos (7 \pi / 9)$ ?
a) 1
b) -1
c) $-1 / 2$
d) $1 / 2$
48. If $y=\sec ^{2} \theta+\cos ^{2} \theta$, where $0<\theta<\pi / 2$, then which one of the following is correct?
a) $y=0$
b) $0 \leq y \leq 2$
c) $y \geq 2$
d) None of these
49. What is the maximum value of $3 \cos x+4 \sin x+$ 5 ?
a) 5
b) 7
c) 10
d) 12
50. What is the value of $\sin \left(1920^{\circ}\right)$ ?
a) $1 / 2$
b) $1 / \sqrt{ } 2$
c) $\sqrt{3} / 2$
d) $1 / 3$
51. If $\operatorname{cosec} \theta+\cot \theta=c$, then what is $\cos \theta$ equal to?
a) $\frac{c}{c^{2}-1}$
b) $\frac{c}{c^{2}+1}$
b) $\frac{c^{2}-1}{c^{2}+1}$
d) None of these
52. If the perimeter of a triangle $A B C$ is 30 cm , then what is the value of $a \cos ^{2}(\mathrm{C} / 2)+c \cos ^{2}(\mathrm{~A} / 2)$ ?
a) 15 cm
b) 10 cm
c) $15 / 2 \mathrm{~cm}$
d) 13 cm
53. Let $-1 \leq x \leq 1$. If $\cos (\sin -1 x)=1 / 2$, then how many value does $\tan (\cos -1 x)$ assume?
a) One
b) Two
c) Four
d) Infinite
54. If angles $A, B$ and $C$ are in $A P$, then what is $\sin A+$ $2 \sin B+\sin C$ equal to?
a) $4 \sin \mathbf{B} \cos ^{2}\left(\frac{A-C}{2}\right)$
b) $4 \sin B \cos ^{2}\left(\frac{A-C}{4}\right)$
c) $4 \sin (2 B) \cos ^{2}\left(\frac{A-C}{2}\right)$
d) $4 \sin (2 B) \cos ^{2}\left(\frac{A-C}{4}\right)$
55. If the sides of a triangle are in the ratio $2: \sqrt{6}: 1+$ $\sqrt{3}$, then what is the smallest angle of the triangle?
a) $75^{\circ}$
b) $60^{\circ}$
c) $45^{\circ}$
d) $30^{\circ}$
56. PT, a tower of height $2 x$ metre, $P$ being the foot, $T$ being the top of the tower. $A, B$ are points on the same line with $P$. If $A P=2^{x+1} \mathrm{~m}, B P=192 \mathrm{~m}$ and if the angle of elevation of the tower as seen from $b$ is double the angle of the elevation of the tower as seen from $A$, then what is the value of $x$ ?
a) 6
b) 7
c) 8
d) 9
57. The angle of elevation of a tower at a level ground is $\mathbf{3 0}$. The angle of elevation becomes $\boldsymbol{\theta}$ when 10 m moved towards the tower. If the height of tower is $5 \sqrt{3} \mathrm{~m}$, then what is $\theta$ equal to?
a) $45^{\circ}$
b) $60^{\circ}$
c) $75^{\circ}$
d) None of the above
58. If $f(x)=(1+x)^{5 / x}$ is continuous at $x=0$, then what is the value of $f(0)$ ?
a) 0
b) 1
c) $\infty$
d) $e^{5}$
59. A function $f$ is defined as follows
$f(x)=x^{p} \cos \left(\frac{1}{x}\right), x \neq 0$
$f(0)=0$
What conditions should be imposed on $p$ so that $f$ may be continuous at $x=0$ ?
a) $\mathrm{p}=0$
b) $p>0$
c) $\mathrm{p}<0$
d) No value of $p$
60. What is the value of $\lim _{x \rightarrow \alpha} \frac{\sqrt{\alpha+2 x}}{\sqrt{3 \alpha+x}}-\left(\frac{\sqrt{3} x}{2 \sqrt{x}}\right)$ ?
a) $2 \sqrt{3}$
b) $1 /(3 \sqrt{3})$
c) $2 /(3 \sqrt{3})$
d) $1 / \sqrt{3}$
61. What is the value of $\lim _{x \rightarrow 1} \frac{(x-1)^{2}}{|x-1|}$ ?
a) 0
b) 1
c) -1
d) The limit does not exist
62. What is $\lim _{x \rightarrow \infty}\left(\sqrt{a^{2} x^{2}+a x+1}-\sqrt{a^{2} x^{2}+1}\right)$ equal to ?
a) $1 / 2$
b) 1
c) 2
d) 0
63. Let $A=\{x \in R \mid x \geq 0\}$. A function $f: A \rightarrow \in A$ is defined by $f(x)=x^{2}$. Which one of the following is correct?
a) The function does not have inverse
b) fis its own inverse
c) The function has an inverse but $f$ is not its own Inverse
d) None of the above
64. What is the probability of having a knave and a queen when two cards are drawn from a pack of 52 cards?
a) $16 / 663$
b) $2 / 663$
c) $4 / 663$
d) $8 / 663$
65. Give $P(A \cup B)=\frac{5}{6}, P(A \cap B)=\frac{1}{3}$ and $\mathrm{P}(\bar{B})=\frac{1}{2}$. What is $P(\bar{A})$ ?
a) $1 / 6$
b) $1 / 3$
c) $2 / 3$
d) $1 / 2$
66. The outcomes of 5 tosses of a coin are recorded in a single sequence as $H$ (head) and $T$ (tail) for each toss. What is the number of elementary events in the sample space?
a) 5
b) 10
c) 25
d) 32
67. For a binomial distribution $B(n, p), n p=4$ and variance $n p q=4 / 3$. What is the probability $P(x \geq$ 5) equal to?
a) $(2 / 3)^{6}$
b) $(1 / 3)^{6}$
c) $(1 / 3)^{6}$
d) $\left(2^{8} / 3^{6}\right)$
68. The probability of guessing a correct answer is $X / 12$. If the probability of not guessing the correct answer is $2 / 3$, then what is $x$ equal to?
a) 2
b) 3
c) 4
d) 6
69. In a random arrangement of the letters of the word 'UNIVERSITY', what is the probability that two I's do not come together?
a) $4 / 5$
b) $1 / 5$
c) $1 / 10$
d) $9 / 10$
70. Consider a random experiment of throwing together a die and two coins. The associated
sample space has
a) 8 points
b) 12 points
c) 24 points
d) 36 points
71. What is the length of the perpendicular from the origin to the plane $a x+b y+\sqrt{2 a b z}=1$ ?
a) $1 /(a b)$
b) $1 /(a+b)$
c) $a+b$
d) $a b$
72. What are the direction cosines of the line represented by $3 x+y+2 z=7, x+2 y+3 z=5$ ?
a) $(-1,-7,5)$
b) $(-1,7,5)$
c) $\left(-\frac{1}{\sqrt{75}},-\frac{7}{\sqrt{75}}, \frac{5}{\sqrt{75}}\right)$
d) $\left(-\frac{1}{\sqrt{75}}, \frac{7}{\sqrt{75}}, \frac{5}{\sqrt{75}}\right)$
73. Curve of intersection of two spheres is
a) an ellipse
b) a circle
c) a parabola
d) None of these
74. DIRECTIONS: The vertices of a cube are
$(0,0,0),(2,0,0),(0,2,0),(0,0,2),(2,2,0),(2,0,2)$, $(0,2,2),(2,2,2)$ respectively.
What is the angle between any two diagonals of the cube?
a) $\cos ^{-1}(1 / 2)$
b) $\cos ^{-1}(1 / 3)$
c) $\cos ^{-1}(1 / \sqrt{3})$
d) $\cos ^{-1}(2 / \sqrt{3})$
75. The equation to sphere passing through origin and the points $(-1,0,0),(0,-2,0)$ and $(0,0,-3)$ is $x^{2}+y^{2}+z^{2}+f(x, y, z)=0$. What is $f(x, y, z)$ equal to?
a) $-x-2 y-3 z$
b) $x+2 y+3 z$
c) $x+2 y+3 z-1$
d) $x+2 y+3 z+1$
76. What is the distance between the planes
$x-2 y+z-1=0$ and $-3 x+6 y-3 z+2=0$ ?
a) 3 unit
b) 1 unit
c) 0
d) None of the above
77. The definition of Mode fails if:
a) the maximum frequency is repeated
b) the maximum frequency is not repeated
c) the maximum frequency occurs in the middle
d) the curve drawn with the help of given data is Symmetrical
78. Consider the following statements: The appropriate number of classes while constructing a frequency distribution should be chosen such that

1. the class-frequency first increases to a peak and then declines.
2. the class-frequency should cluster around the class mid point.
Which of the statements given is/are correct?
a) 1 only
b) 2 only
c) Both 1 and 2
d) Neither 1 nor 2
3. In a factory, there are 30 men and 20 women employees. If the average salary of men is Rs 4050 and the average salary of all the employees is Rs 3550, then what is the average salary of women?
a) Rs 3800
b) Rs 3300
c) Rs 3000
d) Rs 2800
4. The two lines of regression are $8 x-10 y=66$ and $40 x-18 y=214$ and variance of $x$ series is 9 . What is thestandard deviation of $y$ series?
a) 3
b) 4
c) 6
d) 8
5. Students of three sections of a class, having 30,30 and $\mathbf{4 0}$ students appeared for a test of $\mathbf{1 0 0}$ marks. The arithmetic means of the marks of the three sections are $72.2,69.0$ and 64.1 in that order. What is the arithmetic mean of the marks of all the students of the three sections?
a) 66.6
b) 67.3
c) $\quad 68.0$
d) 70.6
6. 

## DIRECTIONS- Note : Study the pie chart

given below and answer the questions that follow :
The following pie chart gives the distribution of funds in a five year plan under the major heads of development expenditures:
Agriculture (A), Industry (B), Education (C), Employment (D) and Miscellaneous(E)
The total allocation is 36,000 (in crores of rupees).

Q. How much money (in crores) is allocated to both Agriculture and Employment?
a) 20000
b) 21000
c) 24000
d) 27000
83. If the mean of few observations is 40 and standard deviation is 8 , then what is the coefficient of variation?
a) $1 \%$
b) $10 \%$
c) $20 \%$
d) $30 \%$
84. What is the derivative of $f(x)=x|x|$ ?
a) $\quad|x|+x$
b) $2 x$
c) $2|x|$
d) $-2|x|$
85. For the curve $\sqrt{x}+\sqrt{y}=1$, what is the value of $\frac{d y}{d x}$ at $\left(\frac{1}{4}, \frac{1}{4}\right)$ ?
a) $1 / 2$
b) 1
c) -1
d) 2
86. If $y=\sin ^{-1}\left(\frac{4 x}{1+4 x^{2}}\right)$, then what is $\frac{d y}{d x}$ equal to ?
a) $\frac{1}{1+4 x^{2}}$
b) $-\frac{1}{1+4 x^{2}}$
c) $\frac{4}{1+4 x^{2}}$
d) $\frac{4 x}{1+4 x^{2}}$
87. Consider the following statements;

1. If $y=\ln (\sec x+\tan x)$, then $\frac{d y}{d x}=\sec x$.
2. $y=\ln (\operatorname{cosec} x-\cot x)$, then $\frac{d y}{d x}=\operatorname{cosec} x$.
a) 1 only
b) 2 only
c) Both 1 and 2
d) Neither 1 nor 2
3. What is the minimum value of $p x+q y$ ( $p>0, q>$
0) when $x y=r^{2}$ ?
a) $2 r \sqrt{p q}$
b) $2 p q \sqrt{ } r$
c) $\quad-2 r \sqrt{ } \mathrm{pq}$
d) 2 rpq
89. What is the maximum value of the function $\log x-$ $\mathbf{x}$ ?
a) -1
b) 0
c) 1
d) $\infty$
90. A balloon is pumped at the rate of 4 cm 3 per second. What is the rate at which its surface area increases and radius is $4 \mathbf{c m}$ ?
a) $1 \mathrm{~cm}^{2} / \mathrm{s}$ ?
b) $2 \mathrm{~cm}^{2} / \mathrm{s}$
c) $3 \mathrm{~cm}^{2} / \mathrm{s}$
d) $4 \mathrm{~cm}^{2} / \mathrm{s}$
91. If the rate of change in volume of spherical soap bubble is uniform, then the rate of change of surface area varies as
a) square of radius
b) square root of radius
c) inversely proportional to radius
d) cube of the radius
92. What is the value of $\int \frac{d x}{\left(x^{2}+a^{2}\right)\left(x^{2}+b^{2}\right)}$ ?
a) $\int \frac{\left[\left\{\tan ^{-1}(x / a)\right\} / a-\left\{\tan ^{-1}(x / b)\right\} / b\right]}{\left(a^{2}+b^{2}\right)}+c$
b) $\int \frac{\left[\left\{\tan ^{1}(x / a)\right\} / a+\left\{\tan ^{1}(x / b)\right\} / b\right]}{\left(a^{2}+b^{2}\right)}+c$
c) $\int \frac{\left[\left\{\tan ^{1}(x / a)\right\} / a+\left\{\tan ^{1}(x / b)\right\} / b\right]}{\left(b^{2}-a^{2}\right)}+c$
d) $\int \frac{\left[\left\{\tan ^{-1}(x / a)\right\} / a+\left\{\tan ^{-1}(x / b)\right\} / b\right]}{\left(b^{2}-a^{2}\right)}+c$

93 If $\int x^{2} \operatorname{In} x d x=\frac{x^{3}}{m} \operatorname{In} x+\frac{x^{3}}{n}+c$, then what are the values of $m$ and $n$ respectively?
a) $1 / 3,-1 / 9$
b) $3,-9$
c) 3,9
d) 3,3
94. Question not available
a) $\ln (\ln x)+c$
b) $\quad \ln x+c$
c) $(\ln x)^{2}+c$
d) None of the above
95. What is the area of the ellipse $4 \mathrm{x} 2+9 \mathrm{y} 2=1$
a) $6 \pi$
b) $\frac{\pi}{36}$
c) $\frac{\pi}{6}$
d) $\frac{\pi}{\sqrt{6}}$
96. What is the value of the integral $\int_{-1}^{1}|x| d x$ ?
a) 1
b) 0
c) 2
d) -1
97. What is the area of the portion of the curve $y=\sin$ $x$, lying between $x=0, y=0$ and $x=2 \pi$ ?
a) 1 square unit
b) 2 square units
c) 4 square units
d) 8 square units
98. What is the solution of the differential equation $\frac{d y}{d x}=\sec (x+y)$ ?
a) $\mathrm{y}+\tan (\mathrm{x}+\mathrm{y})=\mathrm{c}$
b) $y-\tan \left\{\frac{(x+y)}{2}\right\}=c$
c) $y+\tan \left\{\frac{(x+y)}{2}\right\}=c$
d) $y+\tan \left\{\frac{(x-y)}{2}\right\}=c$
99. What does the solution of the differential equation $x d y-y d x=0$ represent?
a) Rectangular hyperbola
b) Straight line passing through the origin
c) Parabola whose vertex is at origin
d) Circle whose centre is at origin
100. Which one of the following is the differential equation to family of circles having centre at the origin?
a) $\left(x^{2}-y^{2}\right) \frac{d y}{d x}=2 x y$
b) $\left(x^{2}+y^{2}\right) \frac{d y}{d x}=2 x y$
c) $\frac{d y}{d x}=\left(x^{2}+y^{2}\right)$
d) $x d x+y d y=0$
101. The differential equation representing the family of curves $y=a \sin (\lambda x+\alpha)$ is:
a) $\frac{d^{2} y}{d x^{2}}+\lambda^{2} y=0$
b) $\frac{d^{2} y}{d x^{2}}-\lambda^{1} y=0$
c) $\frac{d^{2} y}{d x^{2}}+\lambda y=0$
d) none of these
102. If a matrix $B$ is obtained from a square matrix $A$ by interchanging any two of its rows, then what is $|A+B|$ equal to
a) $2|\mathrm{~A}|$
b) $2|B|$
c) 0
d) $|A|-|B|$
103. If $A$ is any $2 x 2$ matrix such that $\left[\begin{array}{ll}1 & 2 \\ 0 & 3\end{array}\right] A=\left[\begin{array}{ll}-1 & 0 \\ 6 & 3\end{array}\right]$ then what is $A$ equal to?
a) $\left[\begin{array}{ll}-5 & 1 \\ -2 & 2\end{array}\right]$
b) $\left[\begin{array}{lr}-5 & -2 \\ 1 & 2\end{array}\right]$
c) $\left[\begin{array}{ll}-5 & -2 \\ 2 & 1\end{array}\right]$
d) $\left[\begin{array}{ll}5 & 2 \\ -2 & -1\end{array}\right]$
104. If the least number of zeroes in a lower triangular matrix is 10 , then what is the order of the matrix?
a) $3 \times 3$
b) $4 \times 4$
c) $5 \times 5$
d) $10 \times 10$
105. If $\mathbf{l}+\mathbf{m}+\mathbf{n}=\mathbf{0}$, then the system of equations $-2 x+y+z=1 \quad x-2 y+z=m \quad x+y-2 z=n h a s$
a) a trivial solution
b) no solution
c) a unique solution
d) infinitely many solutions
106. If $A=\left|\begin{array}{lll}1 & -2 & -3 \\ 2 & 1 & -2 \\ 3 & 2 & 1\end{array}\right|$, then which one of the following is correct?
a) A is symmetric matrix
b) A is anti- symmetric matrix
c) $A$ is singular matrix
d) $A$ is non-singular matrix
107. If $|A|=8$, where $A$ is square matrix of order 3 , then what is |adj $A \mid$ equal to?
a) 16
b) 24
c) 64
d) 512
108. The roots of the equation $\left[\begin{array}{lll}x & \alpha & 1 \\ \beta & x & 1 \\ \beta & \gamma & 1\end{array}\right]=0$ are independent of
a) $\alpha$
b) $\beta$
c) $\gamma$
d) $\alpha, \beta$ and $\gamma$
109. If $A=\left[\begin{array}{ll}1 & 2 \\ 1 & 1\end{array}\right]$ and $B=\left[\begin{array}{ll}0 & -1 \\ 1 & 2\end{array}\right]$, then what is $B^{-1} A^{-1}$ equal to?
a) $\left[\begin{array}{ll}1 & -3 \\ 1 & -2\end{array}\right]$
b) $\left[\begin{array}{lr}-1 & 3 \\ 1 & -2\end{array}\right]$
c) $\left[\begin{array}{cc}-1 & 3 \\ -1 & -2\end{array}\right]$
d) $\left[\begin{array}{ll}-1 & -3 \\ 1 & -2\end{array}\right]$
110. Consider the following statements:

1. A matrix is not a number
2. Two determinants of different order may have the same value.
Which of the above statements is/are correct?
a) 1 only
b) 2 only
c) Both 1 and 2
d) Neither 1 nor 2
3. A force $m \hat{i}-3 \hat{j}+\hat{k}$ acts on point and so the point moves from $(20,3 m, 0)$ to $(0,0,7)$. If the
work done by the force is $\mathbf{- 4 8}$ unit, what is the value of $m$ ?
a) 5
b) 3
c) 2
d) 1
4. If $\bar{a}=2 \hat{i}-3 j-\hat{k}, \bar{b}=\hat{i}+4 \hat{j}-2 \hat{k}$; then what is $(\bar{a}+\bar{b}) \times(\bar{a}-\bar{b})$ equal to?
a) $2(\vec{a} \times \vec{b})$
b) $-2(\vec{a} \times \vec{b})$
c) $(\vec{a} \times \vec{b})$
d) $-(\vec{a} \times \vec{b})$
5. If $\bar{r}_{1}=\lambda \hat{i}+2 \hat{j}+\hat{k} \bar{r}_{2}=\hat{i}+(2-\lambda) \hat{j}+3 \hat{k}$ are such that $\left|\bar{r}_{1}\right|>\left|\bar{r}_{2}\right|$, then $\lambda$ satisfies which one of the following?
a) $\lambda=0$ only
b) $\lambda=1$
c) $\lambda<1$
d) $\lambda>1$
6. Consider the diagonals of a quadrilateral formed by the vectors $3 \hat{i}+6 \hat{j}-2 \hat{k}$ and $4 \hat{i}-\hat{j}+3 \hat{k}$. The quadrilateral must be a
a) Square
b) Rhombus
c) Rectangle
d) None of these
7. What is the value of $b$ such that the scalar product of the vector $\hat{i}+\hat{j}+\hat{k}$ with the unit vector parallel to the sum of the vectors $2 \hat{i}+4 \hat{j}-5 \hat{k}$ and b $\hat{i}+2 \hat{j}+3 \hat{k}$ is unity?
a) -2
b) -1
c) 0
d) 1
8. If the magnitudes of two vectors $a$ and $b$ are equal then which one of the following is correct?
a) $(\bar{a}+\bar{b})$ is parallel to $(\bar{a}-\bar{b})$
b) $(\bar{a}+\bar{b}) \bullet(\bar{a}-\bar{b})=1$
c) $(\bar{a}+\bar{b})$ is perpendicualr to $(\bar{a}-\bar{b})$
d) None of the above
9. If the magnitude of $\bar{a} \times \bar{b}$ equals to $\bar{a} \cdot \bar{b}$, then which one of the following is correct?
a) $\vec{a}=\vec{b}$
b) The angle between $\bar{a}$ and $\bar{b}$ is $45^{\circ}$
c) $\vec{a}$ is parallel to $\vec{b}$
d) $\bar{a}$ is perpendicular to $\bar{b}$
10. For non-empty sets $A, B$ and $C$, the following two statements are given:
Statement $P: A \cap(B \cup C)=(A \cap B) \cup C$
Statement $Q: C$ is a subset of $A$
Which one of the following is correct?
a) $P \Leftarrow Q$
b) $\quad P \Leftrightarrow Q$
c) $\quad P \Rightarrow Q$
d) Nothing can be said about the correctness of the above three with certainty
11. Which one of the following is correct? The real number $\sqrt[3]{2+\sqrt{5}}+\sqrt[3]{2-\sqrt{5}}$ is:
a) an integer
b) a rational number but not an integer
c) an irrational number
d) none of the above
12. Let $\mathbf{A}=\{x \in R \mid-9 \leq x<4\} ; B=\{x \in R \mid-13<x \leq 5\}$ and $C=\{x \in R \mid-7 \leq x \leq 8\}$. Then, which one of the following is correct?
a) $-9 \in(A \cap B \cap C)$
b) $\quad-7 \in(A \cap B \cap C)$
c) $\quad 4 \in(A \cap B \cap C)$
d) $5 \in(A \cap B \cap C)$
