MATHEMATICS

1. If 'Z' denotes the set of all integers, which of the following is not true? (1)
   a. If $x \in Z, y \in Z$ then $x + y \in Z$
   b. If $x \in Z, y \in Z$ and $x, y \neq 0$, then $x = 0$ or $y = 0$
   c. If $x \in Z$, $y \in Z$ and $y \neq 0$, then there exist $q \in Z$, $r \in Z$ with $0 \leq r < |y|$ such that $x = qy + r$
   d. Every non-void subset of Z has least element.

2. If 'N' stands for the set of natural numbers, then of the following, the unbounded set is
   a. $X = \left\{x \mid x = \left(\frac{1}{n}\right), n \in N\right\}$
   b. $Y = \left\{x \mid x = \left(\frac{1}{2}\right)^n, n \in N\right\}$
   c. $Z = \{x \mid x = 2^n, n \in N\}$
   d. $W = \{x \mid x \in N, x < 4532\}$

3. The set of real numbers is a group with respect to
   a. Arithmetic subtraction
   b. Arithmetic multiplication
   c. Arithmetic division
   d. Composition defined by $a \circ b = a + b + 1$ for all real a and b

4. Consider Assertion (A) and Reason (R) given below:
   Assertion (A): The rational numbers Q do not constitute a complete ordered field.
   Reason (R): The set of all rational numbers whose squares are less than 2 has a l.u.b in Q.
   The correct answer is
   a. Both A and R are true and R is the correct explanation of A
   b. Both A and R are true but R is not a correct explanation of A
   c. A is true but R is false
   d. A is false but R is true

5. The geometric meaning of the relation $|3-z|+|3+z|=5$
   a. Is a circle
   b. Is a parabola
   c. Is an ellipse
   d. Is a hyperbola

6. 2^7 is congruent mod 7 to
   a. 0
   b. 2
   c. 5
   d. 18

7. Let p|q mean 'p divides q' and let (p, q) denote the g.c.d. of two integers p and q not both zero. Decide which of the following statement(s) is/are correct?
   1. p|q and q|p $\Rightarrow$ p = q
   2. p|q $\Rightarrow$ p = q
   3. (p, q) = (|p|, |q|)
   The correct answer is
   a. Only 1
   b. Only 2
   c. Only 3
   d. 1, 2 and 3

8. Consider Assertion (A) and Reason(R) given below
   Assertion(A): The polynomial equation $f(x) \equiv x^3 - 6x^2 + 12x - 8 = 0$ has a triple root
   Reason (R): $f'(x) \equiv 3(x-2)^2$
   The correct answer is
   a. Both A and R are true and R is the correct explanation of A
   b. Both A and R are true but R is not a correct explanation of A
   c. A is true but R is false
   d. A is false but R is true

9. When the polynomial $x^3 - kx - 56$ is divided by (x- 2) and if the remainder is –50, then the value of k is
   a. +2
   b. +1
   c. –1
   d. –2

10. If α, β, γ are the roots of the equation $4x^3 - 28x^2 + 43x - 15 = 0$ then $\Sigma \alpha^2 \beta$ is

a. 64
b. –64
c. $\frac{173}{2}$
d. $-\frac{173}{2}$

11. If the roots of $x^3 - 3x^2 + px + 1 = 0$ are in arithmetic progression then the sum of squares of the largest and the smallest roots is
a. 3
b. 5
c. 6
d. 10

12. One of the roots of the equation $f(x) = x^n + a_{n-1}x^{n-1} + \ldots + a_1x + a_0 = 0$, where $a_0, a_1, \ldots a_{n-1}$ are real, is given to be 2-3i. Of the remaining , the next n-2 roots are given to be 1,2,3,.... n-2. The nth root is
a. n
b. n-1
c. 2-3i
d. –2+3i

13. A root of $x^3 - 8x^2 + px + q = 0$ where p and q are real numbers, is $3 + i\sqrt{3}$. The re root is
a. 2
b. 6
c. 9
d. 12

14. Match list 1 and 2
List 1
A.
B.
C.
D.

List 2
1. $X \cap Y \cap Z$
2. $X \cap (Y \cup Z)$
3. $Y \cap (X \cup Z)$
4. $Z \cap (X \cup Y)$

The correct match is

	A	B	C	D
a.	2	3	1	4
b.	3	2	4	1
c.	4	3	2	1
d.	2	3	4	1

15. If 'A' and 'B' are sub s of a se 'X', then $[A \cap (X \setminus B)] \cup B$ is eq al to
a. $A \cup B$
b. $A \cap B$
c. A
d. B

16. Let 'X' an 'Y' be two finite sets having m and n elements respectively. What will be the number of distinct relations that can be defined from 'X' to 'Y'?
a. m− n
b. mn
c. 2^{mn}
d. 2^{m+n}

17. The relation of fatherhood in the set of all men is
a. Symmetric
b. Reflexive
c. Transitive
d. None of the above

18. Let 'G' be a group and $\alpha, \beta \in G$. Then $(\alpha^{-1}\beta)^{-1}$ is
a. $\alpha\beta^{-1}$
b. $\beta^{-1}\alpha$
c. $\alpha^{-1}\beta^{-1}$
d. $\beta^{-1}\alpha^{-1}$

19. If 'G' be a cyclic group of order 15, then 'G' has a subgroup of order
a. 2
b. 3
c. 4
d. 6

20. Which one of the following statements is correct?

a. In a ring ab=0 implies either a = 0 or b = 0
b. Every finite ring is an integral domain
c. Every finite integral domain is a field
d. The set of natural numbers is a ring with respect to the usual addition and multiplication

21. The elements of a matrix $A=[a_{ij}]_{m\times n}$ are real if
a. $\overline{[a_{ij}]}_{m\times n}=[a_{ij}]_{m\times n}$
b. $\overline{[a_{ij}]}^{T}_{m\times n}=[a_{ij}]_{m\times n}$
c. $[a_{ij}]_{m\times n}$ is invertible
d. a_{ij} are all complex numbers.

22. If $A=\begin{bmatrix}1 & 0\\ 0 & 1\end{bmatrix}$, $B=\begin{bmatrix}0 & 1\\ -1 & 0\end{bmatrix}$ and $C=\begin{bmatrix}\cos\theta & \sin\theta\\ -\sin\theta & \cos\theta\end{bmatrix}$ then which one of the following relations is true?
a. $C= A\cos\theta - B\sin\theta$
b. $C= a\sin\theta + B\sin\theta$
c. $C= A\sin\theta - B\cos\theta$
d. $C = A\cos\theta + B\sin\theta$

23. Which one of the following row operations will restore the elementary matrix $\begin{bmatrix}1 & \\ & 1\end{bmatrix}$ to the identity matrix?
a. Interchange the first and second rows
b. Multiply the second row by
c. Add(-5) times the first row to the second
d. Add 5 times the second row to the first

24. Let $A=\begin{bmatrix}1 & 0 & 0\\ 1 & 1 & 0\\ \alpha & \beta & \gamma\end{bmatrix}$ and $B=\begin{bmatrix}1 & 0 & 0\\ 2 & 1 & 0\\ 3 & 4 & 1\end{bmatrix}$. Then
a. A is row equivalent to B only when $\alpha = 2$, $\beta = 3$ and $\gamma = 4$
b. A is row equivalent to B only when $\alpha = 0$, $\beta = 0$ and $\gamma = 0$
c. A is not row equivalent to B
d. A is row equivalent to B for all values of α, β, γ

25. If $A= \text{Diag}(\lambda_1, \lambda_2, \ldots, \lambda_n)$, then the roots of the equation $\det(A-xI)=0$ are
a. All equal to 1
b. All equal to zero
c. λ_i, $1\le i\le n$
d. $-\lambda_i$, $1\le i\le n$

26. 'A' is a square matrix of order 4 and 'I' is a unit matrix ,then it is true that
a. $\det(2A) = 16\det(A)$
b. $\det(-A) = -\det(A)$
c. $\det(2A) = 2\det(A)$
d. $\det(A+I) = \det(A) + 1$

27. Consider Assertion (A) and Reason (R) given below :
Assertion (A) : The inverse of $\begin{bmatrix}3\\ 1\end{bmatrix}$ does not exist.
Reason (R): The matrix is non-singular.
The correct answer is
a. Both A and R are true and R is the correct explanation of A.
b. Both A and R are true and R is not a correct explanation of A
c. A is true but R is false
d. A is false but R is true.

28. If $\gamma(A)$ denotes rank of matrix 'A' ,then $\gamma(AB)$
a. $=\gamma(A)$
b. $=\gamma(B)$
c. $\le \min[\gamma(A), \gamma(B)]$
d. $> \min[\gamma(A), \gamma(B)]$

29. The number of linearly independent vectors when $X\neq 0$ such that $X\begin{bmatrix}4 & 2 & 1\\ 6 & 3 & 4\\ 2 & 1 & 0\end{bmatrix}=0$ is
a. zero
b. one
c. two
d. infinite

30. Consider the Assertion (A) and Reason(R) given below:
Assertion (A) : The system of linear equations
$x - 4y + 5z = 8;$
$3x + 7y - z = 3$
$x + 15y - 11z = -14;$
is inconsistent
Reason(R): Rank $\gamma(A)$ of the coefficient matrix of the system is equal to 2, which is less than the number of variables of the system
The correct answer is

a. Both A and R are true and R is the correct explanation of A
b. Both A and R are true but R is not a correct explanation of A
c. A is true but R is false
d. A is false but R is true

31. If 'R' denotes the system of all real numbers, 'Z' denotes the system of all integers and 'Q' denotes the system of all rational numbers, then the system that satisfy the axiom of completeness namely : any non-empty subset of the system bounded above has a least upper bound are given by
a. All the three R,Z and Q
b. R alone but not Z and Q
c. R and Z but not Q
d. None of the above

32. Consider the following statements
1. If f is a real continuous function on the interval [a, b] such that $f(a) < f(b)$ and if λ is a number such that $f(a) < \lambda < f(b)$, then there exists a point x, $a < x < b$ such that $f(x) = \lambda$
2. If f is a real differentiable function on the interval [a, b] such that $f'(a)$ $f'(b)$ and λ is a number such that $f'(a) < \lambda < f'(b)$, then there exists a point $a < x < b$ such that $f'(x) = \lambda$

The correct statement(s) is
a. Neither 1 nor 2
b. 1 alone
c. 2 alone
d. Both 1 and 2

33. Suppose 'I' is an interval contained in the reals such that every continuous function on 'I' is bounded, then
a. I cannot be an unbounded closed interval
b. I should be a bounded interval but not necessarily closed interval
c. I is necessarily a bounded and closed interval
d. We cannot say anything definite about the interval

34. $\lim_{x \to \frac{\pi}{2}} \frac{\cos x}{\frac{\pi}{2} - x}$ is
a. 1
b. 0
c. ∞
d. does not exist

35. The function $f(x) = \begin{cases} x^2 \sin\frac{1}{x} & \text{if } x \neq 0 \\ 0 & \text{if } x = 0 \end{cases}$
a. is differentiable at x = 0 and $f'(0) = 0$
b. is not differentiable at x = 0 ,since $\frac{1}{x} \to \infty$ as $x \to 0$
c. is differentiable at x = and the derivative is continuous at x =
d. is not differentiable at any x since it is not continuous for any

36. The net profit an industry makes in a year is given by $y = 2ax - x^2$, where x denotes the input. The profit increases in relation to x if
a. $0 < a < x$
b. $x < a$
c. $a < 2x$
d. $x > a$

37. $y = \log_e\left[e^x\left(\frac{x-2}{x+2}\right)^{x+2}\right]$ then $\frac{dy}{dx}$ is
a. $\frac{x-2}{x+2}$
b. $\frac{x^2-1}{x^2-4}$
c. $\frac{3}{4}\left[\frac{x^2-2}{x^2+2}\right]$
d. $\frac{x^2-3}{x^2-4}$

38. If $x = \sin^{-1}(t)$; $y = \cos^{-1}(t)$ then $\frac{dy}{dx}$ is
a. 1
b. $2\sqrt{1-x^2}$
c. $\frac{2}{\sqrt{1-x^2}}$
d. -1

39. If $y = \tan^{-1}\frac{2x}{1+4x^2} + \tan^{-1}\frac{1+4x^2}{2x}$ then $\frac{dy}{dx} =$
a. 0
b. 1
c. $\frac{4x^2}{(1+4x^2)^2}$
d. $\sec^2\frac{2x}{1+4x^2}$

40. If $f(x) = (x-1)(x-2)(x-3)(x-4)$ then out of the three roots of $f'(x)=0$

a. three are positive
b. three are negative
c. two are complex
d. three are real, some positive , some negative

41. 'P' is a polynomial such that P'(0)= 1=P''(0) while P'''(0)=2 .If P is of the third degree, then P'(x) is
a. $2x^2 + x + 1$
b. $x^2 + x + 2$
c. $x^2+x + 1$
d. x^2+2x+1

42. A triangle of maximum area inscribed in a circle of radius r
a. is a right angled triangle with hypotenuse measuring 2r
b. is an equilateral triangle
c. is an isosceles triangle of height r
d. does not exist

43. The equation of the asymptotes of $x^3 + y^3 = 3axy$, $a > 0$ is
a. $x + y - a = 0$
b. $x - y + a = 0$
c. $x + y + a = 0$
d. $x - y - a = 0$

44. The tangents to the hyperbola $y =$ [illegible] points at which it cuts the co-ordinate [illegible]
a. cut at right angles
b. are parallel
c. do not exist
d. meet at the point(4,2)

45. If $u = f\left(\frac{y}{x}\right)$ [illegible] $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} =$
a. $f\left(\frac{y}{x}\right)$
b. $f'\left(\frac{y}{x}\right)$
c. 0
d. none of the above

46. For the curve $y^2(1+x)= x^2(1-x)$, the origin is a
a. node
b. cusp
c. point of inflexion
d. none of the above

47. Which one of the following lines is a line of symmetry of the curve $x^3 + y^3 = 3(xy^2 + yx^2)$
a. $x = 0$
b. $y = 0$
c. $y = x$
d. $y = -x$

48. Using the definition of integration as a process of summation $\lim_{n\to\infty}\left(\frac{1}{n}+\frac{1}{n+1}+\frac{1}{n+2}+\ldots+\frac{1}{3n}\right)$ equa[illegible]
a. $\log_e 2$
b. $2\log_e 2$
c. $\log_e 3$
d. $2\log_e 3$

49. $\int_0^{\pi} xF(\sin x)dx$
a. $\frac{\pi}{2}\int_0^{\pi} F(\sin x)dx$
b. $\int_0^{\pi} F(\sin x)dx$
c. $\pi\int_0^{\pi/2} F(\sin x)dx$
d. $\frac{\pi}{4}\int_0^{\pi} F(\sin x)dx$

50. Consider the Assertion (A) and Reason (R) given below:

Assertion(A): $\int_0^t \sin x\,dx = 1 - \cos t$

Reason(R): sin x is continuous in any closed interval [0, t]

The correct answer is
a. Both A and R are true and R is the correct explanation of A
b. Both A and R are true but R is not a correct explanation of A
c. A is true but R is false
d. A is false but R is true

51. Integral $\int_0^{\infty}\frac{dx}{\sqrt{x}e^{\sqrt{x}}}$ is equal to
a. 1
b. 2
c. $\frac{1}{e}$
d. $\frac{2}{e}$

52. The figure bounded by graphs of $y^2 = 4x$, y = 0 and x = 1 is rotated round the

line x = 1. The volume of the resulting solid is

a. $\frac{16\pi}{15}$

b. $\frac{15}{16}\pi$

c. $\frac{16\pi}{5}$

d. $\frac{5\pi}{16}$

53. The area of the region in the first quadrant bounded by the y-axis and the curves y = sin x and y= cos x is

a. $\sqrt{2}$

b. $\sqrt{2}+1$

c. $\sqrt{2}-1$

d. $2\sqrt{2}-1$

54. Which one of the following infinite series is convergent?

a. $\sum_{1}^{\infty}\frac{1}{n^2-n}$

b. $\sum_{1}^{\infty}\frac{1}{n^{1/2}+n}$

c. $\sum_{1}^{\infty}\frac{1}{n-\sqrt{n}}$

d. $\sum_{1}^{\infty}\frac{n^2}{(n^3-n^2+1)}$

55. Match list I and with list II

LIST I

A. $\sum_{n=1}^{\infty}\frac{(-1)^n}{n}$

B. $\sum_{n=1}^{\infty}(-1)^n$

C. $\sum_{n=1}^{\infty}\frac{(-1)^n}{n^n}$

D. $\sum_{n=1}^{\infty}\frac{(-1)^n}{\log n}$

LIST II

1. Converges conditionally
2. Converges
3. Diverges
4. Converges absolutely

The correct match is

	A	B	C	D
a.	2	3	4	1
b.	3	4	1	2
c.	4	1	2	3
d.	1	2	3	4

56. The solution of the different-ial equation $(x-y^2)dx + 2xy\,dy = 0$ is

a. $ye^{y^2/x} = A$

b. $xe^{y^2/x} = A$

c. $ye^{x/y^2} = A$

d. $xe^{x/y^2} = A$

57. The solution of differential equation $\frac{dy}{dx} + y\frac{d\phi}{dx} = \phi(x)\frac{d\phi}{dx}$ is

a. $y = \phi(x) - 1 + Ce^{-\phi}$

b. $y = Ce^{-\phi}$

c. $y = x\phi(x) - Ce^{-\phi}$

d. $y = [\phi(x) - 1]e^{-\phi} + C$

58. The general solution of the differential equation $\frac{dy}{dx} = \frac{y}{x} + \tan\frac{y}{x}$ is

a. $\sin\frac{y}{x} = C$

b. $\cos\frac{y}{x} = Cx$

c. $\sin\frac{y}{x} = Cx$

d. $\cos\frac{y}{x} = C$

59. The differential equation $x\,dy - y\,dx - 2x^2\,dx = 0$ has the solution

a. $y + x^2 = C_1x$

b. $-y + x^3 = C_2x$

c. $y - x^3 = C_3x$

d. $y^3 - x^3 = C_4x$

60. The differential equation $x\left(\frac{dy}{dx}\right)^2 - (x-3)^2 = 0$ has p-discriminant relation as $x(x-3)^2=0$ and c discriminant relation as $x(x-9)^2 = 0$.

This singular solution is

a. $(x-3) = 0$

b. $(x-9) = 0$

c. $x = 0$

d. $x(x-3)(x-9) = 0$

61. Consider the Assertion (A) and Reason (R) given below

Assertion (A): The singular solution of the differential equation $y = 2xp + p^2$ is given by $x^2 + y = 0$

Reason (R): The p and the c discriminant are equal and given by $x^2 + y = 0$

The correct answer is

a. Both A and R are true and R is the correct explanation of A

b. Both A and R are true but R is not a correct explanation of A

c. A is true but R is false

d. A is false but R is true

62. The equation $8ap^3 = 27y$, where $p=\frac{dy}{dx}$ has a singular solution given by

a. $y = 0$

b. $y = c$

c. $y^2 = \frac{(x-c)^2}{a}$

d. $y = \frac{(x-c)^2}{a}$

63. The differential equation of the orthogonal trajectories of the system of parabolas $y=ax^2$ is

a. $y' = x^2 + y$

b. $y' = x - y^2$

c. $y' = -\frac{x}{2y}$

d. $y' = \frac{x}{2y}$

64. Consider the Assertion (A) and [illegible] (R) given below:

Assertion (A) : The curves $y = ax^3$ and $x^2+3y^2=c^2$ from orthogonal trajectories

Reason(R): The differential equation of the second curve is obtained from the differential equation of the first by replacement of $\frac{dy}{dx}$ by $-\frac{dx}{dy}$

The correct answer is

a. Both A and R are true and R is the correct explanation of A

b. Both A and R are true but R is not a correct explanation of A

c. A is true but R is false

d. A is false but R is true

65. The differential equation of the family of circles of radius 'r' whose centers lie on the x-axis , is

a. $y\frac{dy}{dx} + y^2 = r^2$

b. $y\left(\frac{dy}{dx}+1\right) = r^2$

c. $y^2\left[\left(\frac{dy}{dx}\right)+1\right] = r^2$

d. $y^2\left[\left(\frac{dy}{dx}\right)^2+1\right] = r^2$

66. The equation of the curve for which the angle between the tangent and the radius vector is twice the vectorial angle is $r^2 = A \sin 2\theta$. This satisfies the differential equation

a. $r\frac{dr}{d\theta} = \tan 2\theta$

b. $\frac{dr}{dr} = \tan 2\theta$

c. $\frac{r}{d\theta} = \cos 2\theta$

d. $r\frac{d\theta}{dr} = \cos 2\theta$

67. If $x = A\cos(mt - \alpha)$ then the differential equation satisfying the relation is

a. $\frac{dx}{dt} = 1 - x^2$

b. $\frac{d^2x}{dt^2} = -\alpha^2 x$

c. $\frac{d^2x}{dt^2} = -m^2 x$

d. $\frac{dx}{dt} = -m^2 x$

68. The solution of the differential equation $(D^2+1)^2 y = 0$, $D \equiv \frac{d}{dx}$ is

a. $A\cos x + B\sin x$

b. $E^x(A\cos x + B\sin x)$

c. $(A_1+A_2)\cos x + (A_3 + A_4)\sin x$

d. $(A_1 + A_2x)\cos x + (A_3+A_4x)\sin x$

69. The solution of the differential equation $\frac{d^2y}{dx^2} - 3\frac{dy}{dx} + 2y = e^{3x}$ is given by

a. $y = C_1e^x + C_2e^{2x} + \frac{1}{2}e^{3x}$

b. $y = C_1e^{-x} + C_2e^{-2x} + \frac{1}{2}e^{3x}$

c. $y = C_1e^{-x} + C_2e^{2x} + \frac{1}{2}e^{-3x}$

d. $y = C_1e^{-x} + C_2e^{2x} + \frac{1}{2}e^{-3x}$

70. The particular integral of the differential equation $(D^3 - D)y = e^x + e^{-x}$, $D = \frac{d}{dx}$ is

a. $\frac{1}{2}(e^x + e^{-x})$

b. $\frac{1}{2}x(e^x + e^{-x})$

c. $\frac{1}{2}x^2(e^x + e^{-x})$

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

71. The bisector of the angle of the pair of straight line represented by $33y^2 - 136xy + 135x^2 = 0$ I s

a. $x + 2y = 0$

b. $x - 2y = 0$

c. $x + 2y = 5$

d. $x - 2y = 5$

72. $x^2 - pxy - y^2 = 0$ represents a pair of perpendicular straight lines

a. only when $p \neq 0$

b. only when $p > 0$

c. only when $p < 0$

d. for all real number

73. The length of the perpendicular drawn from the pole on the line $\frac{1}{r} = 5\cos\theta - 3\sin\theta$ is

a. $\sqrt{34}$

b. $\frac{1}{\sqrt{34}}$

c. [illegible]

d. $\frac{1}{34}$

74. The polar equation $r\cos\left(\theta - \frac{\pi}{3}\right) = 4$ represents

a. a line making an intercept of 4 units on the x-axis and making an angle $\frac{\pi}{3}$ with the x-axis

b. a line making an intercept of 8 units in the x-axis and $\sqrt{3}$ units on the y-axis

c. a line making an intercept of 8 units on x-axis and $\frac{8}{\sqrt{3}}$ units on the y-axis

d. a line making an intercept of $\frac{8}{\sqrt{3}}$ units in the x-axis and 8 units in the y-axis

75. $ax + by + cz + d = 0$ is the equation of a plane. Then a, b, c represent

a. the direction ratios of the normal to the plane

b. the direction cosines of the normal to the plane

c. the direction ratios of a line parallel to the plane

d. none of the above

76. The sum of the direction cosines of a straight line is

a. Zero

b. One

c. Constant

d. None of the above

77. Which of the following does not represent a straight line?

a. $ax + by + cz + d = 0$
$a'x + by + cz + d = 0$ $(a \neq a')$

b. $ax + by + cz + d = 0$
$ax + b'y + cz + d = 0$ $(b \neq b')$

c. $ax + by + cz + d = 0$
$ax + by + c'z + d = 0$ $(c \neq c')$

d. $ax + by + cz + d = 0$
$ax + by + cz + d' = 0$ $(d \neq d')$

78. The equation of a straight line parallel to the x-axis is given by

a. $\frac{x-a}{1} = \frac{y-b}{1} = \frac{z-c}{1}$

b. $\frac{x-a}{0} = \frac{y-b}{1} = \frac{z-c}{1}$

c. $\frac{x-a}{0} = \frac{y-b}{0} = \frac{z-c}{1}$

d. $\frac{x-a}{1} = \frac{y-b}{0} = \frac{z-c}{0}$

79. Which one of the following is the best condition for the plane $ax + by + cz + d = 0$ to intersect the x and y axes at equal angles

a. $a = b$

b. $a = -b$

c. $|a| = |b|$

d. $a^2 + b^2 = 1$

80. If S=0 is the equation of a sphere and 0 is a plane, then S+ λu = 0 represents
   a. a circle
   b. a sphere containing the circle S= 0
   c. ellipsoid
   d. none of the above

81. Consider the Assertion (A) and Reason(R) given below:
   Assertion (A): A homogeneous equation of second degree represents cone and whose vertex is the origin
   Reason (R): A homogeneous expression in second degree can be factorize into homogeneous linear factor
   The correct answer is
   a. Both A and R are true and R is the correct explanation of A
   b. Both A and R are true but R is not a correct explanation of A
   c. A is true but R is false
   d. A is false but R is true

82. The equation $4x^2 - y^2 + 2z^2 + 2xy - 3yz + 12x - 11y + 6z + 4 = 0$ represents a cone whose vertex is
   a. (1, 2, 3)
   b. (-1, 2, 3)
   c. (-1, -2, 3)
   d. (-1, -2, -3)

83. The plane ax + by + cz = 0 cuts the cone yz + zx + xy = 0 in perpendicular lines if
   a. a + b + c = 0
   b. $\frac{1}{a}+\frac{1}{b}+\frac{1}{c}=0$
   c. a, b, c are in A.P.
   d. a, b, c are in G.P.

84. In three dimensions, the equation $x^2-y^2=a^2$ represents
   a. a pair of straight lines
   b. a hyperbola
   c. a cylinder
   d. a cone

85. The equation to the axis of the right circular cylinder whose guiding circle is $x^2 + y^2 + z^2 = 9, x - y + z = 3$ is given by
   a. x = y = z
   b. x = y = z
   c. x = y = -z
   d. x = -y = -z

86. A boat is being towed through a canal by a cable which makes an angle of 30^0 with the shore. If the pull in the cable is 200kg then the force tending to move the boat along the canal is
   a. 173 kg
   b. 150 kg
   c. 125 kg
   d. 100kg

87. The volume of a parallelopiped with sides $A= 6i - 2j$, $B= j + 2k$, $C=$ [illegible] is
   a. 5 cubic unit
   b. 10 cubic unit
   c. 15 cubic unit
   d. 20 cubic unit

88. Two forces of magnitude 50kg and $50\sqrt{2}$ kg act on a particle in the direction inclined at an angle of 135^0 to each other, then the magnitude and direction of the resultant
   [illegible] kg wt at right angles to the first component
   b. 50 kg wt at right angles to the 2nd component
   c. 50 kg wt at 100^0 angle to the first component
   d. 50 kg wt at 100^0 angle to the 2nd component

89. Parallel forces of 5,12 and 7 Newtons act at two ends and middle point respectively of a light rod AB of length meters. The line of action of the resultant passes through a point whose distance measured from A in metres is
   a. $\frac{31}{24}$
   b. $\frac{31}{14}$
   c. $\frac{14}{10}$
   d. $\frac{12}{19}$

90. The arm AB of a common balance has length equal to 1 metre and the fulcrum 'O' is at a distance of 51 cm from 'A'. A piece of sandalwood in the pan at 'A' is balanced by weight of 1 kg in the pan at 'B'. If the sandalwood is placed at 'B', the weight in kg at 'A' that would balance it, would be

a. $\frac{49}{51}$

b. $\frac{49^2}{51^2}$

c. $\frac{51^3}{49^2}$

d. $\frac{51}{49}$

91. A weight 'W' hangs by a string. It is pushed aside by a horizontal force until the string makes an angle of 30 with the vertical. The tension in the string is

a. W

b. $\frac{2}{\sqrt{3}}W$

c. 2W

d. 3W

92. A weight of 10 kg is tied to a string and hangs from a peg. The horizontal force necessary to keep the string inclined at 60^0 to the vertical is

a. 20 kgs

b. $10\sqrt{3}$ kgs

c. $10\sqrt{2}$ kgs

d. $5\sqrt{3}$ kgs

93. If a body starting from rest , moving with uniform acceleration, describes 10[illegible] in seconds, then the acceleration with which body moves , will be

a. 20 cm/sec^2

b. 25cm/sec^2

c. 30cm/sec^2

d. 35cm/sec^2

94. Two masses of 5kg and 9kg are fastened to ends of a co[illegible]ing over a frictionless pully. The acceleration of the resulting motion is

a. 2.8 m/sec^2

b. 2.9 m/sec^2

c. 5.6 m/sec^2

d. 5.0 m/sec^2

95. Which one of the following pairs is not correctly matched?

a. Simple pendulum - simple harmonic motion

b. Planets - Rectilinear motion

c. Conical pendulum - Circular motion

d. Projectiles - Parabolic motion

96. A point moves with S.H.M whose period is 4 seconds if it starts from rest at a distance 4 metres from the center of its path then the time it takes before it has described metres is

a. $\frac{1}{3}$second

b. $\frac{2}{3}$second

c. $\frac{3}{4}$second

d. $\frac{4}{5}$second

97. In S.H.M, if f be the acceleration and v the velocity at any instant and T is the periodic time, then

$f^2 T^2 + 4\pi^2 v^2$ is

a. constant

b. variable and varies with f

c. variable and varies with v

d. variable and varies with T

98. A particle is projected at an angle 30^0 to the horizon with a velocity of 1962 cm/second. The time of flight is

a. 1 second

b. 2 seconds

c. 2.5 seconds

d. 3 seconds

99. A particle with mass 'm' is tied to one end of light inextensible string of length 'ℓ' and at displaced from its vertical position of equilibrium with a velocity 'u' ,then

a. $\frac{T}{m} = \frac{(u^2 + lg - 3gh)}{l}$

b. the particle will oscillate if u^2 is greater than 5/g

c. the particle will leave the circular path $5lg > u^2 > lg$

d. the particle will make revolutions if $u^2 = 2lg$

100. Taking the radius of the earth to be 6.4×10^8 cm and the value of 'g' to be 981 cm/sec^2 the escape velocity from the surface of the earth is

a. 11.2×10^5 cm/sec

b. 12.9×10^5 cm/sec

c. 8.1×10^5 cm/sec

d. 9.7×10^5 cm/sec