MATHEMATICS

1. Consider the following vector spaces over the reals:
   1. The set of all complex numbers with usual operations.
   2. The set of all polynomials with real coefficients of degree ≤ 3.
   3. The set of point $x = 2t$, $y = -t$, $z = 4t$, $t \in R$.
   4. The set of all 3×3 matrices having real entries with usual operations.

   The correct sequence of these vectors spaces in decreasing order of their dimensions is
   a. 1, 2, 3, 4
   b. 2, 1, 4, 3
   c. 4, 2, 1, 3
   d. 4, 3, 2, 1

2. Consider the following assertions :
   1. Rank (ST)= Rank S= Rank T
   2. Rank (ST)= Rank S, if T is non singular
   3. Rank (ST)=Rank T ,if T is non singular
   4. Where S, T: V $\rightarrow$ V are linear transformations of a finite dimensional vector space V.

   Which of these is /are correct?
   a. Only 1
   b. Only 2
   c. 1 and 2
   d. 2 and 3

3. If S = {(1, 1, 0), (2, 1, 3)} $\subseteq R^3$, then which one of the following vectors of R^3 is not in the span [S]?
   a. (0, 0, 0)
   b. (3, 2, 3)
   c. (1, 2, 3)
   d. (4/3 , 1, 1)

4. If det A= 7 ,where A= $\begin{bmatrix} a & b & c \\ d & e & f \\ g & h & c \end{bmatrix}$ then det $(2A)^{-1}$ is equal to
   a. 1/14
   b. 1/49
   c. 1/56
   d. 7/2

5. Let A be a square matrix. If i^{th} and j^{th} rows of A are interchanged then
   a. i^{th} and j^{th} column of A^{-1} will also be interchanged
   b. i^{th} and j^{th} rows of A^{-1} will also be interchanged
   c. i^{th} row of A^{-1} will be the j^{th} row of A and vice versa
   d. i^{th} column of A^{-1} will be the j^{th} column of A and vice versa

6. If A, B are two square matrices such that AB = A and BA = B ,t hen
   a. both A and B are idempotent
   b. only A is idempotent
   c. only B is idempotent
   d. both A and B are not idempotent

7. If A= $\begin{bmatrix} 198 & 0 & 99 & 99 \\ 1 & 1 & -2 & 0 \\ 1 & 2 & 1 & 2 \\ 1 & -3 & 6 & 1 \end{bmatrix}$ then |A| is equal to
   a. -89
   b. -99
   c. -109
   d. -119

8. If B is a non-singular matrix and A is a square matrix, then det $(B^{-1} AB)$ is equal to
   a. det B
   b. det A
   c. det (B^{-1})
   d. det (A^{-1})

9. The matrix $\begin{bmatrix} \cos\theta & \sin\theta \\ -\sin\theta & \cos\theta \end{bmatrix}$, is
   a. symmetric
   b. singular
   c. orthogonal

d. hermitian

10. If a, b, c and d ≠ 0, then the determinant
$$\begin{vmatrix} a^2+\lambda & ab & ac & ad \\ ab & b^2+\lambda & bc & bd \\ ac & bc & c^2+\lambda & cd \\ ad & bd & cd & d^2+\lambda \end{vmatrix}$$ is divisible by

a. $a^2+b^2+c^2+d^2$

b. $a^2+b^2+c^2+d^2+\lambda^2$

c. $a+b+c+d+\lambda$

d. $a^2+b^2+c^2+d^2+\lambda$

11. If Adj A= $\begin{bmatrix} -2 & 3 & 1 \\ 6 & -8 & -2 \\ -4 & 7 & 1 \end{bmatrix}$ and |A|=4, then A is equal to

a. $\begin{bmatrix} 3 & 2 & 1 \\ 1 & 1 & 1 \\ 5 & 1 & -1 \end{bmatrix}$

b. $\begin{bmatrix} 12 & 8 & 4 \\ 4 & 4 & 4 \\ 20 & 4 & -4 \end{bmatrix}$

c. $\begin{bmatrix} 6 & 4 & 2 \\ 2 & 2 & 2 \\ 10 & 2 & -2 \end{bmatrix}$

d. $\begin{bmatrix} 1 & 3 & -2 \\ -2 & -8 & 6 \\ 1 & 7 & -4 \end{bmatrix}$

12. The system of equations kx + y + z= [illegible] x + ky + z = k , and x + y + kz [illegible] does not have a solution if k is equal to

a. 0

b. 1

c. −1

d. −2

13. If x + 3[illegible] 2, 3x − y + 4z = 9 and x- 4y [illegible] 7, then

a. x = -1, y = 2 , z= 3/2

b. x = 2, y = -1, z = ½

c. x= -1, y = -2, z = ½

d. x = -1, y- 2 , z = - ½

14. Let α, β and γ be distinct real numbers. The points with the position vector $\alpha\hat{i}+\beta\hat{j}+\gamma\hat{k}$, $\beta\hat{i}+\gamma\hat{j}+\alpha\hat{k}$ and $\gamma\hat{i}+\alpha\hat{j}+\beta\hat{k}$

a. are collinear

b. form an equilateral triangle

c. form a scalene triangle

d. form a right angled triangle

15. The equation of the plane passing through the points A, B and C with position vector $\hat{i}+\hat{j}$, $\hat{j}+\hat{k}$ and $\hat{k}+\hat{i}$, respectively, is

a. $\vec{r}\cdot(\hat{i}+\hat{j}+\hat{k})=-2$

b. $\vec{r}\cdot(\hat{i}-\hat{j}+\hat{k})=2$

c. $\vec{r}\cdot(\hat{i}+\hat{j}+\hat{k})=2$

d. $\vec{r}\cdot(\hat{i}+\hat{j}-\hat{k})=-2$

16. If $(\vec{a}\times\vec{b})\times\vec{c}=\vec{a}\times(\vec{b}\times\vec{c})$, then

a. $\vec{a}, \vec{b}$ are collinear

b. $\vec{a}, \vec{b}$ are perpendicular

c. $\vec{a}, \vec{c}$ are collinear

d. $\vec{a}, \vec{c}$ are perpendicular

17. The [illegible] the straight line joining the point (1, 2[illegible] with the point of intersection of the pair of the straight lines x^2+2xy+ 4[illegible] 0 is

a. [illegible]

b. 4

c. 6

d. 8

18. If $(\sqrt{3}+i)^{100}=2^{99}(a+ib)$, then (a^2+b^2) is equal to

a. 1

b. 2

c. 3

d. 4

19. If the roots of the equation $m^2x^2+2mx+1=0$ are positive integers, then m is equal to

a. −2

b. −1

c. 0

d. 1

20. If the sum of the roots of the equation $ax^2+bx+c=0$ is equal to the sum of their squares, then

a. $a^2+b^2=c^2$

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

c. $2ac=ab+b^2$

d. $2ac=ab-b^2$

21. The equation $x-\frac{2}{x-1}=1-\frac{2}{x-1}$ has

a. no root
b. one root
c. two equal roots
d. infinitely many roots

22. If α, β, γ are the roots of the equation $x^3+x+1=0$, then the value of $1/\alpha^3+1/\beta^3+1/\gamma^3$ is equal to
a. 4
b. –4
c. –1
d. –14

23. If for the equation $x^3-3x^2+kx+3=0$, one root is the negative of another, then the value of k is
a. –3
b. –1
c. 1
d. 3

24. If one of the values assumed by $\left(\frac{1+i}{\sqrt{2}}\right)^{1/2}$ equals $\sqrt{\frac{1}{2}\left(1+\frac{1}{\sqrt{2}}\right)}+i\sqrt{\frac{1}{2}\left(1-\frac{1}{\sqrt{2}}\right)}$ then
a. $\cot^2 \pi/8 = 2\sqrt{2}(\sqrt{2}-1)$
b. $\operatorname{cosec}^2 \pi/8 = 2\sqrt{2}(\sqrt{2}+1)$
c. $\sec^2\pi/8 = 4\sqrt{2}(\sqrt{2}-1)$
d. $\tan^2 \pi/8 = \frac{\sqrt{2}+1}{\sqrt{2}-1}$

25. If $x^2 - 2x\cos\theta + 1 = 0$, then the value of $x^n + \frac{1}{x^n}$ is equal to
a. [illegible] θ
b. $2^n \cos^n\theta$
c. $2\cos n\theta$
d. $2\cos^n\theta$

26. If A= (x: $x^2+6x-7=0$) and B = (x:$x^2+9x+14=0$), then A- B is equal to
a. (1, -7)
b. (1)
c. (-7)
d. (1, 2, -7)

27. Consider the following pairs of sets:
1. $A\cup C$; $B\cup D$
2. $A\cap C$; $B\cup D$
3. $A\cup C$; $B\cap D$
4. $A\cap C$; $B\cap D$

Where A,B,C and D are four sets such that $A\cap B = \phi = C\cap D$.
Which of these pairs of sets are disjoint in general?
a. 1 and 2
b. 2 and 3
c. 1 and 4
d. 3 and 4

28. In which one of the following cases, given * is a binary operation on the given set S?
a. S= (1, [illegible], 3, [illegible], 18); a*b=ab
b. S=([illegible], 3, 2, -4); a * b = |b|
c. [illegible] = Z, the set of all integers; a*b= a+b²
d. S= [illegible] then set of natural numbers; a*b = a-b

29. If the matrices $\begin{pmatrix}1 & 0\\0 & 0\end{pmatrix}$, $\begin{pmatrix}-1 & 0\\0 & 0\end{pmatrix}$, $\begin{pmatrix}i & 0\\0 & 0\end{pmatrix}$ & $\begin{pmatrix}-i & 0\\0 & 0\end{pmatrix}$ form a group with respect to matrix multiplication, then which one of the following statements about the group, thus formed is correct?
a. The group has no element of order 4
b. The group has an element of order 3
c. The group is non abelian
d. $\begin{pmatrix}-1 & 0\\0 & 0\end{pmatrix}$ is its own inverse

30. A subset S of a field (F, +, *) having at least two elements is a subfield if and only if for a, b∈S
a. a + b ∈S
b. a. b∈S
c. a- b∈S and a. b^{-1}∈S; b ≠ 0
d. a + b∈S and a. b^{-1}∈S; b≠0

31. The sets $S_1=\left\{\alpha=\begin{bmatrix}1 & -2 & 4\\3 & 0 & -1\end{bmatrix}, \beta=\begin{bmatrix}2 & -4 & 8\\6 & 0 & -2\end{bmatrix}\right\}$ and S_2 = (f = u^3+3u+4, g = u^3+4u+3) are
a. both linearly dependent
b. both linearly independent

c. S_1 is linearly dependent but S_2 is not

d. S_2 is linearly dependent but S_1 is not

32. If the linear transformation T: $R^2 \to R^3$ is such that T(1, 0) = (2, 3,1) and T(1, 1)= (3, 0, 2) ,then

a. T(x, y)= (x + y , 2x + y , 3x – 3y)

b. T(x, y) = (2x + y, 3x – 3y , x +y)

c. T(x, y) = (2x-y , 3x + 3y , x – y)

d. T(x, y) = (x- y , 2x – y , 3x + 3y)

33. If T: $R^3 \to R^3$, T(x, y, z)= (x- y, y + 3z , x +2y) ,then T^{-1} is

a. 1/3 (2x + z , -x +z, 1/3 x + y – z/3)

b. 1/3 (2x + y, -x+y, 1/3 x – 1/3 y + z)

c. 1/3 (x + 2y , x- y, -1/3x + 1/3 y- z)

d. 1/3(x- 2y, x + y, x/3 –y/3 -z)

34. If X=AY, where A= $1/\sqrt{2}\begin{bmatrix}1 & -1\\ 1 & 1\end{bmatrix}$ X= $(x_1,x_2)^T$ and Y=$(y_1, y_2)^T$; then $x_1^2+x_2^2$ transforms to

a. $\sqrt{2}\,(y_1^2+y_2^2)$

b. y_1y_2

c. $y_1^2+y_1y_2+y_2^2$

d. $y_1^2+y_2^2$

35. Let V be a vector space of 2×2 m[illegible] over R. Let T be the linear map[illegible] V→V, such that T([illegible])=A[illegible]-BA[illegible] B=$\begin{bmatrix}2 & 1\\ 0 & 3\end{bmatrix}$ then the nullity of [illegible]

a. 1

b. 2

c. 3

d. 4

36. Let M_2[illegible](R) [illegible] the vector space of all 2 × 2 [illegible] over R and Let W_1= $\left\{\begin{bmatrix}x & y\\ 0 & [illegible]\end{bmatrix} : x, y \in R\right\}$ and W_2= $\left\{\begin{bmatrix}x & y\\ [illegible] & 0\end{bmatrix} : x, y, z \in R\right\}$, then dim ($W_1 \cap W_2$) is equal to

a. 0

b. 1

c. 2

d. 3

37. Let $P_2[x]$ be the vector space of all polynomials over R of degree less than or equal to 2. Let D be the differential operator on $P_2[x]$ .Then matrix of D relative to the basis {x^2, 1, x} is equal to

a. $\begin{bmatrix}0 & 0 & 0\\ 0 & 0 & 1\\ 2 & 0 & 0\end{bmatrix}$

b. $\begin{bmatrix}0 & 0 & 0\\ 2 & 0 & 0\\ 0 & 0 & 1\end{bmatrix}$

c. $\begin{bmatrix}0 & 0 & 2\\ 2 & 0 & 0\\ 0 & 1 & 0\end{bmatrix}$

d. $\begin{bmatrix}0 & 0 & 0\\ 0 & 0 & 2\\ 0 & 1 & 0\end{bmatrix}$

38. If f(x) = [illegible] then which one of the following [illegible]ts is correct?

a. The poi[illegible] , f(1/4)] is an inflexion point of the graph of f(x) as f''(1/4)>0

b. The point {1/3, f(3)] is an inflexion point of the graph of f(x0 as f'(3) <0

c. The point [1/3, f(1/3)] is an inflexion point of the graph of f(x)

d. The point [1/3, f(1)] is an inflexion point as f'(1/3)=0 and f(1)=0

39. If $f'(x) = \frac{x^2}{2} - kx + 1$ and f(0) = 0 , f(3) = 15, then the value of k is equal to

a. 5/3

b. 3/5

c. –5/3

d. –3/5

40. If $A=\int_0^{\pi}\frac{\sin x}{\sin x+\cos x}dx$ and $B=\int_0^{\pi}\frac{\sin x}{\sin x-\cos x}dx$, then

a. A+ B= π/2

b. A=B = π

c. A= B = π/2

d. A= - B = π

41. The hexadecimal number AB7 is decimal is

a. 2347

b. 4723

c. 1234

d. 2743

42. The volume of the region enclosed by revolving the ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$, about its major axis through an angle of 2π radians is equal to

a. πab^2

b. $4/3\ \pi ab^2$

c. $1/3\pi ab^2$

d. $4\pi ab^2$

43. If the length of the curve $x= 1/3(2t+3)^{3/2}$, $y = t^2/2 + t$ between the point $t = 0$ to $t = \alpha$ is 6, then the value of α is equal to

a. 1

b. 2

c. 3

d. 4

44. The area included between the parabolas $y^2=4a(x+a)$ and $y^2=4b(b-x)$ is equal to

a. $4/3ab\sqrt{a+b}$

b. $4/3(a+b)\sqrt{a+b}$

c. $8/3ab$

d. $8/3(a+b)\sqrt{a+b}\sqrt{a+b}$

45. The solution of the equation (x+y-[illegible] dy=(x+y)dx ,is

a. $y + x = \log(y- x + 1) + c$

b. $y- x = \log(x +y - 1) +c$

c. $y- 2x = \log(x + y - 1) + c$

d. $y + 2x = \log(x + y$ [illegible]

46. The solution of $(x+1)dy$ [illegible] $- e^y$, is

a. $(x+1)e^y = x$ [illegible]

b. $(x + 1)$ [illegible] c

c. $\frac{(x}{(1+e}$ [illegible]

d. $\frac{(\ +1)}{(1\ e^y)} = c$

47. [illegible] singular solution of the differential equation $(xp - y)^2 = p^2-1$, is

a. $x^2- y^2 = 1$

b. $y^2 - x^2 = 1$

c. $x^2 + y = 1$

d. $x^2 - y = 1$

48. The orthogonal trajectory of the family $r^n \sin n\theta = a^n$, is

a. $r^n \sin n\theta= c$

b. $r^n \cos n\theta = c$

c. $r^n \sin^n\theta = c$

d. $r^n \cos^n \theta = c$

49. If $\phi_1(x)$ is a particular integral of $Ly=\frac{d^2y}{dx^2}-a\frac{dy}{dx}+by=e^{ax}+f(x)$ and $\phi_2(x)$ is a particular integral of Ly = [illegible] (x); a ,b being constants, then a particular integral of $Ly= 2be^{ax}$ is

a. $b\phi_1(x) + \phi_2(x)$

b. $\phi_1(x)- b\phi_2(x)$

c. $a\phi_1(x)+b\phi_2(x)$

d. $b[\phi_1(x)+\phi_2(x)]$

50. If $e^{ax}u(x)$ [illegible] particular integral of $\frac{d^2y}{dx^2}-2a\frac{dy}{dx}+a^2y=f(x)$ where a is a constant , then $\frac{d^2u}{dx^2}$ is equal to

a. $f(x)$

b. $f(x)e^{ax}$

c. $f(x)e^{-ax}$

d. $f(x)(e^{ax}+e^{-ax})$

51. The decimal number 9695.25 after conversion to octal becomes

a. 22737.20

b. 22773.20

c. 22773.02

d. 22737.02

52. The differential equation of the family of circles passing through the origin and having centers on the x-axis is

a. $2xy\ dy/dx = x^2 - y^2$

b. $2xy\ dy/dx = y^2- x^2$

c. $2xy\ dy/dx= x^2+y^2$

d. $2xy\ dy/dx + x^2+y^2=0$

53. Consider the following differential equations:

1. $x^2\left(\frac{d^2y}{dx^2}\right)^6 + y^{-2/3}\sqrt{1+\left(\frac{d^3y}{dx^3}\right)^5} + \frac{d^2}{dx^2}\left\{\left(\frac{d^2y}{dx^2}\right)^{-2/3}\right\} = 0$

2. $\frac{dy}{dx} - 6x = \left(ay + bx\frac{dy}{dx}\right)^{-3/2}$, b≠ 0

The sum of the order of 1st differential equation and the degree of the 2nd differential equation is

a. 6
b. 7
c. 8
d. 9

54. If five particles with position vectors $\vec{r_i}$(t) = 1,2,3,4, 5 at time t with respect to a given moving point, are rigidly connected ,then

a. $|\vec{r_i}|$ are constants
b. $|\vec{r_i}.\vec{r_j}|$ are constant for each pair i, j (i≠ j)
c. $|\vec{r_i}-\vec{r_j}|$ are constant for each pair i, j (i≠ j)
d. $|\vec{r_i}\times\vec{r_j}|$ are constants for each i, j

55. Let $\vec{x} = 2\hat{i} + 3$, $\vec{y} = \hat{i} + \hat{j}$, $\vec{z} = \hat{i} - \hat{j}$, where $\hat{i}$, $\hat{j}$, $\hat{k}$ are unit vectors in x, y, z directions respectively .If $\vec{w} = \vec{x}\times\vec{y}$ and $\vec{u} = \vec{x}\times\vec{z}$, then which one of the following is not correct?

The angle between $\vec{w}$ and $\vec{u}$ is $\cos^{-1}(3/\sqrt{22})$

a. $\vec{w}$, $\vec{u}$, $(\vec{y}\times\vec{z})$ are coplanar
b. $\vec{w}$, $\vec{u}$, $(\vec{z}\times\vec{x})$ are coplanar
c. $\vec{w}$, $\vec{u}$, $(\vec{z}\times\vec{x})$ are coplanar
d. $\vec{w}$, $\vec{u}$, $(\vec{x}\times\vec{y})$ are coplanar

56. $\vec{P}$ and $\vec{Q}$ are two forces acting at a point O at such an angle that their resultant $\vec{P}$ has a magnitude equal to that of $\vec{P}$. If the magnitude of $\vec{P}$ is doubled, then the angle between the new resultant $\vec{R_1}$ and $\vec{Q}$ is

a. 30^0
b. 45^0
c. 60^0
d. 90^0

57. A light ladder of length 10 m is supported on a rough floor having the coefficient of friction $\sqrt{3}/4$ and leans against a smooth wall. If the ladder makes an angle of 30^0 with the wall and a man can climb up the ladder without slipping taking place upto a distance D along the ladder from the foot of the ladder, then D is equal to

a. 9.5 m
b. 7. 5 m
c. 6.5 m
d. 5.5 m

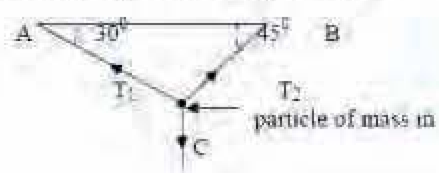
58. Unlike parallel forces 240N and 120N act on a body at A and B respectively. AB is perpendicular to the line of action of the forces and is equal to 6m in length. Their resultant will pass through C in

a. AB where AC = 3m
b. AB where BC = 2m
c. AB produced such that BC = 6m
d. BA produced such that AC = 6m

59. A trader has a weighing scale two arms of which are in the ratio 3:4 .He weights one kg of a commodity for a customer by placing the 1 kg measure on the one weighing pan, and the commodity being weighed on the other. For the next customer , for the same commodity he places the 1kg weight on the other side and commodity being weighted on the weighing pan on which in the earlier transaction , he had placed the 1kg weight. By doing so, for the two weighments taken together, he has sold

a. exactly 2kg
b. 1/6 kg less
c. 1/12 kg less
d. 1/12 kg more

60. A particle of mass m is suspended in equilibrium by two inelastic massless strings AC and BC, as shown in the figure. Tension T_1 in the string AC equal



a. $\frac{mg}{1+\sqrt{3}}$
b. $\frac{mg}{1+\sqrt{3}}$

c. $\frac{2mg}{1+\sqrt{3}}$

d. $\frac{2mg}{\sqrt{3}-1}$

61. $m_1, m_2, \ldots m_n$ are the masses of n particle on xy-plane) and ($\bar{x}$, $\bar{y}$) is the center of gravity of the system of particles. If now each particle is rotated about origin through an angle α, then the center of gravity of the system in the new position is ($\bar{x}', \bar{y}'$) where

a. $\bar{x}' = \bar{x}\cos\alpha + \bar{y}\sin\alpha$
   $\bar{y}' = -\bar{x}\sin\alpha - \bar{y}\cos\alpha$

b. $\bar{x}' = \bar{x}\cos\alpha - \bar{y}\sin\alpha$
   $\bar{y}' = \bar{x}\sin\alpha + \bar{y}\cos\alpha$

c. $\bar{x}' = \bar{x}\cos\alpha - \bar{y}\sin\alpha$
   $\bar{y}' = -\bar{x}\sin\alpha + \bar{y}\cos\alpha$

d. $\bar{x}' = \bar{x}\sin\alpha + \bar{y}\cos\alpha$
   $\bar{y}' = \bar{x}\cos\alpha + \bar{y}\sin\alpha$

62. A particle moves along a space curve such that its position vector $\vec{r}(t)$ at time t is given by $\vec{r}(t) = (2\cos t)\,\hat{i} + (2\sin t)\,\hat{j} + 3t^2\,\hat{k}$, then the particle has

a. constant speed

b. constant acceleration

c. speed which continuously decreases with t

d. acceleration which continuously increases with t

63. A bus starts from rest with an acceleration of $1 m/s^2$. A man who is 48 m behind the bus, starts running towards it with uniform velocity of 10 m/s .He will be able to catch the bus in

a. 6 s

b. 7 s

c. 8 s

d. 9 s

64. A particle of unit mass is traveling along the x-axis such that at t = 0, it is located at x = 0 and has speed v_0. If the particle is acted upon by a force which opposes the motion and has magnitude proportional to the square of the instantaneous speed, then the speed at time t is proportional to

a. 1+ kt , where k is a constant

b. $(1+t)^2$

c. 1/t

d. $\frac{1}{1+kt}$, where k is a constant

65. If the ratio of the major axes of the elliptical orbits of two planets is 4/9 ,then the ratio of their periodic times is equal to

a. 2/3

b. 4/9

c. 8/27

d. 16/81

66. A particle of mass 2 units moving along the x-axis is attracted towards the origin by a force whose magnitude is 8x, when the particle is at rest a distance x from the origin. If the particle is at x = 20, then the maximum speed attained by the particle is equal to

a. 10 units

b. 20 units

c. 30 units

d. 40 units

67. An object was thrown vertically downward with the initial speed v_0. If during the fifth second of its fall, it travels 3/2 times the distance it had traveled during the third second, then the value of v_0 is equal to

a. 2 g m/s

b. 3/2 g m/s

c. g m/s

d. g/ 2 m/s

68. Let A= 3.2, B= 4.5 and C= 6.2 .Now A. GT. B. AND. (A. LE. C. OR. B. NE. C). OR. NOT(A. EQ. B) is

a. false

b. true

c. AND

d. OR

69. The conversion of the binary number 11101.0101_2 to the decimal equivalent gives

a. 29.3125_{10}

b. 31.9375_{10}

c. 19.3125_{10}

d. 19.9375_{10}

70. Assertion (A): The inverse of $\begin{bmatrix} \alpha & -1 \\ \beta & 1 \end{bmatrix}$ exists, where α and β are the roots of the quadratic equation $x^2-2x-3=0$.

Reason (R) : $\alpha + \beta = 0$

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 the correct explanation of A

c. A is true but R is false

d. A is false but R is true

71. Assertion (A): The differential equation $(e^y-4)\sin x\, dx - e^y \cos x\, dy = 0$ is not correct.

Reason (R): The differential equation $M dx + N dy = 0$ is exact if $\frac{\partial M}{\partial y} = \frac{\partial N}{\partial x}$

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 the correct explanation of A

c. A is true but R is false

d. A is false but R is true

72. **Assertion (A):** The function $f: R \to R$ such that $f(a) = a^3$ for all $a \in R$ is one-one.

Reason(R): $f(a) = f(b) \Rightarrow a = b\ \forall a, b \in R$.

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 the correct explanation of A

c. A is true but R is false

d. A is false but R is true

73. Assertion (A): There exists real numbers x and y such that $\frac{1}{x+y} = \frac{1}{x} + \frac{1}{y}$.

Reason (R): Any real number can be written as a sum of two distinct real numbers.

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 the correct explanation of A

c. A is true but R is false

d. A is false but R is true

74. Assertion (A): If ω is the n^{th} root of unity, then $|\omega| = 1$.

Reason (R) : For any complex number ω, $|\omega|^n = 1$ implies that $|\omega| = 1$

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 the correct explanation of A

c. A is true but R is false

d. A is false but R is true

75. Assertion (A) : y = 0 is the singular solution of the equation $9yp^2 + 4 = 0$

Reason (R): y = 0 occurs both in p-discriminant and c-discriminant obtained from the general solution $y^3 + (x+c)^2 = 0$ of the equation $9yp^2 + 4 = 0$.

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 the correct explanation of A

c. A is true but R is false

d. A is false but R is true

76. Assertion (A): A computer of 8-bit word length of which 3-bit is used for operation code, can perform 8 operations.

Reason(R): The number of operation performed is two to the power of the bits reserved for operation code.

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 the correct explanation of A

c. A is true but R is false

d. A is false but R is true

77. If the slope of one line in the pair $ax^2 + 4xy + y^2 = 0$, is three times the other, then a is equal to

a. 3

b. 1

c. –3

d. –1

78. The condition that the straight line $1/r = 1/a \cos\theta + 1/b \sin\theta$ may touch the circle $r = 2c\cos\theta$ is

a. $2c/a = 1 - b^2/c^2$

b. $2c/a = 1 - c^2/b^2$

c. $2c/a = 1+c^2/b^2$

d. $2a/c = 1-c^2/b^2$

79. If the circle $x^2+y^2+2gx-8=0$ touches the line $x-y=4$, then the values of g are

a. 0, -8

b. 0, 8

c. 2, 8

d. 3, 5

80. If the length of the radical axis of two circle $x^2+y^2+8x+1=0$ and $x^2+y^2+2\mu y-1=0$ is $2\sqrt{6}$, then the values of μ are

a. ± 2

b. ±3

c. ± 4

d. ± 8

81. The equation $x^2+xy+y^2+2x+3=0$, represents a/an

a. parabola

b. hyperbola

c. pair of straight lines

d. ellipse

82. If the latus rectum of an ellipse is equal to half its minor axis, then its eccentricity is equal to

a. $1/\sqrt{3}$

b. $1/\sqrt{2}$

c. $\sqrt{3}/2$

d. $2/\sqrt{3}$

83. The condition that the line $l/r = A\cos\theta + B\sin\theta$ may be a tangent to the conic $l/r = 1 + e\cos\theta$; ($l \neq 0$, $e \neq 0$) is given by

a. $(A-e)^2+(B-e)^2=1$

b. $(A-e)^2+B^2=0$

c. $A^2+(B-e)^2+0$

d. $(A-e)^2+B^2=1$

84. The equation of the tangent to the parabola $y^2=ax$, which is perpendicular to the line $2x+3y=4$, is given by

a. $6y = 9x + a$

b. $6y = 9x + 4a$

c. $6x = 9y + 4a$

d. $6x = 9y + a$

85. The planes $bx - ay = n$, $cy - bz = l$ and $az - cx = m$ intersect in a line if

a. $a + b + c = 0$

b. $a = b = c$

c. $al + bm + cn = 0$

d. $l + m + n = 0$

86. The equation of the cone whose generators pass through the point (α, β, γ) and whose direction cosines satisfy the relation $al^2+bm^2+cn^2=0$ is given by

a. $a(x-\alpha)^2+b(y-\beta)^2+c(z-\gamma)^2=0$

b. $\alpha(x-a)^2+\beta(y-b)^2+\gamma(z-c)^2=0$

c. $a\alpha x^2+b\beta y^2+c\gamma z^2=0$

d. $(\alpha/a)x^2+(\beta/b)y^2+(\gamma/c)z^2=0$

87. The equation of the cylinder generated by a straight line which is parallel to the line $x = mz$, $y = nz$ and intersects circle $x^2+y^2=1$, $z=0$, is given by

a. $(mz-x)^2+(nz-y)^2=1$

b. $(mz+x)^2+(nz+y)^2=1$

c. $(z-mx)^2+(z-ny)^2=1$

d. $(z+mx)^2+(z+ny)^2=1$

88. If $f(x) = \frac{x-5}{x+5}$, $x \neq -5$, then the domain of $f^{-1}(x)$, is

a. R

b. R-(1)

c. $(-\infty, 1)$

d. $(1, \infty)$

89. If $af(x+1)+bf\left(\frac{1}{x+1}\right)=x$, $x \neq -1$, $a \neq b$, then f(2) is equal to

a. $\frac{2a+b}{a(a^2-b^2)}$

b. $\frac{a}{a^2-b^2}$

c. $\frac{a+2b}{a^2-b^2}$

d. $\frac{b}{a^2-b^2}$

90. $\lim_{x\to\infty}(4^x+5^x)^{1/x}$ equals to

a. 4

b. 5

c. e

d. 5e

91. At the point x = 1, the function

$f(x) = \begin{cases} x^2 - 1, & 1 < x < \infty \\ x - 1, & -\infty < x \le 1 \end{cases}$ is

a. continuous and differentiable

b. continuous and not differentiable

c. discontinuous and monotonically increasing

d. discontinuous and monotonically decreasing

92. For a tangent to the curve
$x = (y-1)(y-2)(y-3)$
to be parallel to the y-axis ,the point of tangency has y coordinates given by

a. $1 \pm \frac{1}{\sqrt{3}}$

b. $2 \pm \frac{1}{\sqrt{3}}$

c. $3 \pm \frac{1}{\sqrt{3}}$

d. $4 \pm \frac{1}{\sqrt{3}}$

93. The function $f(x) = -2x^3 - 9x^2 - 12x + 1$ is an increasing function in the interval

a. $-2 < x < -1$

b. $-2 < x < 1$

c. $-1 < x < 2$

d. $1 < x < 2$

94. If $f(x) = \begin{vmatrix} \sin x & \cos x & \sin x \\ \cos x & -\sin x & \cos x \\ x & 1 & 1 \end{vmatrix}$ then $f'(x)$ is equal to

a. 0

b. 1

c. 3

d. 5

95. If $S_1 = \sum_{n=1}^{\infty} \frac{(n!)^n}{(n^n)^2}$ and $S_2 = \sum_{n=1}^{\infty} \frac{1}{(2n-1)(2n+1)}$ then which one of the following statements is correct?

a. Both S_1 and S_2 are convergent

b. S_1 is divergent and S_2 is convergent

c. S_1 is convergent and S_2 is divergent

d. Both S_1 and S_2 are divergent

96. Let f(x) and g(x) be differentiable for $0 \le x \le 2$, such that $f(0) = 4$, $f(2) = 8$, $g(0) = 0$ and $f'(x) = g'(x)$ for all x in [0, 2], then the value of g(2) must be

a. 2

b. –2

c. 4

d. –4

97. If the functions f and g be defined and continuous on [l, m] and be differentiable on (l, m) then which one of the following is not correct?

a. When $f(l) = f(m)$ there is $p \in (l, m)$ such that $f'(p) = 0$

b. There is $p \in (l, m)$ such that $f(m) - f(l) = f'(p)(m - l)$

c. There is $p \in (l, m)$ such that $f(m) - f(l) = f'(p)[g(m) - g(l)]$

d. There is $p \in (l, m)$ such that $\frac{f(m) - f(l)}{g(m) - g(l)} = \frac{f'(p)}{g'(p)}$, where $g(m) \neq g(l)$ and $f'(p)$, $g'(p)$ are not simultaneously zero .

98. $\lim_{x \to 0} \frac{e^x + e^{-x} - 2}{x^2}$ is equal to

a. 1

b. – 1

c. 1/2

d. –1/2

99. The maximum value of $\left(\frac{1}{x}\right)^{2x^2}$, $x > 0$ is equal to

a. e

b. $e^{2/e}$

c. $e\sqrt{e}$

d. 1/e

100. If the equation of the tangent to $y = 3x^2 - 4x$ at (1, -1) is $ax = y + b$, then the value of a and b , respectively are

a. 2 and 3

b. 3 and 2

c. 1 and 2

d. 2 and 1