2.20 OBJECTIVE TYPE OF QUESTIONS

PROBLEMS 2.12

Choose the correct answer or fill up the blanks in the following problems :

1. To multiply a matrix by scalar k, multiply
   (*a*) any row by k (*b*) every element by k (*c*) any column by k.

2. If $A = \begin{bmatrix} 3 & -4 \\ 1 & -1 \end{bmatrix}$, then A^n is
   (*a*) $\begin{bmatrix} 1+2n & -4n \\ n & 1-2n \end{bmatrix}$ (*b*) $\begin{bmatrix} 3^n & (-4)^n \\ 1 & (-1)^n \end{bmatrix}$ (*c*) $\begin{bmatrix} 1+3n & 1-4n \\ 1+n & 1-n \end{bmatrix}$ (*d*) $\begin{bmatrix} 1+2n & -4n \\ 1+n & 1-2n \end{bmatrix}$

3. The inverse of the matrix $\begin{bmatrix} -0.5 & 0 & 0 \\ 0 & 4 & 0 \\ 0 & 0 & 1 \end{bmatrix}$ is
   (*a*) $\begin{bmatrix} 0.5 & 0 & 0 \\ 0 & -4 & 0 \\ 0 & 0 & 1 \end{bmatrix}$ (*b*) $\begin{bmatrix} 0.5 & 0 & 0 \\ 0 & -4 & 0 \\ 0 & 0 & 1 \end{bmatrix}$ (*c*) $\begin{bmatrix} -2 & 0 & 0 \\ 0 & 0.25 & 0 \\ 0 & 0 & 1 \end{bmatrix}$ (*d*) $\begin{bmatrix} 2 & 0 & 0 \\ 0 & -0.25 & 0 \\ 0 & 0 & -1 \end{bmatrix}$

4. If $A = \begin{bmatrix} 2 & 0 & 0 \\ 0 & 2 & 0 \\ 0 & 0 & 2 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & 2 & 3 \\ 0 & 1 & 3 \\ 0 & 0 & 2 \end{bmatrix}$, then the determinant AB has the value
   (*a*) 4 (*b*) 8 (*c*) 16 (*d*) 32

5. The system of equations $x + 2y + z = 9$, $2x + y + 3z = 7$ can be expressed as
   (*a*) $\begin{bmatrix} 1 & 2 & 1 \\ 2 & 1 & 3 \end{bmatrix} = \begin{bmatrix} 9 \\ 7 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix}$ (*b*) $\begin{bmatrix} 1 & 2 & 1 \\ 2 & 1 & 3 \end{bmatrix} = \begin{bmatrix} 9 \\ 7 \end{bmatrix} = \begin{bmatrix} x \\ y \\ z \end{bmatrix}$
   (*c*) $\begin{bmatrix} 1 & 2 & 1 \\ 2 & 1 & 3 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 9 \\ 7 \end{bmatrix}$ (*d*) none of the above.

6. If $\begin{bmatrix} 5 & 4 \\ 1 & 1 \end{bmatrix} X = \begin{bmatrix} 1 & -2 \\ 1 & 3 \end{bmatrix}$, then X equals
   (*a*) $\begin{bmatrix} -3 & -14 \\ 4 & 17 \end{bmatrix}$ (*b*) $\begin{bmatrix} 1 & -2 \\ 3 & 1 \end{bmatrix}$ (*c*) $\begin{bmatrix} 1 & 3 \\ -2 & 1 \end{bmatrix}$ (*d*) $\begin{bmatrix} 3 & -14 \\ 4 & -17 \end{bmatrix}$

7. If $A = \begin{bmatrix} 3 & 2 \\ 1 & 4 \end{bmatrix}$, then A (adj A) equals
   (*a*) $\begin{bmatrix} 10 & 0 \\ 0 & 10 \end{bmatrix}$ (*b*) $\begin{bmatrix} 0 & 10 \\ 10 & 0 \end{bmatrix}$ (*c*) $\begin{bmatrix} 10 & 1 \\ 1 & 10 \end{bmatrix}$ (*d*) none of the above.

8. If $3x + 2y + z = 0$, $x + 4y + z = 0$, $2x + y + 4z = 0$, be a system of equations, then
   (*a*) it is inconsistent
   (*b*) it has only the trivial solution $x = 0, y = 0, z = 0$.
   (*c*) it can be reduced to a single equation and so a solution does not exist.
   (*d*) determinant of the matrix of coefficients is zero.

9. 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
   (*a*) $C = A\cos\theta - B\sin\theta$ (*b*) $C = A\sin\theta + B\cos\theta$
   (*c*) $C = A\sin\theta - B\cos\theta$ (*d*) $C = A\cos\theta + B\sin\theta$.

10. Let $A = \begin{bmatrix} 1 & 0 & 0 \\ \alpha & 1 & 0 \\ \beta & \gamma & 1 \end{bmatrix}$ 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 $\alpha \neq 0, \beta \neq 0$, and $\gamma = 0$

(c) A is not row equivalent to B

(d) A is row equivalent to B for all value of α, β, γ.

11. If $A \begin{bmatrix} 0 & 1 \\ 2 & -1 \end{bmatrix} = \begin{bmatrix} 2 & 1 \\ -1 & 0 \end{bmatrix}$ where $A = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$, then A is

(a) $\begin{bmatrix} 2 & 1 \\ 0 & 0 \end{bmatrix}$ (b) $\begin{bmatrix} 0 & 1 \\ 2 & -1 \end{bmatrix}$ (c) $\begin{bmatrix} 2 & 1 \\ -1 & 0 \end{bmatrix}$ (d) $\begin{bmatrix} 2 & 1 \\ -1/2 & -1/2 \end{bmatrix}$

12. Matrix has a value. This statement

(a) is always true (b) depends upon the matrices

(c) is false

13. If A is a square matrix such that $AA' = I$, then value of $A'A$ is

(a) A^2 (b) I (c) A^{-1}

14. If every minor of order r of a matrix A is zero, then rank of A is

(a) greater than r (b) equal to r (c) less than or equal to r (d) less than r.

15. A square matrix A is called orthogonal if

(a) $A = A^2$ (b) $A' = A^{-1}$ (c) $AA^{-1} = I$

16. The rank of matrix $\begin{bmatrix} 2 & -1 & 3 & 1 \\ 1 & 4 & -2 & 1 \\ 5 & 2 & 4 & 3 \end{bmatrix}$ is ....

17. The sum of the eigen values of a matrix is the .... of the elements of the principal diagonal.

18. The sum and product of the eigen values of the matrix $\begin{bmatrix} 2 & -3 \\ 4 & -2 \end{bmatrix}$ are .... and .... respectively. (*Anna*, 2009)

19. Inverse of $\begin{bmatrix} 1 & 2 & -2 \\ -1 & 3 & 0 \\ 0 & -2 & 1 \end{bmatrix}$ is $\begin{bmatrix} 3 & 2 & 6 \\ 1 & 1 & k \\ 2 & 2 & 5 \end{bmatrix}$ then k is ....

20. Using Cayley-Hamilton theorem, the value of $A^4 - 4A^3 - 5A^2 - A + 2I$ when $A = \begin{bmatrix} 1 & 2 \\ 4 & 2 \end{bmatrix}$ is .... (*Anna, 2009*)

21. If two eigen values of $\begin{bmatrix} 8 & -6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{bmatrix}$ are 3 and 15, then the third eigen value is ....

22. A quadratic form is positive semi-definite when ....

23. $A_{m \times n}$ and $B_{p \times q}$ are two matrices. When will

(a) $A \,.\, B$ exist (b) $A + B$ exist ?

24. The product of the eigen values of $\begin{bmatrix} 1 & 0 & 0 \\ 0 & 3 & -1 \\ 0 & -1 & 3 \end{bmatrix}$ is ....

25. The quadratic form corresponding to the diagonal matrix diag $(\lambda_1, \lambda_2, ..., \lambda_n)$ is

(a) $x_1^2 + x_2^2 + ... + x_n^2$ (b) $\lambda_1 x_1^2 + \lambda_2 x_2^2 + ... + \lambda_n x_n^2$

(c) $\lambda_1^2 x_1^2 + \lambda_2^2 x_2^2 + ... + \lambda_n^2 x_n^2$

26. An example of a 3 × 3 matrix of rank one is ....

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

28. Solving the equations $x + 2y + 3z = 0$, $3x + 4y + 4z = 0$, $7x + 10y + 12z = 0$, $x =$ ...., $y =$ ...., $z =$ ....

29. The eigen values of the matrix $\begin{bmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{bmatrix}$ are ....

30. A matrix A is *idempotent* if ....

31. The rank of the matrix $\begin{bmatrix} 1 & 1 & -1 \\ 2 & -3 & 4 \\ 3 & -2 & 3 \end{bmatrix}$ is ....

32. If A = $\begin{bmatrix} -1 & 2 & 3 \\ 0 & 3 & 5 \\ 0 & 0 & -2 \end{bmatrix}$, then the eigen values of A^2 are ....

33. The sum of the eigen values of $\begin{bmatrix} 1 & 1 & 3 \\ 1 & 5 & 1 \\ 3 & -1 & -1 \end{bmatrix}$ is

(*i*) – 2 (*ii*) 3 (*iii*) 6 (*iv*) 7 (*S.V.T.U., 2009*)

34. The maximum value of the rank of a 4 × 5 matrix is ....

35. The sum of two eigen values and trace of a 3 × 3 matrix are equal, then the value of | A | is .... (*Anna, 2009*)

36. If the sum of the eigen values of the matrix of the quadratic form is zero, then the nature of the quadratic form is ....

37. The eigen values of matrix $\begin{bmatrix} \cos\theta & -\sin\theta \\ -\sin\theta & -\cos\theta \end{bmatrix}$ are ....

38. The eigen values of a triangular matrix are ....

39. If the product of two eigen values of the matrix $\begin{bmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{bmatrix}$ is 16, then the third eigen value is ....

40. If λ_i, $i = 1, 2, \ldots\ldots n$ are the eigen values of a square matrix A, then the eigen values of A^T are ....

41. By applying elementary transformations to a matrix, its rank

(*a*) increases (*b*) decreases (*c*) does not change

42. If λ is an eigen value of A, then it is an eigen value of B, only if B = ...

43. If $A = \begin{bmatrix} 1 & 2 & 3 \\ 0 & 2 & 5 \\ 0 & 0 & 3 \end{bmatrix}$, then eigen values of A^{-1} are ....

44. The characteristic equation of $\begin{bmatrix} 3 & 10 & 5 \\ -2 & -3 & -4 \\ 3 & 5 & 7 \end{bmatrix}$ is ....

45. If $A = \begin{bmatrix} 2 & 1 \\ 1 & 2 \end{bmatrix}$, then eigen values of A^{-1} are ....

46. Matrix $\begin{bmatrix} x & 2 \\ 1 & x-1 \end{bmatrix}$ is singular for x = ...

47. Every Hermitian matrix can be written as $A + iB$, where A is real and .... and B is real and ....

48. The sum and product of the eigen values of $\begin{bmatrix} 2 & 2 & 1 \\ 1 & 3 & 1 \\ 1 & 2 & 2 \end{bmatrix}$ are .... and ....

49. If $A = \begin{bmatrix} \cos\theta & \sin\theta \\ -\sin\theta & \cos\theta \end{bmatrix}$, then A^3 = ...

50. The product of the eigen values of a matrix is equal to ....

51. The eigen values of $A = \begin{bmatrix} 1 & 1 \\ 2 & 5 \end{bmatrix}$ are the roots of the equation ....

52. A system of linear non-homogeneous equations is consistent, if and only if the rank of coefficient matrix is equal to rank of ....
53. The matrix of the quadratic form $q = 4x^2 - 2y^2 + z^2 - 2xy + 6zx$ is ....
54. If $\lambda_1, \lambda_2, \lambda_3$ are the eigen values of a matrix A, then A^3 has the eigen values ....
55. If λ is an eigen value of a non-singular matrix A, then the eigen value of A^{-1} is ....
56. The matrix corresponding to the quadratic form $x^2 + 2y^2 - 7z^2 - 4xy + 8xy + 5yz$ is ....
57. The sum of the squares of the eigen values of $\begin{bmatrix} 3 & 1 & 4 \\ 0 & 2 & 6 \\ 0 & 0 & 5 \end{bmatrix}$ is ....
58. If the rank of a matrix A is 2, then the rank of A' is ....
59. The index and signature of the quadratic form $x_1^2 + 2x_2^2 - 3x_3^2$ are respectively .... and ....
60. The equations $x + 2y = 1$, $7x + 14y = 12$ are consistent. (True or False)
61. If rank $(A) = 2$, rank $(B) = 3$, then rank $(AB) = 6$. (True or False)
62. Any set of vectors which includes the zero vector is linearly independent. (True or False)
63. If λ is an eigen value of a symmetric matrix,then λ is real. (True or False)
64. Every square matrix does not satisfy its own characteristic equation. (True or False)
65. If λ is an eigen value of an orthogonal matrix, then $1/\lambda$ is also its eigen value. (True or False)
66. If the rank of a matrix A is 3, then the rank of $3A^T$ is 1. (True or False)
67. The vectors $[1, 1, -1, 1]$, $[1, -1, 2, -1]$, $[3, 1, 0, 1]$ are linearly dependent. (True or False)
68. The eigen values of a skew-symmetric matrix are real. (True or False)
69. Inverse of a unitary matrix is a unitary matrix. (True or False)
70. A is a non-zero column matrix and B is a non-zero row matrix, then rank of AB is one. (True or False)
71. The sum of the eigen values of A equals to the trace of $A = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 3 & -1 \\ 0 & -1 & 3 \end{bmatrix}$. (True or False)

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1. (*b*) **2.** (*a*) **3.** (*c*) **4.** (*c*) **5.** (*c*) **6.** (*a*)
7. (*a*) **8.** (*b*) **9.** (*d*) **10.** (*a*) **11.** (*d*) **12.** (*c*)
13. (*b*) **14.** (*d*) **15.** (*c*) **16.** 2 **17.** sum **18.** 0, 8
19. 2 **20.** $\begin{bmatrix} 3 & 2 \\ 4 & 5 \end{bmatrix}$ **21.** 0
22. All the eigen values are ≥ 0 and at least one eigen value is zero.
23. (*a*) $n = p$, (*b*) $m = p$, $n = q$ **24.** 8 **25.** (*b*)

26. $\begin{bmatrix} 2 & 3 & 1 \\ 4 & 6 & 2 \\ 6 & 9 & 3 \end{bmatrix}$ **27.** $x^2 + 4xy - 4y^2$ **28.** $x = y = z = 0$ **29.** 2, 2, 8
30. $A^2 = A$ **31.** 2 **32.** 1, 4, 9 **33.** (*iv*)
34. 4 **35.** zero **36.** Indefinite **37.** $1 - 1$
38. The elements of its leading diagonal **39.** 2 **40.** λ_i, $i = 1, 2, \ldots, n$
41. (*c*) **42.** A or A^T **43.** 1, 1/2, 1/3 **44.** $\lambda^3 - 7\lambda^2 + 16\lambda - 12 = 0$
45. 1, 1/3 **46.** $x = 3 - 1$ **47.** Symmetric ; skew-symmetric **48.** 7 ; 5
49. $\begin{bmatrix} \cos 3\theta & \sin 3\theta \\ -\sin 3\theta & \cos 3\theta \end{bmatrix}$ **50.** its determinant **51.** $\lambda^2 - 6\lambda + 3 = 0$ **52.** Augmented matrix
53. $\begin{bmatrix} 4 & -1 & 3 \\ -1 & -2 & 0 \\ 3 & 0 & 1 \end{bmatrix}$ **54.** $\lambda_1^3, \lambda_2^3, \lambda_3^3$ **55.** $1/\lambda$ **56.** $\begin{bmatrix} 1 & -0.5 & -0.5 \\ -0.5 & 1 & -0.5 \\ -0.5 & -0.5 & 1 \end{bmatrix}$
57. 38 **58.** 2 **59.** Index = 2, Signature = 1
60. False **61.** False **62.** False **63.** True
64. False **65.** True **66.** False **67.** True
68. False **69.** True **70.** True **71.** True.

Exercise 1

Only One Correct Option

1. If $\begin{bmatrix} x+y & 2x+z \\ x-y & 2z+w \end{bmatrix} = \begin{bmatrix} 4 & 7 \\ 0 & 10 \end{bmatrix}$, then the values of x, y, z, w are
   (a) 2, 2, 3, 4 (b) 2, 3, 1, 2
   (c) 3, 3, 0, 1 (d) None of these

2. What must be the matrix X, if $2X + \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix} = \begin{bmatrix} 3 & 8 \\ 7 & 2 \end{bmatrix}$?
   (a) $\begin{bmatrix} 1 & 3 \\ 2 & -1 \end{bmatrix}$ (b) $\begin{bmatrix} 1 & -3 \\ 2 & -1 \end{bmatrix}$
   (c) $\begin{bmatrix} 2 & 6 \\ 4 & -2 \end{bmatrix}$ (d) $\begin{bmatrix} 2 & -6 \\ 4 & -2 \end{bmatrix}$

3. If $2X - \begin{bmatrix} 1 & 2 \\ 7 & 4 \end{bmatrix} = \begin{bmatrix} 3 & 2 \\ 0 & -2 \end{bmatrix}$, then X is equal to
   (a) $\begin{bmatrix} 2 & 2 \\ 7 & 4 \end{bmatrix}$ (b) $\begin{bmatrix} 1 & 2 \\ \frac{7}{2} & 2 \end{bmatrix}$
   (c) $\begin{bmatrix} 2 & 2 \\ \frac{7}{2} & 1 \end{bmatrix}$ (d) None of these

4. If $A = \begin{bmatrix} 0 & 2 \\ 3 & -4 \end{bmatrix}$ and $kA = \begin{bmatrix} 0 & 3a \\ 2b & 24 \end{bmatrix}$, then the values of k, a, b are respectively
   (a) $-6, -12, -18$ (b) $-6, 4, 9$
   (c) $-6, -4, -9$ (d) $-6, 12, 18$

5. If $A = [a_{ij}]$ is a 4×4 matrix and C_{ij} is the cofactor of the element a_{ij} in $|A|$, then the expression $a_{11}C_{11} + a_{12}C_{12} + a_{13}C_{13} + a_{14}C_{14}$ is equal to
   (a) 0 (b) -1
   (c) 1 (d) $|A|$

6. If I is a unit matrix of order 10, then the determinant of I is equal to
   (a) 10 (b) 1
   (c) 1/10 (d) 9

7. If $A = \begin{bmatrix} 1 & \log_b a \\ \log_a b & 1 \end{bmatrix}$, then $|A|$ is equal to
   (a) 1 (b) 0
   (c) $\log_a b$ (d) $\log_b a$

8. If A is any square matrix, then $\det(A - A^T)^T$ is equal to
   (a) 0
   (b) 1
   (c) can be 0 or a perfect square
   (d) cannot be determined

9. If $A = [a_{ij}]_{n \times n}$ be a diagonal matrix with diagonal element all different and $B = [b_{ij}]_{n \times n}$ be some another matrix. Let $AB = [c_{ij}]_{n \times n}$, then c_{ij} is equal to
   (a) $a_{jj}\, b_{ij}$ (b) $a_{ii}\, b_{ij}$
   (c) $a_{ij}\, b_{ij}$ (d) $a_{ij}\, b_{ji}$

10. Assuming that the sum and product given below are defined, which of the following is not true for matrices ?
    (a) $A + B = B + A$
    (b) $AB = AC$ does not imply $B = C$
    (c) $AB = O$ implies $A = O$ or $B = O$
    (d) $(AB)' = B'A'$

11. If A and B are 3×3 matrices such that $AB = A$ and $BA = B$, then
    (a) $A^2 = A$ and $B^2 \neq B$ (b) $A^2 \neq A$ and $B^2 = B$
    (c) $A^2 = A$ and $B^2 = B$ (d) $A^2 \neq A$ and $B^2 \neq B$

12. If $A = \begin{bmatrix} 1 & 2 & -1 \\ 3 & 0 & 2 \\ 4 & 5 & 0 \end{bmatrix}$, $B = \begin{bmatrix} 1 & 0 & 0 \\ 2 & 1 & 0 \\ 0 & 1 & 3 \end{bmatrix}$, then AB is equal to
    (a) $\begin{bmatrix} 5 & 1 & -3 \\ 3 & 2 & 6 \\ 14 & 5 & 0 \end{bmatrix}$ (b) $\begin{bmatrix} 11 & 4 & 3 \\ 1 & 2 & 3 \\ 0 & 3 & 3 \end{bmatrix}$
    (c) $\begin{bmatrix} 1 & 8 & 4 \\ 2 & 9 & 6 \\ 0 & 2 & 0 \end{bmatrix}$ (d) $\begin{bmatrix} 0 & 1 & 2 \\ 5 & 4 & 3 \\ 1 & 8 & 2 \end{bmatrix}$

13. $\begin{bmatrix} 7 & 1 & 2 \\ 9 & 2 & 1 \end{bmatrix} \begin{bmatrix} 3 \\ 4 \\ 5 \end{bmatrix} + 2\begin{bmatrix} 4 \\ 2 \end{bmatrix}$ is equal to
    (a) $\begin{bmatrix} 43 \\ 44 \end{bmatrix}$ (b) $\begin{bmatrix} 43 \\ 45 \end{bmatrix}$
    (c) $\begin{bmatrix} 45 \\ 44 \end{bmatrix}$ (d) $\begin{bmatrix} 44 \\ 45 \end{bmatrix}$

14. If $A = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ a & b & -1 \end{bmatrix}$, then A^2 is equal to
    (a) null matrix (b) unit matrix
    (c) $-A$ (d) A

15. If $A = \begin{bmatrix} 2 & -1 \\ -1 & 2 \end{bmatrix}$ and I is the unit matrix of order 2, then A^2 equals
    (a) $4A - 3I$ (b) $3A - 4I$
    (c) $A - I$ (d) $A + I$

16. If A is a skew-symmetric matrix of order 3, then matrix A^3 is
(a) skew-symmetric matrix
(b) symmetric matrix
(c) diagonal matrix
(d) None of the above

17. If $A = \begin{bmatrix} \alpha & 0 \\ 1 & 1 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & 0 \\ 5 & 1 \end{bmatrix}$, then value of α for which $A^2 = B$ is
(a) 1 (b) -1
(c) 4 (d) No real values

18. If $A = \begin{bmatrix} 1 & -2 & 1 \\ 2 & 1 & 3 \end{bmatrix}$ and $B = \begin{bmatrix} 2 & 1 \\ 3 & 2 \\ 1 & 1 \end{bmatrix}$, then $(AB)^T$ is equal to
(a) $\begin{bmatrix} -3 & -2 \\ 10 & 7 \end{bmatrix}$ (b) $\begin{bmatrix} -3 & 10 \\ -2 & 7 \end{bmatrix}$
(c) $\begin{bmatrix} -3 & 7 \\ 10 & 2 \end{bmatrix}$ (d) None of these

19. For the matrix $A = \begin{bmatrix} 1 & 1 & 0 \\ 1 & 2 & 1 \\ 2 & 1 & 0 \end{bmatrix}$, which of the following is correct ?
(a) $A^3 + 3A^2 - I = O$ (b) $A^3 - 3A^2 - I = O$
(c) $A^3 + 2A^2 - I = O$ (d) $A^3 - A^2 + I = O$

20. If $P = \begin{bmatrix} i & 0 & -i \\ 0 & -i & i \\ -i & i & 0 \end{bmatrix}$ and $Q = \begin{bmatrix} -i & i \\ 0 & 0 \\ i & -i \end{bmatrix}$, then PQ is equal to
(a) $\begin{bmatrix} -2 & 2 \\ 1 & -1 \\ 1 & -1 \end{bmatrix}$ (b) $\begin{bmatrix} 2 & -2 \\ -1 & 1 \\ -1 & 1 \end{bmatrix}$
(c) $\begin{bmatrix} 2 & -2 \\ -1 & 1 \end{bmatrix}$ (d) $\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$

21. A square matrix P satisfies $P^2 = I - P$, where I is the identity matrix. If $P^n = 5I - 8P$, then n is equal to
(a) 4 (b) 5
(c) 6 (d) 7

22. Let $A = \begin{bmatrix} \cos^2\theta & \sin\theta\cos\theta \\ \cos\theta\sin\theta & \sin^2\theta \end{bmatrix}$ and
$B = \begin{bmatrix} \cos^2\theta & \sin\phi\cos\phi \\ \cos\phi\sin\phi & \sin^2\phi \end{bmatrix}$, then $AB = O$, if
(a) $\theta = n\phi$, $n = 0, 1, 2, \ldots$
(b) $\theta + \phi = n\pi$, $n = 0, 1, 2, \ldots$
(c) $\theta = \phi + (2n+1)\frac{\pi}{2}$, $n = 0, 1, 2, \ldots$
(d) $\theta = \phi + n\frac{\pi}{2}$, $n = 0, 1, 2, \ldots$

23. The matrix $A = \begin{bmatrix} \frac{1}{\sqrt{2}} & \frac{1}{\sqrt{2}} \\ -\frac{1}{\sqrt{2}} & -\frac{1}{\sqrt{2}} \end{bmatrix}$ is
(a) unitary (b) orthogonal
(c) nilpotent (d) involutory

24. The product of two orthogonal matrices is
(a) orthogonal (b) involutory
(c) unitary (d) idempotent

25. If a square matrix A is such that $AA^T = I = A^T A$, then $|A|$ is equal to
(a) 0 (b) ± 1
(c) ± 2 (d) None of these

26. Let A be an orthogonal non-singular matrix of order n, then the determinant of matrix '$A - I_n$' ie, $|A - I_n|$ is equal to
(a) $|I_n - A|$ (b) $|A|$
(c) $|A||I_n - A|$ (d) $(-1)^n |A||I_n - A|$

27. Let $M = [a_{uv}]_{n \times n}$ be a matrix, where
$a_{uv} = \sin(\theta_u - \theta_v) + i\cos(\theta_u - \theta_v)$,
the M is equal to
(a) $\overline{M}$ (b) $-\overline{M}$
(c) $\overline{M}^T$ (d) $-\overline{M}^T$

28. For any square matrix A, AA^T is a
(a) unit matrix
(b) symmetric matrix
(c) skew-symmetric matrix
(d) diagonal matrix

29. If A is a square matrix, then $A + A^T$ is
(a) non-singular matrix
(b) symmetric matrix
(c) skew-symmetric matrix
(d) unit matrix

30. Match List I with List II and select the correct answer using the codes given below the lists

	List I		List II
A.	A is a square matrix such that $A^2 = A$	1.	Nilpotent matrix
B.	A is a square matrix such that $A^m = O$	2.	Involutory matrix
C.	A is a square matrix such that $A^2 = I$	3.	Symmetric matrix
D.	A is a square matrix such that $A^T = A$	4.	Idempotent matrix

Codes

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

31. If $A = \begin{bmatrix} 6 & 8 & 5 \\ 4 & 2 & 3 \\ 9 & 7 & 1 \end{bmatrix}$ is the sum of a symmetric matrix B and skew-symmetric matrix, C, then B is
(a) $\begin{bmatrix} 6 & 6 & 7 \\ 6 & 2 & 5 \\ 7 & 5 & 1 \end{bmatrix}$ (b) $\begin{bmatrix} 0 & 2 & -2 \\ -2 & 5 & -2 \\ 2 & 2 & 0 \end{bmatrix}$
(c) $\begin{bmatrix} 6 & 6 & 7 \\ -6 & 2 & -5 \\ -7 & 5 & 1 \end{bmatrix}$ (d) $\begin{bmatrix} 0 & 6 & -2 \\ 2 & 0 & -2 \\ -2 & -2 & 0 \end{bmatrix}$

32. Consider the following statements :
   1. A square matrix A is hermitian, if $A = A'$.
   2. Let $A = [a_{ij}]$ be a skew-hermitian matrix, then a_{ij} is purely imaginary.
   3. All integral powers of a symmetric matrix are symmetric.

   Which of these is/are correct ?

   (a) (1) and (2) (b) (2) and (3)
   (c) (3) and (1) (d) (1), (2) and (3)

33. Consider the following statements :
   1. If A and B are two square matrices of same order and commute, then $(A+B)(A-B) = A^2 - B^2$
   2. If A and B are two square matrices of same order, then $(AB)^n = A^n B^n$.
   3. If A and B are two matrices such that $AB = A$ and $BA = B$, then A and B are idempotent.

   Which of these is/are not correct ?

   (a) Only (1) (b) (2) and (3)
   (c) (3) and (1) (d) All of these

34. Consider the following statements :
   1. There can exist two matrices A, B of order 2×2 such that $AB - BA = I_2$.
   2. Positive odd integral power of a skew-symmetric matrix is symmetric.

   Which of these is/are correct ?

   (a) Only (1) (b) Only (2)
   (c) Both of these (d) None of these

35. The matrix $A = \begin{bmatrix} a & 2 \\ 2 & 4 \end{bmatrix}$ is singular, if

   (a) $a \neq 1$ (b) $a = 1$
   (c) $a = 0$ (d) $a = -1$

36. If $\begin{bmatrix} 2+x & 3 & 4 \\ 1 & -1 & 2 \\ x & 1 & -5 \end{bmatrix}$ is a singular matrix, then x is

   (a) $\frac{13}{25}$ (b) $-\frac{25}{13}$
   (c) $\frac{5}{13}$ (d) $\frac{25}{13}$

37. The matrix $\begin{bmatrix} 5 & 10 & 3 \\ -2 & -4 & 6 \\ -1 & -2 & b \end{bmatrix}$ is a singular matrix, if b is equal to

   (a) -3 (b) 3
   (c) 0 (d) for any value of b

38. If ω is a complex cube root of unity, then the matrix $A = \begin{bmatrix} 1 & \omega^2 & \omega \\ \omega^2 & \omega & 1 \\ \omega & 1 & \omega^2 \end{bmatrix}$ is a

   (a) singular matrix (b) non-symmetric matrix
   (c) skew-symmetric matrix (d) None of these

39. Matrix $A = \begin{bmatrix} 1 & 0 & -k \\ 2 & 1 & 3 \\ k & 0 & 1 \end{bmatrix}$ is invertible for

   (a) $k = 1$ (b) $k = -1$
   (c) $k = \pm 1$ (d) None of these

40. If $A = \begin{bmatrix} -2 & 6 \\ -5 & 7 \end{bmatrix}$, then adj A is

   (a) $\begin{bmatrix} 7 & -6 \\ 5 & -2 \end{bmatrix}$ (b) $\begin{bmatrix} 2 & -6 \\ 5 & -7 \end{bmatrix}$
   (c) $\begin{bmatrix} 7 & -5 \\ 6 & -2 \end{bmatrix}$ (d) None of these

41. If $A = \begin{bmatrix} 1 & \tan\frac{\theta}{2} \\ -\tan\frac{\theta}{2} & 1 \end{bmatrix}$ and $AB = I$, then B is equal to

   (a) $\cos^2\frac{\theta}{2} \cdot A$ (b) $\cos^2\frac{\theta}{2} \cdot A^T$
   (c) $\cos^2\theta \cdot I$ (d) $\sin^2\frac{\theta}{2} \cdot A$

42. The adjoint matrix of $\begin{bmatrix} 3 & -3 & 4 \\ 2 & -3 & 4 \\ 0 & -1 & 1 \end{bmatrix}$ is

   (a) $\begin{bmatrix} 4 & 8 & 3 \\ 2 & 1 & 6 \\ 0 & 2 & 1 \end{bmatrix}$ (b) $\begin{bmatrix} 1 & -1 & 0 \\ -2 & 3 & -4 \\ -2 & 3 & -3 \end{bmatrix}$
   (c) $\begin{bmatrix} 11 & 9 & 3 \\ 1 & 2 & 8 \\ 6 & 9 & 1 \end{bmatrix}$ (d) $\begin{bmatrix} 1 & -2 & 1 \\ -1 & 3 & 3 \\ -2 & 3 & -3 \end{bmatrix}$

43. Match List I with List II and select the correct answer using the codes given below the lists

List I	List II
A. $(\text{adj } A)^{-1}$	1. $k^{n-1}(\text{adj } A)$
B. $\text{adj}(A^{-1})$	2. $\frac{A}{\lvert A \rvert}$
C. $\text{adj}(kA)$	3. $\lvert A \rvert^{n-2} A$
D. $\text{adj}(\text{adj } A)$	4. $\frac{\text{adj}(\text{adj } A)}{\lvert A \rvert^2}$

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

44. If A is a singular matrix, then A adj (A)

   (a) is a scalar matrix
   (b) is a zero matrix
   (c) is an identity matrix
   (d) is an orthogonal matrix

45. If $A = \begin{bmatrix} 3 & 4 \\ 5 & 7 \end{bmatrix}$, then $A \cdot (\text{adj } A)$ is equal to

   (a) A (b) $\lvert A \rvert$
   (c) $\lvert A \rvert I$ (d) None of these

46. If A is a skew-symmetric matrix of odd order, then | adj equal to

   (a) 0 (b) n
   (c) n^2 (d) None of these

47. If $A = \begin{bmatrix} 1 & -1 & 1 \\ 0 & 2 & -3 \\ 2 & 1 & 0 \end{bmatrix}$, $B = (\text{adj } A)$ and $C = 5A$, then | is equal to

Mark the correct alternatives of each of the following

1. If $M(\theta) = \begin{bmatrix} \cos\theta & \sin\theta \\ -\sin\theta & \cos\theta \end{bmatrix}$, then $M(\alpha)\,M(\beta)$ is equal to

(a) $M(0)$ (b) $M(\alpha\beta)$

(c) $M(\alpha+\beta)$ (d) $M(\alpha-\beta)$

2. If the product of matrices

$$A = \begin{bmatrix} \cos^2\theta & \cos\theta\sin\theta \\ \cos\theta\sin\theta & \sin^2\theta \end{bmatrix}$$

$$B = \begin{bmatrix} \cos^2\phi & \cos\phi\sin\phi \\ \cos\phi\sin\phi & \sin^2\phi \end{bmatrix}$$

is a null matrix, then θ and ϕ differ by

(a) an odd multiple of π

(b) an even multiple of π

(c) an odd multiple of $\frac{\pi}{2}$

(d) an even multiple of $\frac{\pi}{2}$

3. If $A = \begin{bmatrix} 0 & -\tan(\alpha/2) \\ \tan(\alpha/2) & 0 \end{bmatrix}$

then $(I-A)\begin{bmatrix} \cos\alpha & -\sin\alpha \\ \sin\alpha & \cos\alpha \end{bmatrix}$ is equal to

(a) $I+A$ (b) $I-A$

(c) $I+2A$ (d) $I-2A$

4. If $A_\alpha = \begin{bmatrix} \cos\alpha & \sin\alpha \\ -\sin\alpha & \cos\alpha \end{bmatrix}$, then which of the following statement is correct

(a) $A_\alpha . A_\beta = A_{\alpha\beta}$ (b) $A_\alpha . A_\beta = A_{(\alpha+\beta)}$

(c) $A_\alpha . A_\beta = A_{(\alpha-\beta)}$ (d) None of these

5. If $D = \text{diag}(d_1, d_2, d_3, \ldots, d_n)$, where $d_i \neq 0$ for all $i = 1, 2, \ldots, n$ then D^{-1} is equal to

(a) D

(b) $\text{diag}\left(d_1^{-1}, d_2^{-1}, \ldots, d_n^{-1}\right)$

(c) I_n

(d) None of these

6. If $X = \begin{bmatrix} 3 & -4 \\ 1 & -1 \end{bmatrix}$, the value of X^n is

(a) $\begin{bmatrix} 3n & -4n \\ n & -n \end{bmatrix}$ (b) $\begin{bmatrix} 2+n & 5-n \\ n & -n \end{bmatrix}$

(c) $\begin{bmatrix} 3^n & (-4)^n \\ 1^n & (-1)^n \end{bmatrix}$ (d) None of these

7. The matrix, $A = \begin{bmatrix} 2 & -2 & -4 \\ -1 & 3 & 4 \\ 1 & -2 & -3 \end{bmatrix}$ is

(a) non-singular (b) idempotent
(c) nilpotent (d) orthogonal

8. If A is a square martix such that $A^k = O$, then $(I + A + A^2 + \ldots + A^{k-1})$ is equal to
(a) $(I-A)$ (b) $(I+A)$
(c) $(I-A)^{-1}$ (d) $(I+A)^{-1}$

9. If $A = \begin{bmatrix} 1 & -1 \\ 2 & -1 \end{bmatrix}$, $B = \begin{bmatrix} a & 1 \\ b & -1 \end{bmatrix}$, and $(A+B)^2 = A^2 + B^2$, then the values of a and b are respectively
(a) 2, 2 (b) 3, −2
(c) 1, 4 (d) −4, 7

10. 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 of the following is true?

(a) $C = A\cos\theta - B\sin\theta$

(b) $C = A\sin\theta + B\cos\theta$

(c) $C = A\sin\theta - B\cos\theta$

12. The inverse of the matrix

$$\begin{bmatrix} 2 & -5 & 1 \\ 8 & 6 & 7 \\ \lambda & -10 & 2 \end{bmatrix}$$ does not exist if λ equals to

(a) 0 (b) 2 (c) 4 (d) 5

13. The characteristic roots of the matrix

$$A = \begin{bmatrix} 8 & -6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{bmatrix}$$ are

(a) 0, 3, 15 (b) 0, −3, −15
(c) 0, 3, −15 (d) 0, −3, 15

14. The rank of

$$A = \begin{bmatrix} 6 & 1 & 3 & 8 \\ 4 & 2 & 6 & -1 \\ 10 & 3 & 9 & 7 \\ 16 & 4 & 12 & 15 \end{bmatrix}$$ is

(a) 4 (b) 3 (c) 2 (d) 1

15. The transformation matrix $\begin{bmatrix} 1 & 0 & 0 \\ 0 & 0 & 1 \\ 0 & 1 & 0 \end{bmatrix}$ represents

(a) Rotation about x-axis by 90°
(b) Reflection about $y = z$
(c) Reflexion about x-axis
(d) None of these

16. The matrix $\begin{bmatrix} 1 & 5-i & 3 \\ 5+i & 2 & 3i \\ 3 & -3i & 0 \end{bmatrix}$ is

(a) Symmetric (b) Skew-Symmetric
(c) Hermitian (d) Skew-Hermitian

17. Caley-Hamilton theorem gives $A(A^2 - I)$ equals to

(a) O (b) $A^2 + I$
(c) $A^2 - I$ (d) $A - I$

18. The characteristic equation of the following matrix is $\begin{bmatrix} 2 & -1 & 1 \\ -1 & 2 & -1 \\ 1 & -1 & 2 \end{bmatrix}$

(a) $8x^3 - 6x^2 - 9x + 81 = 0$
(b) $-x^3 + 6x^2 - 9x + 4 = 0$
(c) $x^3 + 6x^2 + 9x + 4 = 0$
(d) $8x^3 - 6x^2 + 9x - 81 = 0$

19. If $U = \begin{bmatrix} 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 \end{bmatrix}$, the rank of U^4 is

(a) 1 (b) 2 (c) 3 (d) 0

20. The rank of the martix $\begin{bmatrix} 2 & 2 & 2 & 2 \\ 3 & 3 & 3 & 3 \\ 4 & 4 & 4 & 4 \\ 5 & 5 & 5 & 5 \end{bmatrix}$ is

(a) 4 (b) 3 (c) 2 (d) 1

[J.N.U. M.C.A.]

21. Given that $b^2 - ac < 0$, $a > 0$ the value of

$$\begin{vmatrix} a & b & ax+by \\ b & c & bx+cy \\ ax+by & bx+cy & 0 \end{vmatrix}$$ is

(a) Zero (b) Positive
(c) Negative (d) None of these

22. Given that $xyz = -1$, the value of the determinant

$$\begin{vmatrix} x & x^2 & 1+x^3 \\ y & y^2 & 1+y^3 \\ z & z^2 & 1+z^3 \end{vmatrix}$$ is

(a) 0 (b) Positive
(c) Negative (d) None of these

23. If the value of the determinant $\begin{vmatrix} a & 1 & 1 \\ 1 & b & 1 \\ 1 & 1 & c \end{vmatrix}$ is positive, then

(a) $abc > 1$ (b) $abc > -8$
(c) $abc < -8$ (d) $abc > -2$

[J.N.U. M.C.A.]

24. If ω is an imaginary cube root of unity, then one of the factors of

$$\begin{vmatrix} a & b & c \\ b & c & a \\ c & a & b \end{vmatrix}$$ is

(a) $(a+b\omega^2+c\omega)$ (b) $(a+b\omega+c\omega^2)$

(c) $(a\omega+b+c\omega^2)$ (d) None of these

25. If $\omega = \dfrac{(-1+\sqrt{3}i)}{2}$, then the value of

$$\begin{vmatrix} 1 & 1 & 1 \\ 1 & \omega & \omega^2 \\ 1 & \omega^2 & \omega \end{vmatrix} \text{ is}$$

(a) $3\sqrt{3}i$ (b) $-3\sqrt{3}i$

(c) $-\sqrt{3}i$ (d) $\sqrt{3}i$

26. If ω is an imaginary cube root of unity, then the value of $\begin{vmatrix} 1 & \omega & \omega^2 \\ \omega & \omega^2 & 1 \\ \omega^2 & 1 & \omega \end{vmatrix}$ is

(a) 1 (b) ω

(c) ω^2 (d) 0

27. If a, b, c be positive real numbers, then the value of $\begin{vmatrix} a & b & c \\ b & c & a \\ c & a & b \end{vmatrix}$ is

(a) 0 (b) positive

(c) negative (d) a perfect square

28. If $\Delta = \begin{vmatrix} \cos\alpha & -\sin\alpha & 1 \\ \sin\alpha & \cos\alpha & 1 \\ \cos(\alpha+\beta) & -\sin(\alpha+\beta) & 1 \end{vmatrix}$, then

(a) $\Delta \in [1-\sqrt{2}, 1+\sqrt{2}]$

(b) $\Delta \in [-1, 1]$

(c) $\Delta \in [-\sqrt{2}, \sqrt{2}]$

(d) None of these

. If $1, \omega, \omega^2$ are the cube roots of unity, then value

$$\begin{vmatrix} 1 & \omega^n & \omega^{2n} \\ \omega^{2n} & 1 & \omega^n \\ \omega^n & \omega^{2n} & 1 \end{vmatrix} \text{ is}$$

(a) 0 (b) 1

(c) ω (d) ω^2

30. Let $D_r = \begin{vmatrix} a & 2^r & 2^{16}-1 \\ b & 3(4^r) & 2(4^{16}-1) \\ c & 7(8^r) & 4(8^{16}-1) \end{vmatrix}$, then the v

of $\sum_{k=1}^{16} D_k$ is

(a) 0 (b) $a+b+c$

(c) $ab+bc+ca$ (d) None of these

[J.N.U. M.C

31. If $d(r) = \begin{vmatrix} 2^{r-1} & 2(3^{r-1}) & 4(5^{r-1}) \\ x & y & z \\ 2^{n-1} & 3^{n-1} & 5^{n-1} \end{vmatrix}$

Then $\sum_{r=1}^{n} d(r)$ is equal to

(a) -1 (b) 0

(c) 1 (d) None of these

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32. If $\begin{vmatrix} x^n & x^{n+2} & x^{n+3} \\ y^n & y^{n+2} & y^{n+3} \\ z^n & z^{n+2} & z^{n+3} \end{vmatrix} = (x-y)(y-z)(z-$

$\left(\dfrac{1}{x}+\dfrac{1}{y}+\dfrac{1}{z}\right)$, then n equals

(a) 1 (b) -1 (c) 2 (d) -2

33. If $a_1, a_2, a_3, \ldots, a_m, \ldots$ are in G.P., the determinant

$$\Delta = \begin{vmatrix} \log a_n & \log a_{n+1} & \log a_{n+2} \\ \log a_{n+3} & \log a_{n+4} & \log a_{n+5} \\ \log a_{n+6} & \log a_{n+7} & \log a_{n+8} \end{vmatrix} \text{ is equ}$$

(a) 0 (b) 1

(c) 2 (d) None of these

34. Value of $\begin{vmatrix} 1 & 1 & 1 \\ a & b & c \\ a^3 & b^3 & c^3 \end{vmatrix}$ is

(a) $(a+b+c)^2(a^2+b^2+c^2)$

(b) $a^2b^2+b^2c^2+c^2a^2$

(c) $(a+b+c)(a-b)(b-c)(c-a)$

(d) $(a+b+c)(a+b)(b+c)(c+a)$

[J.N.U. M.C

35.

3

1. The system of equation $x+y+z=2, 3x-y+2z=6$ and $3x+y+z=-18$ has
   (a) a unique solution
   (b) no solution
   (c) an infinite number of solutions
   (d) zero solution as the only solution

2. The number of solutions of the system of equations

$$2x+y-z=7$$
$$x-3y+2z=1$$
$$x+4y-3z=5$$

is

(a) 3 (b) 2 (c) 1 (d) 0

3. Let $X=\begin{bmatrix}x_1\\x_2\\x_3\end{bmatrix}, A=\begin{bmatrix}1&-1&2\\2&0&1\\3&2&1\end{bmatrix}$ and $B=\begin{bmatrix}3\\1\\4\end{bmatrix}$. If $AX=B$, then X is equal to

(a) $\begin{bmatrix}1\\2\\3\end{bmatrix}$ (b) $\begin{bmatrix}-1\\-2\\-3\end{bmatrix}$ (c) $\begin{bmatrix}-1\\-2\\-3\end{bmatrix}$ (d) $\begin{bmatrix}-1\\2\\3\end{bmatrix}$ (e) $\begin{bmatrix}0\\2\\1\end{bmatrix}$

4. The number of solutions of the system of equations:

$$2x+y-z=7$$
$$x-3y+2z=1$$
$$x+4y-3z=5$$

(a) 3 (b) 2 (c) 1 (d) 0

5. The system of linear equations:

$$x+y+z=2$$
$$2x+y-z=3$$
$$3x+2y+kz=4 \text{ has a unique solution if}$$

(a) $k \neq 0$ (b) $-1<k<1$ (c) $-2<k<2$ (d) $k=0$

6. Consider the system of equations:

$$a_1x+b_1y+c_1z=0$$
$$a_2x+b_2y+c_2z=0$$
$$a_3x+b_3y+c_3z=0,$$

if $\begin{vmatrix}a_1&b_1&c_1\\a_2&b_2&c_2\\a_3&b_3&c_3\end{vmatrix}=0$, then the system has

(a) more than two solutions
(b) one trivial and one non-trivial solutions
(c) no solution
(d) only trivial solution (0, 0, 0)

7. Let a, b, c be positive real numbers. The following system of equations in x

$$\frac{x^2}{a^2}+\frac{y^2}{b^2}-\frac{z^2}{c^2}=1, \frac{x^2}{a^2}-\frac{y^2}{b^2}+\frac{z^2}{c^2}=1, -\frac{x^2}{a^2}+\frac{y^2}{b^2}+\frac{z^2}{c^2}=1 \text{ has}$$

(a) no solution (b) unique solution
(c) infinitely many solutions (d) finitely many solutions

8. For the system of equations:

$$x+2y+3z=1$$
$$2x+y+3z=2$$
$$5x+5y+9z=4$$

(a) there is only one solution
(b) there exists infinitely many solution
(c) there is no solution
(d) none of these

9. The existence of the unique solution of the system of equations:

$$x+y+z=\lambda$$
$$5x-y+\mu z=10$$
$$2x+3y-z=6$$

depends on

(a) μ only (b) λ only
(c) λ and μ both (d) neither λ nor μ

10. The system of equations:

$$x+y+z=5$$
$$x+2y+3z=9$$
$$x+3y+\lambda z=\mu$$

has a unique solution, if

(a) $\lambda=5, \mu=13$ (b) $\lambda \neq 5$
(c) $\lambda=5, \mu \neq 13$ (d) $\mu \neq 13$

Q.2) Echelon form of matrix $\begin{bmatrix}1&1&1&1&1\\5&5&5&5&5\\8&8&8&8&8\end{bmatrix}$ is

A) $\begin{bmatrix}1&1&1&1&1\\4&4&4&4&4\\7&7&7&7&7\end{bmatrix}$ B) $\begin{bmatrix}0&0&0&0&0\\4&4&4&4&4\\7&7&7&7&7\end{bmatrix}$ C) $\begin{bmatrix}1&1&1&1&1\\0&0&0&0&0\\0&0&0&0&0\end{bmatrix}$ D) $\begin{bmatrix}1&1&1&1&1\\6&6&6&6&6\\9&9&9&9&9\end{bmatrix}$

Q.3) Rank of a matrix is nothing but
A) number of zero rows in that matrix B) number of zero rows in its echelon form of matrix
C) number of non-zero rows in that matrix D) number of non-zero rows in its echelon form of matrix.

Q.4) The rank of matrix $A=\begin{bmatrix}1&2&3\\2&2&2\\3&3&3\end{bmatrix}$ is equal to

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

Q5) If $A=\begin{bmatrix}1&2&3\\3&4&5\\4&5&6\end{bmatrix}$ and det(A)=0 then rank of a matrix A is
A) Greater than or equal to 3 B) Strictly less than 3
C) Less than or equal to 3 D) Strictly greater than 3 .

Q.6) Which of the following matrix is in normal form?

A) $\begin{bmatrix}1&0&0\\0&1&0\\0&0&0\end{bmatrix}$ B) $\begin{bmatrix}0&0&0\\0&1&0\\0&0&1\end{bmatrix}$ C) $\begin{bmatrix}1&1&1\\0&1&0\\1&1&1\end{bmatrix}$ D) $\begin{bmatrix}0&0&0\\0&0&0\\0&1&0\end{bmatrix}$

Q.7) Which of the following matrix is in the Normal form?

A) $\begin{bmatrix}1&1&0&0\\0&1&0&0\\0&0&1&0\end{bmatrix}$ B) $\begin{bmatrix}1&0&0&0\\0&1&0&1\\0&0&0&1\end{bmatrix}$ C) $\begin{bmatrix}1&0&0&0\\0&1&0&0\\0&0&1&0\\0&0&0&0\end{bmatrix}$ D) $\begin{bmatrix}1&1&1\\0&1&1\\0&0&1\end{bmatrix}$

Q.8) The rank of matrix $\begin{bmatrix}10&10&10&10&10\\10&10&10&10&10\\10&10&10&10&10\end{bmatrix}$ is

A) 10 B) 5 C)2 D)1.

Q.9)The rank of the matrix $\begin{bmatrix}1&1&1\\1&-1&0\\1&1&1\end{bmatrix}$ is ,

A)0 b) 1 c) 2 d) 3

Q.10) For matrix A of order mxn, the rank r of matrix A is
A) $r \geq \min\{m,n\}$ B) $r \geq \max\{m,n\}$
C) $r \leq \min\{m,n\}$ D) $r \leq \max\{m,n\}$

Q.11)For non singular matrix A If PAQ is in normal form then A^{-1} is equal to

A)PQ B) QP C) P+Q D) Q-P

Q.12) A 5×7 matrix has all its entries equal to -1 , then rank of matrix is

A)7 B) 5 C) 1 D) zero

Q.13) The rank of the following matrix by determinant method $\begin{bmatrix}2&3&4\\4&3&1\\1&2&4\end{bmatrix}$ is

A)2 B) 3 C) 1 D) 0

Q.14)If P=3 then the rank of matrix $A=\begin{bmatrix}3&P&P\\P&3&P\\P&P&3\end{bmatrix}$.

A)1 B) 2 C) 3 D) 0

Q.15) Given system of linear equations x-4y+5z=-1, 2x-y+3z=1,3x+2y+z=3 has
A) unique solution B) no solution
C) infinitely many solutions D) n-r solutions

Q.16) In given system of linear equations AX=B,
if Rank (A) = rank (A/B) =Number of unknowns then the system is,
A) inconsistent & system has no solution B)Consistent & system has infinite solutions

C) Consistent & system has unique solution D) None of the above

Q.17) In given system of linear equations AX=B, A is square matrix of order n.
If Rank (A) =rank (A/B) <Number of unknowns then the system is,
A)inconsistent & system has no solution B)Consistent & system has infinite solutions

C) Consistent & system has unique solution D) None of the above

Q.18) In given system of linear equationsAX=B, if det(A) $\neq$ 0 then system has
A)Unique solution B)No solution C)infinite solutions D) None of the above

Q.19)In set of vectors , if at least one vector of the set can be expressed as a linear combination of the remaining vectors then these vectors are called
A)Linearly independent B)linearly dependent
C)Orthogonal vectors D) none of these