MATRICES QUESTION BANK

Class 12 - Mathematics

1. If A and B are two non-zero square matrices such that AB = 0, then **[1]**

   a) neither matrix is singular b) either of them is singular

   c) both A and B are singular d) none of these

2. If A = [x y z], B= $\begin{bmatrix} a & h & g \\ h & b & f \\ g & f & c \end{bmatrix}$ and C = $[xyz]^t$, then ABC is **[1]**

   a) not defined b) 1×1 matrix

   c) 3×3 matrix d) none of these

3. If A = [2 -3 4], B = $\begin{bmatrix} 3 \\ 2 \\ 2 \end{bmatrix}$, X = [1 2 3] and Y = $\begin{bmatrix} 2 \\ 3 \\ 4 \end{bmatrix}$, then AB + XY equals: **[1]**

   a) 24 b) [24]

   c) [28] d) 28

4. From the matrix equation AB = AC we can conclude B = C, provided **[1]**

   a) A is symmetric matrix b) A is singular matrix

   c) A is square matrix d) A is non-singular matrix

5. If (2A - B) $= \begin{bmatrix} 6 & -6 & 0 \\ -4 & 2 & 1 \end{bmatrix}$ and (2B + A) $= \begin{bmatrix} 3 & 2 & 5 \\ -2 & 1 & -7 \end{bmatrix}$ then A = ? **[1]**

   a) None of these b) $\begin{bmatrix} -3 & 2 & 1 \\ 2 & 1 & -1 \end{bmatrix}$

   c) $\begin{bmatrix} 3 & -2 & 1 \\ -2 & 1 & -1 \end{bmatrix}$ d) $\begin{bmatrix} 3 & 2 & -1 \\ 2 & -1 & 1 \end{bmatrix}$

6. If A = $\begin{bmatrix} \cos\alpha & -\sin\alpha \\ \sin\alpha & \cos\alpha \end{bmatrix}$, and A + A' = I, if the value of α is **[1]**

   a) $\frac{\pi}{6}$ b) $\frac{\pi}{3}$

   c) $\frac{3\pi}{2}$ d) π

7. If $\begin{bmatrix} 2x+y & 4x \\ 5x-7 & 4x \end{bmatrix}$ = $\begin{bmatrix} 7 & 7y-13 \\ y & x+6 \end{bmatrix}$, then the value of x, y is **[1]**

   a) x = 3, y = 1 b) x = 2, y = 3

   c) x = 2, y = 4 d) x = 3, y = 3

8. If A and B are two matrices such that AB = A and BA = B, then B^2 is equal to **[1]**

   a) 0 b) A

c) B

d) 1

9. If A and B are square matrices of the same order, then (A + B) (A – B) is equal to **[1]**

a) $A^2 - B^2$

b) $A^2 - B^2 + BA - AB$

c) $A^2 - BA + B^2 + AB$

d) $A^2 - BA - AB - B^2$

10. If (A - 2B) = $\begin{bmatrix} 1 & -2 \\ 3 & 0 \end{bmatrix}$ and (2A - 3B) = $\begin{bmatrix} -2 & 2 \\ 3 & -3 \end{bmatrix}$ then B = ? **[1]**

a) $\begin{bmatrix} -4 & 6 \\ -3 & -3 \end{bmatrix}$

b) None of these

c) $\begin{bmatrix} 4 & -6 \\ 3 & -3 \end{bmatrix}$

d) $\begin{bmatrix} 6 & -4 \\ -3 & 3 \end{bmatrix}$

11. If S = $[s_{ij}]$ is a scalar matrix such that s_{ii} = k and A is a square matrix of the same order, then AS = SA =? **[1]**

a) kA

b) k + A

c) A^k

d) kS

12. If A and B are symmetric matrices of order n ($A \neq B$), then **[1]**

a) A + B is skew symmetric

b) A + B is a diagonal matrix

c) A + B is a zero matrix

d) A + B is symmetric

13. If A = $\begin{bmatrix} 2 & 0 & -3 \\ 4 & 3 & 1 \\ -5 & 7 & 2 \end{bmatrix}$ is expressed as the sum of a symmetric and skew-symmetric matrix, then the symmetric matrix is **[1]**

a) $\begin{bmatrix} 2 & 2 & -4 \\ 2 & 3 & 4 \\ -4 & 4 & 2 \end{bmatrix}$

b) $\begin{bmatrix} 2 & 4 & -5 \\ 0 & 3 & 7 \\ -3 & 1 & 2 \end{bmatrix}$

c) $\begin{bmatrix} 4 & 4 & -8 \\ 4 & 6 & 8 \\ -8 & 8 & 4 \end{bmatrix}$

d) $\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$

14. If $A = \begin{bmatrix} 1 & 1 & 3 \\ 5 & 2 & 6 \\ -2 & -1 & -3 \end{bmatrix}$. Then |A| is **[1]**

a) None of these

b) Idempotent

c) Nilpotent

d) Symmetric

15. If A is a square matrix, then AA is a **[1]**

a) none of these

b) skew-symmetric matrix

c) symmetric matrix

d) diagonal matrix

16. If A is a square matrix such that $A^2 = A$, then $(I - A)^3 + A$ is equal to: **[1]**

a) I

b) I - A

c) I + A

d) 0

17. If $A = \begin{bmatrix} 2 & 0 \\ -3 & 1 \end{bmatrix}$ and $B = \begin{bmatrix} 4 & -3 \\ -6 & 2 \end{bmatrix}$ are such that 4A + 3X = 5B then X = ? **[1]**

a)

b)

a) $\begin{bmatrix} 4 & -5 \\ -6 & 2 \end{bmatrix}$

b) $\begin{bmatrix} 4 & 5 \\ -6 & -2 \end{bmatrix}$

c) None of these

d) $\begin{bmatrix} -4 & 5 \\ 6 & -2 \end{bmatrix}$

18. If A and B are two matrices of the order $3 \times m$ and $3 \times n$, respectively, and m = n, then the order of matrix (5A – 2B) is **[1]**

a) 3×3

b) $m \times n$

c) $3 \times n$

d) $m \times 3$

19. If A and B are any two matrices, then **[1]**

a) AB may or may not be defined.

b) AB = O

c) $A^2 = O$

d) $2A^2$

20. If A is 3×4 matrix and B is a matrix such that $A^T B$ and BA^T are both defined. Then, B is of the type **[1]**

a) 4×4

b) 4×3

c) 3×3

d) 3×4

21. If A = $\begin{bmatrix} 2 & 4 \\ 3 & 2 \end{bmatrix}$, $B = \begin{bmatrix} 1 & 3 \\ -2 & 5 \end{bmatrix}$ and $C = \begin{bmatrix} -2 & 5 \\ 3 & 4 \end{bmatrix}$, Find: A + 2B **[1]**

22. Compute the indicated product $\begin{bmatrix} 2 & 3 & 4 \\ 3 & 4 & 5 \\ 4 & 5 & 6 \end{bmatrix} \begin{bmatrix} 1 & -3 & 5 \\ 0 & 2 & 4 \\ 3 & 0 & 5 \end{bmatrix}$ **[1]**

23. Construct a 3×4 matrix A = [a_{ij}] whose elements are given by: **[1]**

$a_{ij} = i + j$

24. Give an example of a row matrix which is also a column matrix. **[1]**

25. Let $A = \begin{bmatrix} 2 & 4 \\ 3 & 2 \end{bmatrix}$, $B = \begin{bmatrix} 1 & 3 \\ -2 & 5 \end{bmatrix}$ find BA **[1]**

26. If A = $\begin{bmatrix} 2 & 4 \\ 3 & 2 \end{bmatrix}$, $B = \begin{bmatrix} 1 & 3 \\ -2 & 5 \end{bmatrix}$ and $C = \begin{bmatrix} -2 & 5 \\ 3 & 4 \end{bmatrix}$, Find: A - 2B + 3C **[1]**

27. Consider the matrix $A = \begin{bmatrix} 3 & -2 & 5 \\ 6 & 9 & 1 \end{bmatrix}$. **[1]**

then write the values of a11, a12, a13, a21, a22 and a23.

28. If the matrix A is both symmetric and skew symmetric matrix, then A will be. **[1]**

29. Give an example of a triangular matrix. **[1]**

30. Let A = diag [3, -5 , 7] and B = diag [-1, 2, 4]. Find, (2A + 3B). **[1]**

31. Find the transpose of the matrix: $\begin{bmatrix} -1 & 5 & 6 \\ \sqrt{3} & 5 & 6 \\ 2 & 3 & -1 \end{bmatrix}$ **[1]**

32. If $\begin{bmatrix} 2 & 3 \\ 5 & 7 \end{bmatrix} \begin{bmatrix} 1 & -3 \\ -2 & 4 \end{bmatrix} = \begin{bmatrix} -4 & 6 \\ -9 & x \end{bmatrix}$, write the value of x. **[1]**

33. Consider the following information regarding the number of men and women workers in three factories I, II and III **[1]**

	Men workers	Women workers
I	30	25
II	25	31

III	27	26

Represent the above information in the form of a 3×2 matrix. What does the entry in the third row and second column represent?

34. If A = $\begin{bmatrix} 3 & \sqrt{3} & 2 \\ 4 & 2 & 0 \end{bmatrix}$, verify that (A′)′ = A. **[1]**

35. If A = $\begin{bmatrix} 3 & 5 \\ 7 & 9 \end{bmatrix}$ is written as A = P + Q, where as A = P + Q, where P is symmetric and Q is skew-symmetry matrix, then write the matrix P. **[1]**

36. **Assertion (A):** If A = $\begin{bmatrix} 3 & 1 \\ -5 & x \end{bmatrix}$, then (-A) is given by $\begin{bmatrix} -3 & -1 \\ 5 & -x \end{bmatrix}$. **[1]**

Reason (R): The negative of a matrix is given by -A and is defined as -A = (-1)A.

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.

37. **Assertion (A):** $\begin{bmatrix} 5 & -1 \\ 6 & 7 \end{bmatrix} \begin{bmatrix} 2 & 1 \\ 3 & 4 \end{bmatrix} = \begin{bmatrix} 2 & 1 \\ 3 & 4 \end{bmatrix} \begin{bmatrix} 5 & -1 \\ 6 & 7 \end{bmatrix}$ **[1]**

Reason (R): $\begin{bmatrix} 1 & 2 & 3 \\ 0 & 1 & 0 \\ 1 & 1 & 0 \end{bmatrix} \begin{bmatrix} -1 & 1 & 0 \\ 0 & -1 & 1 \\ 2 & 3 & 4 \end{bmatrix} \neq \begin{bmatrix} -1 & 1 & 0 \\ 0 & -1 & 1 \\ 2 & 3 & 4 \end{bmatrix} \begin{bmatrix} 1 & 2 & 3 \\ 0 & 1 & 0 \\ 1 & 1 & 0 \end{bmatrix}$

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.

38. Let A, B and C are three matrices of same order. Now, consider the following statements **[1]**

Assertion (A): If A = B, then AC = BC.

Reason (R): If AC = BC, then A = B.

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.

39. **Assertion (A):** If A = $\begin{bmatrix} 2 & 3 & -1 \\ 1 & 4 & 2 \end{bmatrix}$ and B = $\begin{bmatrix} 2 & 3 \\ 4 & 5 \\ 2 & 1 \end{bmatrix}$, then AB and BA both are defined. **[1]**

Reason (R): For the two matrices A and B, the product AB is defined, if number of columns in A is equal to the number of rows in B.

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.

40. **Assertion (A):** If A = $\begin{bmatrix} 3 & -2 \\ 4 & -2 \end{bmatrix}$ and $I = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$, then the value of k such that A^2 = kA - 2I, is -1. **[1]**

Reason (R): If A and B are square matrices of same order, then (A + B)(A + B) is equal to A^2 + AB + BA + B^2.

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

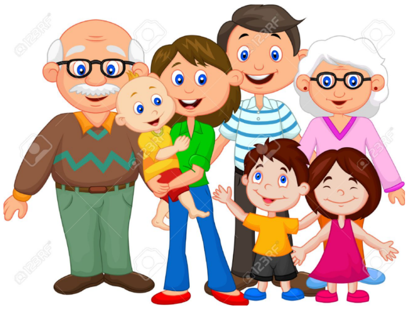
b) Both A and R are true but R is not the correct explanation of A.

c) A is true but R is false.

d) A is false but R is true.

41. **Read the text carefully and answer the questions:** **[1]**

Consider 2 families A and B. Suppose there are 4 men, 4 women and 4 children in family A and 2 men, 2 women and 2 children in family B. The recommended daily amount of calories is 2400 for a man, 1900 for a woman, 1800 for children and 45 grams of proteins for a man, 55 grams for a woman and 33 grams for children.

(i) Represent the requirement of calories and proteins for each person in matrix form.

42. **Read the text carefully and answer the questions:** **[1]**

In a city, there are two factories A and B. Each factory produces sports clothes for boys and girls. There are three types of clothes produced in both the factories, type I, II and III. For boys, the number of units of types I, II, and III respectively are 80, 70, and 65 in factory A and 85, 65, and 72 are in factory B. For girls the number of units of types I, II, and III respectively are 80, 75, 90 in factory A and 50, 55, 80 are in factory B.

(i) Represent the number of units of each type produced by factory A for both boys and girls and number of units of each type produced by factory B for both boys and girls in matrix form.

43. Let $f(x)=\begin{bmatrix}\cos x & -\sin x & 0\\ \sin x & \cos x & 0\\ 0 & 0 & 1\end{bmatrix}$; Show that f(x). f(y) = f(x+y) **[2]**

44. Show that all the diagonal elements of a skew-symmetric matrix are zero. **[2]**

45. If $A^T = \begin{bmatrix}3 & 4\\ -1 & 2\\ 0 & 1\end{bmatrix}$ and $B = \begin{bmatrix}-1 & 2 & 1\\ 1 & 2 & 3\end{bmatrix}$, find $A^T - B^T$. **[2]**

46. Find x, y, z when $\begin{bmatrix}5 & 3\\ x & 7\end{bmatrix} = \begin{bmatrix}y & z\\ 1 & 7\end{bmatrix}$. **[2]**

47. If A is a symmetric matrix and $n \in N$, write whether A^n is symmetric or skew-symmetric or neither of these two. **[2]**

48. If A and B are symmetric matrices of the same order, write whether AB - BA is symmetric or skew-symmetric or neither of the two. **[2]**

49. If $A = \begin{bmatrix}3 & 5\\ -2 & 0\\ 6 & -1\end{bmatrix}, B = \begin{bmatrix}-1 & -3\\ 4 & 2\\ -2 & 3\end{bmatrix}$ and $C = \begin{bmatrix}0 & 2\\ 3 & -4\\ 1 & 6\end{bmatrix}$, verify that (A + B) + C = A + (B + C). **[2]**

50. Find matrices A and B, if $A + B = \begin{bmatrix}1 & 0 & 2\\ 5 & 4 & -6\\ 7 & 3 & 8\end{bmatrix}$ and $A - B = \begin{bmatrix}-5 & -4 & 8\\ 11 & 2 & 0\\ -1 & 7 & 4\end{bmatrix}$ **[2]**

51. If $A = [a_{ij}] = \begin{bmatrix}2 & 3 & -5\\ 1 & 4 & 9\\ 0 & 7 & -2\end{bmatrix}$ and $B = [b_{ij}] = \begin{bmatrix}2 & -1\\ -3 & 4\\ 1 & 2\end{bmatrix}$ then find $a_{11} b_{11} + a_{22} b_{22}$ **[2]**

[2]

52. For the pair of matrices A and B, verify that (AB)' = (B'A'): $A = \begin{bmatrix} -1 & 2 & -3 \\ 4 & -5 & 6 \end{bmatrix}$ and $B = \begin{bmatrix} 3 & -4 \\ 2 & 1 \\ -1 & 0 \end{bmatrix}$ **[2]**

53. If A = $\begin{bmatrix} 1 & 2 \\ 4 & 1 \\ 5 & 6 \end{bmatrix}$, B = $\begin{bmatrix} 1 & 2 \\ 6 & 4 \\ 7 & 3 \end{bmatrix}$ then verify that: (2A + B)′ = 2A′ + B′ **[2]**

54. If A = $\begin{bmatrix} 2 & 3 & -5 \\ 0 & -1 & 4 \end{bmatrix}$,verify that (3A)' = 3A' **[2]**

55. For the matrices A and B, verify that $(AB)^T = B^T A^T$, where A = $\begin{bmatrix} 1 & 3 \\ 2 & 4 \end{bmatrix}$, B = $\begin{bmatrix} 1 & 4 \\ 2 & 5 \end{bmatrix}$. **[2]**

56. Show that $\begin{bmatrix} 5 & -1 \\ 6 & 7 \end{bmatrix} \begin{bmatrix} 2 & 1 \\ 3 & 4 \end{bmatrix} \neq \begin{bmatrix} 2 & 1 \\ 3 & 4 \end{bmatrix} \begin{bmatrix} 5 & -1 \\ 6 & 7 \end{bmatrix}$ **[2]**

57. Let A = $\begin{bmatrix} 1 & 2 \\ -1 & 3 \end{bmatrix}$, B = $\begin{bmatrix} 4 & 0 \\ 1 & 5 \end{bmatrix}$, C = $\begin{bmatrix} 2 & 0 \\ 1 & -2 \end{bmatrix}$ **[2]**

Show that A + (B + C) = (A + B) + C

58. If $A = \begin{bmatrix} 3 & 5 \end{bmatrix}$ and $B = \begin{bmatrix} 7 & 3 \end{bmatrix}$ then find a non-zero matrix C such that AC = BC. **[5]**

59. If $\begin{bmatrix} x+y \\ x-y \end{bmatrix} = \begin{bmatrix} 2 & 1 \\ 4 & 3 \end{bmatrix} \begin{bmatrix} 1 \\ -2 \end{bmatrix}$, then write the value of (x, y) **[5]**

60. If $A = \begin{bmatrix} 2 & 3 \\ 1 & -4 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & -2 \\ -1 & 3 \end{bmatrix}$ then verify that $(AB)^{-1} = B^{-1} A^{-1}$ **[5]**

61. Express the matrix A = $\begin{bmatrix} 4 & 2 & -1 \\ 3 & 5 & 7 \\ 1 & -2 & 1 \end{bmatrix}$ as the sum of a symmetric and a skew-symmetric matrix. **[5]**

62. Prove by Mathematical Induction that $(A')^n = (A^n)'$ where n∈N for any square matrix A. **[5]**

63. If $A = \begin{bmatrix} 1 & 0 & 2 \\ 0 & 2 & 1 \\ 2 & 0 & 3 \end{bmatrix}$ and $A^3 - 6A^2 + 7A + kI_3 = 0$, find the value of k. **[5]**

64. Express the matrix A = $\begin{bmatrix} 1 & 3 & 5 \\ -6 & 8 & 3 \\ -4 & 6 & 5 \end{bmatrix}$ as the sum of a symmetric and a skew-symmetric matrix. **[5]**

65. For a matrix $A = \begin{bmatrix} 1 & 5 \\ 6 & 7 \end{bmatrix}$, verify that: **[5]**

i. (A + A’) is a symmetric matrix.

ii. (A – A’) is a skew symmetric matrix.

66. If $A = \begin{bmatrix} 0 & -\tan\frac{\alpha}{2} \\ \tan\frac{\alpha}{2} & 0 \end{bmatrix}$ and I is the identity matrix of order 2, show that **[5]**

$I + A = (I - A) \begin{bmatrix} \cos\alpha & -\sin\alpha \\ \sin\alpha & \cos\alpha \end{bmatrix}$.

67. If $A = \begin{bmatrix} 3 & -4 \\ 1 & -1 \end{bmatrix}$, then prove that $A^n = \begin{bmatrix} 1+2n & -4n \\ n & 1-2n \end{bmatrix}$ where n is any positive integer. **[5]**

68. Three shopkeepers A, B and C go to a store to buy stationery. A purchases 12 dozen notebooks, 5 dozen pens and 6 dozen pencils. B purchases 10 dozen notebooks, 6 dozen pens and 7 dozen pencils. C purchases 11 dozen notebooks, 13 dozen pens and 8 dozen pencils. A notebook costs 40 paise, a pen costs ₹1.25 and a pencil costs 35 paise. Use matrix multiplication to calculate each individual's bill. **[5]**

69. If A = $\begin{bmatrix} 3 & 1 \\ -1 & 2 \end{bmatrix}$ then show that $A^2 - 5A + 7I = 0$ and hence find A^4. **[5]**

70. Find X and Y, if: **[5]**

i. $X + Y = \begin{bmatrix} 7 & 0 \\ 2 & 5 \end{bmatrix}$ and $X - Y = \begin{bmatrix} 3 & 0 \\ 0 & 3 \end{bmatrix}$

ii. $2X + 3Y = \begin{bmatrix} 2 & 3 \\ 4 & 0 \end{bmatrix}$ and $3X + 2Y = \begin{bmatrix} -2 & -2 \\ -1 & 5 \end{bmatrix}$

71. If $A = \begin{bmatrix} 0 & -1 & 2 \\ 4 & 3 & -4 \end{bmatrix}$ and $B = \begin{bmatrix} 4 & 0 \\ 1 & 3 \\ 2 & 6 \end{bmatrix}$ then verify that: **[5]**

i. (A')' = A

ii. (AB)' = B'A'

iii. (kA)' = (kA').

72. If A = $\begin{bmatrix} 9 & 1 \\ 7 & 8 \end{bmatrix}$, B = $\begin{bmatrix} 1 & 5 \\ 7 & 12 \end{bmatrix}$, find matrix C such that 5A + 3B + 2C is a null matrix. **[5]**

73. If $A = \begin{bmatrix} 1 & 0 & 2 \\ 0 & 2 & 1 \\ 2 & 0 & 3 \end{bmatrix}$, prove that $A^3 - 6A^2 + 7A + 2I = 0$. **[5]**

74. If A = $\begin{bmatrix} \cos\alpha + \sin\alpha & \sqrt{2}\sin\alpha \\ -\sqrt{2}\sin\alpha & \cos\alpha - \sin\alpha \end{bmatrix}$, prove that A^n = $\begin{bmatrix} \cos n\alpha + \sin n\alpha & \sqrt{2}\sin n\alpha \\ -\sqrt{2}\sin n\alpha & \cos n\alpha - \sin n\alpha \end{bmatrix}$ for all n $\in$ N. **[5]**

75. If $P(x) = \begin{bmatrix} \cos x & \sin x \\ -\sin x & \cos x \end{bmatrix}$ then show that P(x).P(y) = P(x + y) = P(y).P(x). **[5]**