25/05/2020 **JESUS AND MARY SCHOOL AND COLLEGE** MODULE-1

**CLASS-12 ( MATHS )**

**CHAPTER NAME– MATRICES**

**TOPICS**:

* To find the transpose of a matrix and properties of transpose matrix
* To find the Symmetric and skew-symmetric matrices of a given matrix
* To find the adjoint and inverse of a given matrix

**TRANSPOSE MATRIX**

The matrix obtained from any given matrix A by interchanging its rows and the columns is called

The transpose of the given matrix and is denoted by or .Thus,

1. if the order of A is then the order of is
2. (i-jth) element of A = (j-ith) element of .

For example, on interchanging rows and columns then

***From this example it is clear that the order of matrix A is but the order of is***

**PROPERTIES OF TRANSPOSE MATRIX**

1. If A is any matrix then .
2. If A and B are two matrices of same order, then and

.

1. If A is matrix and B is matrix, then
2. If A is a matrix and k is a scalar, then

**SYMMETRIC MATRIX**

A square matrix is said to be symmetric if its element is the same as it’s

element, i.e., if It means a symmetric matrix is one which is symmetric about the principal diagonal. Thus the elements on one side of the principle diagonal are the reflected images of the elements on the other side of the principal diagonal.

For example: and are symmetric matrices. Since and

**Note:**  *i) Symmetric matrix is always a square matrix.*

*ii) A necessary and sufficient condition for matrix A to be symmetric is that it is equal*

*to its transpose matrix, i.e.,*

*iii) Diagonal matrices are always symmetric.*

**SKEW SYMMETRIC MATRIX**

A square matrix is said to be skew-symmetric if the element is the negative of the element of A, i.e., if It means that a skew-symmetric matrix is one which is symmetric about the principal diagonal but reverse signs. Thus the elements on one side of the principal diagonal are the reflected images of the elements on the other side of the principal diagonal with changed signs.

For example, is a skew-symmetric matrix.

**Note:** *(i) Each element on the principal diagonal of a skew-symmetric matrix is zero.*

*(ii) A matrix which is both symmetric and skew symmetric is called a square null matrix.*

**THEOREMS**

1. If A be any square matrix then is symmetric and is skew symmetric
2. Every square matrix is uniquely expressible as the sum of a symmetric matrix and a skew-symmetric matrix. It means if A is a square matrix, then we can write

or

where , symmetric part of matrix

and , skew-symmetric part of matrix.

**Ques.** Express the matrix as the sum of a symmetric and a skew-symmetric and

verify your result.

**Ans. Step 1:** Firstly we find , for that we have to interchange rows and columns

**Step 2:** Now for symmetric matrix we have to add *A* and

Thus, symmetric part of the matrix

Let P

**Step 3:** Now for skew-symmetric matrix we have to subtract *A* and

Thus, skew-symmetric part of the matrix

Let Q

**Step 4:** Now Matrix A can be written as sum of symmetric and skew symmetric matrix

**Verification**: it means . So, it is symmetric

it means . So, it is skew-symmetric.

**ADJOINT AND INVERSE OF A MATRIX**

We can calculate the adjoint of a matrix by:

* **Step 1**: Calculating the matrix of minors,
* **Step 2**: Then turn that into the matrix of cofactors,
* **Step 3**: Then find transpose of matrix that we get from step 2, it will be adjoint
* **Step 4**: After multiply adjoint of a matrix by we get inverse of the given matrix.

**Note:** *(i) A square matrix is said to be singular if otherwise it is said to be non-singular.*

*(ii) Inverse of a singular matrix is not possible.*

But it is best explained by working through an example!

**Example**: Find the inverse of

**Solution:** It needs 4 steps. It is all simple arithmetic but there is a lot of it, so try not to make a

mistake!

**Step 1: Matrix of Minors**

The first step is to create a “Matrix of Minors”. This step has the most calculations.

For each element of the matrix:

* ignore the values on the current row and column
* calculate the determinant of the remaining values

Put those determinants into a matrix (the “Matrix of Minors”).

Here is the calculation for the whole matrix:

(Matrix of Minors)

**Step 2: Matrix of Cofactors**

This is easy! Just apply a “checkerboard” of minuses to the “Matrix of Minors”.

|  |  |  |
| --- | --- | --- |
|  |  |  |
|  |  |  |
|  |  |  |

In other words, we need to change the sign of alternate cells, like this:

(Matrix of Minors) (Matrix of co-factors)

**Step 3: Adjoint of Matrix**

Now “Transpose” all elements of the previous matrix. In other words swap their positions over the diagonal (the diagonal stay same)

Adjoint of

**Step 4: Multiply by 1/Determinant**

Now find the determinant of original matrix. This is not too hard, because we already calculatedthe determinants of the smaller parts when we did “Matrix of Minors”. In practice we can just multiply each of the top row elements by the cofactor for the samelocation:

Element of top row:

Cofactors for top row:

Det of A i.e.

And now multiply the adjoint by 1/det.

It means,

(Adjoint) (Inverse)

**WORKSHEET-1**

**Q*.1.*** If *,* find *.*

***Q.2.*** Findwhere

***Q.3.*** If *,* then prove that *.*

***Q.4.*** Find *x* and *y* if the matrixmay satisfy the condition *.*

***Q.5.*** Ifis a symmetric matrix, find *x.*

***Q.6.*** Let *,* find *X* and *Y* such thatand *X* is a symmetric and *Y* is skew

symmetric matrix.

***Q.7.*** Express the matrix as the sum of a symmetric and skew symmetric matrix*.*

***Q.8.*** Find the adjoint of the matrix *.*

***Q.9.*** For the matrix *,* prove that

***Q.10.*** Find the adjoint of the matrix and hence show that *.*

***Q.11.***If *,* find a non-zero unit matrix B such that *.*

***Q.12.***Find *x* ifis a singular matrix.

***Q.13.***Find the inverse of the matrixand verify your result.

***Q.14.***Verify that *,* if *.*

***Q.15.***Ifand *,* find

***Q.16.***If *,* show that *.* Hence find *.*

***Q.17.*** If *,* verify that

***Q.18.*** If *,* prove that *.*

**Note**- **Please do this assignment in your copies. It will be checked when the school re-opens.**

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