MORE ABOUT MATRICES

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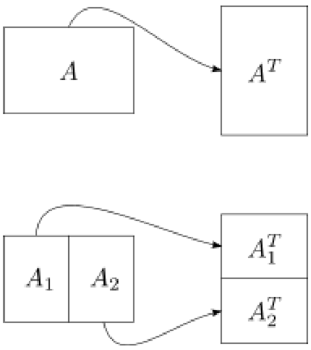

Under this section, we will be learning about important terms which are frequently used in matrices.
We will discuss the following:

- Transpose of a Matrix
- Minors
- Co-factors

Let’s study each one in detail.

Transpose of a Matrix

Let A be a m x n matrix, then its transpose is obtained by interchanging rows into columns. It is denoted by A^T or A’
If A is of order m x n, then the order of A’ is n x m

For example: $A = \begin{pmatrix} 1 & 4 & 5 \\ 0 & -6 & 9 \end{pmatrix}$ Order of A=2x3

$A' = \begin{pmatrix} 1 & 0 \\ 4 & -6 \\ 5 & 9 \end{pmatrix}$ Order of A’=3x2

Properties of transpose of the Matrix

For any matrices A and B of suitable orders, we have

1) (A’)’= A
2) (kA)’ = kA’
3) (A + B)’ = A’ + B’
4) (AB)’ = B’A’

Let’s try the following examples:
1) If A= [1 4 5] then show that (A’)’ = A

Solution: $A = [1 \quad 4 \quad 5]$

$$A' = \begin{pmatrix} 1 \\ 4 \\ 5 \end{pmatrix}$$

$(A')' = [1 \quad 4 \quad 5] = A$

2) If $A = \begin{pmatrix} 1 & 2 & 3 \\ 5 & 7 & 9 \\ -2 & 1 & 1 \end{pmatrix}$ and $B = \begin{pmatrix} 4 & 1 & -5 \\ 1 & 2 & 0 \\ 1 & 3 & 1 \end{pmatrix}$ then verify that $(A+B)' = A' + B'$

Solution: $A + B = \begin{pmatrix} -5 & 3 & -2 \\ 6 & 9 & 9 \\ -1 & 4 & 2 \end{pmatrix}$

$$(A + B)' = \begin{pmatrix} -5 & 6 & -1 \\ 3 & 9 & 4 \\ -2 & 9 & 2 \end{pmatrix} \ldots \text{(i)}$$

$$A' = \begin{pmatrix} -1 & 5 & -2 \\ 2 & 7 & 1 \\ 3 & 9 & 1 \end{pmatrix} \qquad B' = \begin{pmatrix} -4 & 1 & 1 \\ 1 & 2 & 3 \\ -5 & 0 & 1 \end{pmatrix}$$

$$A' + B' = \begin{pmatrix} -5 & 6 & -1 \\ 3 & 9 & 4 \\ -2 & 9 & 2 \end{pmatrix} \ldots \text{(ii)}$$

From (i) and (ii), we get, (A + B)’ = A’ + B’

Minor of an element

Minor of an element a_{ij} of a determinant is the determinant obtained by deleting its i^{th} row and j^{th} column in which a_{ij} lies. It is denoted by M_{ij}.
Minor of an element of a determinant of order n (n ? 2) is a determinant of order n - 1
Example: Find the minor of the element 3 in the determinant

$$\Delta = \begin{vmatrix} 1 & 2 & 3 \\ 0 & 5 & 6 \\ -3 & 4 & 7 \end{vmatrix}$$

Solution: The element 3 lies in first row and third column, so it is denoted by M^{13} and is given by $M_{13} = \begin{vmatrix} 0 & 5 \\ -3 & 4 \end{vmatrix}$

[Deleting 1st row and 3rd column]

= 0 – (-15)
= 15

Co-factor of an element

Co-factor of an element aij denoted by A_{ij} is defined by $A_{ij} = (-1)i+j\, M_{ij}$, where M_{ij} is the minor of a_{ij}.

Example: Find the co-factor of element -5 in the determinant $\Delta = \begin{vmatrix} 2 & -1 & 3 \\ -1 & 5 & 0 \\ -5 & 3 & 6 \end{vmatrix}$

Solution: -5 belongs to 3rd row and 1st column, so it is denoted by

$$A_{31} = (-1)^{3+1} \begin{vmatrix} -1 & 3 \\ 5 & 0 \end{vmatrix}$$

= + (0 - 15)
= -15

Now try it yourself! Should you still need any help, click here to schedule live online session with e Tutor!

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Reference Links:

- http://en.wikipedia.org/wiki/Transpose
- http://www.mathreference.com/la-mpoly,order.html
- http://en.wikipedia.org/wiki/Minor_(linear_algebra)
- http://en.wikipedia.org/wiki/Determinant
- http://en.wikipedia.org/wiki/Cofactor_(linear_algebra)

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