ADJOINT AND INVERSE OF A MATRIX

Created: Thursday, 24 November 2011 10:06 | Published: Thursday, 24 November 2011 10:06 | Written by Super User | Print

Co-factors

 $A^{-1} = \frac{\text{adj}(A)}{|A|}$ It is a square matrix which consists of <u>co-factors</u> of each element. In this case, we find the co-factors of each element and enter these values in their corresponding places.

Adjoint of a Matrix

The <u>adjoint</u> of a square matrix A = [aij] n x n is defined as the transpose of the matrix [Aij] n x n, where Aij are the co-factor of each element aij. It is denoted by Adj A.

In general, adjoint of A is the transpose of its co-factor matrix.

If A =
$$\begin{pmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{pmatrix}$$
 then Adj A = Transpose of $\begin{pmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{pmatrix}$
Adj A = $\begin{pmatrix} a_{11} & a_{21} & a_{31} \\ a_{12} & a_{22} & a_{32} \\ a_{13} & a_{23} & a_{33} \end{pmatrix}$

Important Results

1. If A be any given square matrix of order 'n' then

A (Adj A) = (Adj A) A = IAI I, where I is the <u>identity matrix</u> of order n

i) A square matrix A is said to be singular if lAl=0

ii) A square matrix A is said to be non-singular if 1A1?0

iii) If A is a non-singular matrix of order n the ladjAl=lAln-1

2. If A and B are nonsingular matrices of the same order, then AB and BA are also non singular matrices of the same order.

3. The determinant of the product of matrices is equal to product of their respective determinants, that is IABI = IAI IBI, where A and B are square matrices of same order.

4. A square matrix A is invertible if and only if A is non-singular matrix.

$$A = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$$

Example: Find the adjoint of

 $Adj A = \begin{bmatrix} 4 & -2 \\ -3 & 1 \end{bmatrix}$ Solution:

Adjoint of a 2 x 2 matrix is obtained by interchanging the elements of principal diagonal and changing the sign of remaining elements.

Inverse of a Matrix

If A is a square matrix then its <u>inverse</u> is given by: $A^{-1} = Adj A$,

provided A is a non-singular matrix

Important Result

If A-1 is the inverse of A, then i) AA-1=A-1A=I ii) (AB)-1= B-1 A-1

 $A = \begin{pmatrix} -1 & 2 \\ 0 & 6 \end{pmatrix}$ Example: Find the inverse of $\begin{vmatrix} -1 & 2 \\ 0 & 6 \end{vmatrix}$ |A| = -6 - 0 = -6 ? 0. So, inverse exists

Adj A =
$$\begin{pmatrix} 6 & -2 \\ 0 & -1 \end{pmatrix}$$

Hence A⁻¹ = $-1/6 \begin{pmatrix} 6 & -2 \\ 0 & -1 \end{pmatrix}$

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:

- <u>http://en.wikipedia.org/wiki/Cofactor_(linear_algebra)</u>#Matrix_of_cofactors
- <u>http://www.youtube.com/watch?v=ZMc2WJ1oi-8</u>
- <u>http://en.wikipedia.org/wiki/Transpose</u>
- http://www.britannica.com/EBchecked/topic/561660/square-matrix
- <u>http://en.wikipedia.org/wiki/Identity_matrix</u>
- <u>http://en.wikipedia.org/wiki/Determinant</u>
- http://en.wikipedia.org/wiki/Invertible_matrix
- http://www.wikihow.com/Inverse-a-3X3-Matrix

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