

Rank of a matrix

To find the rank of a matrix, take the following steps:

~~1. Find the largest order of non-zero minor~~

1. If the matrix is of order  $m \times n, m/n$  find the minor of order  $n \times n$ .

2. Find the value of this minor.

If the value of this minor is not zero, then the rank of the given matrix = order of this minor.

3. If the value of this minor is zero, then the rank of this matrix is ~~not~~ less than the order of this minor. Find other minors of less order.

If a minor of order  $r$  is not-zero, then rank of the matrix =  $r$ .

1. Find the rank of  $A = \begin{bmatrix} 1 & 2 & 3 & 4 \\ 2 & 4 & 7 & 8 \\ 3 & 6 & 9 & 5 \end{bmatrix}$

Soln  $A$  is of order  $m \times n$ . Here  $m=3, n=4$ .

$\therefore$  rank of  $A$  cannot be 4.

Now, a minor of order 3 =  $\begin{vmatrix} 1 & 2 & 3 \\ 2 & 4 & 7 \\ 3 & 6 & 9 \end{vmatrix}$

$$= 1 \begin{vmatrix} 4 & 7 \\ 6 & 9 \end{vmatrix} - 2 \begin{vmatrix} 2 & 7 \\ 3 & 9 \end{vmatrix} + 3 \begin{vmatrix} 2 & 4 \\ 3 & 6 \end{vmatrix}$$

$$= (24 - 42) - 2(18 - 21) + 3(12 - 12)$$

$$= -18 + 6 + 0 = -12 \neq 0$$

So, a minor of order 3 exists which is non-zero.

So, rank of the matrix = 3.