= AC + BC as well as C (A + B) =
CA + CB (left and right distributivity) , whenever the size of the matrices is such that the various products are defined . The product AB may be defined without BA being defined , namely if A and B are m @-@ by @-@ n and n @-@ by @-@ k matrices , respectively , and m ? k . Even if both products are defined , they need not be equal , that is , generally
AB ? BA ,
that is , matrix multiplication is not commutative , in marked contrast to (rational , real , or complex) numbers whose product is independent of the order of the factors . An example of two matrices not commuting with each other is :
<formula>
whereas
<formula>
Besides the ordinary matrix multiplication just described , there exist other less frequently used operations on matrices that can be considered forms of multiplication , such as the Hadamard product and the Kronecker product . They arise in solving matrix equations such as the Sylvester equation .

= = = Row operations = = =

There are three types of row operations :
row addition , that is adding a row to another .
row multiplication , that is multiplying all entries of a row by a non @-@ zero constant ;
row switching , that is interchanging two rows of a matrix ;
These operations are used in a number of ways , including solving linear equations and finding matrix inverses .

= = = Submatrix = = =

A submatrix of a matrix is obtained by deleting any collection of rows and / or columns . For example , from the following 3 @-@ by @-@ 4 matrix , we can construct a 2 @-@ by @-@ 3 submatrix by removing row 3 and column 2 :
<formula>
The minors and cofactors of a matrix are found by computing the determinant of certain submatrices .
A principal submatrix is a square submatrix obtained by removing certain rows and columns . The definition varies from author to author . According to some authors , a principal submatrix is a submatrix in which the set of row indices that remain is the same as the set of column indices that remain . Other authors define a principal submatrix to be one in which the first k rows and columns , for some number k , are the ones that remain ; this type of submatrix has also been called a leading principal submatrix .

= = Linear equations = =

Matrices can be used to compactly write and work with multiple linear equations , that is , systems of linear equations . For example , if A is an m @-@ by @-@ n matrix , x designates a column vector (that is , n × 1 @-@ matrix) of n variables x1 , x2 , ... , xn , and b is an m × 1 @-@ column vector , then the matrix equation