

MATRIX RANK**PURPOSE**

Compute the rank of a matrix.

DESCRIPTION

The rank is the number of rows in a matrix with non-zero rows after the matrix has been reduced. DATAPLOT uses the singular value decomposition (SVD) to compute the rank. The SVD computes the singular values and the rank is equal to the number of non-zero singular values. Since the rounding involved in using floating point arithmetic on a computer can result in only approximate zeros, one ambiguity is distinguishing between zeros and small singular values. DATAPLOT uses the following default criterion:

$$\text{TOL} = \text{MAXIMUM}(\text{NUMBER OF ROWS}, \text{NUMBER OF COLUMNS}) \times (\text{FIRST SINGULAR VALUE}) \times \text{EPS}$$

where

$$\text{EPS} = 1./(\text{1} + (\text{134217727}/\text{2.0}))$$

Values smaller than the tolerance are considered to be zero. An alternate form of the command allows you to specify your own tolerance value.

SYNTAX 1

LET <par> = MATRIX RANK <mat>

where <mat> is a matrix for which the rank is to be computed;

and <par> is a parameter where the resulting rank is saved.

SYNTAX 2

LET <par> = MATRIX RANK <mat> <par>

where <mat> is a matrix for which the rank is to be computed;

<par> is a number or parameter that specifies the tolerance to use in determining zero singular values;

and <par> is a parameter where the resulting rank is saved.

EXAMPLES

LET C = MATRIX RANK A

LET C = MATRIX RANK A 0.0000001

DEFAULT

None

SYNONYMS

None

RELATED COMMANDS

MATRIX DETERMINANT	=	Compute a matrix determinant.
MATRIX EIGENVALUES	=	Compute the matrix eigenvalues.
MATRIX EIGENVECTORS	=	Compute the matrix eigenvectors.
MATRIX INVERSE	=	Compute a matrix inverse.
MATRIX NUMBER OF COLUMNS	=	Compute the number of columns in a matrix.
MATRIX NUMBER OF ROWS	=	Compute the number of rows in a matrix.
MATRIX TRACE	=	Compute a matrix trace.

REFERENCE

Any standard text on linear algebra.

APPLICATIONS

Linear Algebra

IMPLEMENTATION DATE

93/8

PROGRAM

```
DIMENSION 100 COLUMNS
READ X Y
-99 -99
1 0
0 1
-1 0
END OF DATA
LET C1 = X**2 + Y**2
LET C2 = X
LET C3 = Y
LET C4 = 1 FOR I = 1 1 4
LET A = MATRIX DEFINITION C1 4 4
LET ARANK = MATRIX RANK A
PRINT ARANK
```

A value of 4 is printed for the rank.