

**VECTOR ANGLE****PURPOSE**

Compute the angle between 2 vectors in  $R^d$  with real elements.

**DESCRIPTION**

The vector angle is defined to be the angle between 0 and 180 degrees that satisfies the relationship:

$$\cos \phi = \frac{\mathbf{v1} \bullet \mathbf{v2}}{\|\mathbf{v1}\| \|\mathbf{v2}\|} \quad (\text{EQ 3-61})$$

where  $\|\cdot\|$  refers to the vector length and the numerator denotes the dot product.

The units for the output (radians, degrees, or grads) are dictated by the prior user-defined setting of the ANGLE UNITS command, the RADIANS command, the DEGREES command, or the GRADS command. The default angle units is radians.

**SYNTAX**

LET <p> = VECTOR ANGLE <v1> <v2> <SUBSET/EXCEPT/FOR/qualification>

where <v1> is the variable containing the (real) elements of the first vector;

<v2> is the variable containing the (real) elements of the second vector;

<p> is a parameter whose value is the computed angle between <v1> and <v2>;

and where the <SUBSET/EXCEPT/FOR qualification> is optional and rarely used in this context.

**EXAMPLES**

LET THETA = VECTOR ANGLE Y1 Y2

**NOTE 1**

The vector  $(x_1, x_2, \dots, x_n)$  represents the line segment from the origin  $(0,0,\dots,0)$  to the point  $(x_1, x_2, \dots, x_n)$ . That is, each element of the vector represents the corresponding value on the corresponding axis. Vectors are sometimes represented in terms of the unit coordinate vectors. For example, for the 3d case the vector  $\mathbf{x}=(x_1,x_2,x_3)$  can be written as  $\mathbf{a}=x_1\mathbf{i} + x_2\mathbf{j} + x_3\mathbf{k}$  where

$$\mathbf{i} = (1,0,0) \quad \mathbf{j} = (0,1,0) \quad \mathbf{l} = (0,0,1)$$

**NOTE 2**

Storagewise, a DATAPLOT "variable" and a mathematical "vector" are identical. The ordering of elements within a DATAPLOT variable is identical to the ordering of elements within a mathematical vector. Thus to store the vector with elements 4 11 37 8 19 in the variable Y, enter the following command (the READ and SERIAL READ commands can be used to store longer vectors):

LET Y = DATA 4 11 37 8 19

**DEFAULT**

None

**SYNONYMS**

None

**RELATED COMMANDS**

ANGLE UNITS	=	Sets the angle units to radians, degrees, or grads.
VECTOR ADDITION	=	Carries out a vector addition.
VECTOR SUBTRACTION	=	Carries out a vector subtraction.
VECTOR DOT PRODUCT	=	Computes a vector dot product.
VECTOR LENGTH	=	Computes the vector length.
VECTOR DISTANCE	=	Computes the vector distance.

**APPLICATIONS**

Mathematics

**IMPLEMENTATION DATE**

87/10

**PROGRAM**

```
LET Y1 = DATA 4 2 3 1 6  
LET Y2 = DATA 1 2 4 6 3  
LET A = VECTOR ANGLE Y1 Y2  
WRITE Y1 Y2 A
```