

# Angle of Vector

Use the matrix operation feature to find the angle  $\theta$  which forms the standard vector and vector. The angle can be calculated at one time against the multiple vectors.

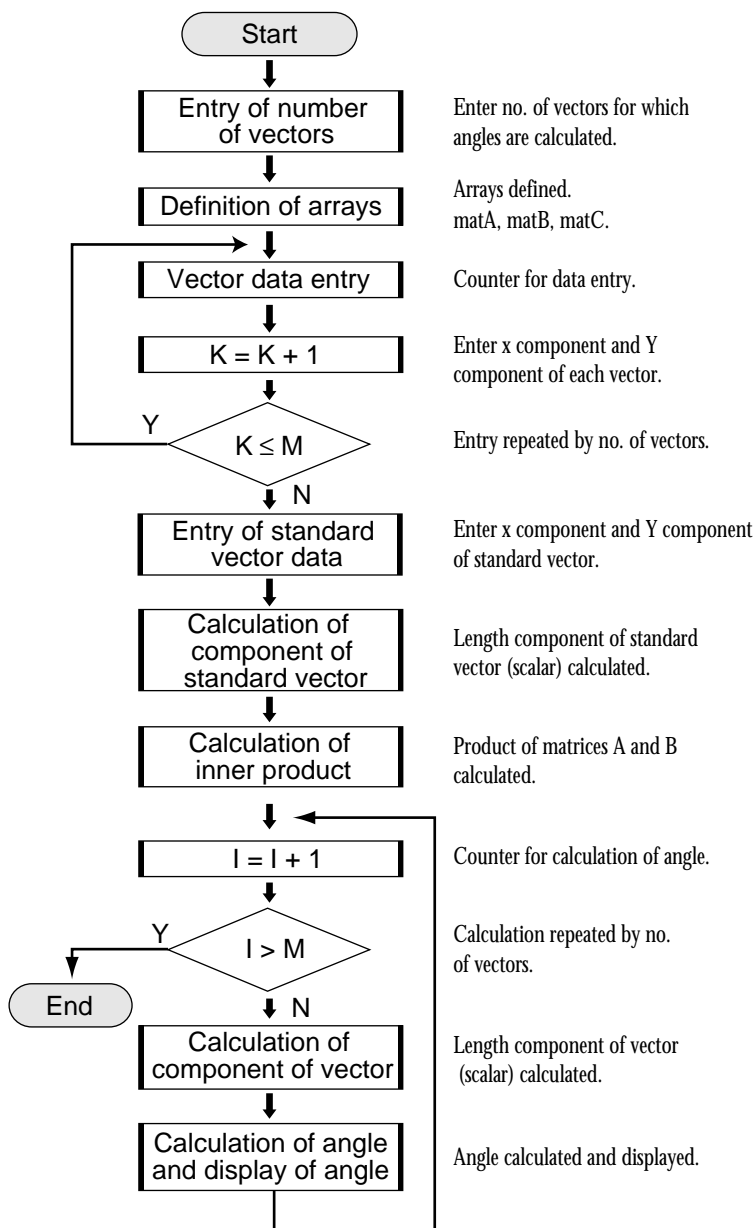
## Calculation

Calculating vector inner product  $\vec{a} \cdot \vec{b} = |\vec{a}| |\vec{b}| \cos \theta$

Use the above expression to derive the following expression

$$\theta = \cos^{-1} \frac{\vec{a} \cdot \vec{b}}{|\vec{a}| |\vec{b}|}$$

## FLOWCHART



## PROGRAMME LIST (MATRIX MODE)

Title : VECTOR

Print " Input NUMBER

Input N

N ⇒ M

{M,2} ⇒ dim (mat A)

{2,1} ⇒ dim (mat B)

{M,1} ⇒ dim (mat C)

For K, 1, M, 1

Print " Input VECTOR

Print K

Input X

X ⇒ mat A(K,1)

Input Y

Y ⇒ mat A(K,2)

NEXT

Print "Input FUNDAMENTAL VECTOR

Input X

X ⇒ mat B(1,1)

Input Y

Y ⇒ mat B(2,1)

$\sqrt{\text{mat B}(1,1)^2 + \text{mat B}(2,1)^2} \Rightarrow B$

mat A \* mat B ⇒ mat C

For I, 1, M, 1

$\sqrt{\text{mat A}(I,1)^2 + \text{mat A}(I,2)^2} \Rightarrow A$

$\cos^{-1} (\text{mat C}(I,1) / (A * B)) \Rightarrow \theta$

Print "ANGLE OF VECTOR

Print I

Print "θ=

Print θ

Wait

NEXT

End

**PARAMETERS**

Name of parameter	Content	Name of parameter	Content
A	vector scalar quantity	$\theta$	vector angle
B	standard vector scalar quantity	K	display
I	calculating counter	N	input of number of vectors
K	input counter	mat A	vector components
M	number of vectors	mat B	standard vector components
X	input of x component	mat C	vector inner product
Y	input of y component		

**Exercise**

Calculate the angle formed by the following 3 vectors and standard vector (2,3).

vector 1 (5, 8)

vector 2 (7, 4)

vector 3 (9, 2)

Set up condition: angle unit in Deg mode, and decimal point in Float Pt mode.

**2ndF** **SETUP** **B** **1** **C** **1** **CL**

**Step**

**Key Operation**

**Display**

- |          |  |  |  |
|----------|--|--|--|
| <b>1</b> | Specify the programme mode.<br>Select the title VECTOR.                      | <b>PRGM</b> <b>A</b>   | <pre>VECTOR Input NUMBER N=?</pre>                     |
| <b>2</b> | Enter the number of vectors.   | <b>3</b> <b>ENTER</b>  | <pre>VECTOR Input NUMBER N= 3 Input VECTOR X=? 1</pre> |
| <b>3</b> | Enter the values of vector 1.  | <b>5</b> <b>ENTER</b> <b>8</b> <b>ENTER</b>  | <pre>X= 1 5 Y= 8 Input VECTOR X=? 2</pre>              |
| <b>4</b> | Enter the values of vectors<br>2 and 3.                                      | <b>7</b> <b>ENTER</b> <b>4</b> <b>ENTER</b><br><b>9</b> <b>ENTER</b> <b>2</b> <b>ENTER</b> | <pre>X= 3 9 Y= 2 Input FUNDAMENTAL VECT OR X=?</pre>   |
| <b>5</b> | Enter the value of standard<br>vector.<br><br>(Display of angle of vector 1) | <b>2</b> <b>ENTER</b> <b>3</b> <b>ENTER</b>  | <pre>X= 2 Y= 3 ANGLE OF VECTOR 1 θ= 1.684684318</pre>  |
| <b>6</b> | (Display of angle of vector 2)   | <b>ENTER</b>   | <pre>ANGLE OF VECTOR 2 θ= 26.56505118</pre>            |
|          | (Display of angle of vector 3)   | <b>ENTER</b>   | <pre>ANGLE OF VECTOR 3 θ= 43.78112476</pre>            |