

# Linear Transformation

Use the matrix to find four types of the linear transformation of x-axis symmetric transformation, y-axis symmetric transformation, similar transformation and revolution around the origin.

## Calculation

1. Symmetric transformation to x-axis (Case 1)

$$\begin{pmatrix} X' \\ Y' \end{pmatrix} = \begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix} \begin{pmatrix} X \\ Y \end{pmatrix}$$

2. Symmetric transformation to y-axis (Case 2)

$$\begin{pmatrix} X' \\ Y' \end{pmatrix} = \begin{pmatrix} -1 & 0 \\ 0 & 1 \end{pmatrix} \begin{pmatrix} X \\ Y \end{pmatrix}$$

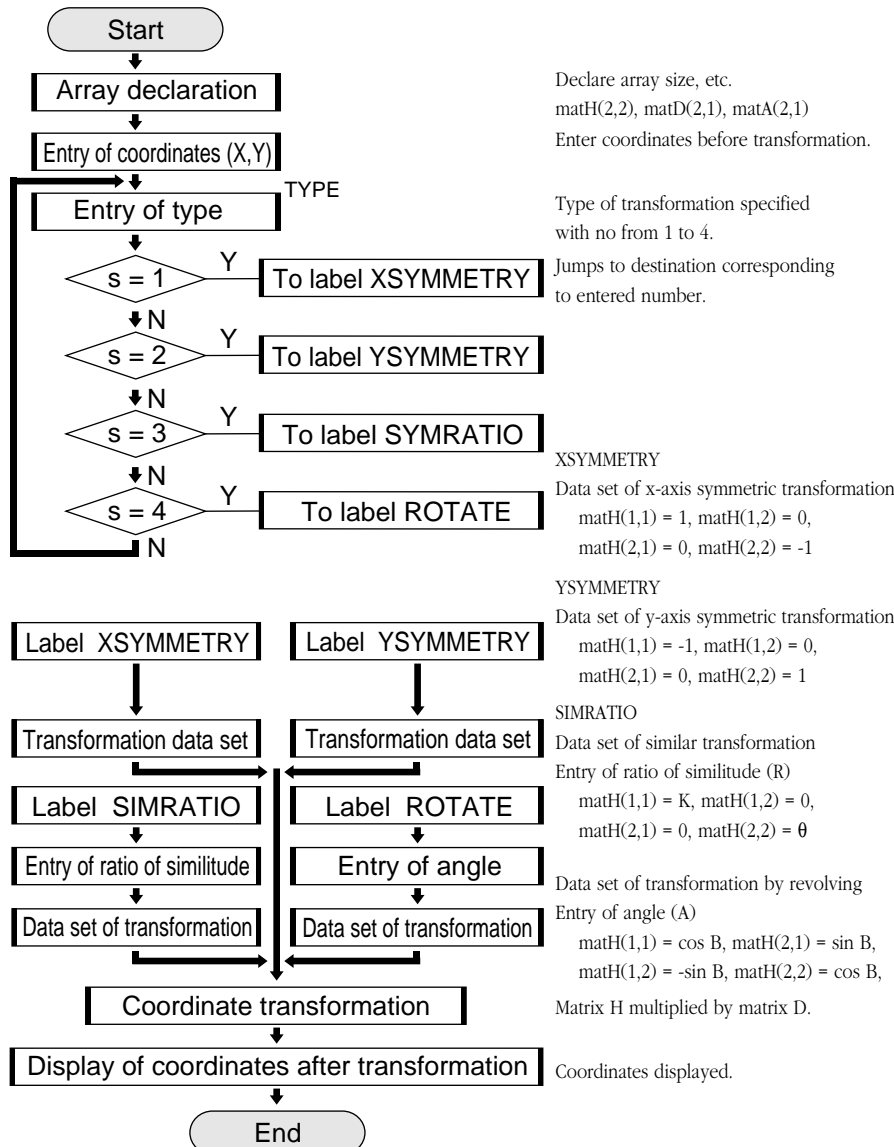
3. Similar transformation with ratio of similitude K around origin (Case 3)

$$\begin{pmatrix} X' \\ Y' \end{pmatrix} = \begin{pmatrix} K & 0 \\ 0 & K \end{pmatrix} \begin{pmatrix} X \\ Y \end{pmatrix}$$

4. Transformation revolving around only angle B at the origin (Case 4)

$$\begin{pmatrix} X' \\ Y' \end{pmatrix} = \begin{pmatrix} \cos B & -\sin B \\ \sin B & \cos B \end{pmatrix} \begin{pmatrix} X \\ Y \end{pmatrix}$$

## FLOWCHART



## PROGRAM LIST (MATRIX MODE)

Title : LINE TRNS

```

{2, 2}⇒dim(mat H)
{2, 1}⇒dim(mat D)
{2, 1}⇒dim(mat A)
Print "Input POINT
Input X
Input Y
X ⇒mat D(1, 1)
Y ⇒mat D(2, 1)
Label TYPE
Print "SELECT 1/2/3/4
Input S
ClrT
If S=1 Goto XSYMMETRY
If S=2 Goto YSYMMETRY
If S=3 Goto SIMRATIO
If S=4 Goto ROTATE
GotoTYPE
Label XSYMMETRY
1 ⇒mat H(1, 1)
0 ⇒mat H(2, 1)
0 ⇒mat H(1, 2)
-1 ⇒mat H(2, 2)
Goto TRANS
Label YSYMMETRY
-1 ⇒mat H(1, 1)
0 ⇒mat H(2, 1)
0 ⇒mat H(1, 2)
1 ⇒mat H(2, 2)
Goto TRANS
Label SIMRATIO
Print "Input SIMILITUDE RATIO
Input R
R ⇒K
K ⇒mat H(1, 1)
0 ⇒mat H(2, 1)
0 ⇒mat H(1, 2)
θ ⇒mat H(2, 2)
Goto TRANS
Label ROTATE
Print "Input ANGLE
Input A
A ⇒B
cos B ⇒mat H(1, 1)
sin B ⇒mat H(2, 1)
-sin B ⇒mat H(1, 2)
cos B ⇒mat H(2, 2)
Label TRANS
mat H*mat D ⇒mat A
Print "mat A(1, 1)
Print mat A(1, 1)
Print "mat A(2, 1)
Print mat A(2, 1)
End
  
```

**PARAMETERS**

Name of parameter	Content	Name of parameter	Content
B	angle	Y	y-coordinate
K	ratio of similitude	A	input of angle
S	selecting type (S=1: case 1, S=2: case 2, S=3: case 3, S=4: case 4)	R	input of ratio of similitude
		mat A	coordinate after transformation
		mat H	transformation data
X	x-coordinate	mat D	x,y-coordinate

**Exercise**

- 1.Transform symmetrically the point (3, 5) to the x-axis.
2. Rotate the point (2, 6) at 45° around the origin.

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

**2nd F** **SET UP** **B**\* **1**\* **C**\* **1**\* **CL**

**Step**

**Key Operation**

**Display**

**1** Specify the program mode.  
Select the title LINE TRNS.

**2nd F** **PRGM** **A**\*

**2** Enter the values of the point.

**3** **ENTER** **5** **ENTER**

**3** Select symmetric transformation to x-axis (case 1).

**1** **ENTER**

**4** Select transformation revolving around only angle B at the origin (case 4).

**ENTER** **2** **ENTER** **6** **ENTER**  
**4** **ENTER**

**5** Enter the angle value.

**4** **5** **ENTER**