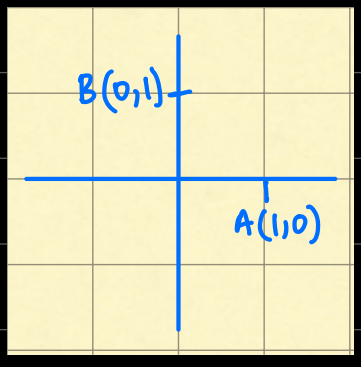
MATRIX TRANSFORMATION

(O Levels ONLY) (NOT PART OF IGCSE).

HOW TO MAKE A MATRIX FOR A TRANSFORMATION

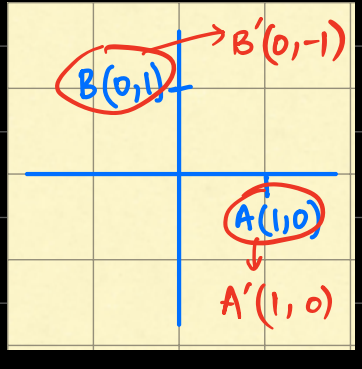
TOOLS: GRID + MATRIX



$$\begin{pmatrix} A' & B' \\ \square & \square \end{pmatrix}$$

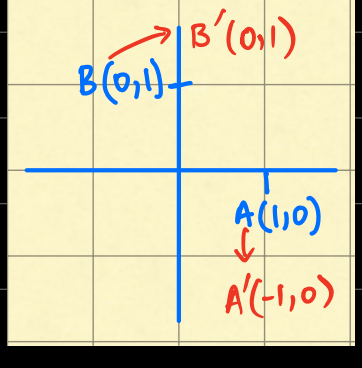
WRITE DOWN MATRIX OF FOLLOWING TRANSFORMATION

[1] REFLECTION IN x-AXIS → change y sign



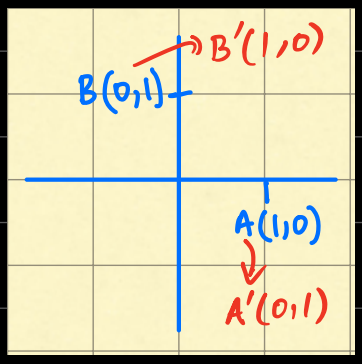
$$\begin{pmatrix} A' & B' \\ 1 & 0 \\ 0 & -1 \end{pmatrix}$$

[2] REFLECTION IN y-AXIS → change x- sign



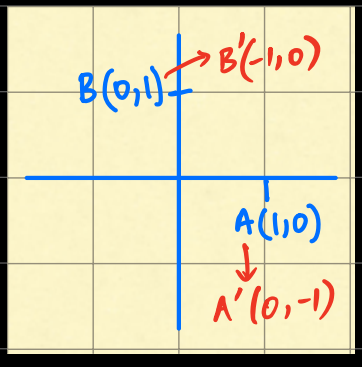
$$\begin{pmatrix} A' & B' \\ -1 & 0 \\ 0 & 1 \end{pmatrix}$$

3 Reflection in line $y = x$ → swap places, change NO signs.



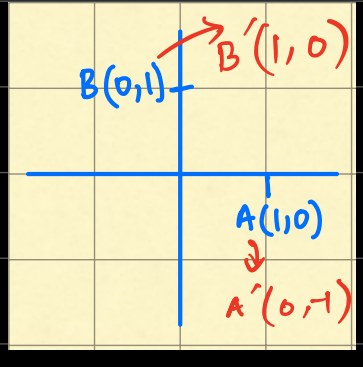
$$\begin{pmatrix} A' & B' \\ 0 & 1 \\ 1 & 0 \end{pmatrix}$$

4 Reflection in line $y = -x$ → swap both places, change both signs



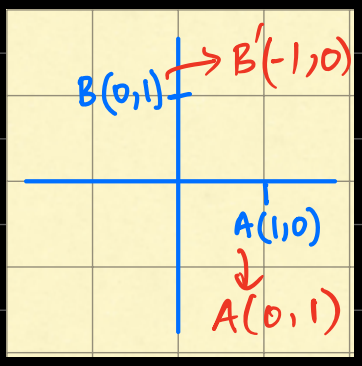
$$\begin{pmatrix} A' & B' \\ 0 & -1 \\ -1 & 0 \end{pmatrix}$$

5 Rotation 90° CW centre (0,0) → swap places, change y



$$\begin{pmatrix} A' & B' \\ 0 & 1 \\ -1 & 0 \end{pmatrix}$$

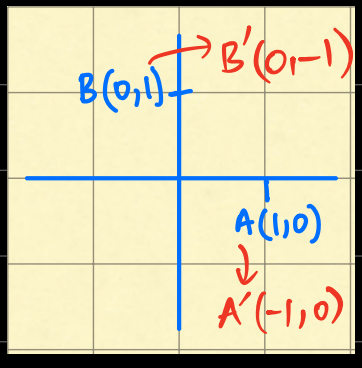
6 ROTATION 90° ACW centre (0,0)



$$\begin{pmatrix} A' & B' \\ 0 & -1 \\ 1 & 0 \end{pmatrix}$$

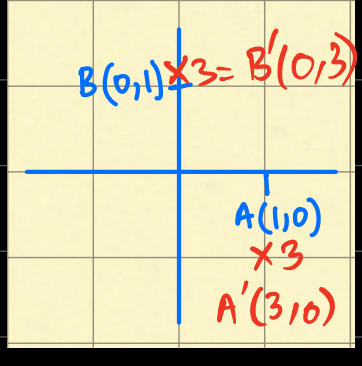
7 ROTATION 180 Degrees centre (0,0)

→ Just change signs.



$$\begin{pmatrix} A' & B' \\ -1 & 0 \\ 0 & -1 \end{pmatrix}$$

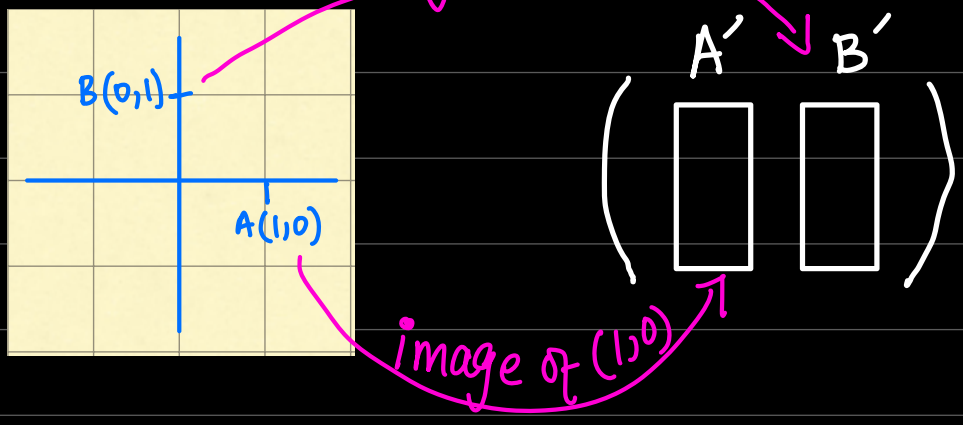
8 ENLARGEMENT, Scale factor 3, centre (0,0).



$$\begin{pmatrix} A' & B' \\ 3 & 0 \\ 0 & 3 \end{pmatrix}$$

270° CW	= 90° ACW
270° ACW	= 90 CW

CONCEPT



3 **(b) (i)** The transformation A is represented by the matrix $\begin{pmatrix} a & b \\ c & d \end{pmatrix}$.

Find, in terms of a, b, c and d as appropriate,

(a) the image of (1, 0) under the transformation A,

A′ = (a, c)

Answer (..a.., ..c..) [1]

(b) the image of (0, 1) under the transformation A.

B′ = (b, d)

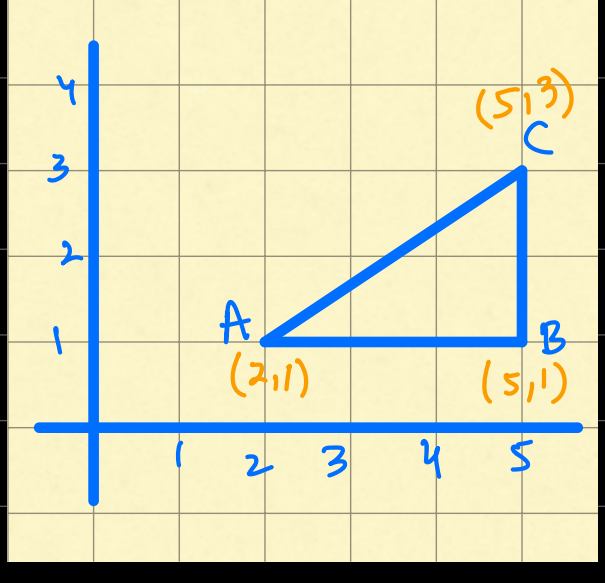
Answer (..b.., ..d..) [1]

HOW TO USE A MATRIX TO FIND IMAGES IN CASE WHERE WE DO NOT KNOW SHORTCUT OF A TRANSFORMATION

TRANSLATION	ALL OTHER TRANSFORMATIONS
$M = \begin{pmatrix} x \\ y \end{pmatrix}$	$M = \begin{pmatrix} a & b \\ c & d \end{pmatrix}$
IMAGE = OBJECT + TRANSLATION MATRIX	IMAGE = [MATRIX][OBJECT]
	IMP: Matrix must be multiplied before the object. (PRE-MULTIPLIED).

Q. A transformation T is represented by matrix $\begin{pmatrix} 3 & 1 \\ 0 & 2 \end{pmatrix}$

Find the coordinates of image of $\triangle ABC$ under this transformation.



[Matrix][object] = [Image]

$$\begin{bmatrix} 3 & 1 \\ 0 & 2 \end{bmatrix} \begin{bmatrix} 2 & 5 & 5 \\ 1 & 1 & 3 \end{bmatrix}$$

L M R

$2 \times (2 \checkmark 2) \times 3$

Ans: 2×3

$$\begin{bmatrix} 7 & 16 & 18 \\ 2 & 2 & 6 \end{bmatrix}$$

UL = (3)(2) + (1)(1) = 7

UM = (3)(5) + (1)(1) = 16 → A'(7, 2)

UR = (3)(5) + (1)(3) = 18 → B'(16, 2)

DL = (0)(2) + (2)(1) = 2 → C'(18, 6)

DM = (0)(5) + (2)(1) = 2

DR = (0)(5) + (2)(3) = 6

LAST BAAT:

ORDER OF TRANSFORMATIONS

Q. R = Reflection in y axis (change x-sign)

M = Rotation 90° cw centre (0,0) (swap places, change y)

E = Enlargement SF = 3 centre (0,0) → x 3

Point A has coordinates (5,7)

Find:

(i) R(A) → means apply R on A = (−5, 7)

(ii) M(A) → means apply M on A = (7, −5)

(iii) E(A) → means apply E on A = (5,7) x 3 = (15, 21)

order of transformation (first apply M, then apply R)

(iv) $RM(A) =$

$(5,7) \xrightarrow[M]{\text{Apply}} (7,-5) \xrightarrow[R]{\text{Apply}} \boxed{(-7,-5)}$