

# TRANSFORMATION (5 - 6 MARKS)

DIFFICULTY ↓  
CRAMMING ↑

Tom & Jerry

- REFLECTION
- ROTATION
- TRANSLATION (DRAG)
- ENLARGEMENT (ZOOM IN / ZOOM OUT)

FOR EVERY TRANSFORMATION MEMORIZE:

- 1) DESCRIBE
- 2) CONSTRUCTIONS (WATCH VIDEO)
- 3) ON-GRID SHORTCUTS.
- 4) MATRIX (NOT FOR IGCSE) (ONLY O LEVELS)

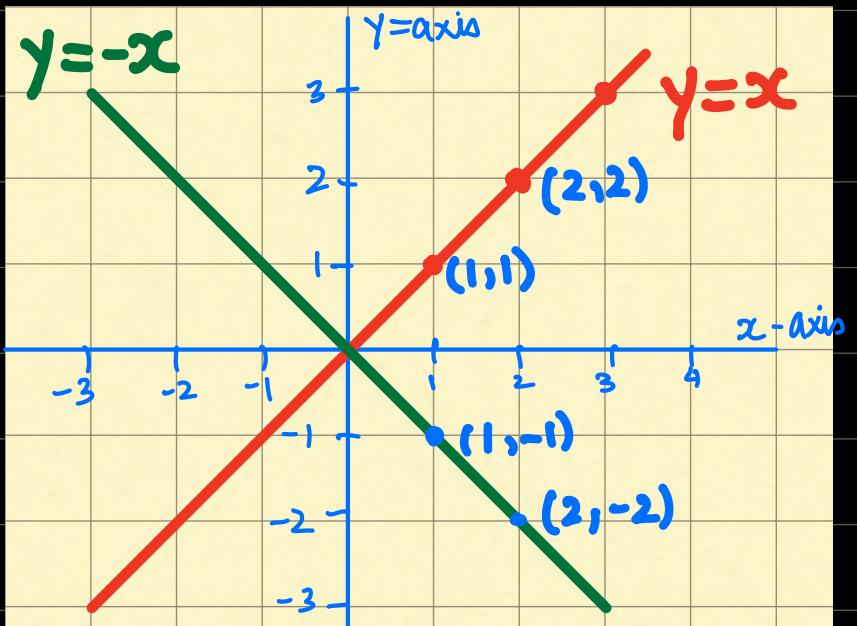


## REFLECTION

- 1) DESCRIBE: EQUATION OF LINE OF REFLECTION.
- 2) CONSTRUCTIONS: (video)
- 3) ON-GRID SHORTCUTS:

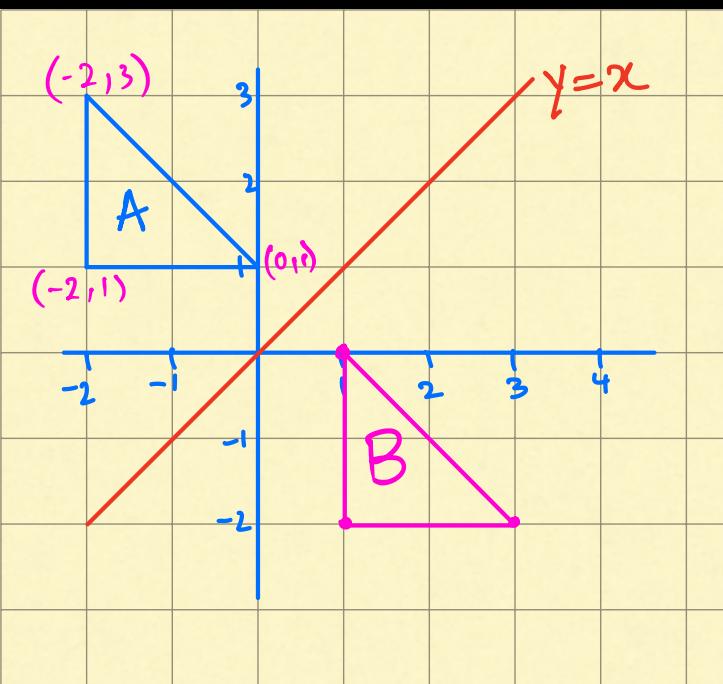
$$A(1, 3)$$

→ Reflection in x-axis, change y sign	$A'(1, -3)$
→ Reflection in y-axis, change x-sign	$A'(-1, 3)$
→ Reflection in $y=x$ , swap both places change NO sign.	$A'(3, 1)$
→ Reflection in $y=-x$ , swap both places change BOTH sign.	$A'(-3, -1)$

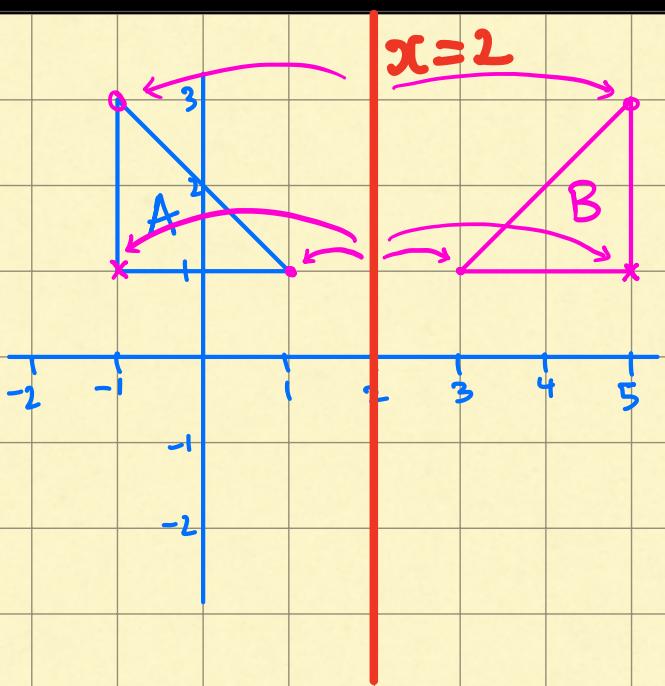


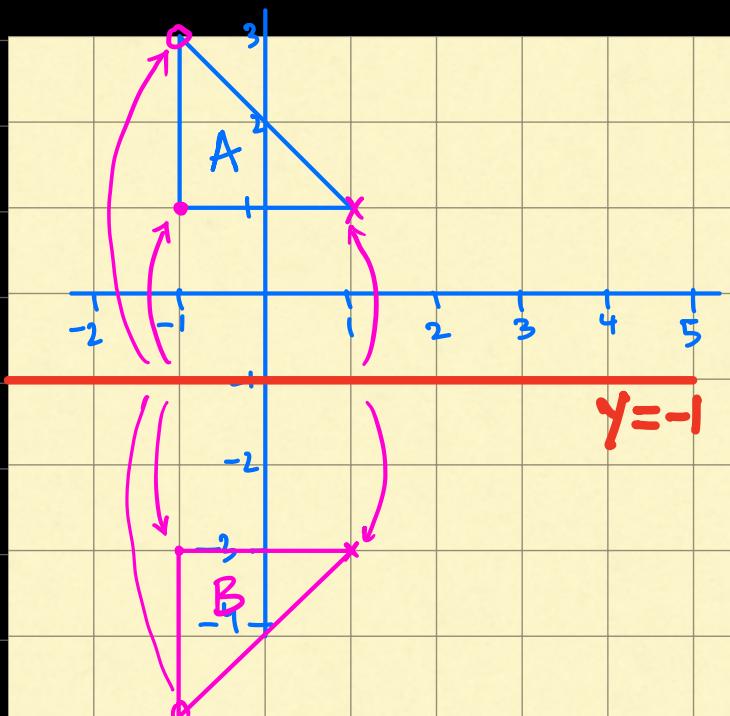
Swap Both places, change No sign

Reflect  $y = x$   $\Delta A$  in line  
Label the image  $B$ .  
 $(0,1)$     $(-2,1)$     $(-2,3)$   
 Swap Both places, change No sign  
 $(1,0)$     $(1,-2)$     $(3,-2)$



$\triangle A$  is mapped onto  $\triangle B$  by a reflection in line  $x = 2$ .  
 Draw and Label  $\triangle B$  vertical.





Q:  $\triangle A$  is mapped onto  $\triangle B$  by a reflection in  $y = -1$ .  
 Draw and label  $\triangle B$ .  
 horizontal line.

## ROTATION

- 1) DESCRIBE : (a) Centre of Rotation  
 (b) Angle of Rotation  
 (c) Direction of Rotation

2) CONSTRUCTIONS (video) (V. V. IMP)

3) ON GRID SHORT CUTS :

Rotate  $90^\circ$  CW, swap both places  
 change y-sign .

Rotate  $90^\circ$  ACW, swap both places  
 change x-sign .

ROTATE  $180$  degree, JUST change signs

$$A(1, 3)$$

$$A'(3, -1)$$

$$A'(-3, 1)$$

$$A'(-1, -3)$$

# ROTATION

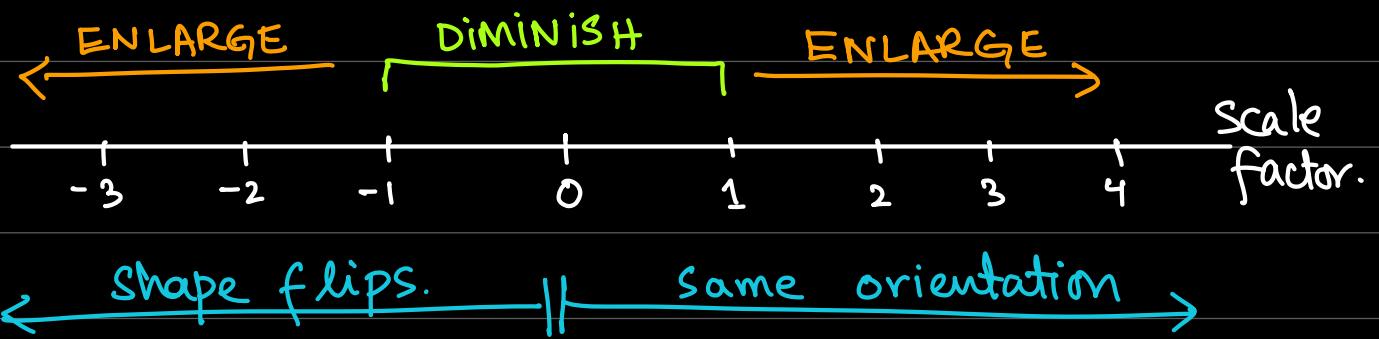
IF CENTRE OF  
ROTATION IS  $(0,0)$

IF CENTRE OF  
ROTATION IS NOT  $(0,0)$

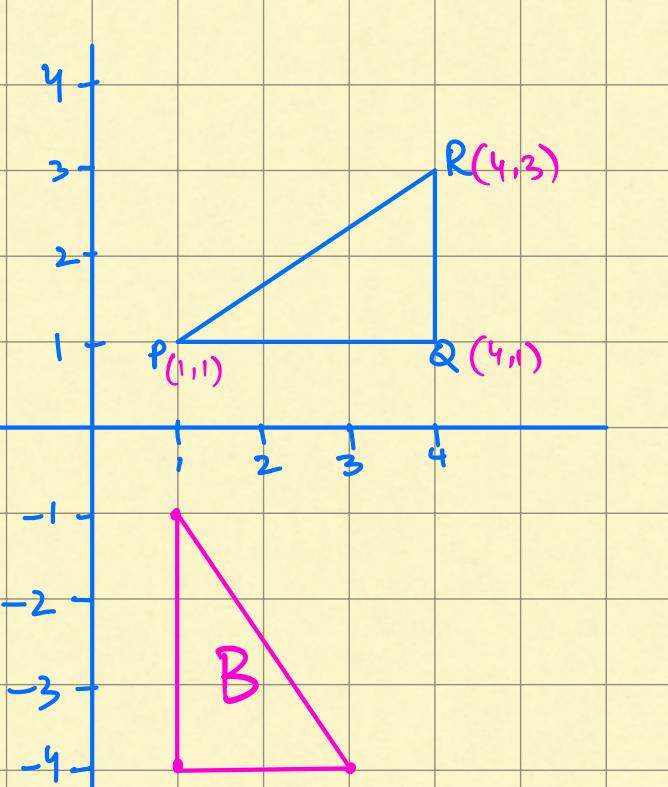
YOU ARE ALLOWED  
TO APPLY SHORTCUTS  
DIRECTLY.

THREE STEP PROCESS.

- 1- SUBTRACT CENTRE
- 2- APPLY SHORTCUT
- 3- ADD CENTRE.



$\leftarrow$  Shape flips. || same orientation  $\rightarrow$



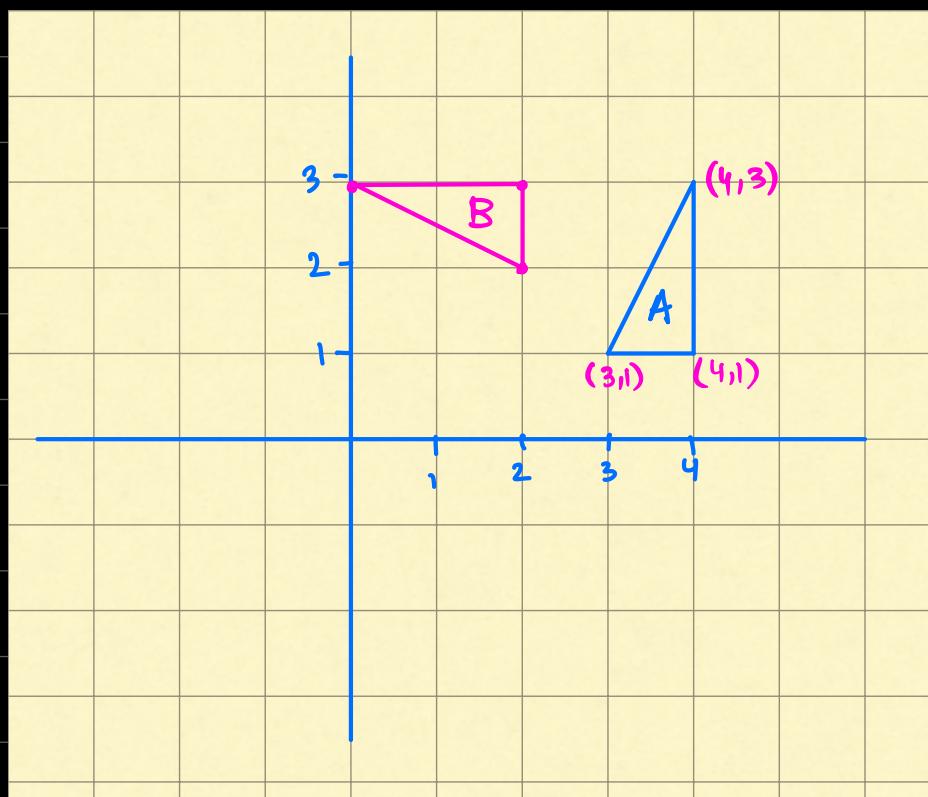
Q Rotate  $\triangle PQR$   
90° CW about  
Centre (0, 0)

Label the image  
as  $\triangle B$

(1, 1) (4, 1) (4, 3) ·

Swap both places, change y sign.

(1, -1) (1, -4) (3, -4)



Q Rotate  $\triangle A$   
90° ACW about  
Centre (2, 1)

Label the image  
as  $\triangle B$

Now centre is not (0, 0)

You cannot apply  
Shortcuts directly.

Object ·	(3, 1)	(4, 1)	(4, 3)
Subtract centre	(2, 1)	(2, 1)	(2, 1)

(1, 0)

(2, 0)

(2, 2)

Apply Shortcut.

Swap places, change x.

ADD Centre

(-0, 1)

(-0, 2)

(-2, 2)

(2, 1)

(2, 1)

(2, 1)

Image .

(2, 2)

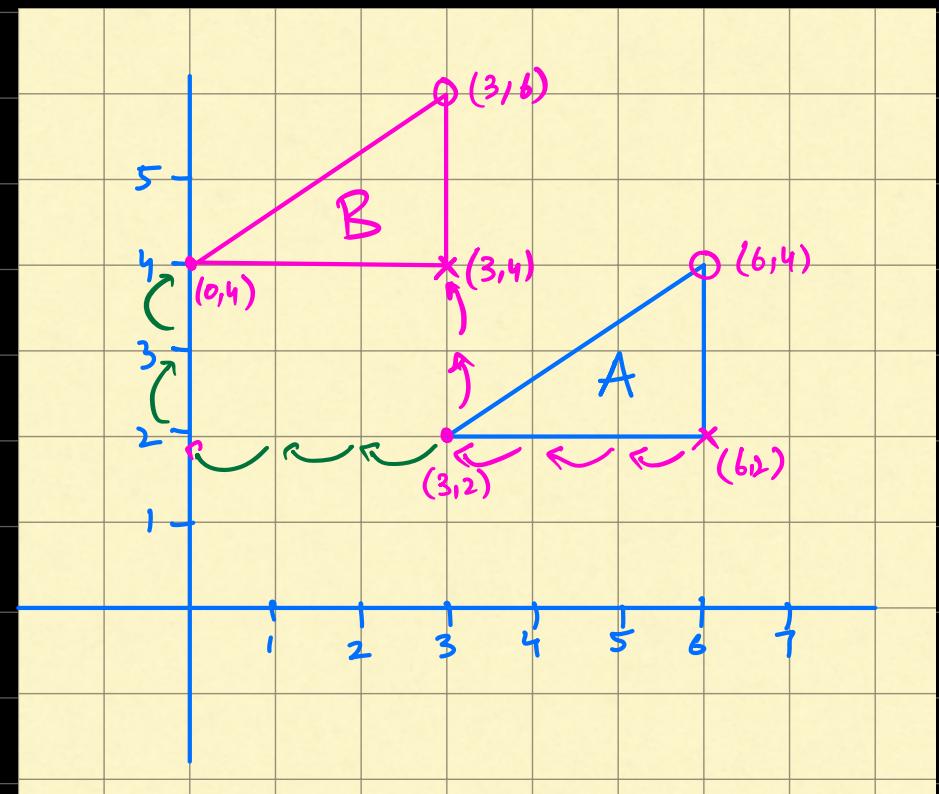
(2, 3)

(0, 3)

## TRANSLATION (DRAG)

DESCRIBE: TRANSLATION VECTOR/MATRIX

$$T = \begin{pmatrix} x \\ y \end{pmatrix} \rightarrow \begin{array}{c} + \\ \text{RIGHT / LEFT} \end{array} \quad \begin{array}{c} - \\ \text{UP / DOWN} \end{array}$$



$\Delta A$  maps onto  
 $\Delta B$  after a  
translation  $\begin{pmatrix} -3 \\ 2 \end{pmatrix}$

On the diagram  
Draw and label  
 $\Delta B$ .

$$T = \begin{pmatrix} -3 \\ 2 \end{pmatrix} \rightarrow \begin{array}{l} \text{left} \\ \text{up} \end{array}$$

OBJECT + TRANSLATION = IMAGE  
VECTOR

$$\begin{pmatrix} 3 \\ 2 \end{pmatrix} + \begin{pmatrix} -3 \\ 2 \end{pmatrix} = \begin{pmatrix} 0 \\ 4 \end{pmatrix}$$

$$\begin{pmatrix} 5 \\ 2 \end{pmatrix} + \begin{pmatrix} -3 \\ 2 \end{pmatrix} = \begin{pmatrix} 3 \\ 4 \end{pmatrix}$$

$$\begin{pmatrix} 6 \\ 4 \end{pmatrix} + \begin{pmatrix} -3 \\ 2 \end{pmatrix} = \begin{pmatrix} 3 \\ 6 \end{pmatrix}$$

## ENLARGEMENT

ZOOM IN - ZOOM OUT

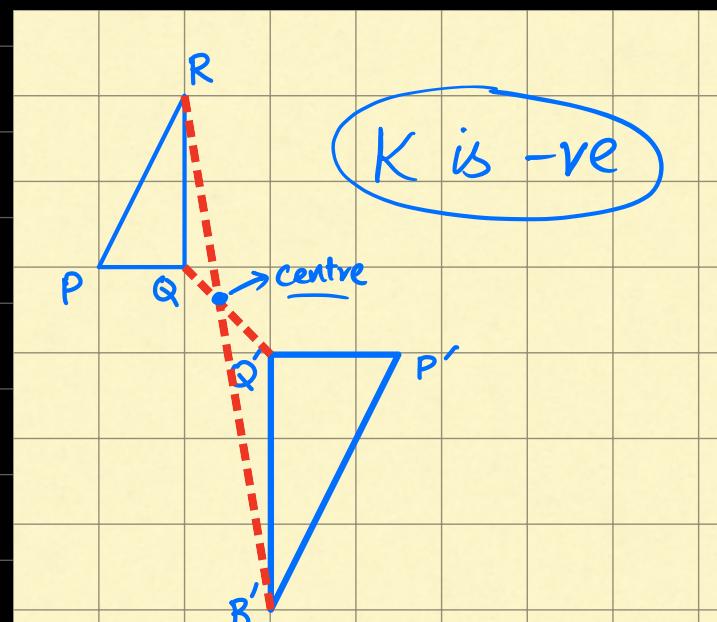
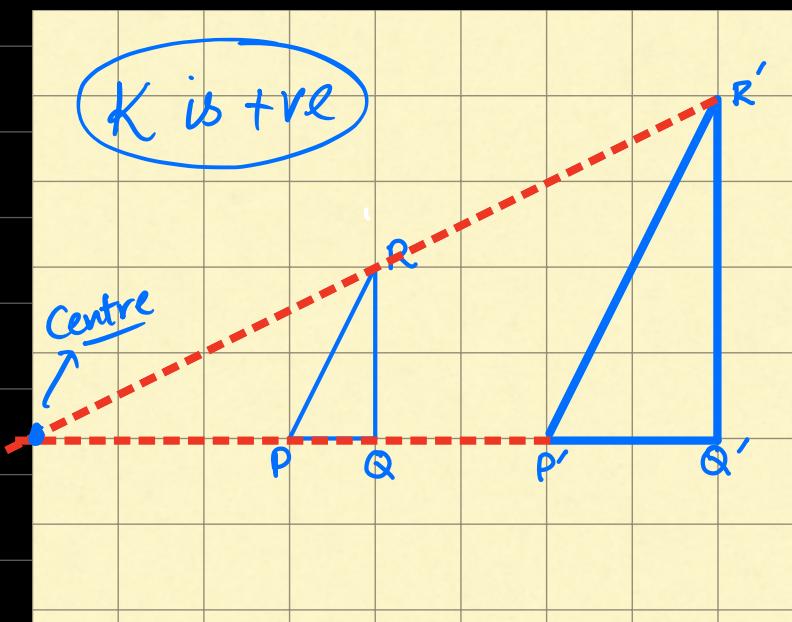
1- DESCRIBE

(a) Centre of enlargement

(b) Scale factor (K)

## 2. CONSTRUCTIONS

HOW TO FIND CENTRE OF ENLARGEMENT:



### 3- ON GRID WORKINGS.

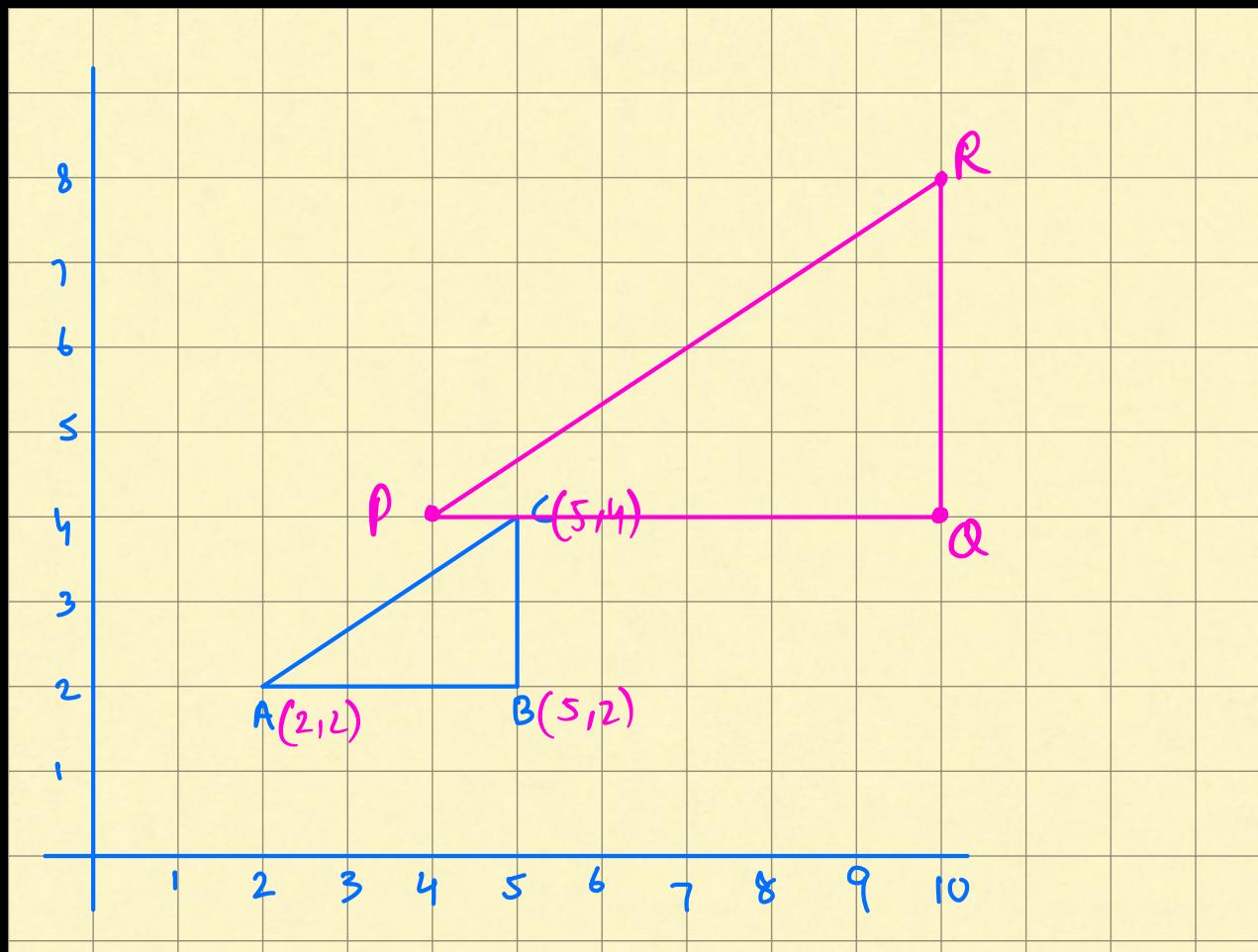


MULTIPLY ALL  
POINTS WITH  
SCALE FACTOR ( $k$ )

THREE STEP PROCESS.

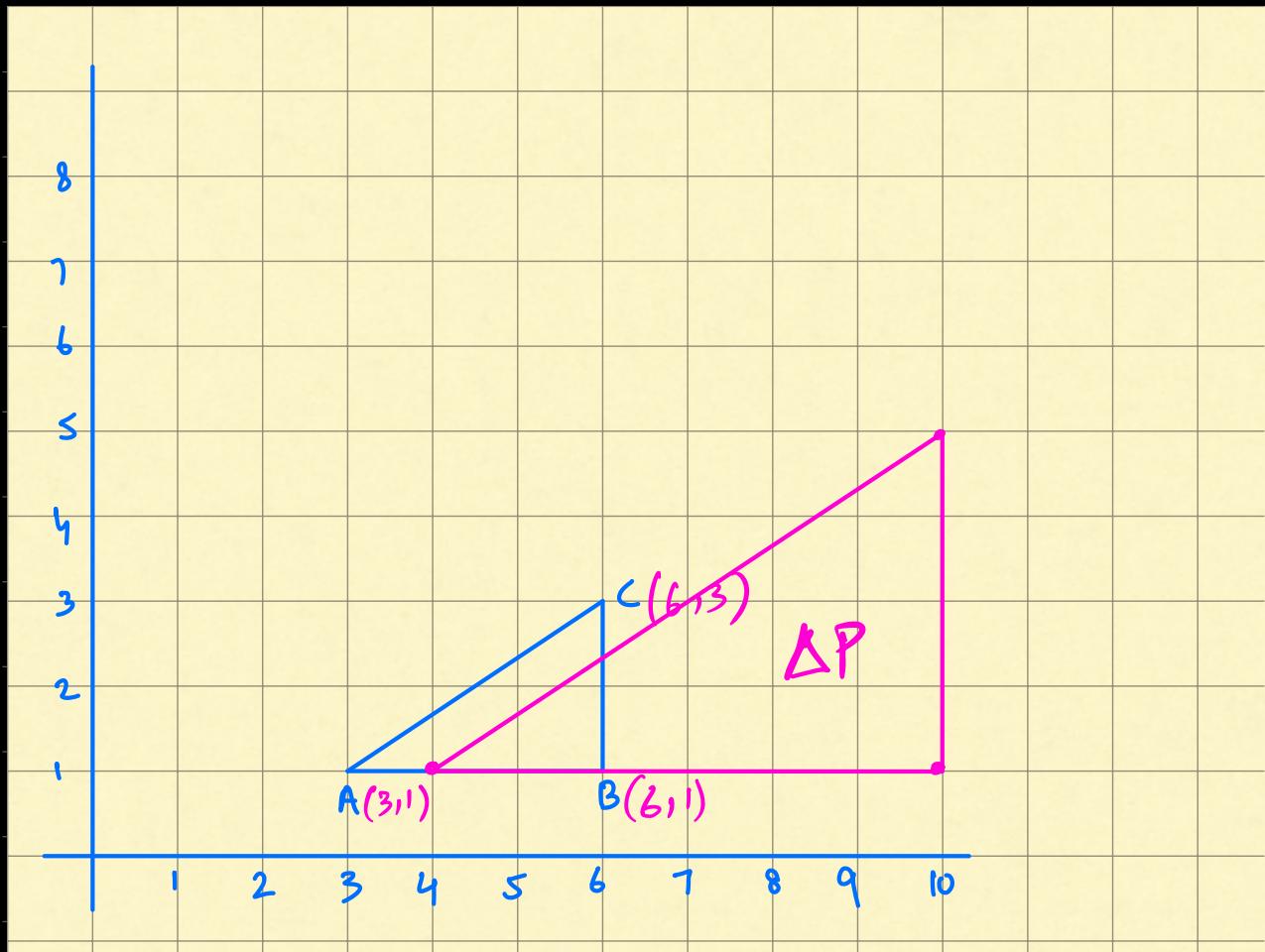
- 1- SUBTRACT CENTRE
- 2- MULTIPLY BY SF( $k$ )
- 3- ADD CENTRE.

Q:  $\triangle ABC$  maps onto  $\triangle PQR$  after an enlargement with  
centre  $(0,0)$  [scale factor 2]. Draw  $\triangle PQR$ .



$$\begin{array}{r} (2, 2) \\ \times 2 \text{ (SF)} \\ \hline (4, 4) \\ (5, 2) \\ \times 2 \text{ (SF)} \\ \hline (10, 4) \\ (5, 4) \\ \times 2 \text{ (SF)} \\ \hline (10, 8) \end{array}$$

Q) Enlarge  $\triangle ABC$  with centre  $(2,1)$  scale factor 2.  
 Draw and label image as  $\triangle P$ .



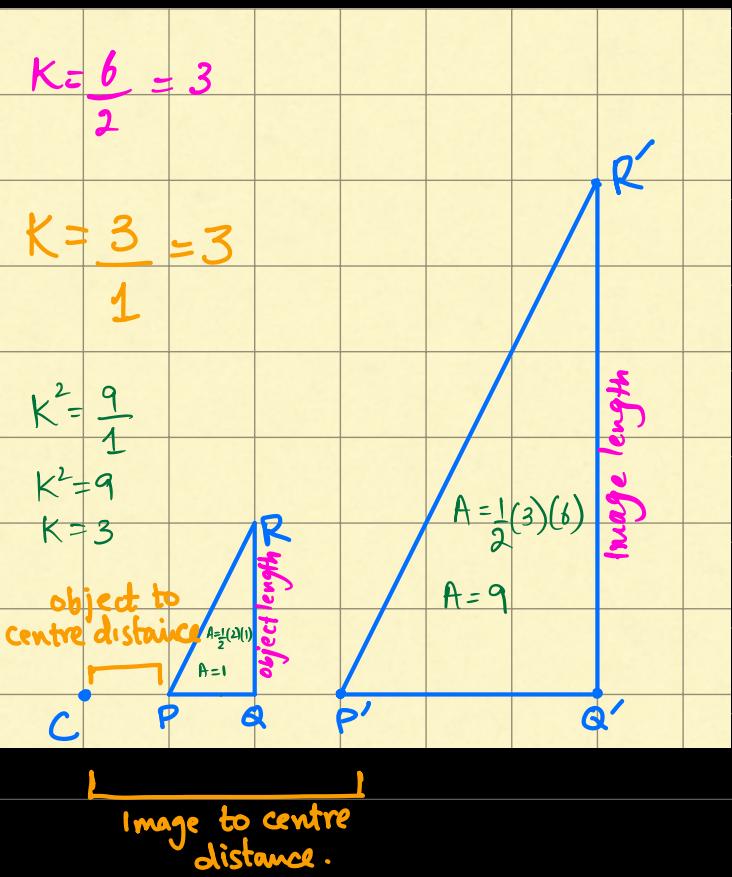
Objects	$(3,1)$	$(6,1)$	$(6,3)$
Subtract Centre	$(2,1)$	$(2,1)$	$(2,1)$
	$(1,0)$	$(4,0)$	$(4,2)$
Multiply by SF	$\times 2$	$\times 2$	$\times 2$
	$(2,0)$	$(8,0)$	$(8,4)$
Add centre	$(2,1)$	$(2,1)$	$(2,1)$
Images	$(4,1)$	$(10,1)$	$(10,5)$

# SCALE FACTOR (K)

$$K = \frac{\text{Image length}}{\text{Object length}}$$

$$K = \frac{\text{Image to centre distance}}{\text{Object to centre distance}}$$

$$K^2 = \frac{\text{Image Area}}{\text{Object area}}$$



**IMP** IF K is +ve, centre of enlargement is on one side of both object and image.

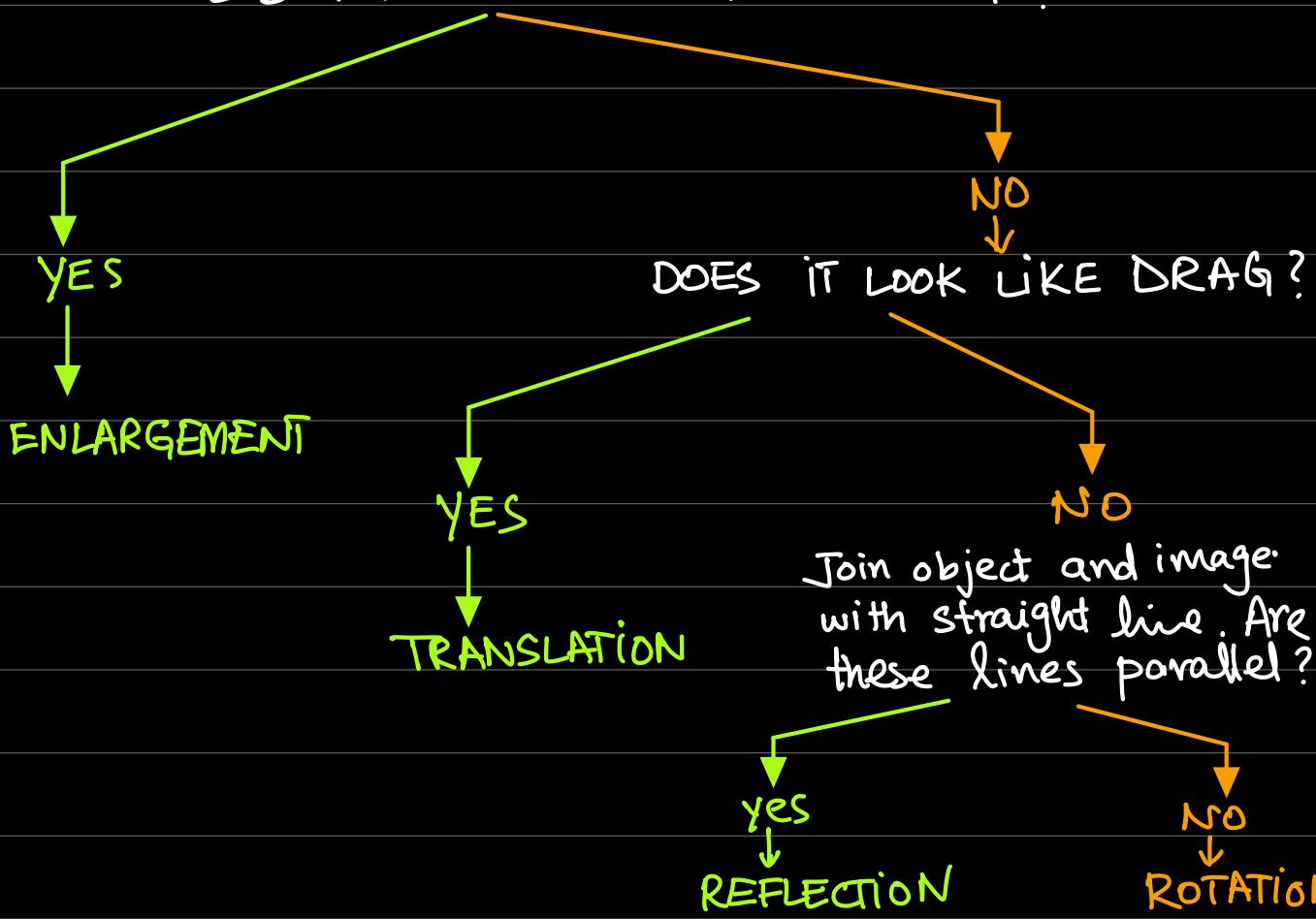
IF K is -ve, centre of enlargement is somewhere between object and image.

# DESCRIBE

1- REFLECTION	EQUATION OF LINE OF REFLECTION
2- ROTATION	1- centre 2- Angle 3- Direction
3- TRANSLATION	Translation vector $\begin{pmatrix} x \\ y \end{pmatrix}$
4- ENLARGEMENT	1- Centre 2- Scale factor ( $k$ )

## HOW TO IDENTIFY AMONG TRANSFORMATIONS

DID THE SIZE OF SHAPE CHANGE?



PRACTICE SESSION } O Levels  
3 - 5 PM            +  
                          IGCSE

MATRIX TRANSFORMATION } O Levels  
5 - 6 PM .            only.

WELL  
DONE