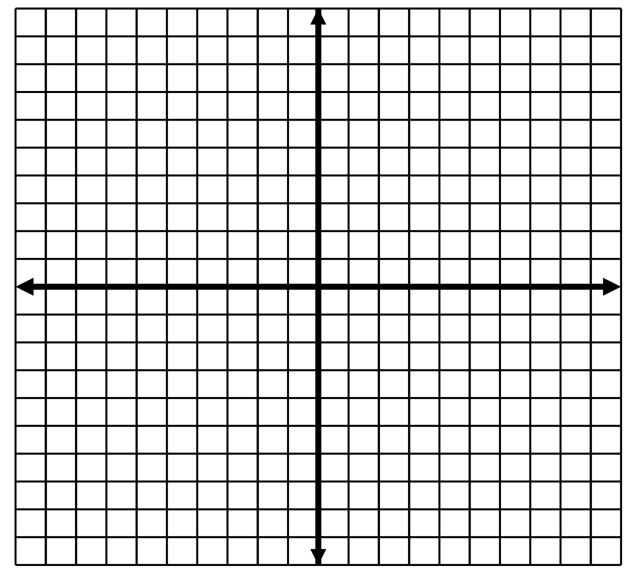
TRANSFORMATIONS

on the coordinate plane



Created by:

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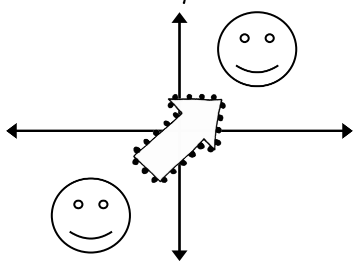
TRANSLATIONS

- A translation moves every point of a figure the same distance in the same direction.
- Can be described by the mapping notation:

$$(x, y) \rightarrow (x + a, y + b)$$

Shifts *a* horizontally and *b* vertically



EXAMPLE 1

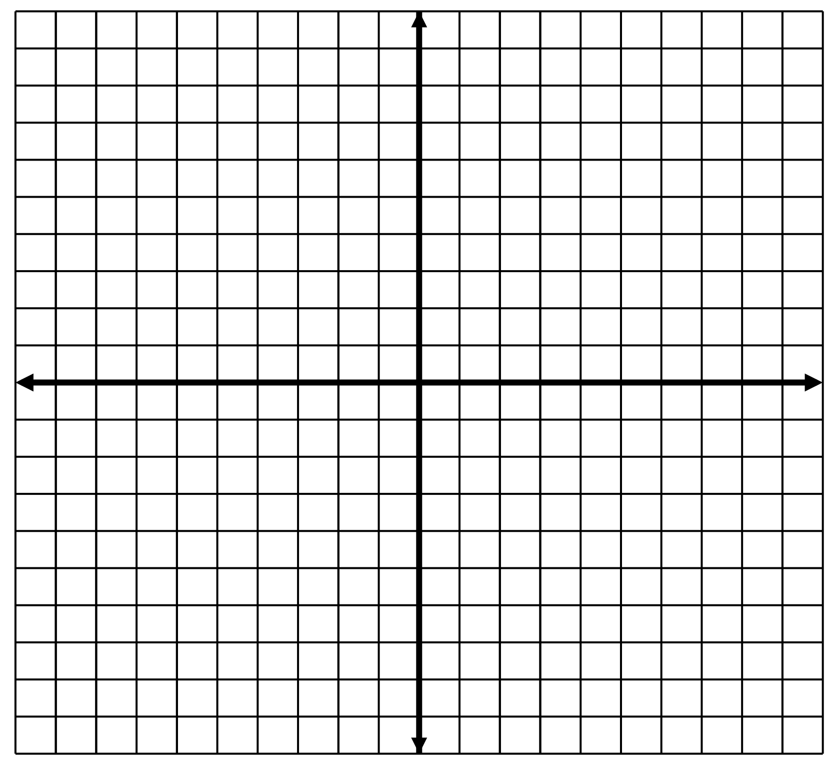
Quadrilateral *ABCD* has vertices *A* (–1, 8), *B* (2, 12), *C* (5, 8), and *D* (–1, –2) and its image has a translation $(x, y) \rightarrow (x + 12, y - 5)$. What are the new coordinates of A'B'C'D'?

POINT	PRE-IMAGE	TRANSLATE	IMAGE
A			
B			
C			
D			

EXAMPLE 3

Find the new coordinates of $\triangle LMN$ when rotated 90° clockwise about the origin and then reflected in the x–axis. *L*(3, 1), *M*(–1, 6), and *N*(–3, 2)

POINT	PRE-IMAGE	ROTATION 90° CW	REFLECT IN X-AXIS	IMAGE
L				
M				
N				



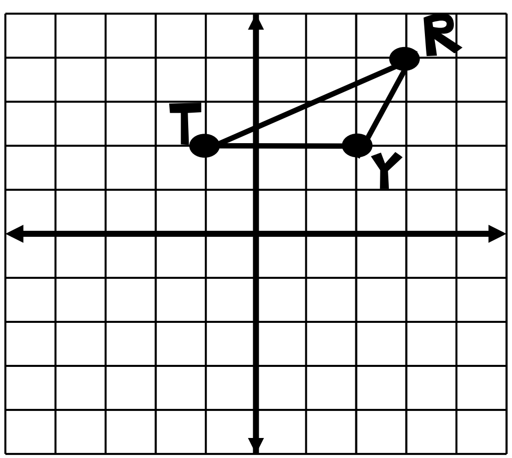
COMPOSITION OF TRANSFORMATIONS

- [ ] Follow the sequence of transformations.

EXAMPLE 1

△ *TRY* is translated (x, y)→ (x – 4, y – 3) and then rotated 90 counterclockwise about the origin. Graph and list the new vertices.

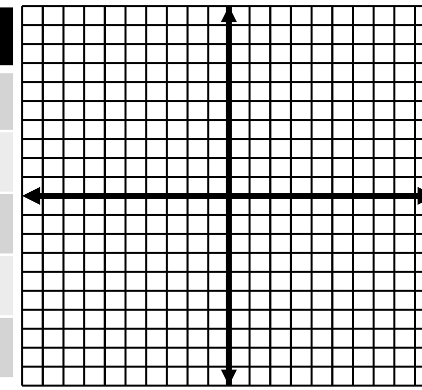
POINT	PRE-IMAGE	TRANSLATE	ROTATE 90° CW	IMAGE
T				
R				
Y				



EXAMPLE 2

Graph quadrilateral *ABCD* with vertices *A* (–1, 2), *B* (–1, 5), *C* (4, 6), and *D* (4,2) and its image after the translation (x, y)→ (x + 3, y – 1).

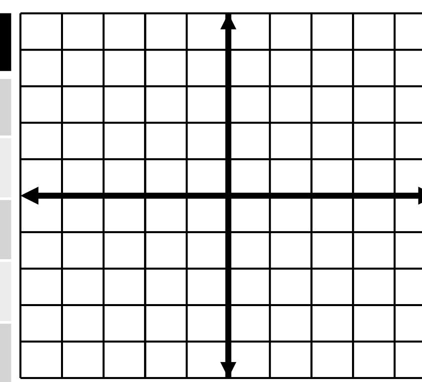
POINT	PRE-IMAGE	TRANSLATE	IMAGE
A			
B			
C			
D			



EXAMPLE 3

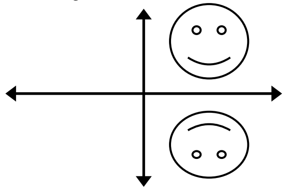
Graph quadrilateral *ABCD* with vertices *A* (1, –2), *B* (3, –1), *C* (0, 3), and *D* (–4, 1) and its image after the translation (x, y)→ (x + 2, y – 2).

POINT	PRE-IMAGE	TRANSLATE	IMAGE
A			
B			
C			
D			



REFLECTIONS

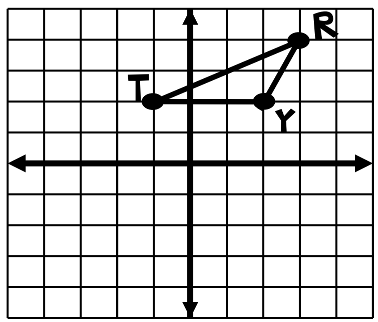
- A reflection is a transformation that uses a line like a mirror to reflect an image.



REFLECTION IN THE X-AXIS

If (x, y) is reflected in x–axis, its image is the point (x, –y).

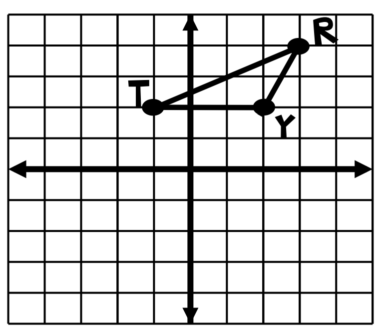
POINT	PRE-IMAGE	REFLECT X-AXIS	IMAGE
T			
R			
Y			



REFLECTION IN THE Y-AXIS

If (x, y) is reflected in y–axis, its image is the point (–x, y).

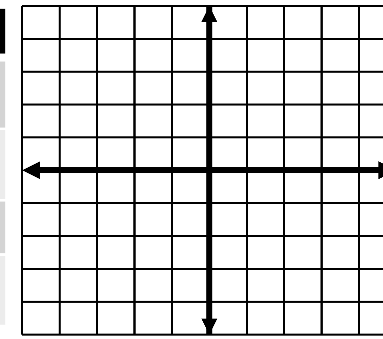
POINT	PRE-IMAGE	REFLECT Y-AXIS	IMAGE
T			
R			
Y			



EXAMPLE 2

Graph $\triangle ABC$ with vertices $A(-2, 0)$, $B(2, 4)$, and $C(4, -4)$ and its image after a dilation centered at (0, 0) with a scale factor of ½.

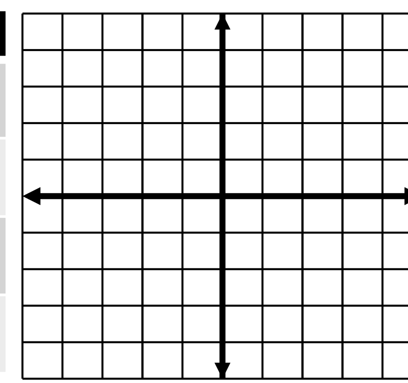
POINT	PRE-IMAGE	DILATION	IMAGE
A			
B			
C			



EXAMPLE 3

Graph $\triangle FGH$ with vertices $F(-4, -2)$, $G(-2, 4)$, and $H(-2, -2)$ and its image after a dilation centered at (0, 0) with a scale factor of –½.

POINT	PRE-IMAGE	DILATION	IMAGE
F			
G			
H			

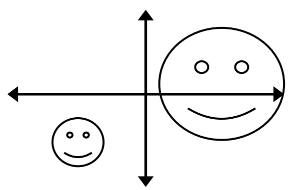


DILATIONS

- ❑ A dilation is a transformation in which a figure is enlarged or reduced.
- ❑ Dilations create similar figures.
- ❑ The scale factor indicates how much the figure will enlarge or reduce.
- ❑ Scale factor = k

$k>1$: A dilation is an enlargement

$k<1$: A dilation is a reduction



EXAMPLE 1

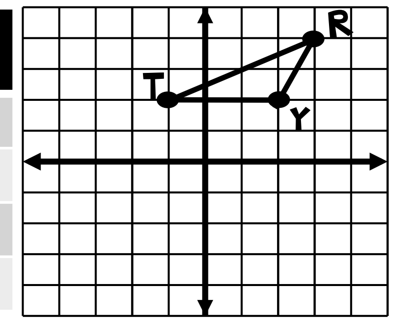
$\triangle ABC$ has vertices $A(-5, 5)$, $B(-5, 10)$, and $C(10, 0)$ with $k = 3$. List the new coordinates of the dilated image.

POINT	PRE-IMAGE	DILATION	IMAGE
A			
B			
C			

REFLECTION IN THE LINE Y = X

If (x, y) is reflected in the line $y = x$, its image is the point (y, x).

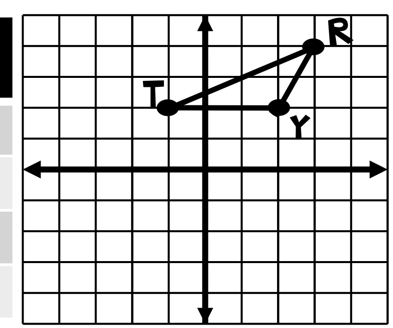
POINT	PRE-IMAGE	REFLECT Y=X	IMAGE
T			
R			
Y			



REFLECTION IN THE LINE Y = -X

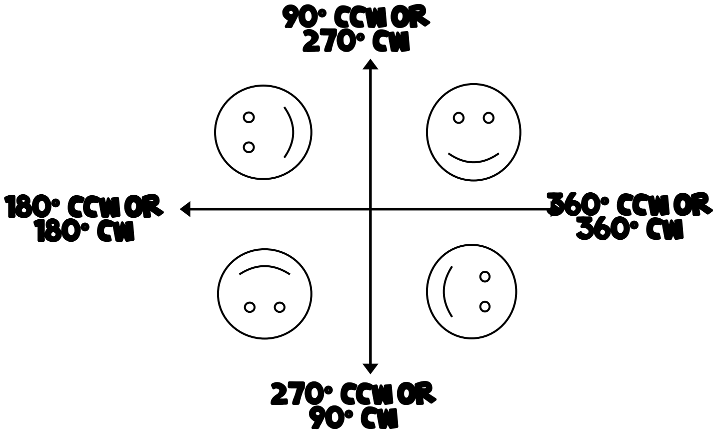
If (x, y) is reflected in the line $y = -x$, its image is the point $(-y, -x)$.

POINT	PRE-IMAGE	REFLECT Y=X	IMAGE
T			
R			
Y			



ROTATIONS

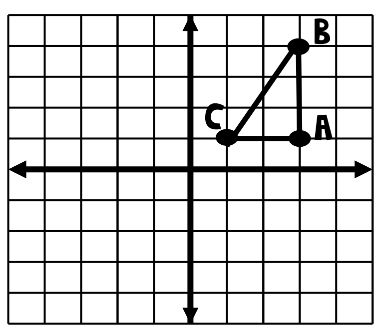
- A rotation is a transformation that is turned about a fixed point.



90° CLOCKWISE OR 270° COUNTERCLOCKWISE

If (x, y) is rotated 90° clockwise or 270° counterclockwise, then its image is the point (y, −x).

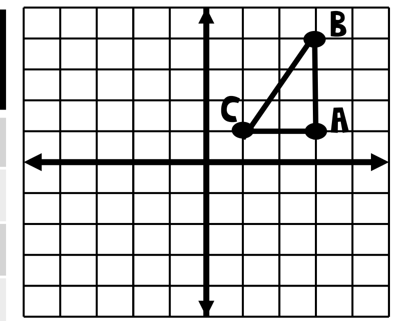
POINT	PRE-IMAGE	ROTATE 90° CW 270° CCW	IMAGE
A			
B			
C			



180° CLOCKWISE OR 180° COUNTERCLOCKWISE

If (x, y) is rotated 180° clockwise or 180° counterclockwise, then its image is the point (−x, −y).

POINT	PRE-IMAGE	ROTATE 180° CW 180° CCW	IMAGE
A			
B			
C			



270° CLOCKWISE OR 90° COUNTERCLOCKWISE

If (x, y) is rotated 270° clockwise or 90° counterclockwise, then its image is the point (−y, x).

POINT	PRE-IMAGE	ROTATE 270° CW 90° CCW	IMAGE
A			
B			
C