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Chapter Transformations
Day 1: Overview of transformations

Warm-Up

1. The coordinate of A on the number line is x-5 and the coordinate of B is 2x+5. $AB = 11$. Find the coordinate of A.

Ruler Postulate

$|A-B| = AB$

$|x-5-(2x+5)| = 11$

$|-x-10| = 11$

Case 1

$-x-10 = 11$

$-x = 21$

$x = -21$

$\boxed{A=-26}$, $B=-37$

Case 2

$-x-10 = -11$

$x = 1$

$\boxed{A=-4}$

$B = 7$

2. In the coordinate plane, A has coordinates (0,2) and B has coordinates (2,-3). Find AB.

$d = \sqrt{(x_2-x_1)^2+(y_2-y_1)^2}$

$= \sqrt{(0-2)^2+(2--3)^2}$

$d = \sqrt{4+25}$

$d = \sqrt{29}$

$\boxed{AB = \sqrt{29}}$

****

(See text section 1.3)

A **transformation** is a change in the position, shape, and/or size of a figure. The original figure is called the pre-image and the transformed figure is called the image.

A transformation is a function:

Functions have input⟶ output; so, transformations have pre-image (input) ⟶ image (output)

Mapping - is a term used to mean a transformation is taking place.

Rigid Motion or Isometry: A transformation that changes the position of a figure without changing shape or size.

Translations, reflections, rotations are rigid motions.

Properties of rigid motion: The following are preserved: distance, angle measure, betweenness, collinearity, parallelism

Then what is NOT a rigid motion? Dilations

Coordinate notation- When you use coordinates to show the transformation or to state the rule of the transformation. Ex: $(x, y) \to (x+1, y-2)$

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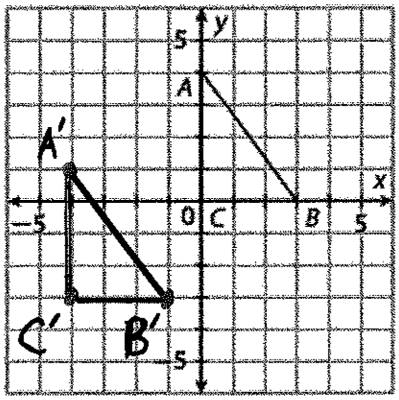
1. Ⓐ Find the unknown coordinates for each transformation and Ⓑ draw the image. Ⓒ Check if each is a rigid motion or a non-rigid motion.

a) $(x, y) \rightarrow (x-4, y-3)$



Ⓐ Pre-image → Image

A (0,4) → A' (-4, 1)

B (3,0) → B' (-1, -3)

C (0,0) → C' (-4, -3)

Ⓒ Check:

① Test distance of every segment.

$AC = 4$, $A'C' = 4$, $BC = 3$, $B'C' = 3$

$AB = \sqrt{(0-3)^2 + (4-0)^2} = 5$

$A'B' = \sqrt{(-4+1)^2 + (1+3)^2} = 5$

$AB = A'B'$

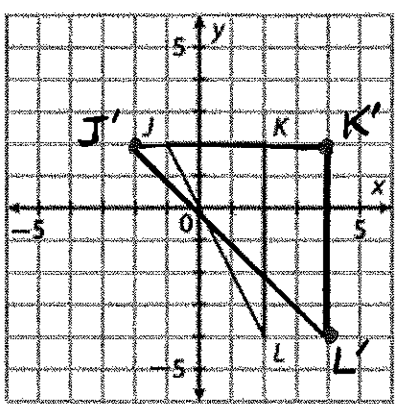
$AC = A'C'$

$BC = B'C'$

② measure angles with protractor.

Conclusion: This is a rigid motion because $AB = A'B'$, $AC = A'C'$, $BC = B'C'$, $m\angle A = m\angle A'$, $m\angle B = m\angle B'$, and $m\angle C = m\angle C'$.

b) $(x, y) \rightarrow (2x, y)$



Pre-image Image

J (-1, 2) → J' (-2, 2)

K (2,2) → K' (4, 2)

L (2,-4) → L' (4, -4)

$JK = 3$, $J'K' = 6$

$JK \neq J'K'$

Conclusion: Because distance is not preserved, this is not a rigid motion.

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2. Use coordinate notation to write the rule that maps each preimage to its image. Then determine whether this is a rigid or nonrigid motion.

ΔJKL *maps to* $\Delta J'K'L'$:

Preimage		Image
J (4, 1)	→	J' (4, 3)
K (-2, -1)	→	K' (-2, -3)
L (0, -3)	→	L' (0 , -9)

Rule in coordinate notation: $(x, y) \to (x, 3y)$

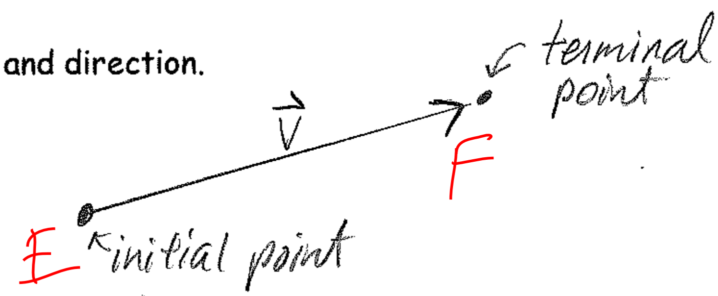
$JK = \sqrt{(4+2)^2+(1+1)^2} = \sqrt{36+4} = \sqrt{40} = 2\sqrt{10}$

$J'K' = \sqrt{(4+2)^2+(3+3)^2} = \sqrt{36+36} = \sqrt{72} = 6\sqrt{2}$

Since $JK \neq J'K'$, this is a nonrigid motion.

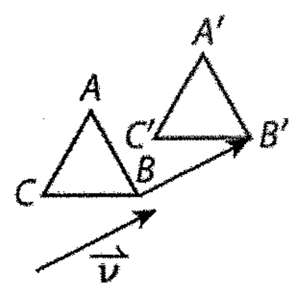
Translations:

A Vector: A quantity with both magnitude and direction.
(length)



The name of this vector is $\overrightarrow{EF}$ or $\vec{v}$.

Translation: A translation is a transformation along a vector such that the segment joining a point and its image.....



1) has the same length as the vector

2) is parallel to the vector.

Two ways to describe a translation:

Coordinate notation: $(x, y) \to (x + a, y - b)$

$(x, y) \to (x - a, y + b)$

Component Form of a vector: $\langle \pm a, \pm b \rangle$

horizontal change

vertical change

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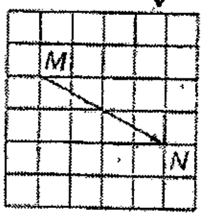
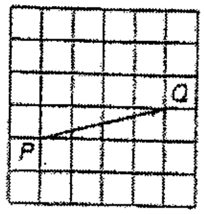
1. Name the vector and write its component form.

a)


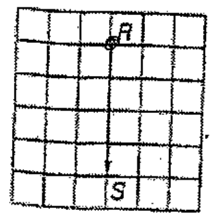
$\overrightarrow{MN}$

$\langle 4, -2 \rangle$

b)


$\overrightarrow{PQ}$

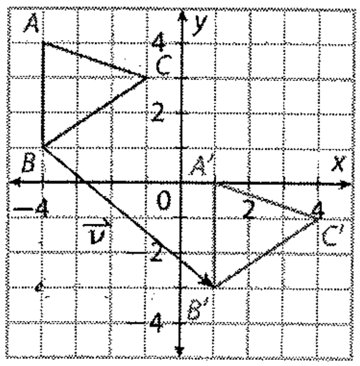
$\langle 4, 1 \rangle$

c)


$\overrightarrow{RS}$

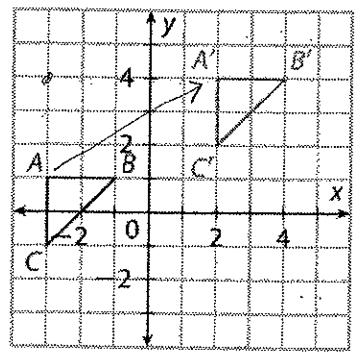
$\langle 0, -4 \rangle$

2 ~~1.~~ Describe the translation using Coordinate notation and component form of vector.

a)


$(x, y) \rightarrow (x+5, y-4)$

$\langle 5, -4 \rangle$

b)


$(x, y) \rightarrow (x+5, y+3)$

$\langle 5, +3 \rangle$

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3. ΔABC has vertices A(0,0), B(1,5) and C(4,1). State the coordinates of the image after each translation.

<u>Examples</u>:

a) $(x, y) \rightarrow (x + 4, y + 3)$

$A(0,0) \rightarrow A'(4, 3)$

$B(1,5) \rightarrow B'(5, 8)$

$C(4,1) \rightarrow C'(8, 4)$

b) $< 6, -4 >$ $(x+6, y-4)$

$A(0,0) \rightarrow A'(6, -4)$

$B(1,5) \rightarrow B'(7, 1)$

$C(4,1) \rightarrow C'(10, -3)$

c) $(x, y) \rightarrow (x - 5, y + 2)$

$A(0,0) \rightarrow A'(-5, 2)$

$B(1,5) \rightarrow B'(-4, 7)$

$C(4,1) \rightarrow C'(-1, 3)$

d) $< -4, -5 >$

$A(0,0) \rightarrow A'(-4, -5)$

$B(1,5) \rightarrow B'(-3, 0)$

$C(4,1) \rightarrow C'(0, -4)$

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. You are given the translation information and the vertices of the image. Find the vertices of the preimage.

a) $(x, y) \rightarrow (x-2, y+1)$

$A(5,1) \longrightarrow A'(3,2)$
$B(-1,3) \rightarrow B'(-3,4)$
$C(8,-2) \longrightarrow C'(6,-1)$

b) $\langle -4, -1 \rangle$

$+4, +1$
$A(6,2) \rightarrow A'(2,1)$
$B(8,5) \rightarrow B'(4,4)$
$C(1,2) \rightarrow C'(-3,1)$

c) $(x, y) \rightarrow (x+3, y+4)$

$(-3,-4)$
$A(-8,-3)$ $A'(-5,1)$
$B(-3,0)$ $B'(0,4)$
$C(1,-7)$ $C'(4,-3)$