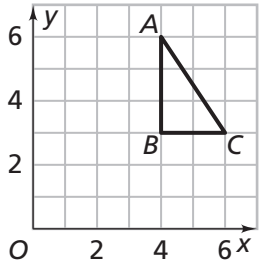
Topic 4: Translations in the Coordinate Plane

for use after ***Shapes and Designs*** **Investigation 4**

A **transformation** is the change in the size, shape, or position of a figure. A **translation** is a transformation in which each point of a figure moves the same distance and in the same direction. This design contains many such figures.

Problem 4.1

A. Copy ΔABC and translate it to $\Delta A'B'C'$ using the steps below.



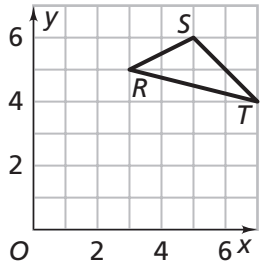
1. From A, count down 2 units and to the left 3 units. Label the new point A'(ay-prime).
2. Find and label points B' and C' by counting down 2 units and left 3 units.
3. Draw $\Delta A'B'C'$.

B. Draw a line from A to A', from B to B', and from C to C'.

1. Compare the length of the three lines.
2. Compare the direction of the three lines.
3. Explain why $\Delta A'B'C'$ is a translation of ΔABC.

Exercises

1. For each of the directions below, copy the graph and translate ΔRST. Label the image $\Delta R'S'T'$.



a. Translate ΔRST up 2 units.

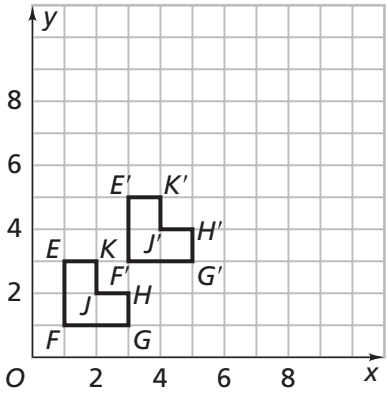
b. Translate ΔRST to the right 2 units.

c. Translate ΔRST to the left 2 units and down 4 units.

d. Translate ΔRST to the right 1 unit and down 1 unit.

e. Translate ΔRST to the left 2 units and up 1 unit.

2. Danielle drew the figures at the right to represent a translation.



a. Describe the translation of point E to point E'.

b. Name the coordinates of an unlabeled point on the bottom figure, then give the coordinates of the translated image of that point.

c. Jeremy says that Danielle only plotted 6 points to do the translation, so that means only 6 points on the original figure were translated. Do you agree with Jeremy?

3. Chee wrote this rule to describe the translation of ΔABC to $\Delta A'B'C'$:
$(x, y) \longrightarrow (x + 1, y - 4)$

a. How does Chee's rule use coordinates to translate a figure?

b. Chee drew ΔKLM with vertices at $K(2, 7)$, $L(4, 6)$, and $M(3, 4)$. He then followed his own rule to draw $\Delta K'L'M'$. Draw both of these triangles.

Topic 4: Translations in the Coordinate Plane

At a Glance

PACING 1 day

Mathematical Goals

- Identify the translations used to move a polygon from one location to another in the coordinate plane.
- Explain how translations affect the location of a polygon in the coordinate plane.

Guided Instruction

Among the three main types of transformations your students will study—translations, rotations, and reflections—translations should be the easiest for the students to grasp. Students will find translations relatively easy to model by tracing the outline of a flat shape on graph paper before and after sliding the shape from one location to another. Have students work in pairs for this type of modeling. In those activities where students copy a shape and then draw its prescribed translation, tracing paper can be used to confirm that the original shape and the translated image are congruent.

In the translation problems and exercises, the points being used for the translation are all vertices. You should briefly review the definition of a vertex as the point in a polygon where two sides meet.

Although the translations in this lesson are shown as occurring only in the first quadrant, more advanced students should be encouraged to translate shapes between any two locations in the coordinate plane.

Before Problem 4.1:

- *Describe some of the figures in the design at the top of the page that are repeated as you move from left to right.* (various descriptions of triangles and a square.)

During Problem 4.1, A:

- *Why do you think it is a good idea to name the translated triangle with A', B', and C' instead of just using other letters altogether?* (It makes it easy to match up the original points with the translated points.)

After Problem 4.1:

- *How can you prove that the direction from A to A' is the same as the direction from B to B' and C to C'?* (They all form a diagonal of a 2 unit $\times$ 3 unit rectangle.)
- *How could you make sure that $\Delta A'B'C'$ is the same size and shape as ΔABC?* (Trace one triangle onto tracing paper and see if the shapes match; or measure all the sides and the angles.)
- *What changes when you translate a figure?* (Its position.)

You will find additional work on transformations in the grade 8 unit *Kaleidoscopes, Hubcaps, and Mirrors.*

Vocabulary

- transformation
- translation

Materials

- Labsheets 4. 1, 4ACE Exercise 1

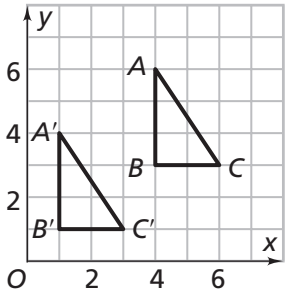
ACE Assignment Guide for Topic 4

Core 1–3

Answers to Topic 4

Problem 4.1

A.



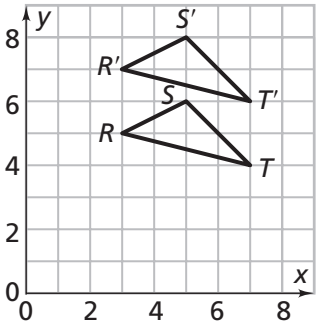
B. 1. The lines are the same length.

2. The lines are in the same direction.

3. Every point on ΔABC moved the same distance and in the same direction.

Exercises

1. a.



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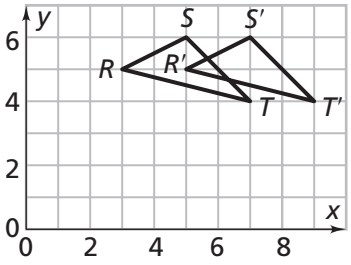

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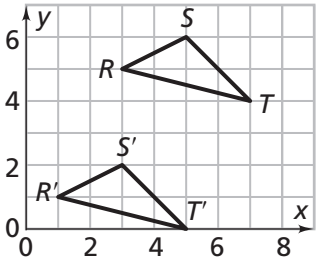

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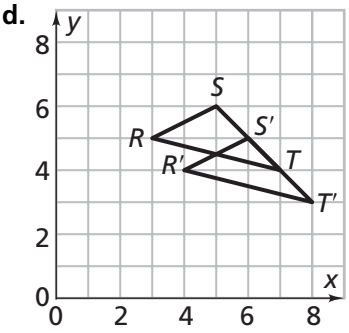

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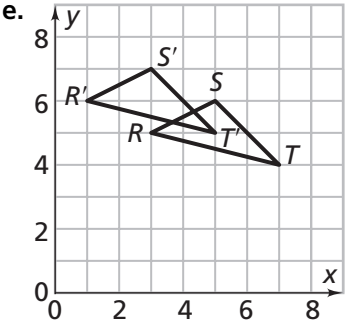


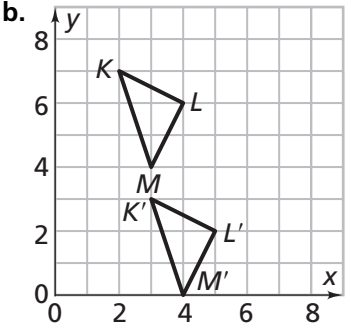
2. a. To the right 2 units then up 2 units.

b. (2, 1); (4, 3)

c. Answers may vary. Sample: Every single point on the original figure was translated. The number of points translated is infinite.

3. a. It says that every point on ΔABC moves 1 unit to the right, then 4 units down.

b.



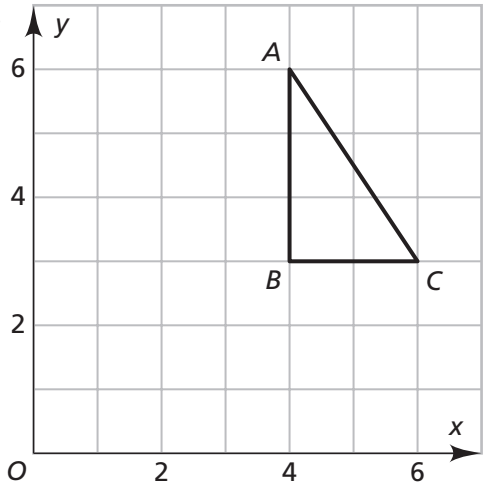
Name _____ Date _____ Class _____

Labsheet 4.1

Topic 4

Translations in the Coordinate Plane

A.

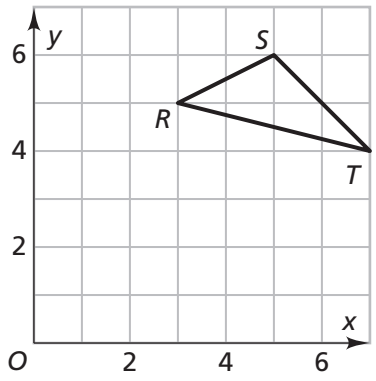


Name _____ Date _____ Class _____

Labsheet 4ACE Exercise 1

Topic 4

a.



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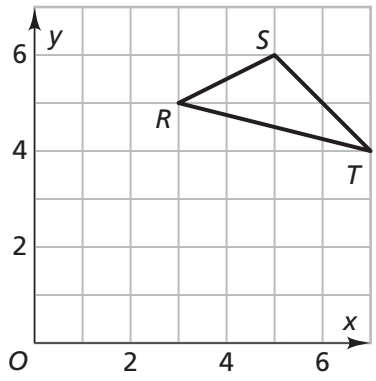

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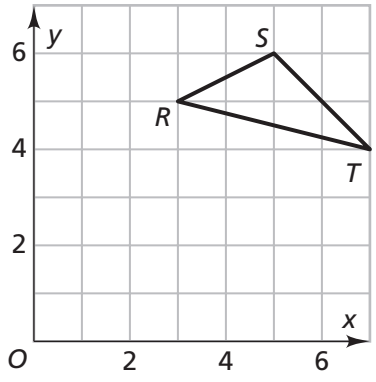

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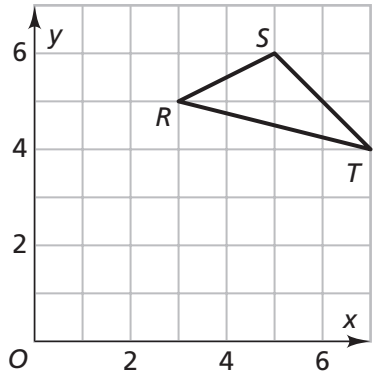

e.