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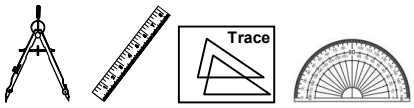
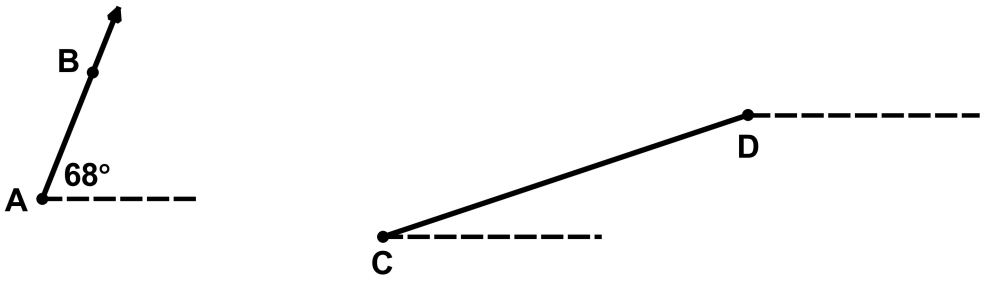


TRANSLATIONS
COMMON CORE GEOMETRY

So far we have studied two of the three basic **rigid motions**: the rotation and the (line) reflection. In this lesson, we study the last of the rigid motions, the **translation**. The basic concept of a translation will be illustrated in the first exercise.

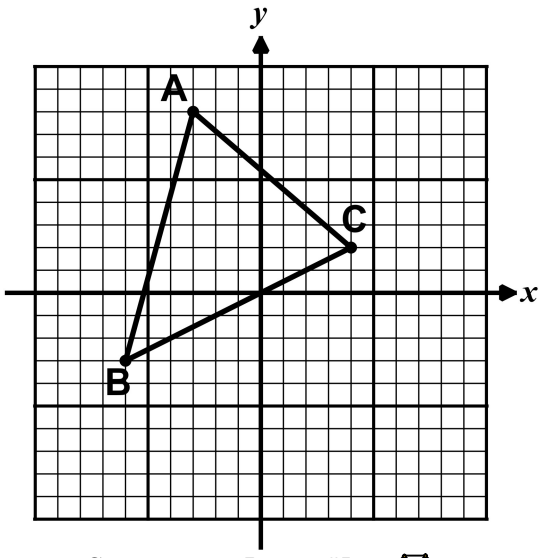
***Exercise* #1:** In the diagram below ray $\overrightarrow{AB}$ is shown along with segment $\overline{CD}$. The dashed lines are all horizontal, and thus parallel. Translate $\overline{CD}$ in the direction of $\overrightarrow{AB}$ by a length of 1.5 inches. Label its image $\overline{C'D'}$. Use your protractor along with a ruler to do the translation.



***Exercise* #2:** What observations can you make about $\overline{CD}$ versus $\overline{C'D'}$ from #1? List as many as you can.

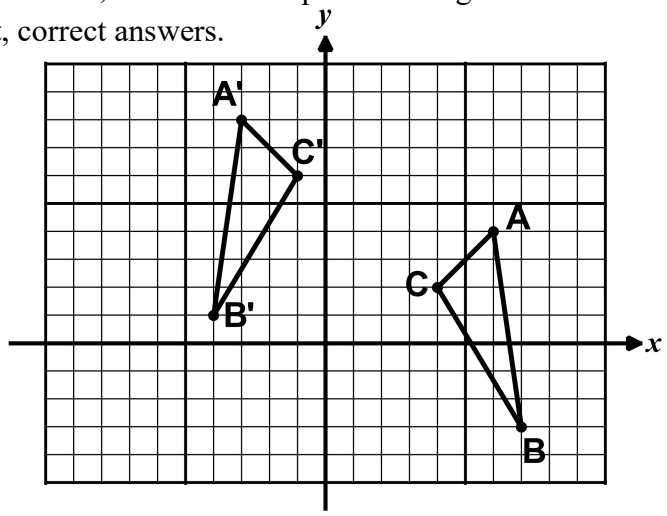
Translations are extremely important. They allow us to move a geometric figure in the plane without rotating or reflecting it. We say that we **shift** the object. Translations are easily given in the coordinate plane.

***Exercise* #3:** Given ΔABC shown at the right with vertices at $A(-3,8)$, $B(-6,-3)$, and $C(4,2)$, find and plot its image after a translation 4 units to the right and 7 units down. Label the image $\Delta A'B'C'$ and state its coordinates. Sometimes this transformation will be symbolized by $T_{4,-7}$.



Sometimes a figure has had multiple rigid motions combined to produce an image.

***Exercise* #4:** Given the two triangles shown in the image below, describe a sequence of rigid motions that would map ΔABC into $\Delta A'B'C'$. There are many different, correct answers.



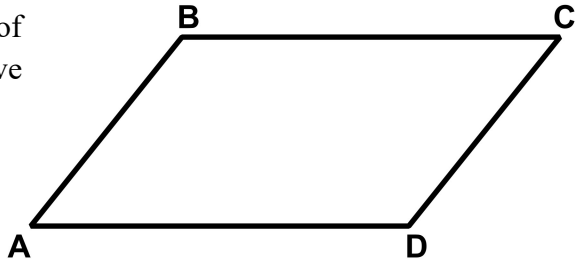
Translations have all the properties of the other two rigid motions with an additional property that you noted in Exercise #2. The summary of all these properties is shown below.

TRANSLATION PROPERTIES

1. Map lines to parallel lines (only true of translations).
2. Preserve angles (true of all rigid motions).
3. Preserve length/distance (true of all rigid motions).

The properties of translations can be used to prove one of the important **properties of a parallelogram**. Remember, the **defining characteristic** of a **parallelogram** is that it has **two pairs of parallel sides.** We will now use this fact, along with the properties of translations, to prove its opposite sides have the same length.

***Exercise* #5:** In the diagram below, parallelogram $ABCD$ is drawn.



(a) If $\overline{AD}$ was translated in the direction of $\overrightarrow{AB}$ with a distance of AB then explain why the image of D, called D', would have to lie on ray $\overrightarrow{BC}$?

(b) Why would D' also have to lie along ray $\overrightarrow{DC}$?

(c) Given that D' must lie along both $\overrightarrow{BC}$ and $\overrightarrow{DC}$, where must it land? Why does this now prove that $AD = BC$?

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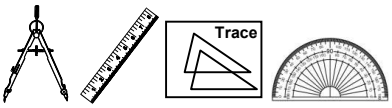
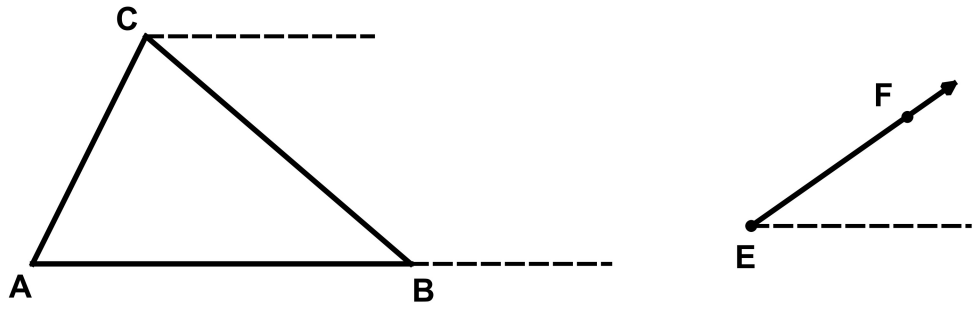


TRANSLATIONS
COMMON CORE GEOMETRY HOMEWORK

MEASUREMENT AND CONSTRUCTION

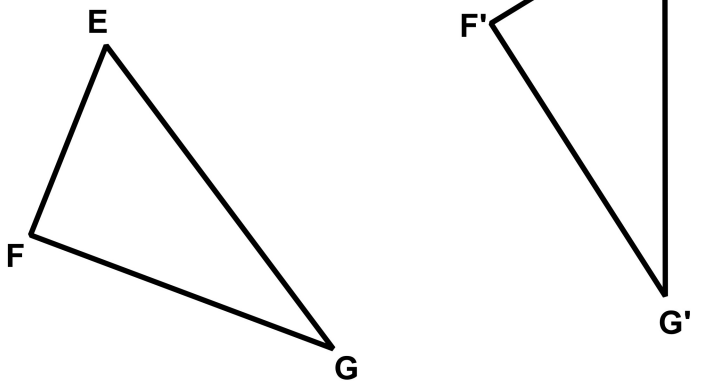
1. Given ΔABC with horizontal base $\overline{AB}$ extended (dashed line) and another horizontal reference line drawn at C, translate ΔABC in the direction of $\overrightarrow{EF}$ a distance of EF. Use your compass to help with the direction. Use your protractor to help with distance.



2. In the diagram below, $\Delta E'F'G'$ is a transformation of ΔEFG.

   (a) Using tracing paper, are the two triangles the same shape and size?

   (b) Could $\Delta E'F'G'$ be the image of ΔEFG after a translation alone? Support your answer with measurements.



PROBLEM SOLVING

3. Which of the following is a property of translations that is *not* also a property of other types of rigid motions?

   (1) they map line segments to other line segments of equal length

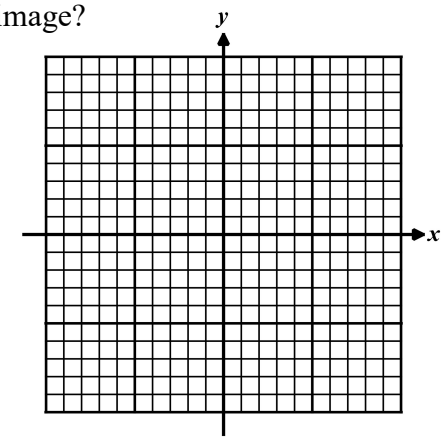
   (2) they map angles to other angles of the same size

   (3) they map lines to parallel lines

   (4) they map lines to perpendicular lines

_____

4. If the point $(-2,-4)$ was reflected in the *x*-axis and then translated five units right and seven units down, which of the following would be the coordinates of its image?

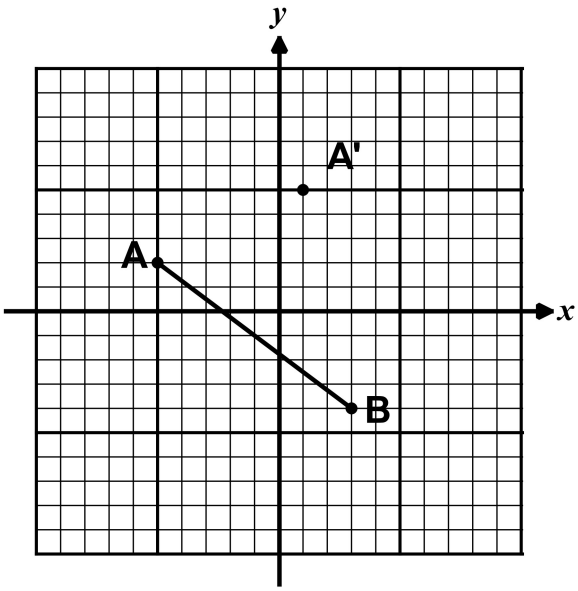


(1) $(2,3)$ (3) $(3,-3)$

(2) $(4,-8)$ (4) $(-7,5)$

_____

5. In the diagram below, line segment $\overline{AB}$ is drawn. Point *A* has been mapped to image point A' by the use of a translation.



(a) Find and plot the coordinates of B', the image of *B* after the same translation that *A* underwent. State the coordinates of B' below.

(b) What is the relationship between segments $\overline{AB}$ and $\overline{A'B'}$? Explain.

6. $\Delta R'S'T'$ is the image of ΔRST after a sequence of rigid motions. Give a sequence of rigid motions that would correctly produce $\Delta R'S'T'$. There are many correct answers.