CHAPTER 6: TRANSFORMATIONS AND SIMILARITY

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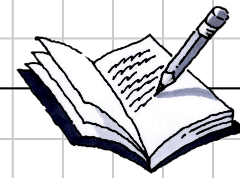

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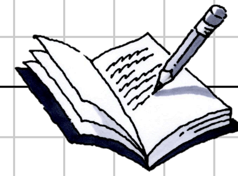

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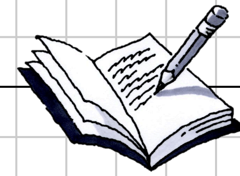
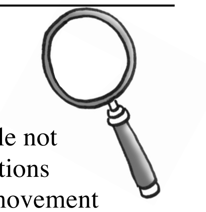


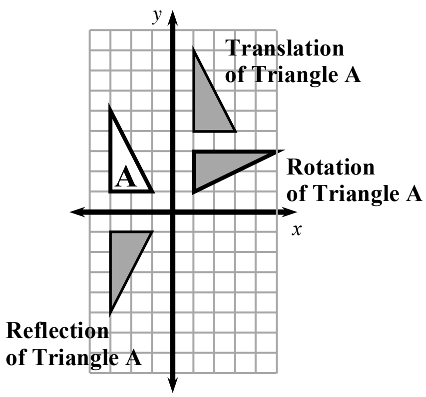
MATH NOTES

RIGID TRANSFORMATIONS



Rigid transformations are ways to move an object while not changing its shape or size. Specifically, they are translations (slides), reflections (flips), and rotations (turns). Each movement is described below.

A **translation** slides an object horizontally (side-to-side), vertically (up or down), or both. To translate an object, you must describe which direction you will move it, and how far it will slide. In the example at right, triangle A is translated 4 units to the right and 3 units up.



A **reflection** flips an object across a line (called a **line of reflection**). To reflect an object, you must describe the line the object will flip across. In the example at right, triangle A is reflected across the *x*-axis.

A **rotation** turns an object about a point. To rotate an object, you must choose a point, direction, and angle of rotation. In the example at right, triangle A is rotated 90° clockwise (↻) about the origin $(0,0)$.

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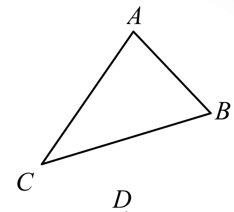
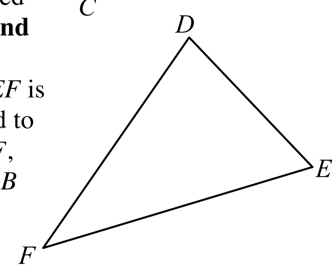
CORRESPONDING PARTS OF SIMILAR SHAPES

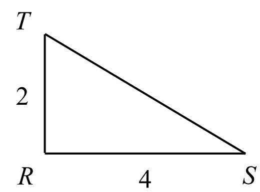
Two figures are **similar** if they have the same shape but not necessarily the same size. For example, all semi-circles are similar, as are all squares, no matter how they are oriented. Dilations create similar figures.



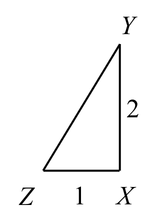
To check whether figures are similar, you need to decide which parts of one figure **correspond** (match up) to which parts of the other. For example, in the triangles at right, triangle *DEF* is a dilation of triangle *ABC*. Side *AB* is dilated to get side *DE*, side *AC* is dilated to get side *DF*, and side *BC* is dilated to get side *EF*. Side *AB* **corresponds** to side *DE*, that is, they are **corresponding sides**. Notice that vertex *A* corresponds to vertex *D*, *C* to *F*, and *B* to *E*.



Not all correspondences are so easily seen. Sometimes you have to rotate or reflect the shapes mentally so that you can tell which parts are the corresponding sides, angles, or vertices. For example, the two triangles at right are similar, with *R* corresponding to *X*, *S* to *Y*, and *T* to *Z*. You can get triangle *XYZ* from triangle *RST* by a dilation of $\frac{1}{2}$ followed by a 90° counter-clockwise (↺) turn.

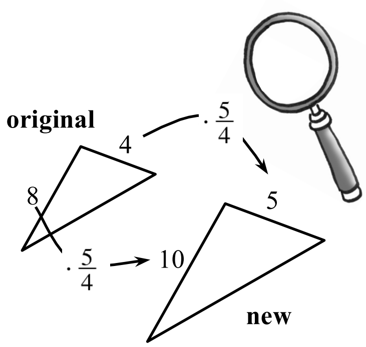


Shapes that are similar and have the same size are called **congruent**. Congruent shapes have corresponding sides of equal length and corresponding angles of equal measure. Rigid transformations (reflections, rotations, and translations), along with dilations with a multiplier of 1 or -1, create congruent shapes.



SCALE FACTOR

A **scale factor** is a ratio that describes how two quantities or lengths are related. A scale factor that describes how two similar shapes are related can be found by writing a ratio between any pair of corresponding sides as $\frac{\text{new}}{\text{original}}$.



For example, the two similar triangles at right are related by a scale factor of $\frac{5}{4}$ because the side lengths of the new triangle can be found by multiplying the corresponding side lengths of the original triangle by $\frac{5}{4}$.

A scale factor greater than one **enlarges** a shape (makes it larger). A scale factor between zero and one **reduces** a shape (makes it smaller). If a scale factor is equal to one, the two similar shapes are identical and are called **congruent**.

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