VOCABULARY

Image An image is a new figure produced from the transformation of a figure.

Preimage A preimage is the original figure in the transformation of a figure.

Isometry An isometry is a transformation that preserves length and angle measure.

Vector A vector is a quantity that has both direction and magnitude, or size.

Initial point The initial point of a vector is the starting point of the vector.

Terminal point The terminal point of a vector is the ending point of the vector.

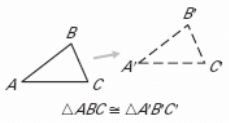
Horizontal component The horizontal component describes the left and right direction of a vector.

Vertical component The vertical component describes the up and down direction of a vector.

Component form The component form of a vector combines the horizontal and vertical components.

THEOREM 9.1: TRANSLATION THEOREM

A translation is an isometry.



VOCABULARY

Matrix A matrix is a rectangular arrangement of numbers in rows and columns.

Element Each number in a matrix is called an element.

Dimensions The dimensions of a matrix are the numbers of rows and columns.

VOCABULARY

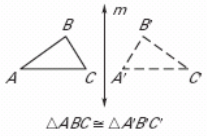
Line of reflection In a reflection, the mirror line is called the line of reflection.

COORDINATE RULES FOR REFLECTIONS

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

THEOREM 9.2: REFLECTION THEOREM

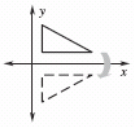
A reflection is an isometry.



REFLECTION MATRICES

Reflection in the x-axis.

$$\begin{bmatrix} 1 & 0 \\ 0 & -1 \end{bmatrix}$$



Reflection in the y-axis.

$$\begin{bmatrix} -1 & 0 \\ 0 & 1 \end{bmatrix}$$

VOCABULARY

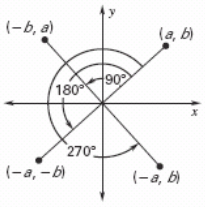
Center of rotation In a rotation, a figure is turned about a fixed point called the center of rotation.

Angle of rotation In a rotation, rays drawn from the center of rotation to a point and its image form the angle of rotation.

COORDINATE RULES FOR ROTATIONS ABOUT THE ORIGIN

When a point (a, b) is rotated counterclockwise about the origin, the following are true:

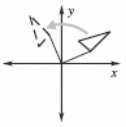
1. For a rotation of 90°, $(a, b) \rightarrow (\ -b\ ,\ a\ )$.
2. For a rotation of 180°, $(a, b) \rightarrow (\ -a\ ,\ -b\ )$.
3. For a rotation of 270°, $(a, b) \rightarrow (\ b\ ,\ -a\ )$.



ROTATION MATRICES (COUNTERCLOCKWISE)

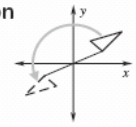
90° rotation

$$\begin{bmatrix} 0 & -1 \\ 1 & 0 \end{bmatrix}$$



180° rotation

$$\begin{bmatrix} -1 & 0 \\ 0 & -1 \end{bmatrix}$$

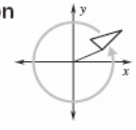


270° rotation

$$\begin{bmatrix} 0 & 1 \\ -1 & 0 \end{bmatrix}$$

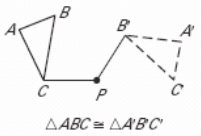
360° rotation

$$\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$$



THEOREM 9.3: ROTATION THEOREM

A rotation is an isometry.



$\triangle ABC \cong \triangle A'B'C'$

VOCABULARY

Glide reflection A glide reflection is a transformation in which every point P is mapped to a point P'' by the following steps:
(1) A translation maps P onto P'.
(2) A reflection in a line k parallel to the direction of the translation maps P' to P''.

Composition of transformations When two or more transformations are combined to form a single transformation, the result is a composition of transformations.

THEOREM 9.4: COMPOSITION THEOREM

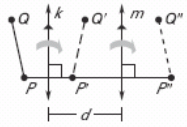
The composition of two (or more) isometries is an isometry.

THEOREM 9.5: REFLECTIONS IN PARALLEL LINES THEOREM

If lines k and m are parallel, then a reflection in line k followed by a reflection in line m is the same as a translation.

If P'' is the image of P, then:

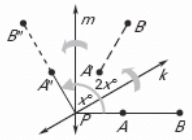
1. $\overline{PP''}$ is perpendicular to k and m, and
2. $PP'' = 2d$, where d is the distance between k and m.



THEOREM 9.6: REFLECTIONS IN INTERSECTING LINES THEOREM

If lines k and m intersect at point P, then a reflection in k followed by a reflection in m is the same as a rotation about P.

The angle of rotation is $2x°$, where $x°$ is the measure of the acute or right angle formed by k and m.



VOCABULARY

Line symmetry A figure in the plane has line symmetry if the figure can be mapped onto itself by a reflection in a line.

Line of symmetry In line symmetry, a line of reflection is called a line of symmetry.

Rotational symmetry A figure in a plane has rotational symmetry if the figure can be mapped onto itself by a rotation of 180° or less about the center of the figure.

Center of symmetry In rotational symmetry, the center of a figure is called the center of symmetry.

VOCABULARY

Scalar multiplication Scalar multiplication is the process of multiplying each element of a matrix by a real number or *scalar*.