Important Concepts of Grade 8 Mathematics

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W3 - Lesson 5..........................Congruence of Polygons
W3 - Review
W3 - Quiz

Materials Required
Protractor
Ruler
Calculator

No Textbook Required
This is a stand-alone course.

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OBJECTIVES

By the end of this lesson, you will be able to:

• Determine the coordinates of the vertices of an image following a given combination of transformations of the original figure.

• Draw the original figure and determine the coordinates of its vertices, given the coordinates of the image’s vertices and a description of the transformation (translation, rotation, reflection).

GLOSSARY

**Tessellation** – a design that consists of congruent copies of a shape with no overlaps or gaps; a tessellation can consist of one shape or a combination of shapes.

**Transformations** – the act of moving a shape from one location to another location on the coordinate plane without changing its size or shape.

**Translation** – a move in a straight line to another position on the same flat surface

**Reflection** – a shape and its image in a line of reflection.

**Rotation** – a shape turned about a fixed point
W3 - Lesson 5: Congruence of Polygons

Materials required:

- Paper, Pencil, Calculator, Square dot paper, Grid paper

Congruence of Polygons

A transformation is the act of moving a shape from one location to another location on the coordinate plane without changing its size or shape.

A translation is a move in a straight or diagonal line to another position on the same flat surface.

A reflection shows a shape and its image in a line of reflection. The reflection can be a vertical reflection or a horizontal reflection.
A rotation is a shape turned about a fixed point. The rotation can happen in a clockwise direction or the counterclockwise direction.

Original position | 90° rotation clockwise | 180° rotation clockwise

A horizontal reflection, the x-coordinates stay the same and the y-coordinates change to the opposite values.

A vertical reflection, the y-coordinates stay the same and the x-coordinates change to the opposite values.
270° rotation clockwise

90° rotation counterclockwise

180° rotation counterclockwise

270° rotation counterclockwise
Example 1

Identify the transformation illustrated in the following diagram.

Step 1: Determine the coordinates of the original shape.

A(-2, -5), B(1, -1), C(-1, 3)

Step 2: Determine the coordinates of the image.

A'(1, -3), B'(4, 1), C(2, 5)

Step 3: Determine the transformation.

The shape has moved 3 units to the left and 2 units up. This diagram illustrates a translation.
Example 2

Identify the transformation illustrated in the following diagram.

![Diagram](image)

Step 1: Determine the coordinates of the original shape.

A(-2, 1), B(-4, 3), C(-5, 0), D(-5, -2), E(-2, -4)

Step 2: Determine the coordinates of the image.

A'(2, 1), B'(4, 3), C'(5, 0), D'(5, -2), E'(2, -4)

Step 3: Determine the transformation.

The second shape is a mirror image of the original shape. The y-coordinates are the same and the x-values have changed to their opposite values. This diagram illustrates a reflection about the y-axis.
Practice Questions

1. Identify the transformation illustrated in the following diagram.

Answer:
Step 1: Determine the coordinates of the original shape.

\[ A(1, 3), B(3, 2), C(0, 0) \]

Step 2: Determine the coordinates of the image.

\[ A'(1, -3), B'(-3, -2), C'(0, 0) \]

Step 3: Determine the transformation

*The coordinates of the image are opposite in value to the coordinates of the original shape. This diagram illustrates a rotation 180° rotation clockwise or counterclockwise.*
2. Identify the transformation illustrated in the following diagram.

Answer:

Step 1: Determine the coordinates of the original shape.

\[ A(3, 1), B(3, -2), C(4, -2), D(4, -3), E(1, -3), F(1, 1) \]

Step 2: Determine the coordinates of the image.

\[ A'(-2, +5), B'(-2, +2), C'(-1, 2), D(-1, +1), E(-4, 1), F'(-4, 5) \]

Step 3: Determine the transformation.

*There is a difference of 5 units in the x-coordinates and 4 units in the y-coordinates. The shape has moved 5 units to the left and 4 units up. This diagram illustrates a translation.*
Constructing Tessellations

A tessellation is a design that consists of congruent copies of a shape with no overlaps or gaps. A tessellation can consist of one shape or a combination of shapes.

To make a tessellation, take the original shape and apply a series of translations, reflections, and rotations to it.

In order for a shape to tessellate, the point where the vertices of the original shape meet, the sum of the angles must be $360^\circ$.

$$50^\circ + 50^\circ + 130^\circ + 130^\circ = 360^\circ$$
Practice Questions

1. Tessellate the following shape.

![Tessellation Shape](image)

Answer:

![Completed Tessellation](image)

2. Determine if the following shapes will tessellate:

a. 

![Triangle Tessellation](image)

Answer:

No this shape will not tessellate because no matter how you arrange the shapes, the point of tessellation will never be 360°.
Yes this shape will tessellate because when you arrange the shapes beside each other, the point of tessellation is $360^\circ$. 

Answer:
Lesson 5: Assignment

1. Identify the following transformations.
   a. Rotation 180° clockwise or counterclockwise

   Answer:
   Rotation 180° clockwise or counterclockwise

   b. Reflection

   Answer:
2. Transform the following shapes.

a. Translate the following shape 6 units right and 4 units down.

Answer:

b. Reflect the following shape across the y-axis.

Answer:
c. Reflect the following shape 270° clockwise.

![Reflecting shape](image)

Answer:

![Answer](image)

3. Tessellate the following shapes.

a.

![Tessellating shapes](image)

Answer:

![Answer](image)
b. Answer:

4. Determine if the following shapes will tessellate.

a. Answer:

*Yes, this shape will tessellate because when you arrange the shapes beside each other, the point of tessellation will be 360°.*
b. 

Answer:

*No this shape will not tessellate because no matter how you arrange the shapes, the point of tessellation will never be 360°.*