**G.CO.2**

**CONCEPT 1 – Describe transformations as functions that take points in the plane as inputs and give other points as outpoints.**

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| --- | --- |
| **Sometimes function are described as input/output machines. The example to the right shows the input/output machine of . When we input x = -1, the function machine produces the output of 4.** |  |

**CONNECTION TO GEOMETRY**

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| --- | --- |
|  | English Translation:  Coordinate Rule T maps all points (x,y) to (x + 3, y – 6) |

**CONCEPT 2 – A transformation is a one to one function.**

**Function & Mapping** -- The word mapping is used in geometry as the word function is used in algebra. While a mapping is a correspondence between sets of points, a function is a correspondence between sets of numbers. **Function and Mapping mean the same thing but just in two different contexts, in Algebra and in Geometry.**

A correspondence between two sets A and B is a **FUNCTION** of A to B IF AND ONLY IF each member of A corresponds to one and only one member of B.

A correspondence between the pre-image and image is a **MAPPING** IF AND ONLY IF each member of the pre-image corresponds to one and only one member of the image.

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| --- | --- | --- | --- |
| **ONE TO ONE FUNCTION** | **NOT ONE TO ONE FUNCTION** | **A TRANSFORMATION** | **NOT A TRANSFORMATION** |
|  |  |  |  |

**Transformations and One to One Correspondence Functions**A transformation is a one to one correspondence between the points of the pre-image and the points of the image. We will only be studying transformations. A transformation guarantees that if our pre-image has three points, then our image will also have three points.

**CONCEPT 3 –** **Compare transformations that preserve distance and angle (i.e. rigid motions) to those that do not (e.g. translation vs. horizontal stretch).**

An **ISOMETRIC TRANSFORMATION (RIGID MOTION**) is a transformation that preserves the distances and/or angles between the pre-image and image.

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| --- | --- | --- |
| Example #1 | Example #2 | Example #3 |
|  |  |  |

Rotate (Turn) – Example #1 Translate (Slide) – Example #2 Reflection (Flip) - Example #3

A **NON-ISOMETRIC TRANSFORMATION (NON-RIGID MOTION)** is a transformation that does not preserve the distances and angles between the pre-image and image.

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| --- | --- | --- |
| Example #1 | Example #2 | Example #3 |
|  |  |  |

**Stretch** – Where one dimension’s scale factor is different than the other dimension’s scale factor. Examples #2 and #3 represent stretches. A stretch definitely distorts the shape making it a NON-ISOMETRIC transformation.

**Dilation** – Where both dimension’s scale factors is the same. The shape is proportional, not identical. Dilation changes the size of the shape making it a NON-ISOMETRIC transformation.

There are many ways to distort a shape but these two are the most popular.

**G.CO.3**

**CONCEPT 1 – Given a shape describe the rotations and reflections that carry it onto itself.**

**To carry a shape onto itself is another way of saying that a shape has symmetry.** There are three types of symmetries that a shape can have: line symmetry, rotation symmetry and point symmetry. Let us look at each of these.

**LINE SYMMETRY (or REFLECTIONAL SYMMETRY)**

**ROTATIONAL SYMMETRY**

**POINT SYMMETRY**

**CONCEPT 2** - Given a **rectangle, parallelogram, trapezoid, or regular polygon,** describe the rotations and reflections that carry it onto itself.

**G.CO.4**

**THE ISOMETRIC TRANSFORMATIONS**

After a transformation, the pre-image and image are identical.

**(1) THE REFLECTION**

**The line of reflection is the perpendicular bisector of the**

**segment joining every point and its image.**

After a reflection, the pre-image and image are identical.

* **DISTANCES ARE DIFFERENT** -- Points farther away from the line of reflection move a greater distance than those closer to the line of reflection. Notice that because line m is the perpendicular bisector to ,  and  they are all parallel to each other.
* **ORIENTATION IS REVERSED** –
* **SPECIAL POINTS** – Points on the line of reflection do not move at all under the reflection. The pre-image (D) = image (D’) when the point is on the line of reflection.

**(2) THE ROTATION**

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| --- | --- |
|  |  |
|  |  |

**EQUIVALENT ROTATIONS = initial angle of rotation + 360 OR initial angle of rotation - 360**

* **DISTANCES ARE DIFFERENT** -- Points in the plane move different distances, depending on their distance from the center of rotation.
* **ORIENTATION IS THE SAME**
* **SPECIAL POINTS** – The center of rotation is the only point in the plane that is unchanged, O = O’.

**(3) THE TRANSLATION**

**T (x,y) ------------------- > (x + 3, y + 4)**

****

1. AA’ = BB’ (a fixed distance).

2.  (a fixed direction).

* **DISTANCES ARE THE SAME** -- Points in the plane all map the exact same distance. Notice how AA’ is EQUAL TO BB’.
* **ORIENTATION IS THE SAME**
* **SPECIAL POINTS** – There are NO special points, **ALL POINTS IN THE PLANE MOVE!!!**

**RULE FOR REFLECTION OVER THE Y AXIS** 

**RULE FOR REFLECTION OVER THE X AXIS** 

**RULE FOR REFLECTION OVER THE Y = X LINE** 

**RULE FOR ROTATION BY 90 ABOUT THE ORIGIN** 

**RULE FOR ROTATION BY 180 ABOUT THE ORIGIN** 

**RULE FOR ROTATION BY 270 ABOUT THE ORIGIN** 

**G.CO.4 COMPOSITE FUNCTIONS**

**ORDER MATTERS (Work from the inside out)**

A double reflection over parallel lines is a TRANSLATION.

The translation is double the distance between the parallel lines and the ORDER determines the DIRECTION.

A double reflection over intersecting lines is a ROTATION.

The rotation is double the angle formed between the intersecting lines and the angle direction will be determined by the order of the reflections.