**The Shape and Space Strand: Outcome SS7.5**

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| **Outcome** | **Indicators** |
| SS7.5 Expand and demonstrate an understanding of transformations (translations, rotations, and reflections) of 2-D shapes in all four quadrants of the Cartesian plane.  [CN, PS, T, V]  *In support of the K-12 Mathematics goals of Spatial Sense, Number Sense, Logical Thinking and Mathematical Attitude..* | *(It is intended that the original shape and its image have vertices with integral coordinates.)*   1. Identify the coordinates of the vertices of a 2-D shape shown on a Cartesian plane. 2. Describe the horizontal and vertical movement required to move from a point to another point on a Cartesian plane. 3. Describe the positional change of the vertices of a 2-D shape to the corresponding vertices of its image as a result of a transformation or successive transformations on a Cartesian plane. 4. Determine the distance between points along horizontal and vertical lines in a Cartesian plane. 5. Perform a transformation or consecutive transformations on a 2-D shape and identify coordinates of the vertices of the image. 6. Describe the positional change of the vertices of a 2-D shape to the corresponding vertices of its image as a result of a transformation or a combination of successive transformations. 7. Describe the image resulting from the transformation of a 2-D shape on a Cartesian plane by identifying the coordinates of the vertices of the image. |
| **Learning Space** [**Top**](#top) | |
| In grade six, the students studied transformations of 2-D shapes in the first quadrant of the Cartesian plane where the coordinates of the vertices of the 2-D shapes are whole numbers. This outcome expands the students’ exploration and understanding of transformations of 2-D shapes on the entire Cartesian plane. It provides yet another context in which the students can practice and become confident in their skills of reading and plotting points in a coordinate plane.  It is very natural for the students to use the terms flip, slide, and turn to describe the movement resulting from a transformation. The use of these terms should not be deemed inappropriate, however; the students should also be familiar with and be able to use the mathematical terms of reflection, translation and rotation as well as the general term of a transformation.  Although this outcome focuses on the carrying out of the transformation and the position of the vertices of the resulting image, students should also be engaged in comparing the original 2-D shape with its image. This can be done through asking the students to compare the shape, size of the shape, and orientation of the shape. It is important for the students’ spatial sense development that these transformations move the shape, but do not fundamentally change it.  The study of transformations not only provides a context for practicing their skills in working on a Cartesian plane, but it also can be tied in to the students study of the areas of 2-D shapes. In both physical education and arts education, the students can describe their movements in terms of transformations, and specifically in terms of translations, reflections, and rotations. | |

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| **What Students Should…** [**Top**](#top) | | |
| **Know**   * The terms transformation, reflection, translation, and rotation. | **Understand**   * That a transformation on a 2-D shape must be applied to every point on the 2-D shape. * Transformations in the form of translations, rotations, and reflections move the 2-D shape and may change it’s orientation, but the shape and size of the 2-D shape does not change. * Different transformations can be used to change a 2-D shape to a particular image. * The transformation applied to the vertices of a 2-D shape impacts each vertex in the same way. * If the vertices of a 2-D shape are transformed, they can be connected in the same order as they were in the original shape to get the transformed image of the shape. * A transformation describes horizontal and vertical movements of a 2-D shape. * It is necessary to have a convention for describing transformational and positional change (e.g., horizontal, vertical). | **Be Able to Do**   * Carry out transformations (translations, reflections and rotations) on a Cartesian plane. * Write the coordinates of the image of a 2-D shape after a transformation of that shape has been completed. * Given two 2-D shapes, describe transformations that could be used to take one shape to the other and vice versa. |
| **Key Questions** [**Top**](#top) | | |
| * What changes happen to a 2-D shape when transformations are carried out? * How can you figure out what transformations occurred to get from a given 2-D shape and its image on a Cartesian plane? * Why do you only need to transform the vertices of a 2-D shape in order to draw the transformed image? * How can you describe a transformation? | | |

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| **Suggestion for Assessment:** [**Top**](#top) |
| **Big Idea:**  Transformations on a Cartesian plane  **Suggestions for assessment tasks:**   1. Provide the students with a series of 2-D shapes shown on a Cartesian plane, a possible image, and a specific transformation that was to have occurred. Have the students verify the transformations that are correct, and have them correct those transformations that are incorrect. Ask the students to explain their strategies for determining if the transformations are correct and for carrying out correct transformations for those examples that have errors.   **What to look for:**   * See [*Transformations on a Cartesian Plane Rubric*](file:///C:\Users\kw426\AppData\Local\Temp\Transformations%20on%20a%20Cartesian%20Plane%20Rubric.doc)*.* |
| **Suggestions for Instruction:** [**Top**](#top) |
| **Big Idea:**  Transformations on a Cartesian plane.  **Suggestions for instructional activities**   1. Have the students all stand beside their desks and give them transformational directions (right 2 steps, back 3 steps, up one level, reflect along the vertical centre of the room…). Have the students discuss their reasoning for each movement. This can also be done using small figures at the desk, or any manipulative available. 2. Ask the students where on their desk they would put the origin of a Cartesian plane and then have them construct a Cartesian plane using masking tape on their desk. Ask the students to put a marker on a point in the 2nd quadrant of the Cartesian plane. Give the students a transformation to carry out and have the students discuss their strategies and reasoning with a partner. Using this new point as their starting point, give the students a different transformation to carry out. Repeat this a few times, then ask the students to describe two different transformations or sets of transformations that would put their new location at a particular point (the origin or any other point will work). A large scale version of this could be done outside, with lines marked in the dirt and each student being given a different point to stand at. 3. Have the students in groups of 4. Give each group a set of cards, each of which has either the original 2-D shape shown on a Cartesian plane, an image of a Cartesian plane on a Cartesian plane, or a description of a transformation. Use different 2-D shapes (triangle, square, parallelogram, trapezoid…) so that the students mostly focus on trying to describe how the two identical shapes are related to each other. Ask the students to match the cards into sets of 3: shape, image, and description of transformation. Encourage the students to use any tools that they feel will be beneficial, such as MIRA, cut outs, or paper folding. Have the groups share their conclusions with the class and discuss any disagreements about pairings. 4. In pairs, have the students draw a 2-D shape on a Cartesian plane. Have their partner give them a transformation to carry out (e.g., rotate it 180° around the origin) and then have the partner check their image against the original shape and transformation directions. If there is a disagreement between partners, have them consult a second group. 5. Once the students are feeling comfortable with the transformations have groups of four create their own set of cards to be sorted by another group. Encourage the students to include a wide variety of difficulty levels in the matches. |