**The Shape and Space Strand: Outcome SS4.4**

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| **Outcome** | **Indicators** |
| SS4.4. Demonstrate an understanding of line symmetry by:* identifying symmetrical 2-D shapes
* creating symmetrical 2-D shapes
* drawing one or more lines of symmetry in a 2-D shape.

[C, CN, V]*In support of the K-12 Mathematics goals of Spatial Sense, Logical Thinking and Mathematical Attitude.* | 1. Identify the characteristics of given symmetrical and non-symmetrical 2-D shapes.
2. Sort a set of 2-D shapes as symmetrical and non-symmetrical.
3. Complete a symmetrical 2-D shape given half the shape and its line of symmetry.
4. Explain how symmetry and fractions are related.
5. Identify lines of symmetry in a set of 2-D shapes and explain why each shape is symmetrical.
6. Determine whether or not a given 2-D shape is symmetrical by using a Mira or by folding and superimposing.
7. Create a symmetrical shape with and without manipulatives.
8. Provide examples of symmetrical shapes found in the environment and identify the line(s) of symmetry.
9. Sort a given set of 2-D shapes as those that have no lines of symmetry, one line of symmetry, or more than one line of symmetry.
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| **Learning Space:** [**Top**](#top) |
| Symmetry is in many ways a very intuitive concept. Prior to grade 4, students have not formally studied symmetry, but they have probably had many experiences in which they have made use of symmetry. For example, students often make hearts on valentines day by folding paper and cutting out a shape that is half of a heart, or make snowflakes by cutting designs into multi-folded paper. As well, symmetry is very common in the world. Symmetry is also a very powerful concept in mathematics, and so it is important that the students have a lot of hands-on learning experiences. It is also very important for students to realize what asymmetry (not having symmetry) looks like.The concept of symmetry can be easily linked to both the students’ study of fractions and of area and can serve as a connection between the two ideas. Students can use lines of symmetry to define fractions of a 2-D shape, such as ½, ¼, or ¾. These fractions represent fractions of the area of the 2-D shape. Students can explore the area of each ½ or ¼ of the 2-D shape that are defined by the lines of symmetry and use the relationships they discover to generalize strategies for determining the entire area of 2-D shapes. When students explore bar graphs and pictographs they may also be able to identify whether the data and the displays appear to be symmetrical. Symmetry in statistical analysis is a very powerful occurrence.There are also many connections between symmetry and the other subject areas that students study. In grade 4 arts education, a major focus is on the achievement and effect of symmetry in the arts. Students will likely also find examples and implications of symmetry in science. Some students may be interested in exploring how beauty is perceived and defined in different cultures and the impact of those perceptions in advertising and everyday life. In many cultures, facial symmetry is felt to define beauty, while in other cultures facial asymmetry is seen as beautiful.  |
| **What Students Should…** [**Top**](#top) |
| **Know*** the terms “symmetry” (asymmetrical is optional) and “lines of symmetry”.
 | **Understand*** lines of symmetry define fractions (½, ¼…) of area.
* there are other fractions of area that cannot be represented by lines of symmetry (such as 1/3).
* not all 2-D shapes have lines of symmetry.
* 2-D shapes with a line of symmetry may or may not have more lines of symmetry and explain what it is about the shape that is causing this.
 | **Be Able to Do*** identify lines of symmetry.
* determine lines of symmetry using miras, paper folding, or superimposing of shapes.
* identify the number of lines of symmetry in 2-D shapes.
* identify lines of symmetry in the environment.
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| **Key Questions:** [**Top**](#top) |
| * What other mathematical ideas is symmetry related to?
* Where do you find symmetry?
* Why do different shapes have different numbers of lines of symmetry, including none?
* Why can a line of symmetry not divide a 2-D shape into thirds?
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| **Suggestions for assessment:** [**Top**](#top) |
| **Big Idea:**Identifying, creating and analyzing symmetrical 2-D shapes. **Suggestions for assessment tasks:**1. Have the students find a design or piece of art (including dance) and identify, with verification, the lines of symmetry in it.
2. Give the students a picture of a 2-D shape and identify one side of the 2-D shape as being contained in a line of symmetry for a larger shape. Ask the students to construct the picture of the larger shape using that line of symmetry and explain the strategy they used.
3. Give the student a picture of a 2-D shape that has a number of lines of symmetry. Give the students the area of a region formed by the lines of symmetry and ask the students to determine the area of the entire 2-D shape.

**What to look for:*** See the [*Symmetry* Rubric](file:///C%3A%5CUsers%5Cru593%5CAppData%5CLocal%5CTemp%5CSymmetry%20Rubric.doc)**.**
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| **Suggestions for instruction:** [**Top**](#top) |
| **Big Idea:**Identifying, creating and analyzing symmetrical 2-D shapes.**Suggestions for instructional activities:**1. Have the students fold pieces of paper in half, and then show them a shape to draw against the fold line. Ask the students to predict what shape they would get if they cut along the drawn lines and then unfolded the paper. Do a couple with the students and then have them go in pairs to challenge each other by predicting the shapes that they design against the fold line. The students can also be given the further challenge of using a horizontal and vertical fold. Debrief the activity by asking the students to explain their strategies for predicting the shape they would get. As the students identify the fold line and its relationship to the shape, give them the term “line of symmetry”. Have the students write their own definition, including examples, of line of symmetry in their journal.
2. Using the shapes from the first learning activity for the previous big idea, have the students return to their pairs and ask them to do tasks with the symmetrical shapes they created: try to find other lines of symmetry and find at least one line of each shape that would not be a line of symmetry. Debrief with the class again, discussing why some shapes had more lines of symmetry and why some didn’t. Also discuss their strategies for finding the other lines of symmetry. Have the students add their new ideas to their journal entry on symmetry.
3. Using fraction blocks, have the students do two different tasks:
4. Create a symmetrical design using fraction blocks and explain their strategies to a partner.
5. Show that the regular hexagon (yellow) is symmetrical and determine how many of lines of symmetry it has.

Debrief the tasks by discussing the strategies used and any new ideas they have about symmetry (repetition and superimposing). If the students don’t think about lines of symmetry dividing the shape in ½, ask the students to explore the relationship between the lines of symmetry for a 2-D shape and fractions.1. Give the students a MIRA, and using the paper cut-outs they made earlier, the symmetrical designs they created, and the fraction blocks, have the students work in pairs to explore how the MIRA can be used to confirm that a shape is symmetrical. Also ask the students to find shapes in the classroom that they can show are not symmetrical using the MIRA.
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