**The Shape and Space Strand: Outcome SS7.3**

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| **Outcome** | **Indicators** |
| SS7.3 Demonstrate an understanding of 2-D relationships involving lines and angles.  [CN, R, V, T]  *In support of the K-12 Mathematics goals of Spatial Sense and Logical Thinking and Mathematical Attitude.* | 1. Identify and describe examples of parallel line segments, perpendicular line segments, perpendicular bisectors, and angle bisectors in the environment. 2. Identify, with justification, line segments on a diagram that are parallel or perpendicular. 3. Investigate and explain how paper, pencil, compass, and rulers can be used to construct parallel lines, perpendicular lines, angle bisectors, and perpendicular bisectors. 4. Investigate how paper folding can be used to construct parallel lines, perpendicular lines, angle bisectors, and perpendicular bisectors. 5. Use technology to construct parallel lines, perpendicular lines, angle bisectors, and perpendicular bisectors. 6. Draw a line segment perpendicular to another line segment and explain why they are perpendicular. 7. Draw a line segment parallel to another line segment and explain why they are parallel. 8. Draw the bisector of a given angle using more than one method and verify that the resulting angles are equal. |
| **Learning Space** [**Top**](#top) | |
| In grade six, the students have studied angle measures and how to construct different triangles in different orientations. They also studied the relationships between angles and sides in polygons. Grade seven takes these experiences that the students have had and provides them with opportunities to formally construct these geometrical figures and relationships. This outcome could easily be addressed prior to, or during the students learning about the area of triangles and parallelograms and then the students understanding of parallel and perpendicular lines can be integrated into their drawing of parallelograms and triangles.  If students are challenged to figure out how they might construct perpendicular lines, parallel lines, angle bisectors, and perpendicular bisectors rather than being shown the steps to follow their learning will be based upon their prior understandings, making the new learnings deeper and interconnected. Students who are visual/spatial learners will excel in this type of learning activity, and other students will strengthen their visual/spatial thinking as well.  The most obvious connections to other subject areas are in the notions of design and visual art, although dance and physical education can also tap into the ideas developed in this learning outcome. | |

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| **What Students Should…** [**Top**](#top) | | |
| **Know**   * The terms parallel, perpendicular, and bisector. | **Understand**   * The relationship between parallel lines. * The relationship between perpendicular lines. * The properties resulting from constructing a perpendicular bisector. * The properties resulting from constructing an angle bisector. * Constructions of geometric relationships reflect the geometric properties. (e.g., a bisector is constructed by finding a way to ensure that the line segment or angle is cut exactly in half)**.** | **Be Able to Do**   * Construct using manipulatives, paper folding and technology parallel lines, perpendicular lines, a perpendicular bisector, and an angle bisector. * Verify a construction by using measurement. |
| **Key Questions** [**Top**](#top) | | |
| * What makes lines parallel? * What makes lines perpendicular? * What makes a line an angle bisector? * What makes a line a perpendicular bisector? * How can you verify your constructions? | | |
| **Suggestions for Assessment:** [**Top**](#top) | | |
| **Big Idea:**  Constructions and Geometrical Properties  **Suggestions for assessment tasks:**   1. Have the students create a picture or design that incorporates parallel lines, perpendicular lines, perpendicular bisectors and angle bisectors. Using a transparent overlay, have the students’ highlight an example of each construction in their picture or design. As a class, create a rubric (referring to *Constructions and Geometrical Properties Rubric*  as well as including class specific criteria) against which the pictures or designs are to be assessed. 2. Have the students write a manual for how to make the four types of constructions. In the manual they must include at least one set of instructions involving paper folding, one involving compass and straight edge, one involving MIRA and one involving technology. The students must also explain why the steps “work”.   **What to look for:**   * See *Constructions and Geometrical Properties.* | | |
| **Suggestions for Instruction:** [**Top**](#top) | | |
| **Big Idea:**  Constructions and Geometrical Properties  **Suggestions for instructional activities**   1. Provide pairs of students with drawings of parallel lines, perpendicular lines, angle bisectors, and perpendicular bisectors. Be sure to include examples that include more than one type of geometrical relationship, such as parallel lines with a perpendicular line crossing them. Have the students discuss each drawing and decide what label they would give it. Do not tell the students that some of the drawings show more than one geometrical relationship - instead let them debate and discuss this as it arises in their pairs. Debrief the activity as a class. Have them discuss conclusions that they feel they can make, such as a perpendicular bisector is always forms perpendicular lines, a perpendicular bisector also is an angle bisector, and two lines perpendicular to the same line are parallel. Challenge the students to try to find contradictions to these generalizations before moving on. Discuss how this information could be useful when trying to construct (accurately draw) one of these geometrical relationships. 2. Have the students identify examples of the four geometrical relationships in objects and environments in their lives. 3. Provide pairs (or small groups) of students with compasses and straightedges, MIRAs, access to dynamic geometrical construction software (such as Geometric Supposer), and paper for paper folding. Tell them that their task is to figure out how to use each of the four sets of tools to construct parallel lines, perpendicular lines, a perpendicular bisector, and an angle bisector. Encourage the students to compare how the paper folding, compass and straightedge, and MIRA approaches are similar. Have the students share their strategies and try out alternative approaches. 4. Have the students copy a diagram that contains at least one of each type of construction. | | |