



## Indirect Measurement Techniques – Grade Eight

### **Ohio Standards Connection:**

#### **Measurement**

##### **Benchmark D**

Use proportional reasoning and apply indirect measurement techniques, including right triangle trigonometry and properties of similar triangles, to solve problems involving measurements and rates.

##### **Indicator 7**

Apply proportional reasoning to solve problems involving indirect measurements or rates.

#### **Geometry and Spatial Sense**

##### **Benchmark B**

Describe and apply the properties of similar and congruent figures; and justify conjectures involving similarity and congruence.

##### **Indicator 3**

Use proportions in several forms to solve problems involving similar figures (part-to-part, part-to-whole, corresponding sides between figures).

### **Lesson Summary:**

*Students explore three different indirect measurement techniques in this lesson that include using shadows and concepts of similarity, using mirrors to see reflected images and applying concepts of similarity to those images, and using a device and technique modeled after that used by real-life surveyors called a stadia. Students work together in small groups to solve problems and discuss solutions. Students reflect on the use of indirect measurement techniques and apply to real-world situations. Students use these techniques in the post-assessment to measure structures in their environment.*

**Estimated Duration:** Three Hours

### **Commentary:**

This lesson provides real-world applications for using proportional reasoning and the trigonometric principle of similar triangles. It assumes that students have prior knowledge of these concepts. A stadia is a surveying tool used to make rapid and efficient topographical measurements. Contact a local engineering firm to provide experiences with surveying tools and career information.

### **Instructional Tip:**

This lesson may be used as a whole, in parts or with other lessons when there is a need for indirect measurement using proportional reasoning. The lesson consists of three different methods of indirect measurement for gauging things that are otherwise difficult or impossible to measure directly.

### **Pre-Assessment:**

- Direct the students to complete *Indirect Measurement Pre-Assessment*, Attachment A. Review the student responses and discuss solution methods.