

## **B0: OVERVIEW OF DILATIONS (UNIT B)**

This unit focuses primarily on dilations, with some summary activities that integrate isometries and dilations. Some of the activities refer back to lessons in the Isometries unit so please refer to that folder to find the A lessons.

In this unit you will find a series of resources that can serve as the backbone for a dilations unit. We recommend that the facilitator review all of activities, and then select the ones that best fit the needs of the training. While reviewing materials, facilitators may want to:

- make answer keys,
- take note of the materials needed,
- identify grouping and share out structures,
- determine what (and how) technology will be used,
- write down key questions that will insure that important ideas are discussed,
- make time estimates.

Throughout this unit participants have the opportunity to engage in activities that involve the CCSS-M mathematical practices. In particular, the following mathematical practices are prominent in this unit.

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Use appropriate tools strategically.
5. Attend to precision.
6. Look for and make use of structure.
7. Look for and express regularity in repeated reasoning.

### **DAY 1:**

#### **Session 1: Introduction**

- B1.1: Transformation Overview. This document has a summary of key ideas relative to dilations, including definitions and theorems. It can be used by the facilitator as background or may be given to participants, particularly for a high school institute, either as a summary of big ideas developed in the institute, or part at a time as ideas are being worked on.
- B1.2: Overview of Isometries: Do Overview Lesson in A1 in Isometry Unit through pp3. This provides an overview of transformations and isometries that may serve as a review before dilations are undertaken.

#### **Session 2: Intuitive Development of Dilation**

- B1.3: Investigating Dilations Using Pattern Blocks. This activity uses Pattern Blocks to build larger, similar shapes to some of the basic pattern block shapes. Then an informal

dilation is set up using one's eye as the center of the dilation, so that a single shape covers the enlarged one. Measurements should generate the scale factor, and linear and area measures are compared for similar shapes.

### **Session 3: Development of Concept and Notation**

- B1.4: Do Overview Lesson in A1 in Isometry Unit pp. 4-5. This activity is a hands on activity using rubber bands to create a dilation. Then properties of isometries and dilations are explored.

### **Additional Resources:**

CaCCSS Introduction; Annotated Bibliography; CaCCSS Geometry Word Bank; Assessments

## **DAY 2**

### **Session 1: Dilations in Coordinate Plane**

- B2.1: Investigating Dilations in the Coordinate System 1. This activity can be done using dynamic geometry software (ideal) or on graph paper if computers are not readily available. It explores the effect of multiplying both coordinates of points by a fixed number, measuring lengths of the new triangle as well as distances of points from the center point.

### **Session 2: Dilations in Coordinate Plane**

- B2.2: Investigating Dilations in the Coordinate System 2. These GeoGebra activities further explore the effect of changing the scale factor on lengths of sides of triangles, quadrilaterals, and pentagons. Either the scale factor can be changed or points can be moved, with associated distances automatically calculated. Computers are needed for this activity.

### **Session 3: Investigating Similar Triangles**

- B2.3 Similar Triangles. This activity reinforces the effect of dilations on lengths in triangles and areas of triangles, leading to the concept of similar triangle. You might also have students measure corresponding angles.

## **DAY 3**

### **Session 1: Properties**

- B3.1: Properties of Dilations. Participants explores basic properties of dilations, including group properties.

### **Session 2: Transformations with Coordinates**

- B3.2: Investigating Transformations Using Coordinates. Participants perform dilations of the plane using different rational numbers as scale factors. They observe the effect of the dilation on a figure. (See A5, Part 4)

### **Session 3: Measurements under Dilations**

- B3.3: Perimeter and Area. In this computer-based activity, participants explore the effect of dilations on perimeter and area of triangles.
- B3.4: Investigating Surface Area and Volume under Dilations. Surface area and volume of prisms are explored for various scale factors, including fractional ones. Unit cubes are useful to have for this activity.

## **DAY 4**

### **Session 1: Similarity**

- B4.1: Similar Figures. Similar figures are defined using dilations combined with isometries. Careful drawings are needed using protractors, straight edges, and tracing paper.

### **Session 2: Justification and Proof**

- B4.2: Justification. Some basic problems using similar figures call for justification of similarity based on dilations.

### **Session 3: Dilation Problems**

- B4. 3 Problem Solving Using Dilations. A set of dilation problems that can be solved by hand or on the computer. Hint cards might be used for groups that get stuck. Each group might be assigned one problem to share solution(s) for with the whole group.

## **DAY 5**

### **Session 1: Extensions**

- B5.1: Algebraic Transformations. Algebraic transformations are performed on a flag (thus orientation) to explore which represent isometries, which represent dilations, and which represent neither an isometry nor a dilation.

### **Session 2: Summary of All Transformations**

- B5.2: Analysis of Transformations. This activity integrates isometries and dilations by having participants focus on fixed points, lines that map to themselves, and lines that map to parallel lines.

### **Session 3: Assessment**

- B5.3: Assessment Items Dilation. These problems might be used as a final assessment of understanding of the key ideas in the unit.