MISSION OVERVIEW

GRADE 7

M1 Scale Drawings

Introduction

In this Mission, students learn to understand and use the terms “scaled copy,” “to scale,” “scale factor,” “scale drawing,” and “scale,” and recognize when two pictures or plane figures are or are not scaled copies of each other. They use tables to reason about measurements in scaled copies, and recognize that angle measures are preserved in scaled copies, but lengths are scaled by a scale factor and areas by the square of the scale factor. They make, interpret, and reason about scale drawings. These include maps and floor plans that have scales with and without units.

Overview of Topics and Lesson Objectives

Each mission is broken down into topics. A topic is a group of lessons that teach the same concept. There is a balance of Independent Digital Lessons and Concept Explorations in each topic of a mission to ensure every student learns with a mix of modalities, feedback, and support while engaging in grade-level content. Throughout each mission, students work on grade-level content with embedded remediation to address unfinished learnings.

	Objective	INDEPENDENT DIGITAL LESSON	CONCEPT EXPLORATION
Topic A	**Scaled Copies**		
Lesson 1	Differentiate between scaled and non-scaled copies of a figure.	✓	✓
Lesson 2	Identify corresponding parts and determine the scale factor between two figures.	✓	✓
Lesson 3	Draw a scaled copy of a given figure using a given scale factor.	✓	✓
Lesson 4	Use corresponding sides, corresponding distances and corresponding angles to tell whether one figure is a scaled copy of another.	✓	✓
Lesson 5	Describe how scale factors of 1, less than 1, and greater than 1 affect the size of a scaled copy, and explain how scaling can be reversed using reciprocal scale factors.	✓	✓
Lesson 6	Describe how the area of a scaled copy is related to the area of the original figure and the scale factor that was used.	X	OPTIONAL
Topic B	**Scale Drawings**		
Lesson 7	Use a scale drawing and its scale to calculate actual distances.	✓	✓
Lesson 8	Use scale drawings to estimate distance traveled, speed, and elapsed time.	X	OPTIONAL
Lesson 9	Determine the scale and the dimensions of a scale drawing when given the actual dimensions of an object.	✓	✓
Lesson 10	Reproduce a scale drawing at a different scale and determine how much actual area is represented by one square unit in a scale drawing.	✓	✓
Lesson 11	Explain (orally and in writing) how to use scales without units to determine scaled or actual distances.	X	✓

	Objective	INDEPENDENT DIGITAL LESSON	CONCEPT EXPLORATION
Lesson 12	Use different scales, with or without units, to describe the same drawings.	✓	✓
Topic C	**Let's Put It to Work**		
Lesson 13	Create scale drawings using an appropriate scale.	X	OPTIONAL
End-of-Mission Assessment: Topics A-C			

Foundational Missions

For each mission, Zearn Math highlights the foundational missions, the earlier content where concepts are introduced and developed. Teachers can access foundational missions directly from the mission page of their Teacher Account to address any unfinished learnings. Zearn recommends that teachers assign foundational missions during Flex Day or during additional non-core instruction time. It is important to use a foundational mission to support students who are struggling, rather than an unaligned mission, because the content students learn in each foundational mission supports their Core Day learning.

Foundational Mission(s) for G7M1: G6M1 Topics A-D

Mission Overview

Work with scale drawings in grade 7 draws on earlier work with geometry and geometric measurement. Students began to learn about two- and three-dimensional shapes in kindergarten, and continued this work in grades 1 and 2, composing, decomposing, and identifying shapes. Students' work with geometric measurement began with length and continued with area. Students learned to "structure two-dimensional space," that is, to see a rectangle with whole-number side lengths as an array of unit squares, or rows or columns of unit squares. In grade 3, students distinguished between perimeter and area. They connected rectangle area with multiplication, understanding why (for whole-number side lengths) multiplying the side lengths of a rectangle yields the number of unit squares that tile the rectangle. They used area diagrams to represent instances of the distributive property. In grade 4, students applied area and perimeter formulas for rectangles to solve real-world and mathematical problems, and learned to use protractors. In grade 5, students extended the formula for the area of a rectangle to include rectangles with fractional side lengths. In grade 6, students built on their knowledge of geometry and geometric measurement to produce formulas for the areas of parallelograms and triangles, using these formulas to find surface areas of polyhedra.

In this mission, students study scaled copies of pictures and plane figures, then apply what they have learned to scale drawings, e.g., maps and floor plans. This provides geometric preparation for grade 7 work on proportional relationships as well as grade 8 work on dilations and similarity.

Students begin by looking at copies of a picture, some of which are to scale, and some of which are not. They use their own words to describe what differentiates scaled and non-scaled copies of a picture. As the mission progresses, students learn that all lengths in a scaled copy are multiplied by a scale factor and all angles stay the same. They draw scaled copies of figures. They learn that if the scale factor is greater than 1, the copy will be larger, and if the scale factor is less than 1, the copy will be smaller. They study how area changes in scaled copies of an image.

Next, students study scale drawings. They see that the principles and strategies that they used to reason about scaled copies of figures can be used with scale drawings. They interpret and draw maps and floor plans. They work with scales that involve units (e.g., "1 cm represents 10 km"), and scales that do not include units (e.g., "the scale is 1 to 100"). They learn to express scales with units as scales without units, and vice versa. They understand that actual lengths are products of a scale factor and corresponding lengths in the scale drawing, thus lengths in the drawing are the product of the actual lengths and the reciprocal of that scale factor. They study the relationship between regions and lengths in scale drawings. Throughout the mission, they discuss their mathematical ideas and respond to the ideas of others (MP3, MP6). In the culminating lesson of this mission, students make a floor plan of their classroom or some other room or space at their school. This is an opportunity for them to apply what they have learned in the mission to everyday life (MP4).

In the mission, several lesson plans suggest that each student have access to a *geometry toolkit*. Each toolkit contains tracing paper, graph paper, colored pencils, scissors, centimeter ruler, protractor (clear protractors with no holes that show radial lines are recommended), and an index card to use as a straightedge or to mark right angles. Providing students with these toolkits gives opportunities for students to develop abilities to select appropriate tools and use them strategically to solve problems (MP5). Note that even students in a digitally enhanced classroom should have access to such tools; apps and simulations should be considered additions to their toolkits, not replacements for physical tools.

Note that the study of scaled copies is limited to pairs of figures that have the same rotation and mirror orientation (i.e. that are not rotations or reflections of each other), because the mission focuses on scaling, scale factors, and scale drawings. In grade 8, students will extend their knowledge of scaled copies when they study translations, rotations, reflections, and dilations.

Progression of Disciplinary Language

In this mission, teachers can anticipate students using language for mathematical purposes such as representing, generalizing, and explaining. Throughout the mission, students will benefit from routines designed to grow robust disciplinary language, both for their own sense-making and for building shared understanding with peers. Teachers can formatively assess how students are using language in these ways, particularly when students are using language to:

Represent

- a scaled copy for a given scale factor (Lessons 3 and 5)
- distances using different scales (Lesson 11)
- relevant features of a classroom with a scale drawing (Lesson 13)

Generalize

- about corresponding distances and angles in scaled copies (Lesson 4)
- about scale factors greater than, less than, and equal to 1 (Lesson 5)
- about scale factors and area (Lessons 6 and 10)
- about scale factors with and without units (Lesson 12)

Explain

- how to use scale drawings to find actual distances (Lessons 7 and 11)
- how to use scale drawings to find actual distances, speed, and elapsed time (Lesson 8)
- how to use scale drawings to find actual areas (Lesson 12)

In addition, students are expected to describe features of scaled copies, justify and critique reasoning about scaled copies, and compare how different scales affect drawings. Over the course of the mission, teachers can support students' mathematical understandings by amplifying (not simplifying) language used for all of these purposes as students demonstrate and develop ideas.

The table shows lessons where new terminology is first introduced, including when students are expected to understand the word or phrase receptively and when students are expected to produce the word or phrase in their own speaking or writing. Terms from the glossary appear bolded. Teachers should continue to support students' use of a new term in the lessons that follow where it was first introduced.

New Terminology		
Lesson	**Receptive**	**Productive**
1	**scaled copy** original polygon	

New Terminology		
Lesson	**Receptive**	**Productive**
2	**corresponding** **scale factor** figure segment	
4	quadrilateral measurementl distance	**corresponding** **scale factor** original
5		reciprocal
6	**area** one-dimensional two-dimensional	squared
7	**scale drawing** **scale** represent actual three-dimensional	**scaled copy**
8	estimate travel constant speed	**scale**
9	floorplan	
10	appropriate dimension	actual represent
11	scale without units _____ to _____	**scale drawing**
12	equivalent scales	_____ to _____

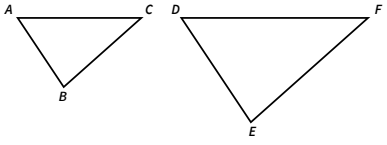
Terminology

Corresponding

When part of an original figure matches up with part of a copy, we call them corresponding parts. These could be points, segments, angles, or distances.

For example, point *B* in the first triangle corresponds to point *E* in the second triangle.

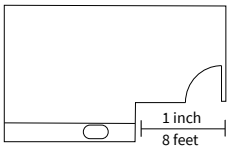
Segment *AC* corresponds to segment *DF*.



Scale

A scale tells how the measurements in a scale drawing represent the actual measurements of the object.

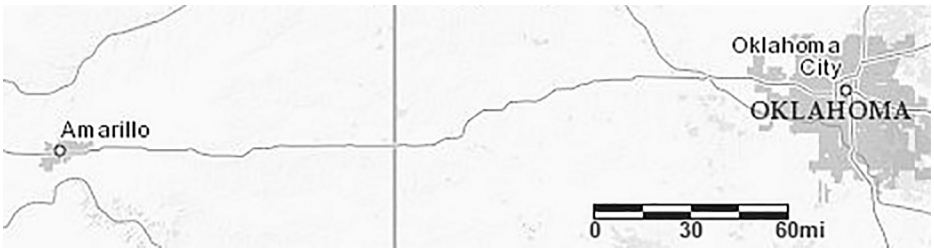
For example, the scale on this floor plan tells us that 1 inch on the drawing represents 8 feet in the actual room. This means that 2 inches would represent 16 feet, and $\frac{1}{2}$ inch would represent 4 feet.



Scale drawing

A scale drawing represents an actual place or object. All the measurements in the drawing correspond to the measurements of the actual object by the same scale.

For example, this map is a scale drawing. The scale shows that 1 cm on the map represents 30 miles on land.

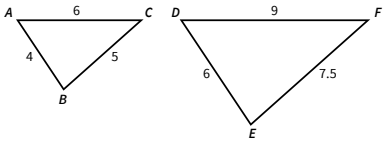


"Map of Texas and Oklahoma" by United States Census Bureau via American Fact Finder. Public Domain

Scale factor

To create a scaled copy, we multiply all the lengths in the original figure by the same number. This number is called the scale factor.

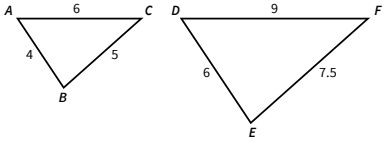
In this example, the scale factor is 1.5, because $4 \cdot 1.5 = 6$, $5 \cdot 1.5 = 7.5$, and $6 \cdot 1.5 = 9$.



Scaled copy

A scaled copy is a copy of an figure where every length in the original figure is multiplied by the same number.

For example, triangle *DEF* is a scaled copy of triangle *ABC*. Each side length on triangle *ABC* was multiplied by 1.5 to get the corresponding side length on triangle *DEF*.



Required Materials

Blank paper

Geometry toolkits

Tracing paper, graph paper, colored pencils, scissors, and an index card to use as a straightedge or to mark right angles.

Graph paper

Measuring tools

Metric and customary unit conversion charts

Pattern blocks

Rulers

Template

Copies of template

Pre-printed slips, cut from copies of the template