General Equivalency Diploma

Mathematics

Geometry Lesson 1
Units of Measure

Version 1.0

Instructor Guide

www.austincc.edu

Author: Doug McIntire, M.A. Adult Education and Distance Learning

Notes:

Course Introduction

TIME: This lesson requires **10 minutes.**

Description

This lesson introduces concepts that will demonstrate units of measure and how they are used to determine distance, length, area and volume.

Outline

This course will cover 3 main topics:

- Distance and Length
- Area
- Volume

Objectives

After completing this lesson, you will be able to:

- Define some common units of measure and use them in practical applications.
- Use units of measure to determine the area of a 2-dimensional object.
- Determine volume of a 3-dimensional object using units of measure.

Notes:

Materials Needed

The following materials are needed for this lesson:

- A ruler or measuring tape.
- A calculator (optional)
- A pen or pencil.
- Writing Paper or notepad for taking notes and performing calculations. The space provided in this workbook on each page may also be used for notes and calculations.

Classroom and Campus Considerations

- Please turn off all cell phones and pagers, or set them to vibrate.
- Do not save questions for break times. Your question may be of interest to others in the class as well.
- Be polite to your fellow students and instructor.
- Austin Community College is a smoke-free campus and smoking is **not** permitted.
- Your instructor will point out the locations of the nearest restroom facilities.

Notes:

Section 1 – Units of Measure

Distance and Length

The terms distance and length can sometimes be used interchangeably. Generally, distance is used on a large scale, such as when measuring miles or kilometers. Length is often used on a smaller scale, such as yards, feet, inches, meters, centimeters, etc.

Examples:

- The **length** of a football field is 100 yards.
- The **distance** between Chicago and Los Angeles is 1,746 miles.

Important Definition: Distance and length are measured along one dimension, in a straight line from one point to another.

New Terms: The term **length** may also be referred to as **width**, **height**, or **depth** if used to measure a 2-dimensional or 3-dimensional object. These terms will be discussed later in this lesson.

Common Units of Measure

Below is a list of some common units of measure along with some simple conversions and abbreviations. These are the units we will be using throughout the remainder of this lesson.

Common units and Conversions:	**Abbreviations:**	
1 foot = 12 inches	inch(es) – in.	foot/feet – ft.
1 yard = 3 feet	yard – yd.	yards – yds.
1 centimeter = 10 millimeters	centimeter(s) – cm	millimeter(s) – mm
1 meter = 100 centimeters	meter – m	
1 kilometer = 100 meters	kilometer – km	

ACTION: Complete Activity 1.1.

Notes:

Activity 1.1

TIME: This activity requires **2 minutes.**

Part 1

Your instructor will hand out index cards with lines drawn on them. Measure the length of the line in inches.

Write your answer here: **Answers vary. 1, 2, 3, or 4 inches**

Once you have written down your answer, turn the card over. The correct answer in printed on the opposite side of the index card. Were you correct?

Part 2

Can you think of any other common units of measure besides those previously listed in the lesson? Write your answers below.

Acres and nautical miles are 2 examples.

Part 3 - Advanced (Optional)

Two trains are traveling towards each other on the same railroad track. The **distance** between them is exactly 60 miles. They are both traveling at exactly 60 miles per hour (mph). What will the **distance** between them be in exactly 2 minutes? Write your answer below.

56 miles. 60 mph = 1 mile per minute. Each train travels 2 miles closer in 2 minutes.

Notes:

Section 2 - Area

Determining Area

Area is described as the amount of space in an object in 2 dimensions. Triangles, squares, rectangles, and circles are some common examples of 2-dimensional objects.

Important Definitions:

- In a rectangle, **length** is the measurement along either of the **longer** sides.
- **Width** is the measurement along either of the **shorter** sides.
- In a square, length and width are assigned to sides that are opposed by 90-degrees (90^o).

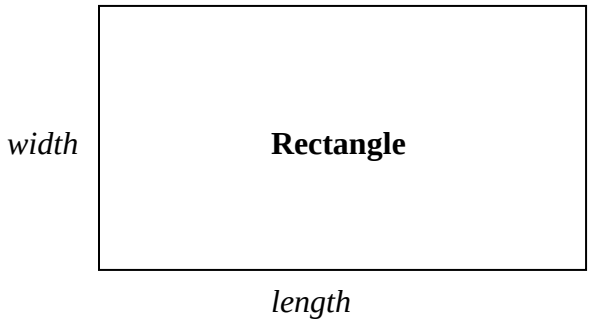


Figure 2.1 – Width and Length of a Rectangle

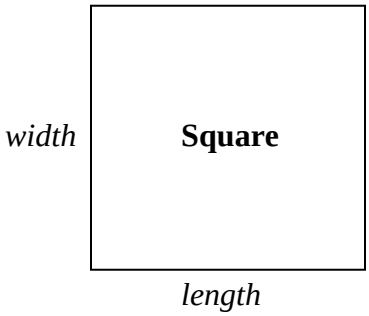


Figure 2.2 – Width and Length of a Square

Notes:

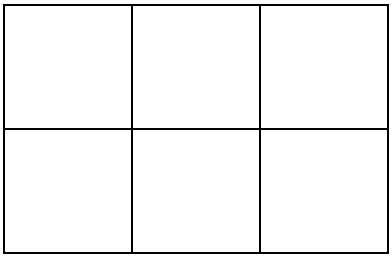
TIP: An object that has a length of 2 inches could also be described as 2 inches *long*. An object that has a width of 2 inches could also be described as 2 inches *wide*.

TIP: When describing the length and width of a rectangle, always describe the smaller number (width) first. For example, 6 x 8, or 10 x 12.

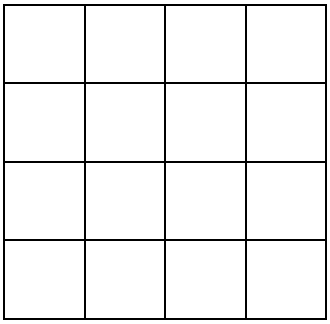
The formula to determine the area of a square or a rectangle is *length* x *width*.

Examples:

- If a rectangle is 2 inches by 3 inches, you would multiply 2 x 3. The answer is 6 so the area of the rectangle is 6 **square** inches.



- If a square is 4 cm x 4 cm, you would multiply 4 x 4. The answer is 16 so the area of the square is 16 square cm.



Notes:

Important Note: When discussing the area of a 2-dimensional object, the unit of measure is always **squared**. That is why the answer is *square inches* in the first example above.

There are multiple ways to express the answer from the example above. Here are 3 ways to write the answer. Can you think of other ways?

- 6 square inches
- 6 inches squared
- 6 $in.^2$

ACTION: Complete Activity 2.1.

Notes:

Activity 2.1

TIME: This activity requires **2 minutes.**

Part 1

Determine the area in the following examples:

Easy: What is the area of a rectangle that is 10 feet by 12 feet?

120 square feet

Medium: Measure the length and width of the index cards handed out to you in Activity 1.1. What is the area of the index card in inches?

3 x 5 cards. 15 square inches

Hard: What is the area of a square if the length of one side is 7 in.?

7 x 7. 49 square in. or 49 in.^{2}

Advanced (optional): What is the area of a rectangle *in inches* if the rectangle is 6 feet by 7 feet?

***Hint**:* You will have to convert the answer from feet to inches.

(6x7) x (12x12). 42 x 144. 6,048 square inches.

Part 2

Medium: Can you think of any other common items that are described by their length and width? Write your answers below.

2 x 4 (lumber), 3 x 5 index cards are 2 examples

Medium: Can you name any other objects that are two dimensional besides those listed in this lesson? Write your answers below.

Pentagon, hexagon, octagon, trapezoid, etc.

Notes:

Section 3 – Volume

Determining Volume

Volume is described as the amount of space in an object in 3 dimensions. A cube is one example of a 3-dimensional object.

Important Definitions: In addition to length and width, 3-dimensional objects add a dimension called **height**. Sometimes height is referred to as **depth**.

Examples:

- To describe a closed shoe box, you might use the term **height**.
- If the lid was removed from that same shoe box, you might choose the term **depth** because the container is open.

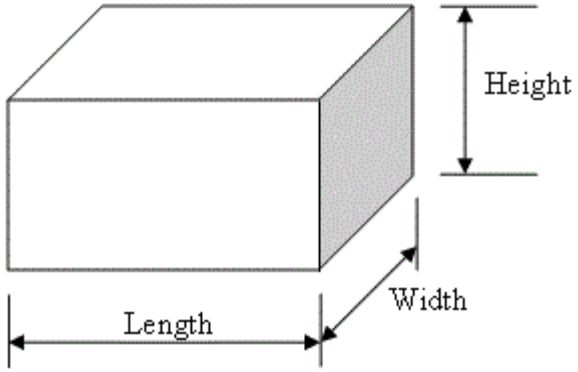


Figure 3.1 – Length, Width and Height of a Box

TIP: An object that has a height of 2 inches could also be described as 2 inches *high*. An object that has a depth of 2 inches could also be described as 2 inches *deep*.

Notes:

The formula to determine the volume of a square or a rectangle is *length* x *width* x *height*.

Examples:

- If a box is 2 inches by 3 inches x 4 inches, you would multiply 2 x 3 x 4. The answer is 24 so the area of the box is 24 **cubic** inches.
- If one side of a cube is 4 m x 4 m 4 m, you would multiply 4 x 4 x 4. The answer is 64 so the area of the cube is 64 cubic meters.

Important Note: When discussing area of a 3-dimensional object, the unit of measure is always **cubed**. That is why the answer is *cubic inches* in the first example above.

There are multiple ways to express the answer from the example above. Here are 3 ways to write the answer. Can you think of other ways?

- 6 cubic inches
- 6 inches cubed
- 6 $in.^3$

ACTION: Complete Activity 3.1.

Notes:

Activity 3.1

TIME: This activity requires **2 minutes.**

Part 1

Determine volume in the following examples:

Easy: What is the volume of a box that is 8 inches wide, 10 inches long, and 2 inches deep?

160 cubic inches

Medium: What is the volume of a cube if all sides are 9 inches?

729 cubic inches

Hard: What is the volume of a 13 x 9 x 2 in. rectangular cooking dish?

234 cubic in.

Advanced (optional): What is the volume of a cube *in inches* if the cube is .5 in. on all sides?

Hint*:* Remember to move the decimal point correctly.

0.125 cubic inches

Part 2

Advanced (optional): Can you think of any common terms that indicate volume as the unit of measure? Write your answers below.

Fluid ounce, cup, pint, gallon, teaspoon, tablespoon, etc.

Notes:

Section 4 – Lesson Summary/Review

Description

This is a group discussion covering all of the presentations and exercises of this lesson. It includes the following topics:

1. Units of Measure
    - What is length?
    - What is distance?
    - What are some units of measure for length and distance?
2. Area
    - What is area?
    - What is the formula to determine the area of an object?
    - How is the area of an object expressed?
3. Volume
    - What is volume?
    - What is the formula used to determine the volume of an object?
    - How is the volume of an object expressed?

Notes:

Final Activity (Optional)

TIME: This activity requires **2 minutes.**

Complete the following activity as a group.

Part 1

Your instructor will give you an unopened box of sugar cubes, along with several loose sugar cubes. The box is 1 pound of sugar, but does not indicate how many sugar cubes are in it. Using the loose sugar cubes, determine how many sugar cubes are in the box. Write your answer below.

6 x 7 x 3 = 126 sugar cubes. Notice how cube is in the name.

Part 2

You are decorating for a wedding reception. There will be 22 tables in the reception hall. Each table will have 2 dishes of sugar cubes. Each dish holds about 25 sugar cubes. Assuming you will not need to refill any of the dishes during the reception, how many boxes of sugar cubes will you need?

22 x 2 x 25 = 1,100. 1,100 / 126 cubes per box = 8.73, so you will need 9 boxes of sugar cubes.

Notes: