

Lesson 1

Points, Lines, and Planes

Objectives

- ⇒ Describe points, lines, and planes.
- ⇒ Sketch and label points, lines, and planes.
- ⇒ Use problem solving to explore points, lines, and planes.

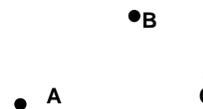


Arguments and misunderstandings can occur when people interpret the same word differently or with varying stipulations. Therefore it is important that words are carefully and clearly defined. There are, however, three terms in geometry that, while considered to be undefined, are rarely misinterpreted because of the way they can be described and are modeled. These three terms are points, lines, and planes.



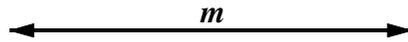
A **point** is considered to be a location in space without width, length, or thickness. The period at the end of this sentence is a model of a point.

Although the period does have some dimension, it can be used as a model so that you can “see” the location. A point is usually labeled in a sketch with a capital letter. Points A, B, and C are shown to the right.



↳ A **line** consists of a set or collection of points extending without end in opposite directions. A line has length, but no width or thickness. You may make a visual representation of a line using a ruler. Even though lines that are drawn this way do have some width and thickness, the model can help you understand the concept of a line.

Line m may be sketched and labeled with a lower case script letter as seen here.



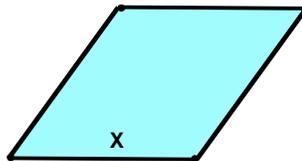
A line also may be named using two points on the line. Line AB, written \overleftrightarrow{AB} , may be sketched and labeled in this way.



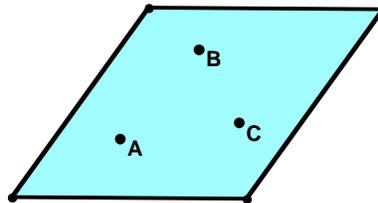
Line \overleftrightarrow{AB} may also have been written \overleftrightarrow{BA} because the order of the letters does not matter.

↳ A **plane** can be thought of as a set of points that form a flat surface extending without end in all directions. Although a plane extends without end, it has no thickness. Imagine that the floor in the room where you are sitting continues indefinitely beyond all four walls of the room. This could be used as a visual model for a plane.

Plane X can be labeled like this:



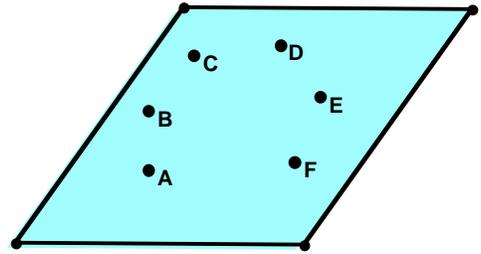
A plane may also be labeled using three points in the plane, not all on the same line. Plane ABC is shown to the right.



Example

Points A, B, C, D, E, and F are all on plane X. No three of the points lie on the same line. Name plane X using three points in as many ways as possible.

Consider only one arrangement of each set of three letters as a name. Thus ABC, ACB, BAC, BCA, CAB, and CBA are all considered the same name.

**Solution**

Use an organized list to name the plane.

ABC	ACD	ADE	AEF	BCD	BDE	BEF	CDE	CEF	DEF
ABD	ACE	ADF		BCE	BDF		CDF		
ABE	ACF			BCF					
ABF									

There are 20 ways to name the plane.



1. Study the organization of the list in the Example on the previous page. In your own words, explain how the list was created so that no arrangement was missed.

2. Sketch a line and label it line \overline{BD} .

3. Mark a point on line \overline{BD} between points B and D and call it point C.

4. Mark a point on line \overline{BD} to the left of point B and call it point A.

5. Mark a point on line \overline{BD} to the right of D and call it point E.

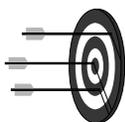
6. Since two points determine a line, the line may be renamed using any two points on the line. Rename the line in as many ways as possible. Consider pairs such as \overline{BD} and \overline{DB} the same name. How many names did you find for the line?

 **Review**

1. Highlight the following terms and their definitions:

- a. point
- b. line
- c. plane

2. Make a list of questions that you would like to discuss with your mentor or write a short paragraph about one new thing you learned in this lesson.



Practice Problems
Unit 1 Lesson 1

Directions: Write your answers in your math journal. Label this exercise Unit 1 – Lesson 1.

Set A

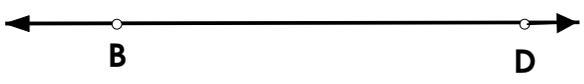
1. What are the three undefined terms in geometry?
2. How many points does it take to determine a line?
3. How many points does it take to determine a plane?
4. Sketch a line and name it \overline{GH} .
5. Sketch a plane and name it Y.
6. Sketch another plane and name it plane CDE.

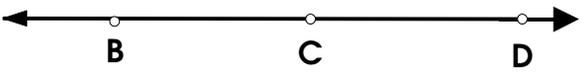
Set B

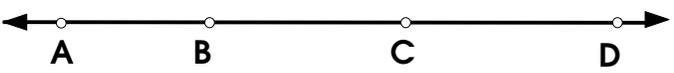
1. Mark a point on your paper. Draw several lines through the point. (Be sure to put arrows on both ends of each line so that it is clear that they extend indefinitely in both directions.) How many lines do you think can be drawn through a single point?
2. Explore the following:
 - a. Draw and label three points on your paper but make sure they are not all on the same line. Sketch and name the three lines that are defined by these points.
 - b. Draw and label four points on your paper so that no three are on the same line. How many lines can you draw using these points? Draw and name each line.

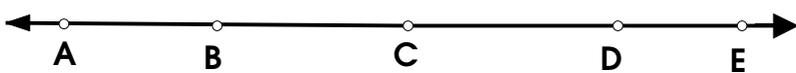
**ANSWERS TO
TRY IT**

1. Answers will vary. Example: Keep letters in alphabetical order and use patterning.

2. 

3. 

4. 

5. 

6. There are 10 names: \overline{AB} , \overline{AC} , \overline{AD} , \overline{AE} , \overline{BC} , \overline{BD} , \overline{BE} , \overline{CD} , \overline{CE} , \overline{DE}



End of Lesson 1