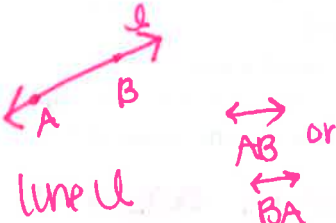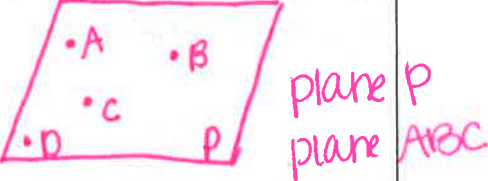# Geometry Notes Chapter 1 Section 1: Points, Lines, and Planes

Geometry is a mathematical system built on accepted facts, basic terms, and definitions.

| Term Description | How to Name It | Diagram |
|---|---|---|
| A **point** indicates a location and has no size. | You can represent a point by a dot and name it by a capital letter, such as A. | •A |
| A **line** is represented by a straight path that extends in two opposite directions without end and has no thickness. A line contains infinitely many points. | You can name a line by any two points on the line, such as AB (read line AB) or BA, or by a single lowercase letter, such as line $\ell$. | line u    $\overleftrightarrow{AB}$ or $\overleftrightarrow{BA}$ |
| A **plane** is represented by a flat surface that extends without end and has no thickness. A plane contains infinitely many lines. | You can name a plane by a capital letter, such as plane P, or by at least three points in the plane that do not all lie on the same line, such as plane ABC. | plane P  plane ABC |

Important things to remember:

- The description of a point—no length, width or area.
- Although lines are named by two points, they are composed of an infinite number of points that extend infinitely in both directions.
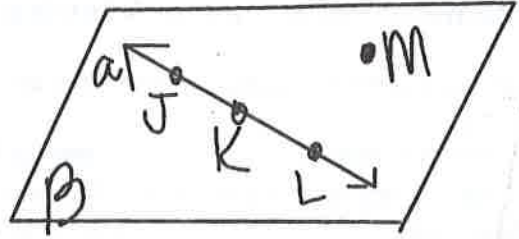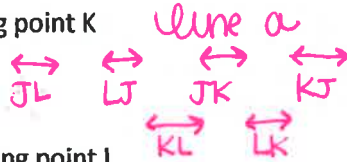- Planes are unbounded flat surfaces with no edges or corners.

Notice the word point is used in the description of a line and the word line is used in the description of a plane. Geometry knowledge is all in this building block nature.

Points that lie on the same line are___Collinear___. Points and lines that lie in the same plane are___Coplanar___. All the points of a line are___Coplanar___.

Example 1:

Use the figure to name each of the following:

A) A line containing point K   *line a*

$\overleftrightarrow{JL}$   $\overleftrightarrow{LJ}$   $\overleftrightarrow{JK}$   $\overleftrightarrow{KJ}$

$\overleftrightarrow{KL}$   $\overleftrightarrow{LK}$

B) A plane containing point L

*plane B*   *plane JKM*
*plane MLK*

| Definition | How to Name It | Diagram |
|---|---|---|
| A **segment** is a part of a line that consists of two endpoints and all points between them.  *can be measured* | You can name a segment by its two endpoints, such as AB (read segment AB) or BA. | A — B  $\overline{AB}$ OR $\overline{BA}$ |
| A **ray** is part of a line that consists of one endpoint and all the points of the line on one side of the endpoint. | You can name a ray by its endpoint and another point on the ray, such as AB (read ray AB).  The order of points indicates the ray's direction. | A B C  $\overrightarrow{AB}$  $\overrightarrow{AC}$ |
| **Opposite rays** are two rays that share the same endpoint and form a line. | You can name opposite rays by their shared endpoint and any other point on each ray, such as CA and AB. | C A B  $\overrightarrow{AC}$ and $\overrightarrow{AB}$ are opposite rays |

Example 2:

Which geometric term is modeled by the following:

A) Long hand of a clock   *line segment*
B) 10x12 patio   *plane*
C) The location where the corner of a driveway and road meet   *point*
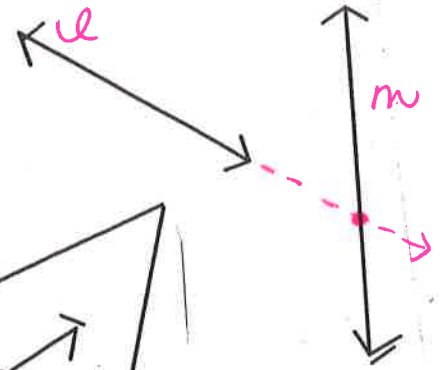
Example 3:

Label the figure where plane R contains line AB and line DE intersecting at point P.  Add point C on plane R so it is not collinear with line AB or line DE.
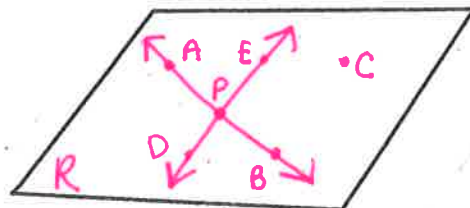
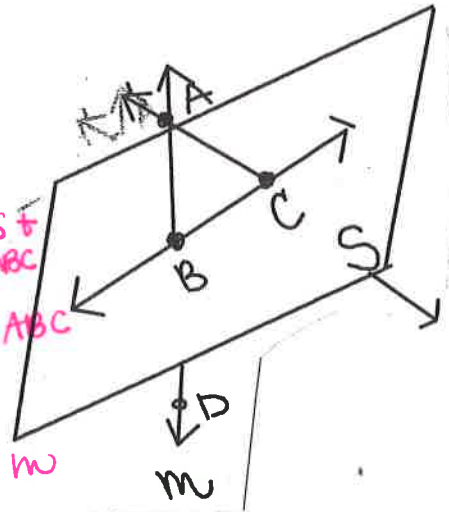<u>Example 4:</u> Use the figure to answer the question.

Do lines *l* and *m* intersect?

**yes, lines are infinite**

<u>Example 5:</u>

A)  How many planes are in the figure? **2 - S & ABC**
B)  Name 3 collinear points. **A, B, D**
C)  Are A, B, C, and D coplanar? **yes, plane ABC**
D)  Where do line DB and line CA intersect? **• A**
E)  Give another name for line AB.

**$\overleftrightarrow{AD}$  $\overleftrightarrow{BD}$  $\overleftrightarrow{BA}$  $\overleftrightarrow{DB}$  line m**

A __**postulate**__ or __**axiom**__ is an accepted statement of fact. Postulates, like undefined terms, are basic building blocks of the logical system in geometry.

**Postulate 1-1**

Through any two points there is exactly one line.

When you have two or more geometric figures, their __**intersection**__ is the set of points the figures have in common.

*Example: Solving system of two equations by graphing the two lines in algebra illustrates Postulate 1-2.

**Postulate 1-2**

If two distinct lines intersect, then they intersect in exactly one point.

A similar postulate exists about the intersection of planes.

**Postulate 1-3**

If two distinct planes intersect, then they intersect in exactly one line.

**Postulate 1-4**

Through any three noncollinear points there is exactly one plane.