

# Points Lines and Planes Guide Notes

In geometry, some words, such as point, line, and plane, are **undefined terms**. Although these words are not formally defined, it is important to have general agreement about what each word means.

**A point** has no dimension. It is usually represented by a small dot and named by a capital letter.

**A line** extends in one dimension. It is usually represented by a straight line with two arrowheads to indicate that the line extends without end in two directions, and is named by two points on the line or a lowercase script letter.

**A plane** extends in two dimensions. It is usually represented by a shape that looks like a tabletop or wall. You must imagine that the plane extends without end, even though the drawing of a plane appears to have edges, and is named by a capital script letter or 3 non-collinear points.

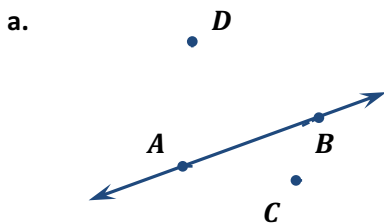
**A line segment** is a set of points and has a specific length i.e. it does not extend indefinitely. It has no thickness or width, is usually represented by a straight line with no arrowheads to indicate that it has a fixed length, and is named by two points on the line segment with a line segment symbol above the letters.

**A ray** is a set of points and extends in one dimension in one direction (not in two directions). It has no thickness or width, is usually represented by a straight line with one arrowhead to indicate that it extends without end in the direction of the arrowhead, and is named by two points on the ray with a ray symbol above the letters.

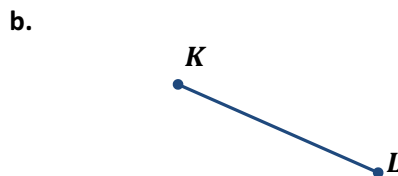
**Collinear points** are points that lie on the same line.

**Coplanar points** are points that lie on the same plane.

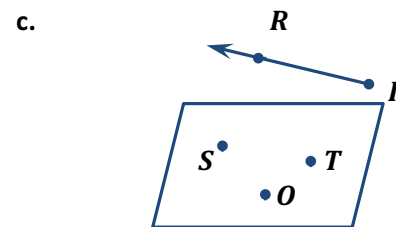
**Sample Problem 1:** Use the figure to name each of the following.



Line  $\overleftrightarrow{AB}$   
 Points  $A, B, C$  and  $D$   
 Collinear points  $A, B$   
 Non collinear points  $A, C, D$



Line segment  $\overline{KL}$   
 Points  $K$  and  $L$



Plane  $\mathcal{STO}$   
 Ray  $\overrightarrow{IR}$   
 Points  $S, T, O, R$  and  $I$   
 Coplanar points  $S, T, O$   
 Non coplanar points  $R, I$

Two or more geometric figures intersect, if they have one or more points in common.

**The intersection** of the figures is the set of points the figures have in common.

**Postulate 1-1** Through any two points there is exactly one line.

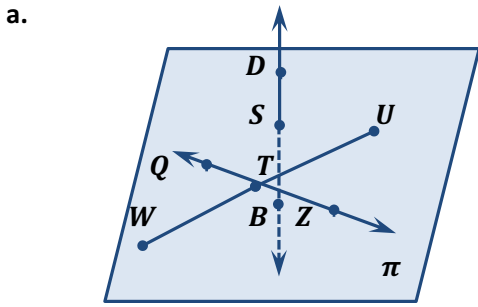
**Postulate 1-2** If two distinct lines intersect, then they intersect in exactly one point.

**Postulate 1-3** If two distinct planes intersect, then they intersect in exactly one line.

**Postulate 1-4** Through any three non collinear points there is exactly one plane.

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Sample Problem 2: Refer to the each figure.

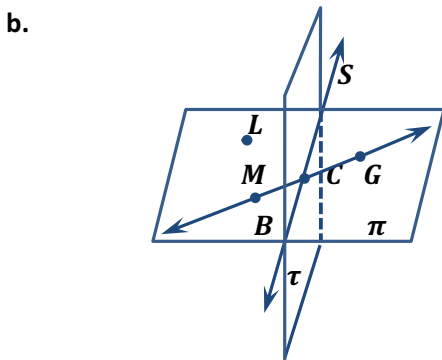


Name the intersection of line  $\overleftrightarrow{QZ}$  and segment  $\overline{WU}$ . **Point  $T$**

Name the intersection of plane  $\pi$  and line  $\overleftrightarrow{DB}$ . **Point  $S$**

Name the two opposite rays at point  $T$ .  **$\overrightarrow{TQ}$  and  $\overrightarrow{TZ}$**

What is another name for plane  $\pi$ ? **Plane  $TSU$**

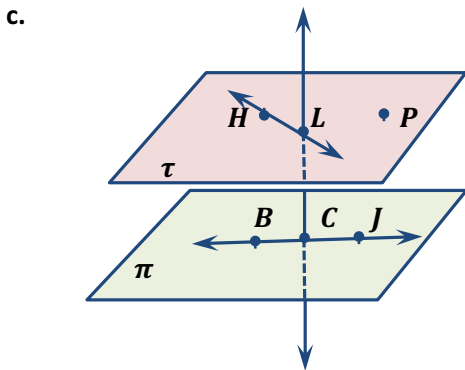


Name the intersection of plane  $\pi$  and plane  $\tau$ . **Line  $\overleftrightarrow{BS}$**

What is another name for plane  $\pi$ ? **Plane  $LMG$**

Name the intersection of line  $\overleftrightarrow{MG}$  and line  $\overleftrightarrow{BS}$ . **Point  $C$**

Name a point that is collinear with  $M$  and  $C$ . **Point  $G$**



Name the intersection of plane  $\pi$  and line  $\overleftrightarrow{LC}$ . **Point  $C$**

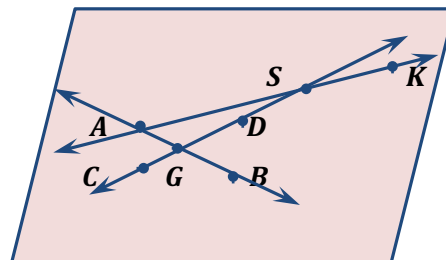
Name the intersection of plane  $\tau$  and line  $\overleftrightarrow{LC}$ . **Point  $L$**

Name a point that is coplanar with  $H$  and  $L$ . **Point  $P$**

Name the opposite ray of ray  $\overrightarrow{CB}$ . **Ray  $\overrightarrow{CJ}$**

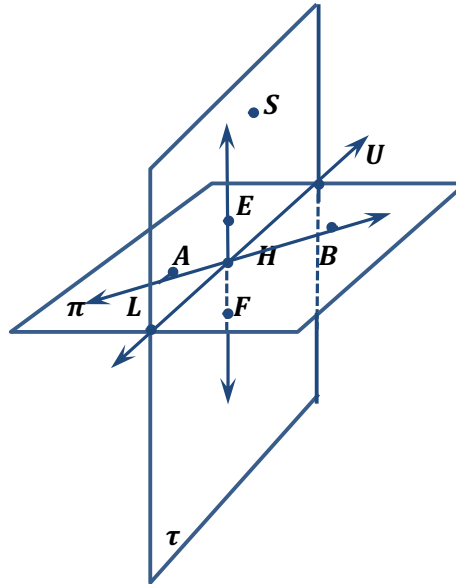
Sample Problem 3: Draw and label figure for each relationship.

- a. Plane  $ABS$  contains lines  $\overleftrightarrow{AB}$ ,  $\overleftrightarrow{CD}$ , and  $\overleftrightarrow{AK}$ .  
 Lines  $\overleftrightarrow{AB}$  and  $\overleftrightarrow{CD}$  intersect in point  $G$ .  
 Lines  $\overleftrightarrow{CD}$  and  $\overleftrightarrow{AK}$  intersect in point  $S$ .  
 Lines  $\overleftrightarrow{AB}$  and  $\overleftrightarrow{AK}$  intersect in point  $A$ .



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- b. Plane  $\pi$  contains line  $\overleftrightarrow{AB}$  and point  $L$ .  
 Plane  $\tau$  contains line  $\overleftrightarrow{EF}$  and point  $S$ .  
 Lines  $\overleftrightarrow{AB}$  and  $\overleftrightarrow{EF}$  intersect in point  $H$ .  
 The intersection of plane  $\pi$  and plane  $\tau$  is line  $\overleftrightarrow{LU}$ .



- c. Plane  $\pi$  and plane  $\tau$  do not intersect.  
 Plane  $\varepsilon$  intersect plane  $\pi$  in line  $\overleftrightarrow{BC}$ .  
 Plane  $\varepsilon$  intersect plane  $\tau$  in line  $\overleftrightarrow{ER}$ .

