Points, Lines, and Planes
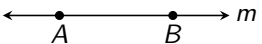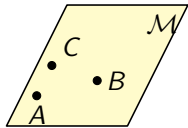
Undefined Terms

The **undefined terms** of geometry are *point*, *line*, and *plane*.

They are considered undefined because we can not give a definition for them without using other geometric terms. We can, at best, describe them.

Term	Description	Named	Diagram
Point	A location without size.	A dot with a capital letter.	$\bullet A$
Line	Straight path that extends in two opposite directions without end. A line contains an infinite number of points.	2 points with a capital letter, such as $\overleftrightarrow{AB}$ or $\overleftrightarrow{BA}$, or as a single lowercase letter such as m.	
Plane	Flat surface that extends without end. A plane contains infinitely many lines.	Capital scripted letter such as $\mathcal{M}$, or by at least 3 points not on the same line such as ABC.	

Now that we have the undefined terms above, we can define other geometry vocabulary in terms of them.

Collinear Points
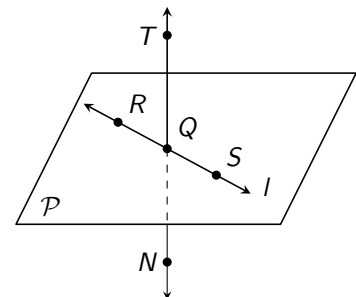
Points that lie on the same line.

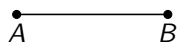**Coplanar Points**

Points and lines that lie on the same plane.

Space

The set of all points in 3 dimensions.

Example 1. Answer each of the following given the diagram shown.

(a) What are two other ways to name $\overleftrightarrow{QT}$?

(b) What are two other ways to name $\mathcal{P}$?

(c) What are the names of 3 collinear points?

(d) What are the names of 4 coplanar points?

Term	Description	Named	Diagram
Segment	Part of a line that contains 2 endpoints and all points in between them.	By 2 endpoints such as $\overline{AB}$ or $\overline{BA}$.	
Ray	Part of a line that consists of 1 endpoint and all the points on the line on one side of the endpoint.	By its endpoint and any point on the ray, such as $\overrightarrow{AB}$.	
Opposite Rays	2 rays that share an endpoint and form a line.	By their shared endpoint and any point on each ray such as $\overrightarrow{CA}$ or $\overrightarrow{CB}$.	

Example 2. Answer each of the following given the diagram shown.

(a) What are the names of the segments in the figure?

(b) What are the names of the rays in the figure?
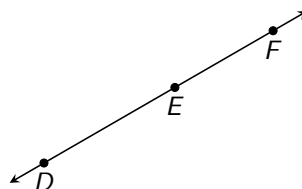
(c) Which of the rays in part (b) are opposite rays?

Postulate (a.k.a. Axiom)

An accepted statement of fact.

Some Geometry Postulates:

- Through any two points there is a line.

- If 2 different lines intersect, they intersect at a point.

- If 2 different planes intersect, they intersect at a line.

- You can draw a plane through any 3 noncollinear points.

Example 3. Each surface of the box represents a plane. What is the intersection of plane *ADC* and plane *BFG*?
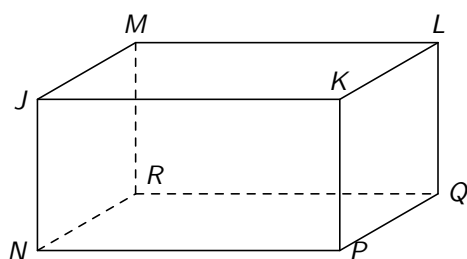
Note: The dashed line segments represent segments you could not see if the figure was constructed in our 3-dimensional space.
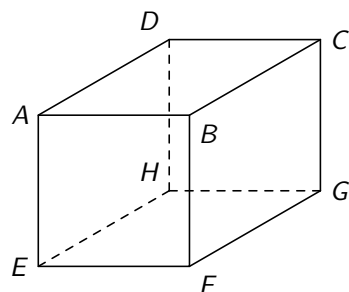
When naming planes with 4 or more points, list the points in order either clockwise or counterclockwise.

Example 4. Use the figure to answer each.

(a) What plane contains *N*, *P*, and *Q*? Shade it.

(b) What plane contains *J*, *M*, and *Q*? Shade it.