1-1 Understanding Points, Lines, and Planes

Essential Learning # 1

1-1 Understanding Points, Lines, and Planes

Objectives

Identify, name, and draw points, lines, segments, rays, and planes.

Apply basic facts about points, lines, and planes.

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Vocabulary

undefined term	point
line	plane
collinear	coplanar
segment	endpoint
ray	opposite rays
postulate	

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The most basic figures in geometry are **undefined terms**, which cannot be defined by using other figures. The undefined terms *point*, *line*, and *plane* are the building blocks of geometry.

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Undefined Terms

TERM	NAME	DIAGRAM
A **point** names a location and has no size. It is represented by a dot.	A capital letter point P	
A **line** is a straight path that has no thickness and extends forever.	A lowercase letter or two points on the line line ℓ, $\overleftrightarrow{XY}$ or $\overleftrightarrow{YX}$	
A **plane** is a flat surface that has no thickness and extends forever.	A script capital letter or three points not on a line plane $\mathcal{R}$ or plane ABC	

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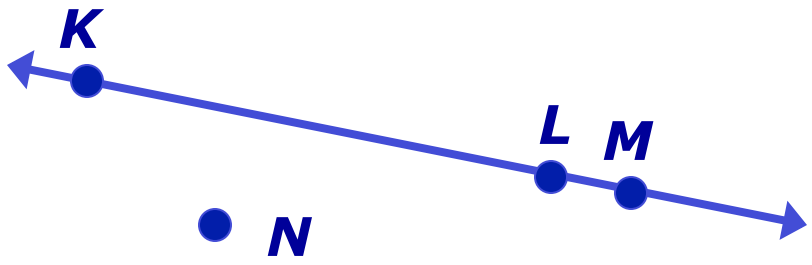
Points that lie on the same line are **collinear**. *K*, *L*, and *M* are collinear. *K*, *L*, and *N* are *noncollinear*. Points that lie on the same plane are **coplanar**. Otherwise they are *noncoplanar*.



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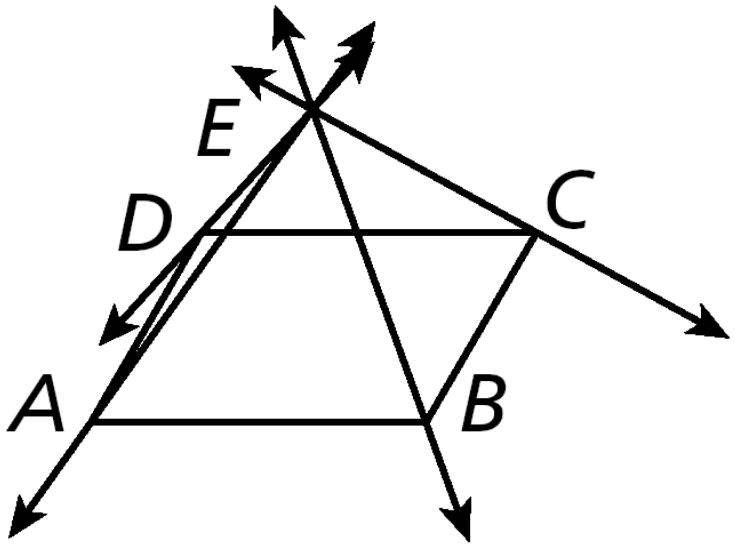
Example 1: Naming Points, Lines, and Planes



A. Name four coplanar points.

A, B, C, D

B. Name three lines.

Possible answer: $\overleftrightarrow{AE}$, $\overleftrightarrow{BE}$, $\overleftrightarrow{CE}$

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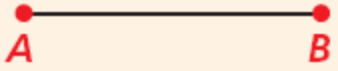
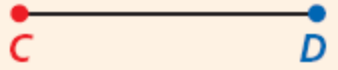
Segments and Rays

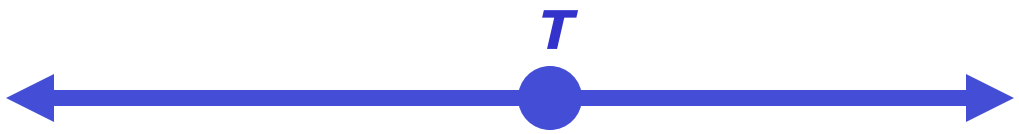
DEFINITION	NAME	DIAGRAM
A **segment**, or line segment, is the part of a line consisting of two points and all points between them.	The two endpoints $\overline{AB}$ or $\overline{BA}$	
An **endpoint** is a point at one end of a segment or the starting point of a *ray*.	A capital letter *C* and *D*	
A **ray** is a part of a line that starts at an endpoint and extends forever in one direction.	Its endpoint and any other point on the ray $\overrightarrow{RS}$	
Opposite rays are two rays that have a common endpoint and form a line.	The common endpoint and any other point on each ray $\overrightarrow{EF}$ and $\overrightarrow{EG}$	

Example 2: Drawing Segments and Rays

Draw and label each of the following.

A. a segment with endpoints *M* and *N*.

B. opposite rays with a common endpoint *T*.



Check It Out! Example 2

Draw and label a ray with endpoint *M* that contains *N*.

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A **postulate**, or *axiom*, is a statement that is accepted as true without proof. Postulates about points, lines, and planes help describe geometric properties.

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Postulates **Points, Lines, and Planes**

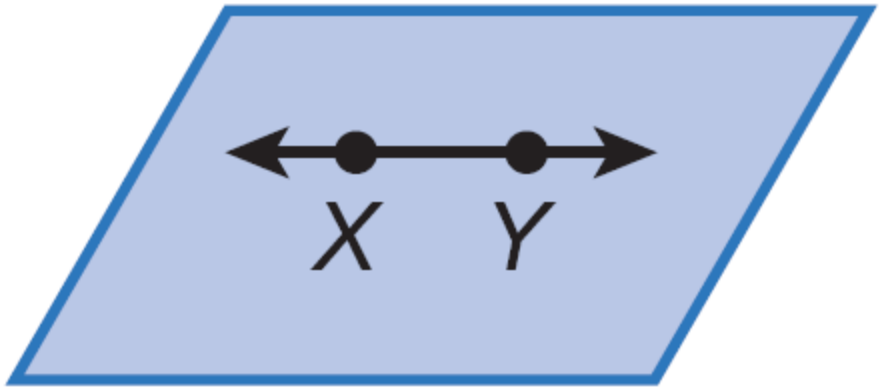
1-1-1 Through any two points there is exactly one line.

1-1-2 Through any three noncollinear points there is exactly one plane containing them.

1-1-3 If two points lie in a plane, then the line containing those points lies in the plane.

Example 3: Identifying Points and Lines in a Plane

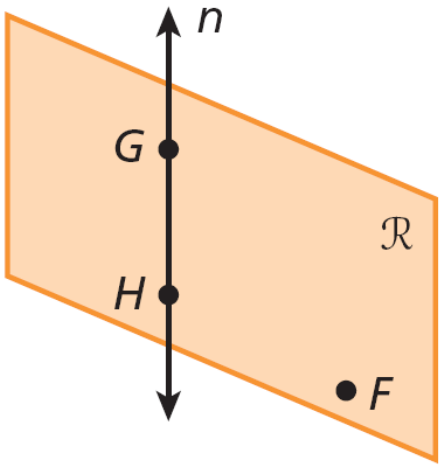
Name a line that passes through two points.



$\overleftrightarrow{XY}$

Check It Out! Example 3

Name a plane that contains three noncollinear points.



plane *GHF*

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Postulates **Intersection of Lines and Planes**

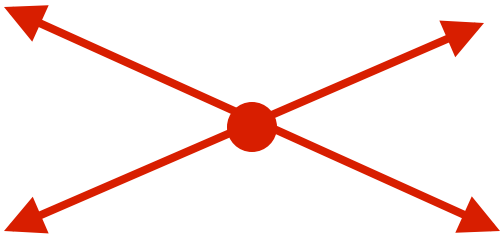
1-1-4 If two lines intersect, then they intersect in exactly one point.

1-1-5 If two planes intersect, then they intersect in exactly one line.

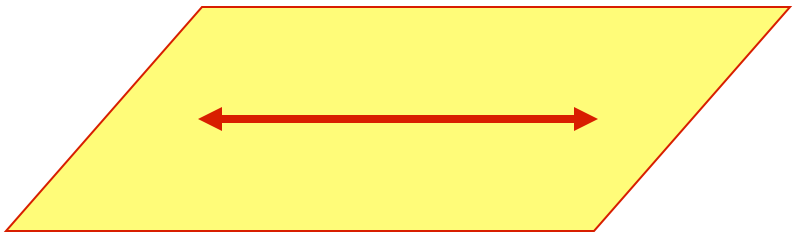
Use a dashed line to show the hidden parts of any figure that you are drawing. A dashed line will indicate the part of the figure that is not seen.

Example 4: Representing Intersections

A. Sketch two lines intersecting in exactly one point.



B. Sketch a figure that shows a line that lies in a plane.



Check It Out! Example 4

Sketch a figure that shows two lines intersect in one point in a plane, but only one of the lines lies in the plane.