

Lesson 1

Points, Lines, and Planes

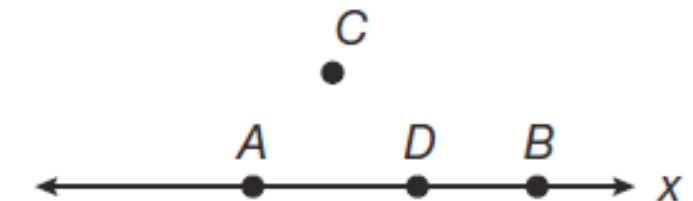
In geometry, a definition of a term is a statement that defines a mathematical object. Definitions usually reference other mathematical terms. A basic mathematical term that is not defined using other mathematical terms is called an undefined term. In geometry, points, lines, and planes are undefined terms that are the building blocks used for defining other terms.

A point names a location and has no size. It is represented by a dot and labeled using a capital letter, such as P .

A line is a straight path that has no thickness and extends forever. There are an infinite number of points on a line. A line is named using either a lowercase letter or any two points on the line. Two possible names for the line shown in the diagram are \overleftrightarrow{AB} and line x .

Any set of points that lie on the same line are called collinear points. In the diagram, A , B , and D are collinear.

If points do not lie on the same line, they are noncollinear. Points A , B , and C are noncollinear.



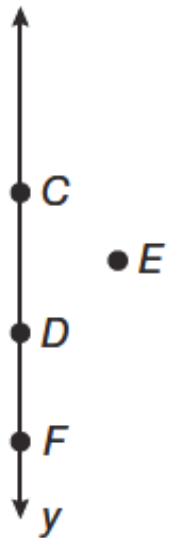
Example 1 Identifying Lines and Collinear Points

a. Give two different names for the line.

SOLUTION

Two possible names for the line are line y and \overleftrightarrow{CD} .

The order of the points does not matter, so \overleftrightarrow{DC} would also be correct.



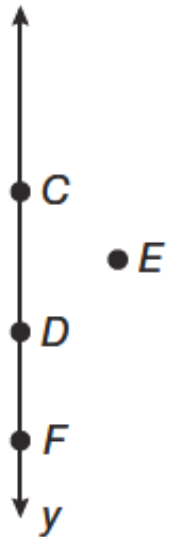
Example 1 Identifying Lines and Collinear Points

b. Name three collinear points and three noncollinear points.

SOLUTION

Points C , D , and F are collinear.

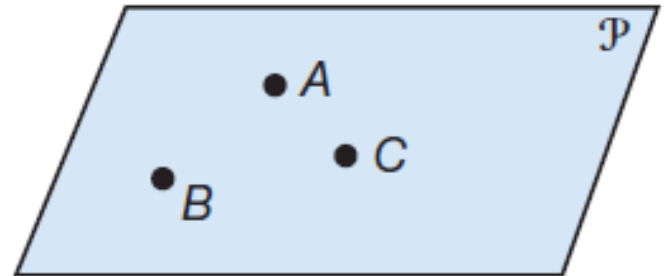
Points C , D , and E are noncollinear.



A plane is a flat surface that has no thickness and extends forever. A plane is named using either an uppercase letter or three noncollinear points that lie in the plane. The plane in the diagram below could be called plane P or plane ABC .

Lines or points that are in the same plane are said to be coplanar. If there is no plane that contains the lines or points, then they are noncoplanar.

Space is the set of all points. Therefore, space includes all lines and all planes.

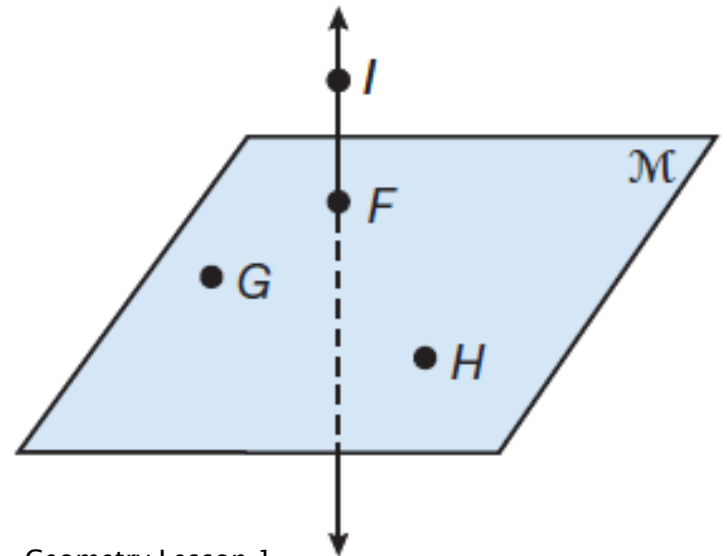


Example 2 Identifying Planes

What are two different names for this plane?

SOLUTION

Two possible names for the plane are plane FGH or plane M .

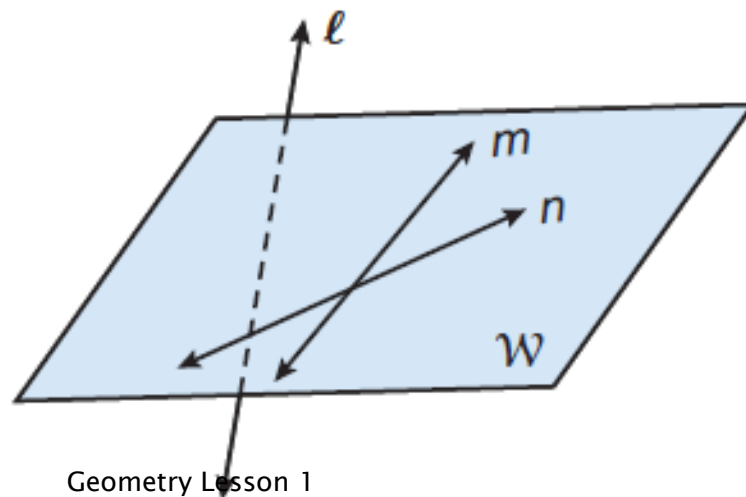


Example 3 Identifying Coplanar Lines

a. Identify the coplanar and noncoplanar lines in the diagram.

SOLUTION

Lines m and n are coplanar. Line l is noncoplanar with lines m and n .

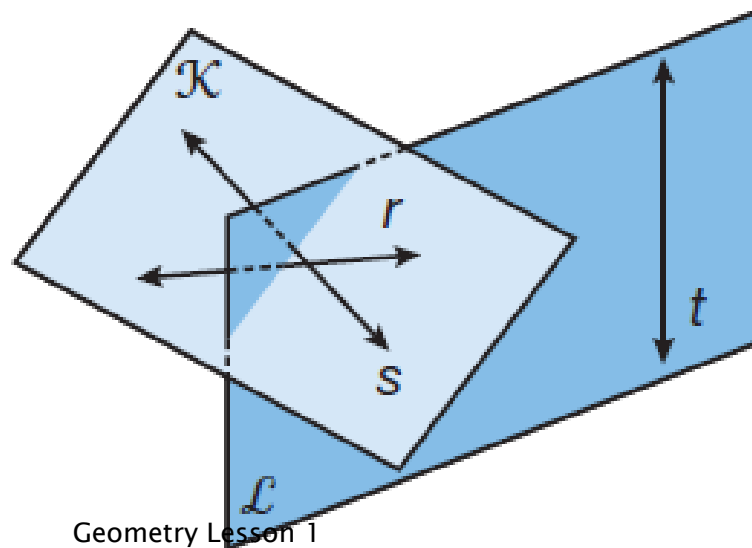


Example 3 Identifying Coplanar Lines

b. Identify the coplanar and noncoplanar lines in the diagram.

SOLUTION

Lines r and s are coplanar. Line t is noncoplanar with lines r and s .

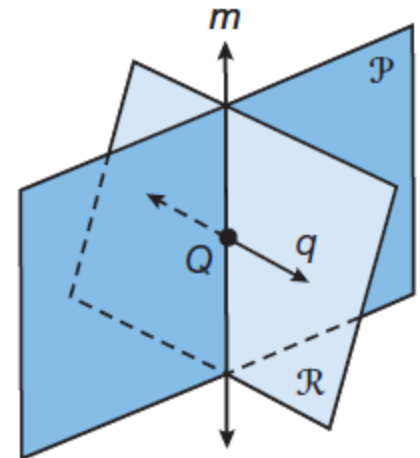


An intersection is the point or set of points in which two figures meet.

When two lines intersect, their intersection is a single point.

When two planes intersect, their intersection is a single line.

If a line lies in a plane, then their intersection is the line itself. If the line does not lie in the plane, then their intersection is a single point.



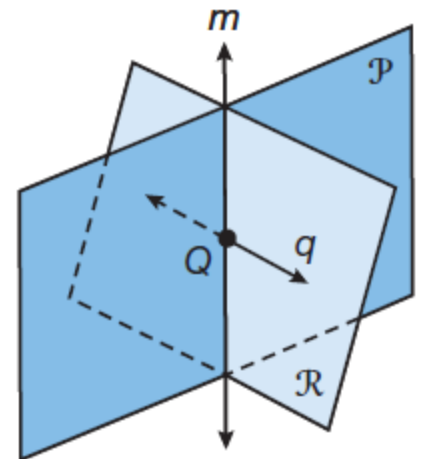
Lines q and m intersect at point Q . Plane R intersects plane P at line m .

The intersection of plane R and line m is line m .

Line q intersects planes R and P at point Q .

Math Reasoning

Model Can two planes have no intersections at all? What common objects illustrate what this might look like?

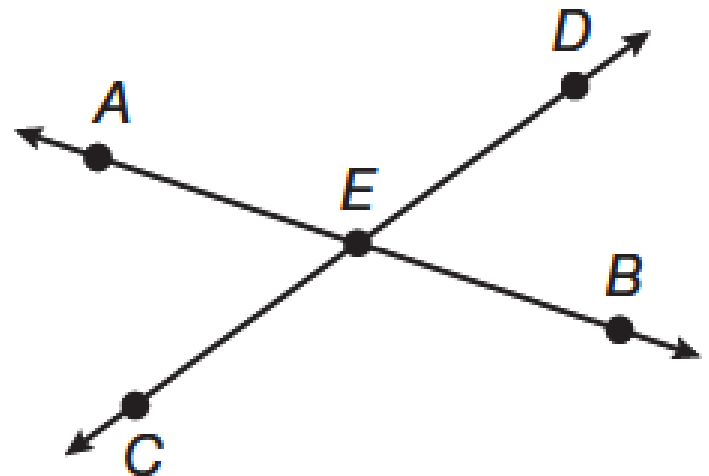


Example 4 Intersecting Lines and Planes

a. What is the intersection of \overleftrightarrow{AB} and \overleftrightarrow{CD} ?

SOLUTION

The intersection of \overleftrightarrow{AB} and \overleftrightarrow{CD} is point E .



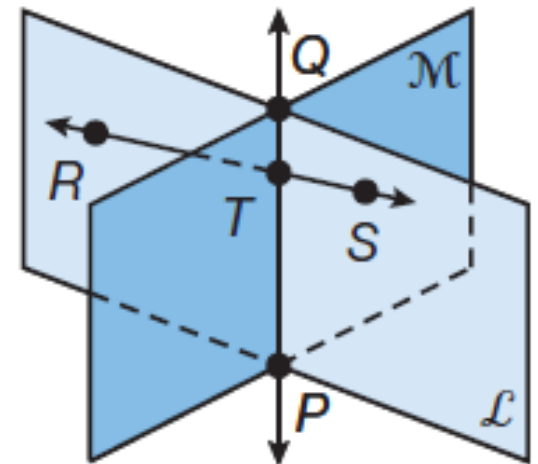
Example 4 Intersecting Lines and Planes

b. What is the intersection of \overleftrightarrow{PQ} and \overleftrightarrow{RS} ? What is the intersection of planes M and L ?

SOLUTION

The intersection of \overleftrightarrow{PQ} and \overleftrightarrow{RS} is point T .

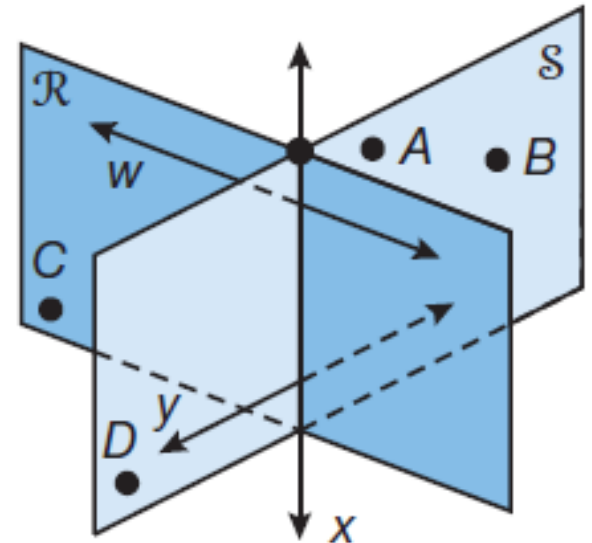
The intersection of the planes M and L is \overleftrightarrow{PQ} .



You Try!!!!

Identify each of the following from the diagram.

- All of the lines.
- A pair of collinear points.
- All of the planes.
- Three coplanar points.
- Two coplanar lines.
- A pair of noncoplanar lines.

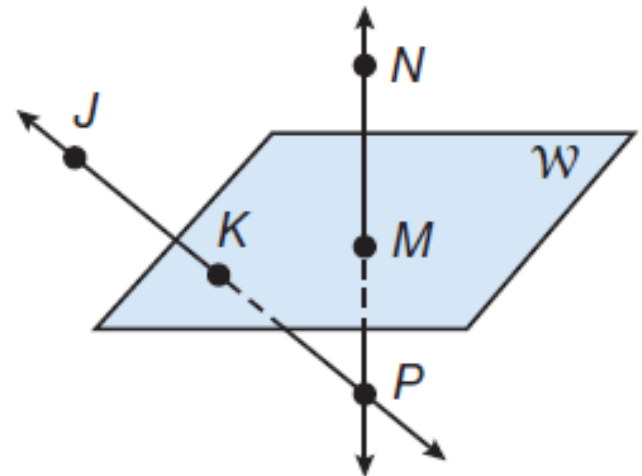


You Try!!!!

Use the diagram to answer each question.

g. What is the intersection of \overleftrightarrow{JK} and \overleftrightarrow{NM} ?

h. What is the intersection of \overleftrightarrow{JK} and plane W ?
What is the intersection of \overleftrightarrow{NP} and plane W ?



Assignment

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Lesson Practice a–f (Ask Mr. Heintz)

Page 5

Practice 1–30 (Do the starred ones first)