

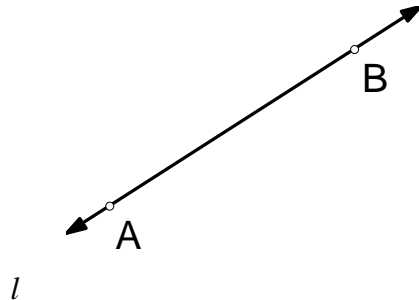
Section 9.1 Basic Notions

UNDEFINED TERMS

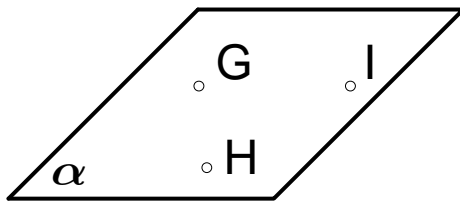
POINT A basic unit in geometry having no dimension



LINE It consists of infinitely many points in a straight arrangement. It has no thickness. It is usually named with a lowercase l or by naming two points on the line. This line could be called line l or \overleftrightarrow{AB} or \overleftrightarrow{BA} .



PLANE A plane is usually represented by a four-sided figure, but it extends endlessly in two directions. It is named by either a lowercase Greek letter or by naming three non-collinear points in the plane. This plane could be called α or plane GHI.



How many points determine a line?

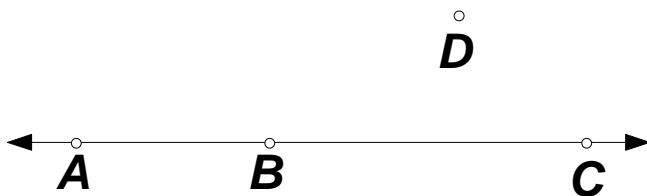
Collinear points are points on the same line.

Example:

A, B and C are collinear.

A, B and D are not.

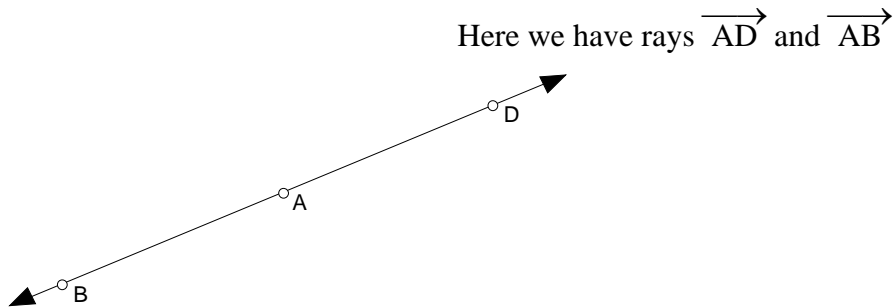
Are A and D collinear?



B is between A and C.

SUBSETS OF A LINE

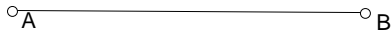
A point separates a line into three sets, two half-lines and the point itself.



and half-lines AD and AB

Are \overrightarrow{AB} and \overrightarrow{BA} the same rays?

A line segment contains two points and all points between those two points. This line segment is denoted \overline{AB} . (AB denotes the length of line segment \overline{AB} .)



MORE ON PLANES

It takes 3 non-collinear points to determine a plane.

Points belonging to the same plane are called coplanar.

Look at Table 9-3 on page 574: Points D, E and G are coplanar.

Are points D, E and F?

Are points D, F and G?

Are points D, G, F and E?

Lines belonging to the same plane are also called coplanar.

\overleftrightarrow{DE} and \overleftrightarrow{DG} are coplanar lines.

\overleftrightarrow{DF} and \overleftrightarrow{GE} are non-coplanar.

TYPES OF LINES

1. Two coplanar lines are called intersecting lines if and only if they have exactly one point in common.
2. Concurrent lines are lines that contain the same point. Concurrent lines may be coplanar or non-coplanar.
3. Two distinct coplanar lines that have no points in common are called parallel lines.
4. Two lines that cannot be contained in the same plane are called skew lines.

PROPERTIES OF POINTS, LINES AND PLANES

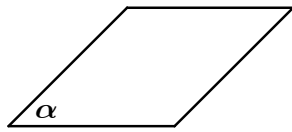
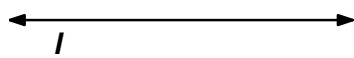
1. There is exactly one _____ that contains any 2 distinct points.
2. There is exactly one _____ that contains any 3 distinct noncollinear points.
3. If 2 points lie in a plane, then the line containing the 2 points _____.
4. If 2 distinct planes intersect, their intersection is a _____.

2 distinct planes can be parallel.

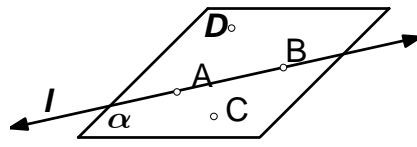
What about 3 distinct planes? Can they be parallel? _____ If they intersect, what would their intersection be? _____

5. A line and a point not on the line determine a _____.
6. Two parallel lines determine a _____.
7. Two intersecting lines determine a _____.

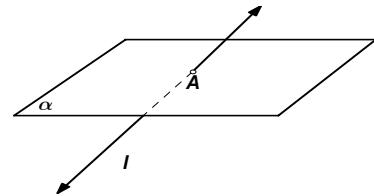
RELATIONSHIP BETWEEN A LINE AND A PLANE



line l is parallel to α



line l is in α

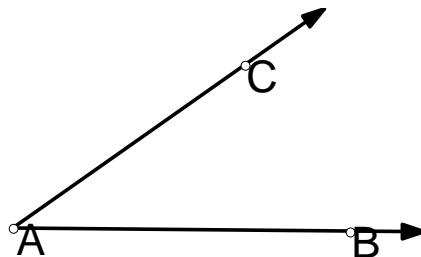


line l intersects α in a single point

A line that lies in a plane separates that plane into two half-planes. In the middle figure above, line l separates α into half-plane AB-C and AB-D.

ANGLES

An Angle is formed when two rays share a common endpoint. The rays are called the sides of the angle and the common endpoint is called the vertex. This angle can be called $\angle \alpha$ or $\angle CAB$ or $\angle BAC$.



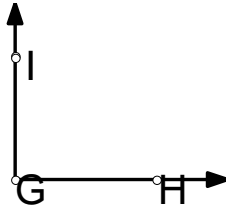
TYPES OF ANGLES

Straight Angle (180°)



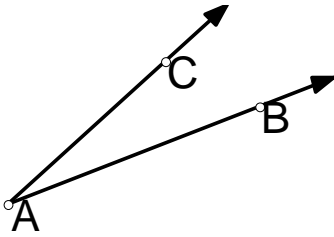
$\angle FDE$ is a Straight Angle

Right Angle (90°)



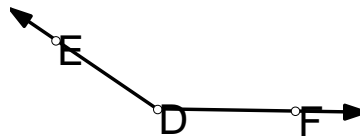
$\angle IGH$ is a Right Angle

Acute Angle (less than 90°)



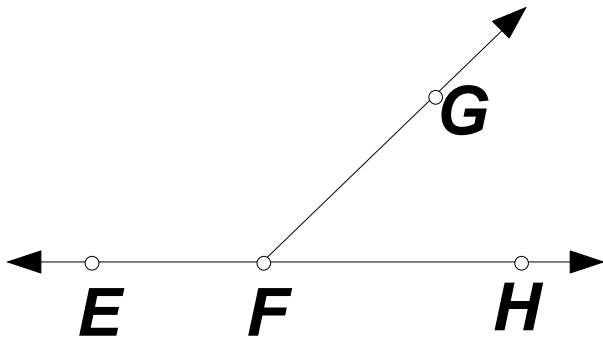
$\angle CAB$ is Acute

Obtuse Angle (greater than 90° and less than 180°)



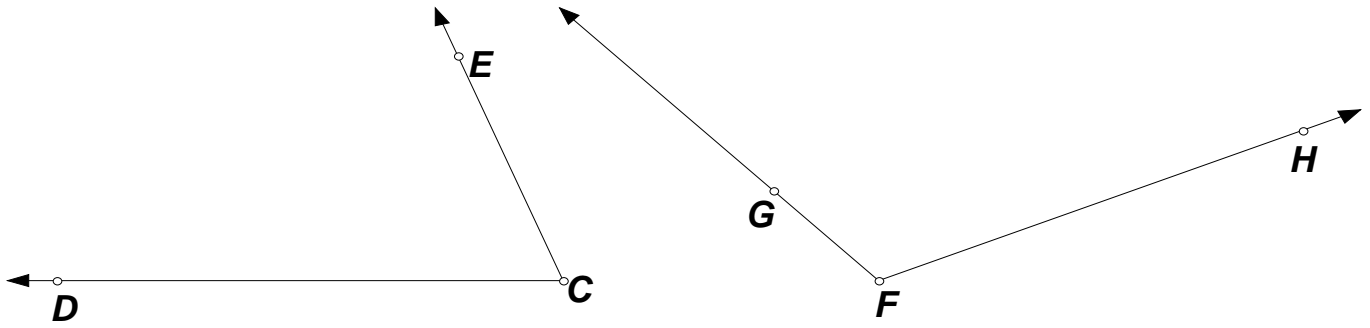
$\angle EDF$ is Obtuse

Adjacent angles share a common side. In the figure below, $\angle EFG$ and $\angle GFH$ are adjacent angles.



ANGLE MEASUREMENT

Angles are measured in degrees and we use a protractor to measure a given angle.



$$m\angle DCE = \underline{\hspace{2cm}}$$

$$m\angle GFH = \underline{\hspace{2cm}}$$

A degree is subdivided into 60 minutes (60') and a minutes is subdivided into 60 seconds (60").

$10^\circ 13' 20''$ is 10 degrees, 13 minutes and 20 seconds

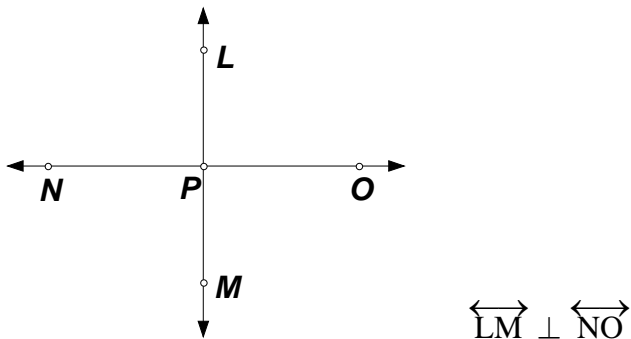
Let's try example 9-1 on page 580

a)

b)

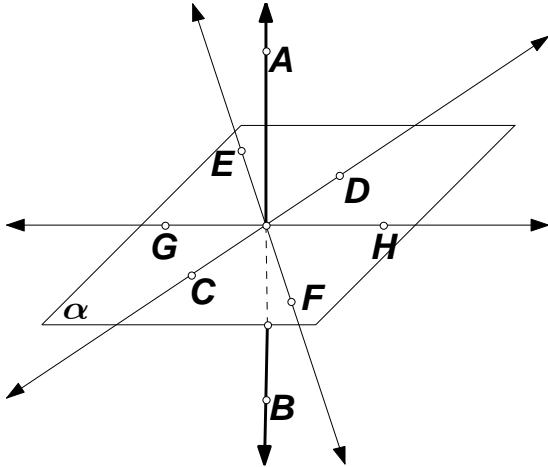
c) Change 36.79° to degrees, minutes and seconds.

PERPENDICULAR LINES When two lines intersect to form right angles, the lines are perpendicular.



Two intersecting segments, two intersecting rays, or one segment and one ray that intersect are perpendicular if the lines they lie on are perpendicular. So, $\overrightarrow{PL} \perp \overrightarrow{NP}$.

A LINE CAN BE PERPENDICULAR TO A PLANE if and only if the line and the plane intersect and the line is perpendicular to every line in the plane that passes through the point of intersection.



THEOREM 9-1: A line perpendicular to two distinct lines in the plane through its intersection with the plane is perpendicular to the plane.