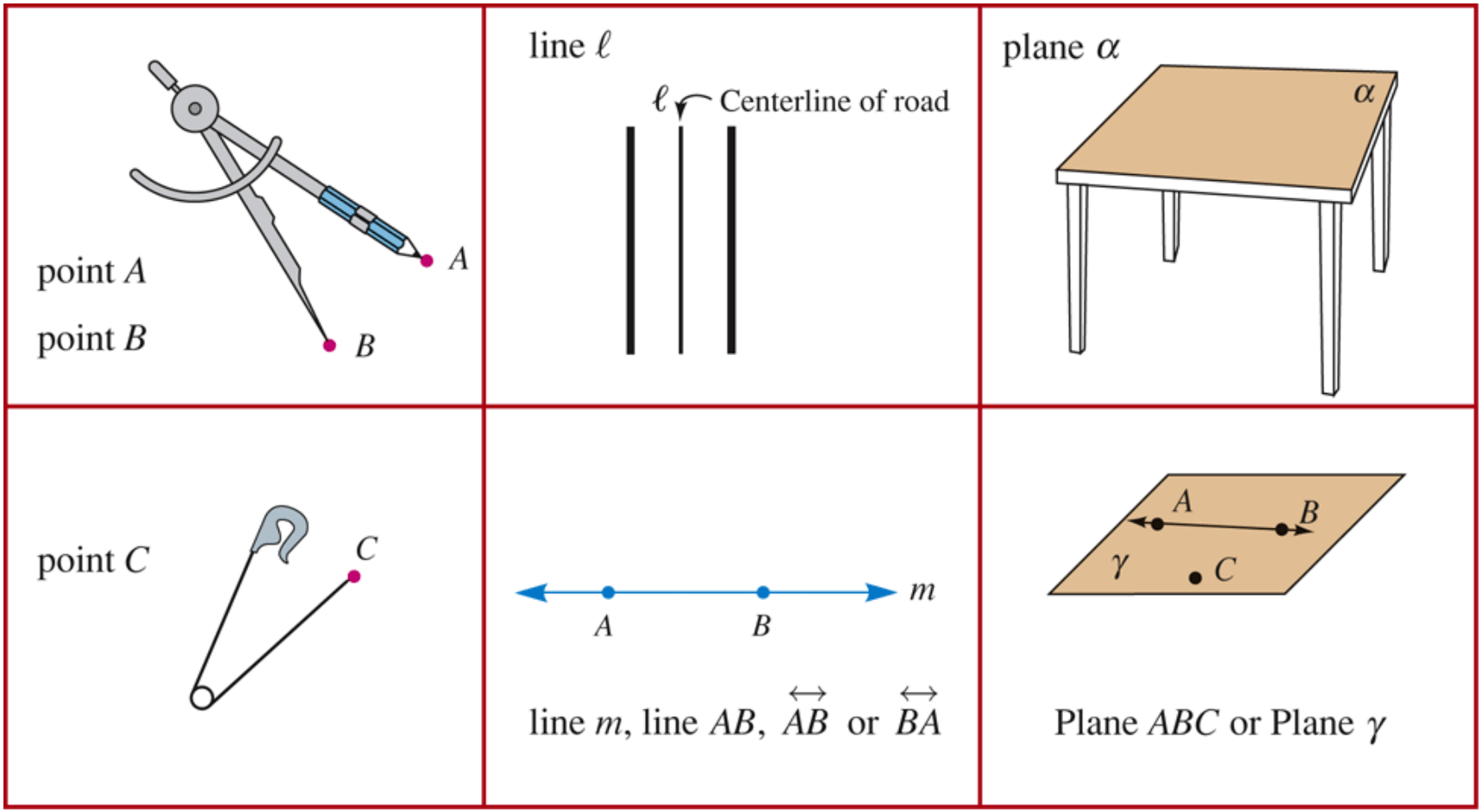
Section 11-1 Basic Notions

Students will be able to understand and explain

- Basic undefined and defined terms of geometry.
- Names, classifications, and measurement of angles.

Undefined Terms: Points, Lines, and Planes



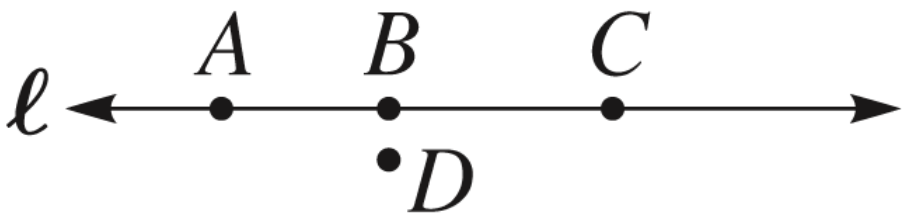
Lines

A line has no thickness and it extends forever in two directions.

Given two points, there is one and only one line that connects these points.

You need at least 2 points to form (determine) a line.

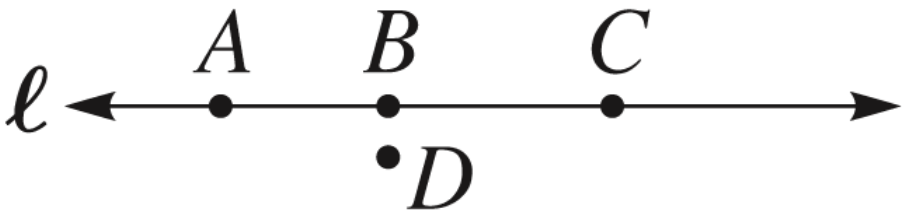
Linear Notions (1 of 5)



Collinear points

- Line ℓ contains points *A*, *B*, and *C*.
- Points *A*, *B*, and *C* belong to line *l.*
- Points *A*, *B*, and *C* are collinear.
- Points *A*, *B*, and *D* are not collinear.

Linear Notions (2 of 5)



Between

- Point *B* is between points *A* and *C* on line ℓ.
- Point *D* is not between points *A* and *C*.

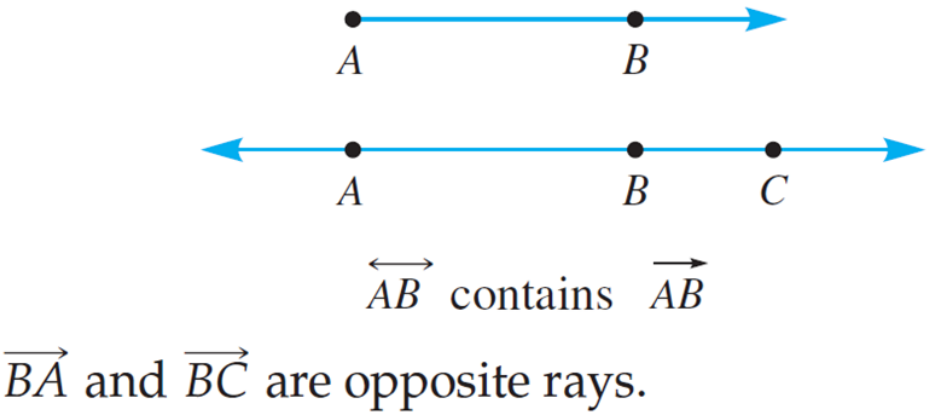
Linear Notions (3 of 5)

$\overline{AB}$ or $\overline{BA}$

Line segment

A subset of a line that contains two points of the line and all points between those two points.

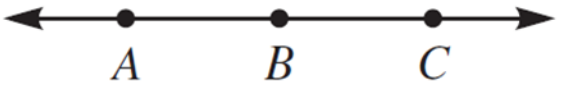
Linear Notions (4 of 5)



Ray

A subset of the line *AB* that contains the endpoint *A*, the point *B*, all points between *A* and *B*, and all points *C* on the line such that *B* is between *A* and *C*. Two rays are **opposite rays** if they have the same endpoint, lie on the same line, and their union is the line.

Linear Notions (5 of 5)



half-line BA, denoted $\overrightarrow{BA}$; half-line BC, denoted $\overrightarrow{BC}$; and point B.

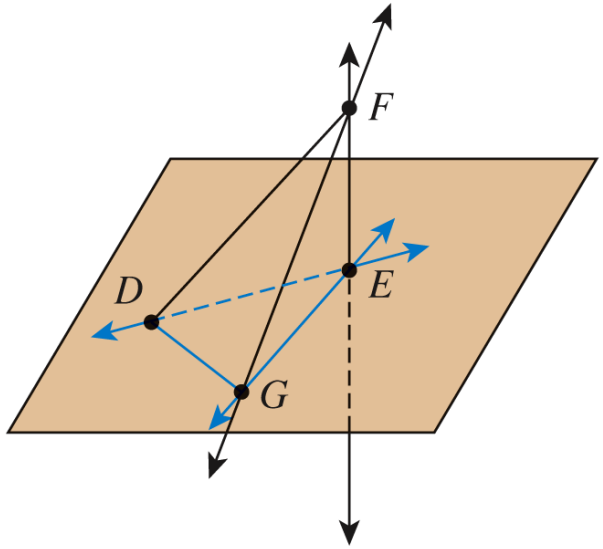
Half-line

A half-line is a ray without an endpoint. A point separates a line into three part: two half-lines and the point itself.

Planar Notions (1 of 3)

Coplanar

- Points *D*, *E*, and *G* are coplanar.
- Points *D*, *E*, *F*, and *G* are not coplanar.
- Lines *DE*, *DF*, and *FE* are not coplanar.

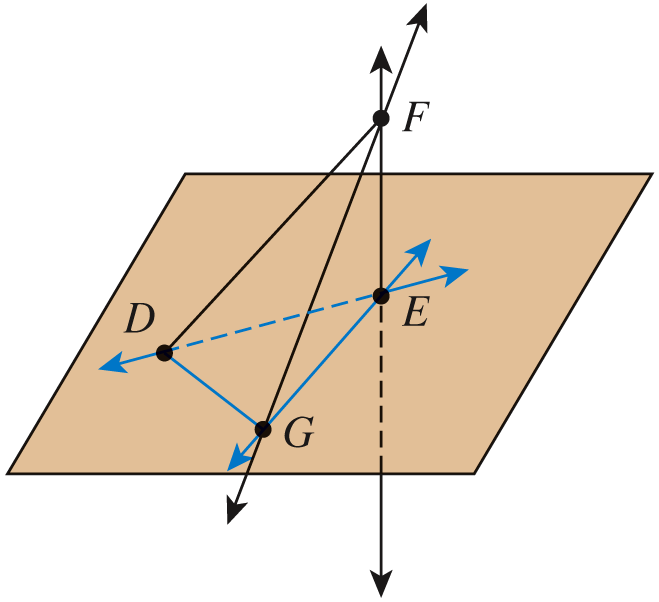


- Lines *DE* and *EG* are coplanar.
- Lines *DE* and *EG* are intersecting lines; they intersect at point *E.*

Planar Notions (2 of 3)

Skew lines

- Lines *GF* and *DE* are skew lines. They do not intersect, and they are noncoplanar.



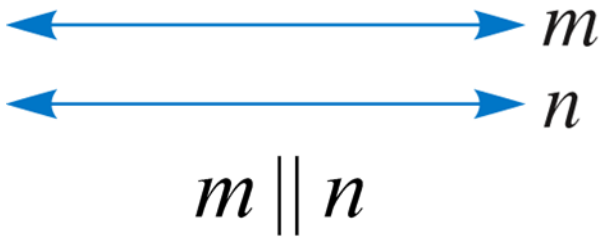
Concurrent lines

- Lines *DE, EG*, and *EF* are concurrent lines; they intersect at point *E.* (contain the same point-may or may not be coplanar.)

Planar Notions (3 of 3)

Parallel lines

Line *m* is parallel to line *n.* They have no points in common and are coplanar.



Intersecting Lines are two copolanar lines with exactly one point in common.

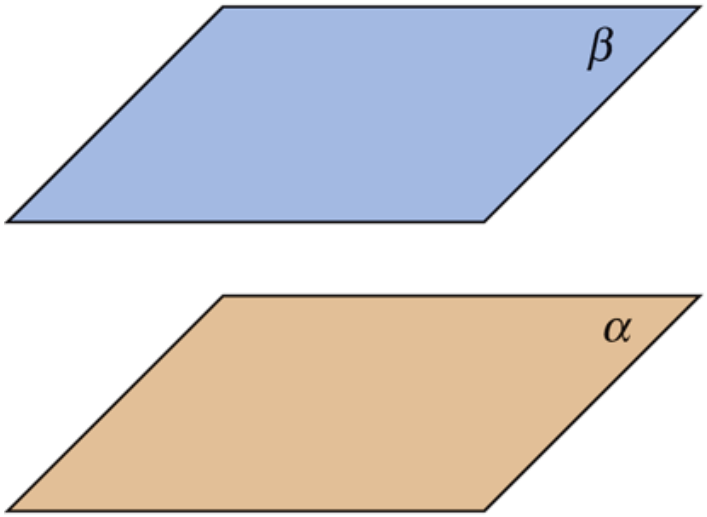
Axioms About Points, Lines, and Planes

- There is exactly one line that contains any two distinct points.
- If two points lie in a plane, then the line containing the points lies in the plane.
- If two distinct planes intersect, then their intersection is a line.
- There is exactly one plane that contains any three distinct noncollinear points.

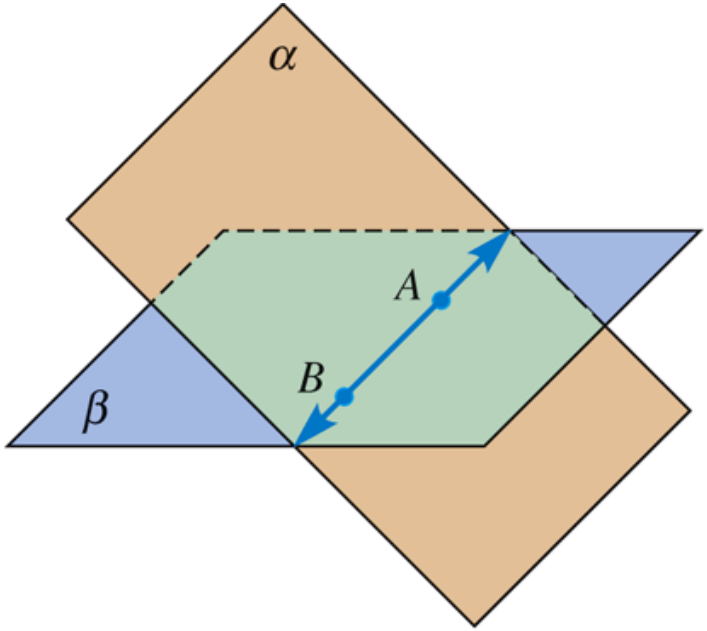
What Determines a Plane?

- A line and a point not on the line determine a plane.
- Two parallel lines determine a plane.
- Two intersecting lines determine a plane.
- Three noncollinear points determine a plane.

Other Planar Notions



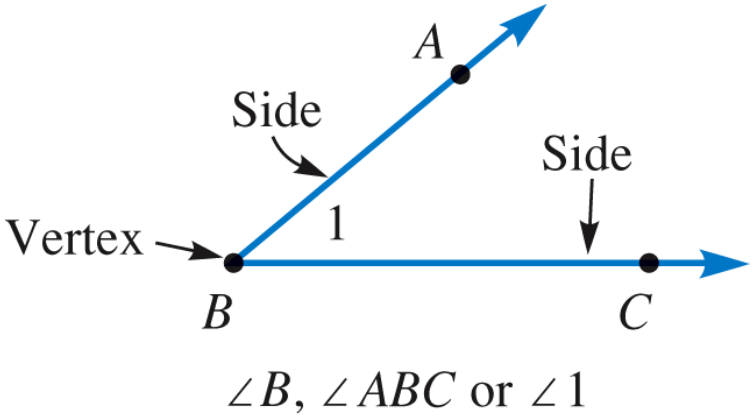
α is parallel to β.



α and β intersect in $\overleftrightarrow{AB}$.

Angles (1 of 2)

Angle – formed by two rays with the same endpoint.



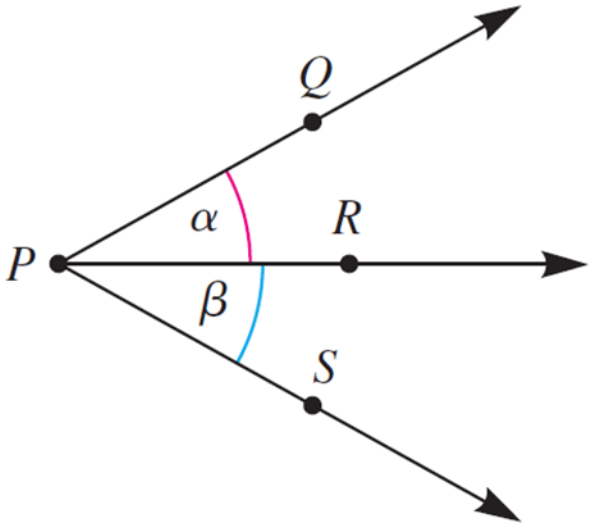
Sides of an angle – the two rays that form an angle.

Vertex – the common endpoint of the two rays that form an angle.

Angles (2 of 2)

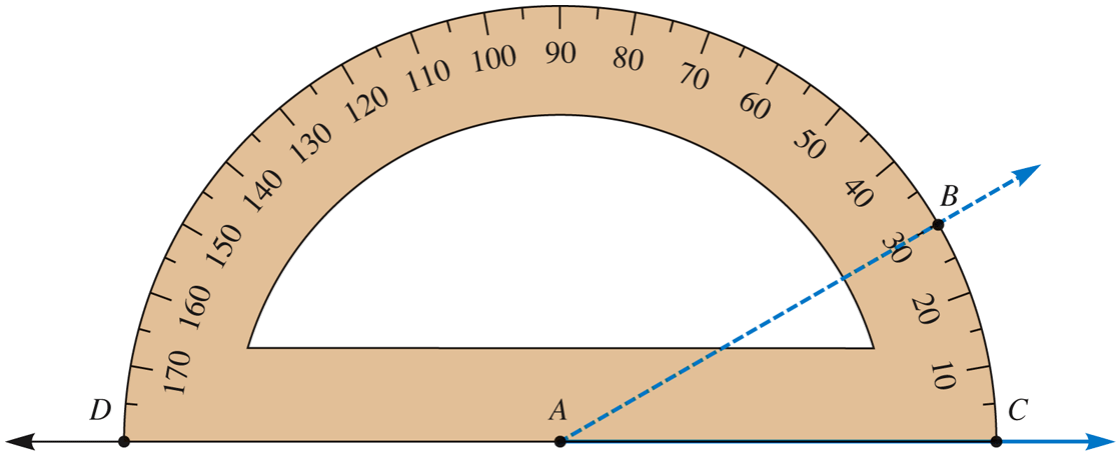
Adjacent angles – two angles with a common vertex and a common side, but without overlapping interiors.

$\angle QPR$ is adjacent to $\angle RPS$.

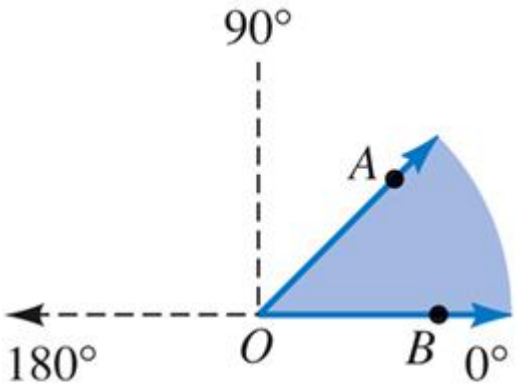


Angle Measurement

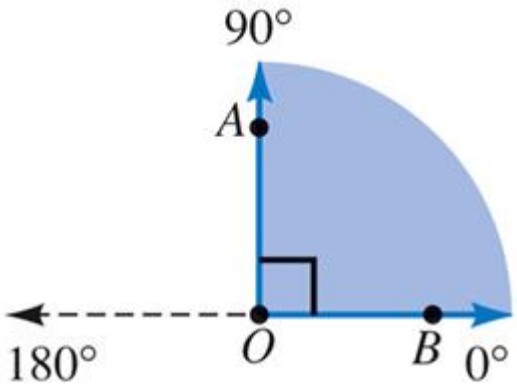
A protractor is used to measure angles. The vertex of the angle goes on point A and one ray runs along the bottom of the protractor. When we measure an angle, we are measuring the opening between the two rays.



Types of Angles (1 of 2)

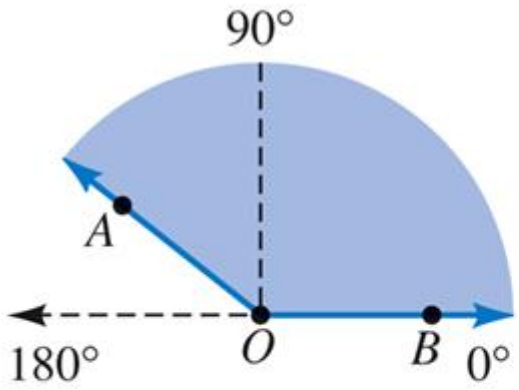


Acute angle *AOB*:
measures less
than 90°

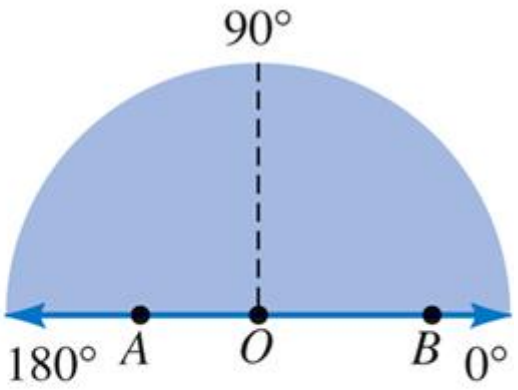


Right angle *AOB*:
measures
exactly 90°

Types of Angles (2 of 2)

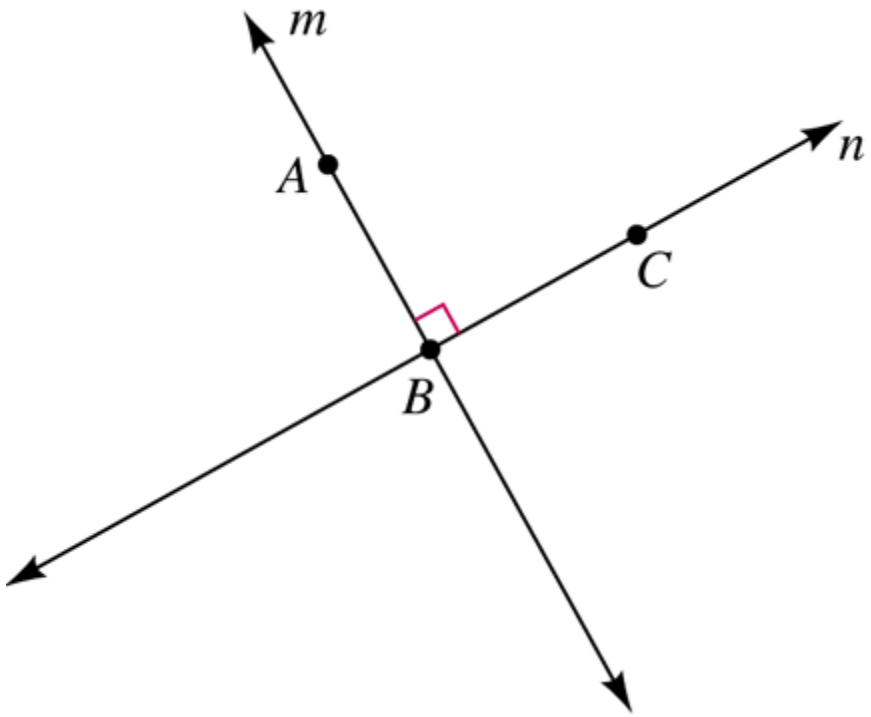


Obtuse angle *AOB*:
measures greater
than 90° and
less than 180°



Straight angle *AOB*:
measures
exactly 180°

Perpendicular Lines



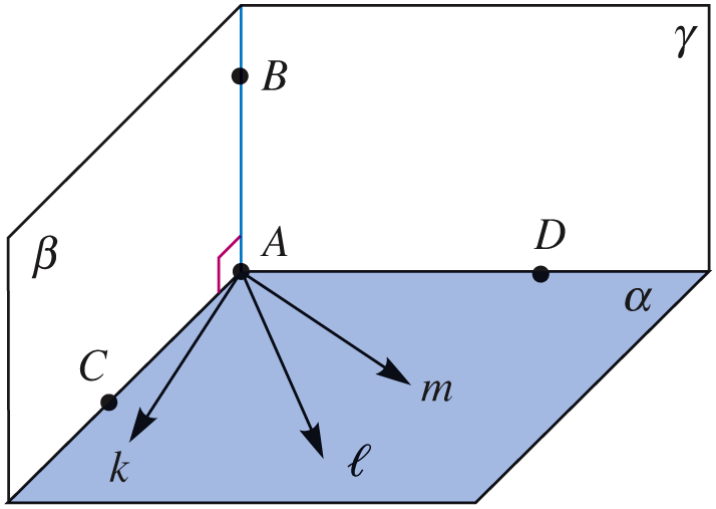
$m \perp n$

$\overline{AB} \perp \overline{BC}$

$\overline{BA} \perp \overline{BC}$

$\overline{AB} \perp \overline{BC}$

A Line Perpendicular to a Plane

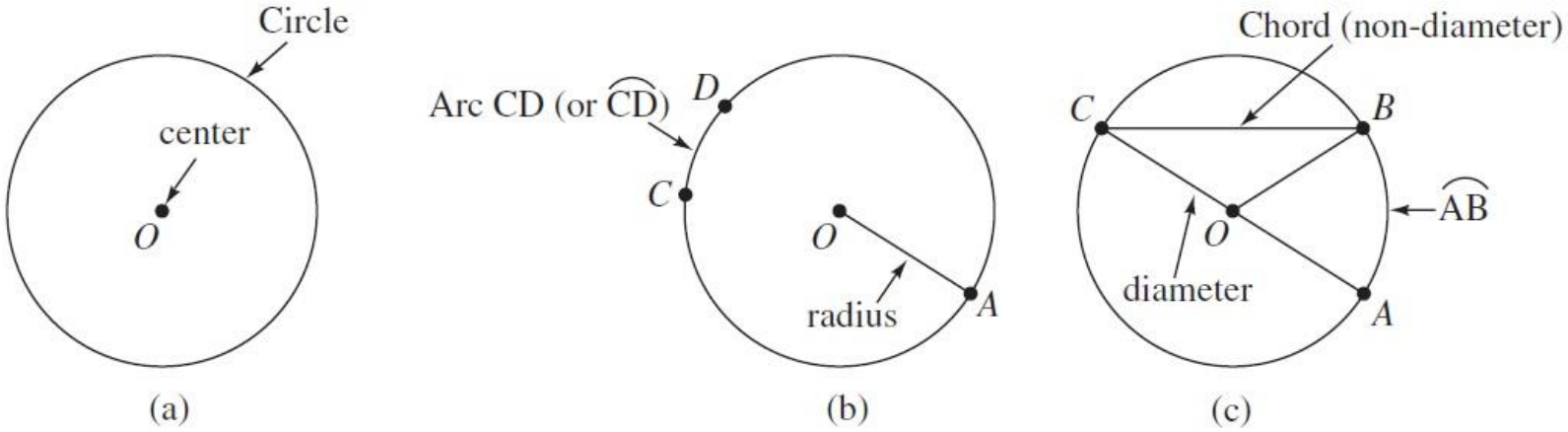


A line perpendicular to a plane is a line that is perpendicular to every line in the plane through its intersection with the plane.

Circles and Arcs (1 of 2)

Circle – the set of all points in a plane that are the same distance (the **radius**) from a given point, the **center**.

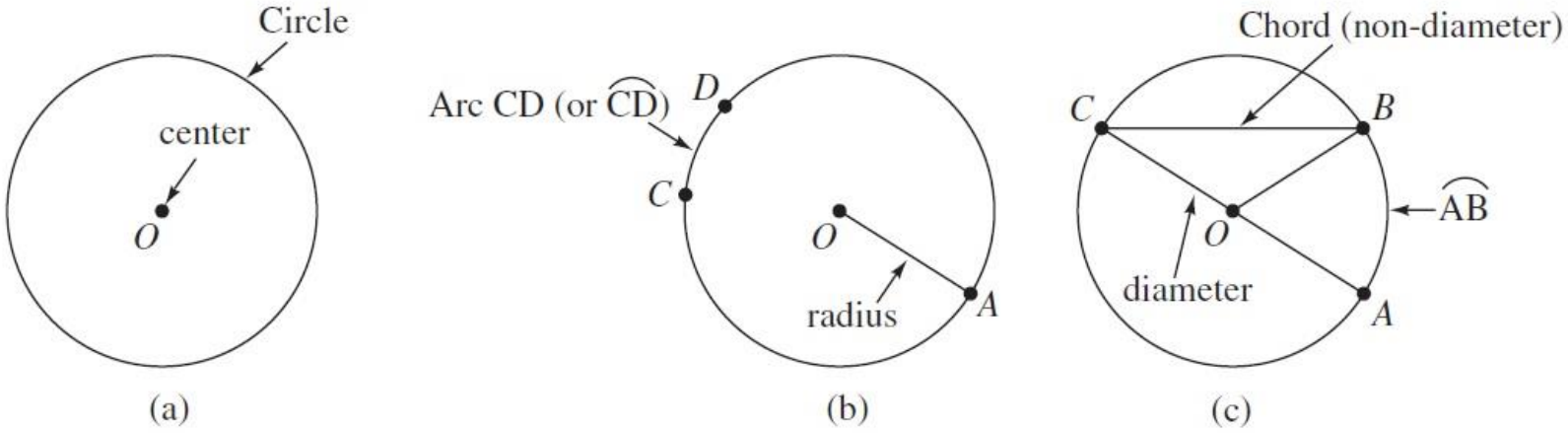
Arc – any part of the circle that can be drawn without lifting a pencil.



Circles and Arcs (2 of 2)

Chord – any segment with endpoints on the circle

Diameter – If a chord contains the center of the circle, it is a diameter.



Example 1

- Can skew lines be parallel?

- No. Parallel lines are coplanar and skew lines are noncoplanar.

Example 2

- If 2 lines are intersecting lines, are they always concurrent lines?

- Yes. 2 concurrent lines share a point and since 2 lines determine a plane, they are also coplanar. Therefore the 2 lines are also intersecting.

Example 3

- If 3 lines are concurrent are they always intersecting?

- No. 3 lines can share a point (thus being concurrent) but they can be noncoplanar.

Example 4

- Will any 3 points always be collinear?

- No. Only 2 points are guaranteed to be collinear. 3 points may or may not be collinear.

Example 5

- Is every diameter a chord?
- Is every chord a diameter?

- Yes! Every diameter is a chord since every diameter connects 2 points along a circle.
- No. It is possible to connect 2 points along a circle and not pass through the center.

This is the end of section 11-1.