3.1 Lines and Angles

Goals • Identify relationships between lines.
• Identify angles formed by transversals.

VOCABULARY

Parallel lines Two lines are parallel lines if they are coplanar and do not intersect.

Skew lines Two lines are skew lines if they are not coplanar and do not intersect.

Parallel planes Two planes are parallel planes if they do not intersect.

Transversal A transversal is a line that intersects two or more coplanar lines at different points.

Corresponding angles Two angles are corresponding angles if they occupy corresponding positions.

Alternate exterior angles Two angles are alternate exterior angles if they lie outside the two lines on opposite sides of the transversal.

Alternate interior angles Two angles are alternate interior angles if they lie between the two lines on opposite sides of the transversal.


Consecutive interior angles Two angles are consecutive interior angles if they lie between the two lines on the same side of the transversal.

Same side interior angles Consecutive interior angles are sometimes called same side interior angles.

Example 1   *Identifying Relationships in Space*

Think of each segment in the diagram as part of a line. Which of the lines appear to fit the description?

a. parallel to $\overleftrightarrow{AG}$ and contains *C*

b. perpendicular to $\overleftrightarrow{AG}$ and contains *B*

c. skew to $\overleftrightarrow{AG}$ and contains *C*

d. Name the plane that contains *C* and appears to be parallel to plane *AFL*.
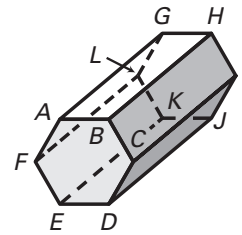
Solution

a. There are __five__ lines that are parallel to $\overleftrightarrow{AG}$, but only __$\overleftrightarrow{CI}$__ passes through *C* and is parallel to $\overleftrightarrow{AG}$.

b. There are __four__ lines that are perpendicular to $\overleftrightarrow{AG}$, but only __$\overleftrightarrow{AB}$__ passes through *B* and is perpendicular to $\overleftrightarrow{AG}$.

c. There are __eight__ lines that are skew to $\overleftrightarrow{AG}$, but only __$\overleftrightarrow{BC}$__ and __$\overleftrightarrow{CD}$__ pass through *C* and are skew to $\overleftrightarrow{AG}$.

**d.** The plane __*CDJ*__ contains *C* and is parallel to plane *AFL*.

✔ *Checkpoint* Think of each segment in the diagram as part of a line. Which of the lines appear to fit the description?

1. parallel to $\overleftrightarrow{PQ}$ and contains *S*

   $\overleftrightarrow{ST}$

2. perpendicular to $\overleftrightarrow{PQ}$ and contains *S*

   $\overleftrightarrow{PS}$

3. skew to $\overleftrightarrow{PQ}$ and contains *S*

   $\overleftrightarrow{SU}$

4. Name the plane that contains *S* and appears to be parallel to plane *PQR*.

   Plane *STU*
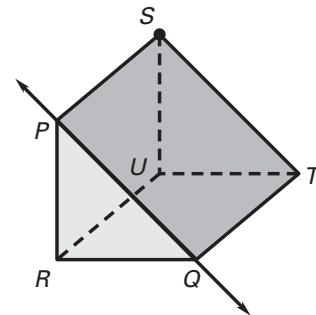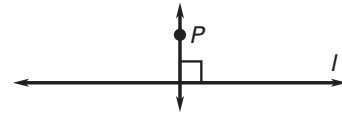
POSTULATE 13: PARALLEL POSTULATE

If there is a line and a point
not on the line, then there is
exactly one line through the
point parallel to the given line.
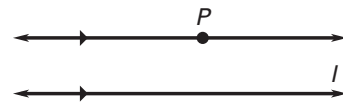
There is _exactly one_ line
through *P* parallel to *l*.

POSTULATE 14: PERPENDICULAR POSTULATE

If there is a line and a point
not on the line, then there is
exactly one line through the
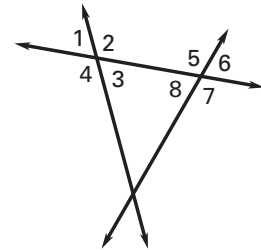point perpendicular to the given
line.

There is _exactly one_ line
through *P* perpendicular to *l*.

Example 2 *Identifying Angle Relationships*

List all pairs of angles that fit the description.

a. corresponding   **b.** alternate exterior

c. alternate interior   **d.** consecutive interior

Solution

a. ∠1 and _∠5_ , _∠3_ and ∠7   **b.** ∠1 and _∠7_ , _∠4_ and _∠6_
   ∠2 and _∠6_ , _∠4_ and _∠8_

c. _∠2_ and ∠8, _∠3_ and _∠5_   **d.** _∠2_ and _∠5_ , _∠3_ and ∠8

✔ *Checkpoint* **Complete the statement using** *corresponding*,
alternate exterior, *alternate interior*, **or** *consecutive interior*.

5. ∠9 and ∠11 are _alternate interior_ angles.

6. ∠6 and ∠10 are _corresponding_ angles.

7. ∠8 and ∠11 are _consecutive interior_ angles.

8. ∠7 and ∠13 are _alternate exterior_ angles.