# 3.1 Pairs of Lines and Angles
**For use with Exploration 3.1**

**Essential Question**   What does it mean when two lines are parallel, intersecting, coincident, or skew?
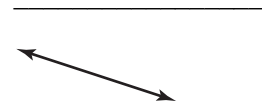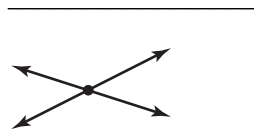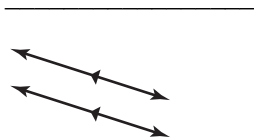
## 1   EXPLORATION: Points of Intersection

**Work with a partner.** Write the number of points of intersection of each pair of coplanar lines.

| **a.** parallel lines | **b.** intersecting lines | **c.** coincident lines |
|---|---|---|
| _____ | _____ | _____ |

## 2   EXPLORATION: Classifying Pairs of Lines

**Work with a partner.** The figure shows a *right rectangular prism.* All its angles are right angles. Classify each of the following pairs of lines as *parallel*, *intersecting*, *coincident*, or *skew*. Justify your answers. (Two lines are **skew lines** when they do not intersect and are not coplanar.)
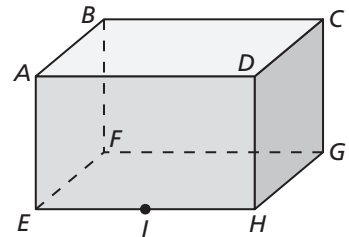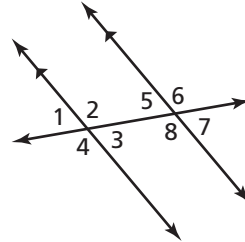
| Pair of Lines | Classification | Reason |
|---|---|---|
| **a.** $\overleftrightarrow{AB}$ and $\overleftrightarrow{BC}$ | | |
| **b.** $\overleftrightarrow{AD}$ and $\overleftrightarrow{BC}$ | | |
| **c.** $\overleftrightarrow{EI}$ and $\overleftrightarrow{IH}$ | | |
| **d.** $\overleftrightarrow{BF}$ and $\overleftrightarrow{EH}$ | | |
| **e.** $\overleftrightarrow{EF}$ and $\overleftrightarrow{CG}$ | | |
| **f.** $\overleftrightarrow{AB}$ and $\overleftrightarrow{GH}$ | | |

**3.1** **Pairs of Lines and Angles** (continued)

**3** **EXPLORATION:** Identifying Pairs of Angles

**Work with a partner.** In the figure, two parallel lines are intersected by a third line called a *transversal*.

a. Identify all the pairs of vertical angles. Explain your reasoning.



b. Identify all the linear pairs of angles. Explain your reasoning.

## Communicate Your Answer

4. What does it mean when two lines are parallel, intersecting, coincident, or skew?

5. In Exploration 2, find three more pairs of lines that are different from those given. Classify the pairs of lines as *parallel*, *intersecting*, *coincident*, or *skew*. Justify your answers.

Name_____ Date _____

**In your own words, write the meaning of each vocabulary term.**

parallel lines


skew lines


parallel planes


transversal


corresponding angles


alternate interior angles


alternate exterior angles


consecutive interior angles


**Notes:**

**3.1** **Notetaking with Vocabulary** (continued)

## Core Concepts

### Parallel Lines, Skew Lines, and Parallel Planes

Two lines that do not intersect are either *parallel lines* or *skew lines*. Two lines are **parallel lines** when they do not intersect and are coplanar. Two lines are **skew lines** when they do not intersect and are not coplanar. Also, two planes that do not intersect are **parallel planes**.
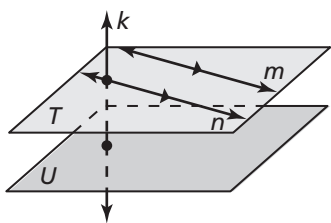


Lines *m* and *n* are parallel lines $(m \parallel n)$.

Lines *m* and *k* are skew lines.

Planes *T* and *U* are parallel planes $(T \parallel U)$.

Lines *k* and *n* are intersecting lines, and there is a plane (not shown) containing them.

Small directed arrows, as shown on lines *m* and *n* above, are used to show that lines are parallel. The symbol ‖ means "is parallel to," as in *m* ‖ *n*.

Segments and rays are parallel when they lie in parallel lines. A line is parallel to a plane when the line is in a plane parallel to the given plane. In the diagram above, line *n* is parallel to plane *U*.

**Notes:**

## Postulate 3.1  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.



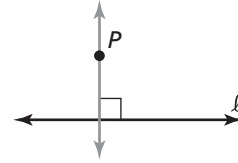There is exactly one line through *P* parallel to $\ell$.
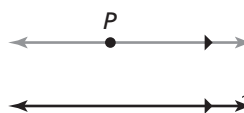
**Notes:**

**3.1** **Notetaking with Vocabulary** (continued)

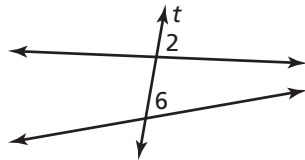## Postulate 3.2 Perpendicular Postulate

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.

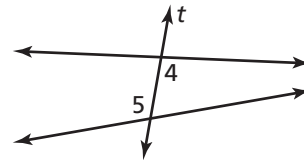There is exactly one line through *P* perpendicular to $\ell$.
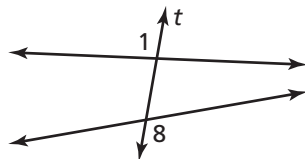
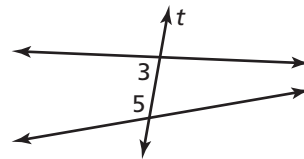**Notes:**

## Angles Formed by Transversals

Two angles are **corresponding angles** when they have corresponding positions. For example, $\angle 2$ and $\angle 6$ are above the lines and to the right of the transversal *t*.

Two angles are **alternate interior angles** when they lie between the two lines and on opposite sides of the transversal *t*.

Two angles are **alternate exterior angles** when they lie outside the two lines and on opposite sides of the transversal *t*.

Two angles are **consecutive interior angles** when they lie between the two lines and on the same side of the transversal *t*.
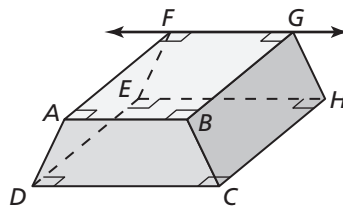
**Notes:**

**3.1**  **Notetaking with Vocabulary** (continued)

## Extra Practice

**In Exercises 1–4, think of each segment in the diagram as part of a line.**
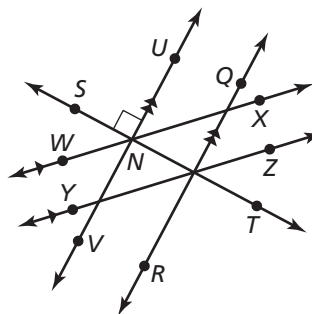**Which line(s) or plane(s) contain point B and appear to fit the description?**

1.  line(s) skew to $\overleftrightarrow{FG}$.

2.  line(s) perpendicular to $\overleftrightarrow{FG}$.

3.  line(s) parallel to $\overleftrightarrow{FG}$.

4.  plane(s) parallel to plane $FGH$.

**In Exercises 5–8, use the diagram.**

5.  Name a pair of parallel lines.

6.  Name a pair of perpendicular lines.

7.  Is $\overleftrightarrow{WX} \parallel \overleftrightarrow{QR}$? Explain.

8.  Is $\overleftrightarrow{ST} \perp \overleftrightarrow{NV}$? Explain.

**In Exercises 9–12, identify all pairs of angles of the given type.**

9.  corresponding

10. alternate interior

11. alternate exterior

12. consecutive interior