3.1 Pairs of Lines and Angles
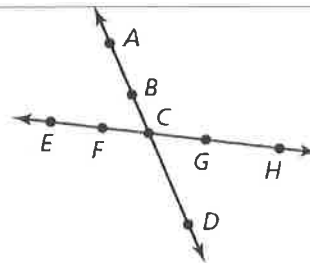
Essential Question

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

Oct 5-11:09 AM

Use the diagram. $\overleftrightarrow{AC}$, $\overleftrightarrow{BC}$, $\overrightarrow{AB}$
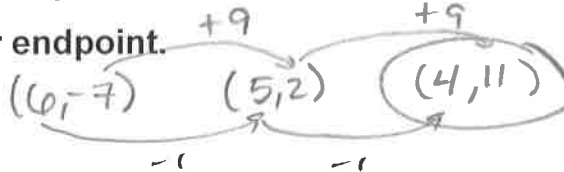
1. What is another name for $\overrightarrow{BD}$?

2. Name one pair of opposite rays.

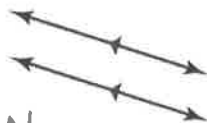$\overrightarrow{CF}$ and $\overrightarrow{CG}$ (many possibilities)

3. The midpoint *M* and one endpoint of $\overline{JK}$ are given. Find the coordinates of the other endpoint.

M(5, 2) and J (6, −7)

$+9$ $+9$

$(6, -7)$ $(5, 2)$ $(4, 11)$

-1 -1

4. Write the number of points of intersection of each pair of coplanar lines.

a. parallel lines
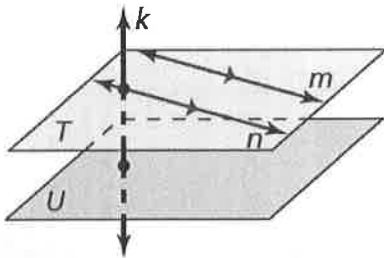
None

b. intersecting lines

One

c. coincident lines

Infinite

Warm Up

1

Skew Lines - lines that do not intersect and are not coplanar.

Parallel Lines - Lines that are coplanar and do not intersect.

Parallel Planes - Planes that don't intersect

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 in red on lines m and n above, are used to show that lines are parallel. The symbol $\parallel$ means "is parallel to," as in $m \parallel n$.

Core Concept

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*.
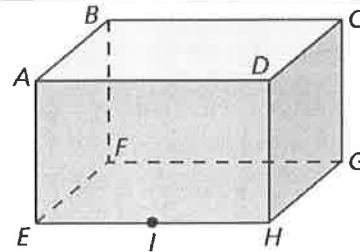
Pair of Lines	Classification	Reason
a. $\overleftrightarrow{AB}$ and $\overleftrightarrow{BC}$	Intersecting	intersect @ B
b. $\overleftrightarrow{AD}$ and $\overleftrightarrow{BC}$	Parallel	coplanar + never intersect
c. $\overleftrightarrow{EI}$ and $\overleftrightarrow{IH}$	Coincident	E, I, H are collinear
d. $\overleftrightarrow{BF}$ and $\overleftrightarrow{EH}$	Skew	not coplanar, don't intersect
e. $\overleftrightarrow{EF}$ and $\overleftrightarrow{CG}$	Skew	not coplanar, don't intersect
f. $\overleftrightarrow{AB}$ and $\overleftrightarrow{GH}$	parallel	both lie on plane ABG (not drawn) and never intersect

Exploration 2

2

Think of each segment in the figure as part of a line. Which line(s) or plane(s) appear to fit the description?
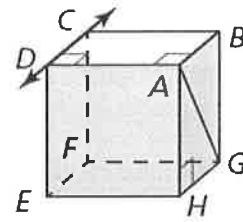
a. line(s) parallel to $\overleftrightarrow{CD}$ and containing point A $\overline{AB}$

b. line(s) skew to $\overleftrightarrow{CD}$ and containing point A $\overline{AH}$

c. line(s) perpendicular to $\overleftrightarrow{CD}$ and containing point A $\overleftrightarrow{AD}$

d. plane(s) parallel to plane EFG and containing point A

   Plane ABC

Example 1

Transversal - A line that intersects two or more coplanar lines at different points.

In the figure, two parallel lines are intersected by a third line called a *transversal*.
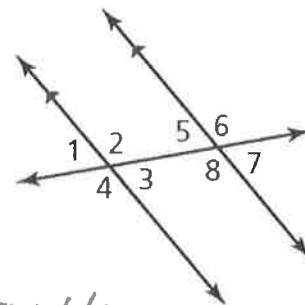
a. Identify all the pairs of vertical angles.

b. Identify all the linear pairs of angles.

a) $\angle 1 + \angle 3$
    $\angle 2 + \angle 4$
    $\angle 6 + \angle 8$
    $\angle 5 + \angle 7$

b) $\angle 1 + \angle 2$ $\angle 5 + \angle 6$
    $\angle 3 + \angle 4$ $\angle 5 + \angle 8$
    $\angle 2 + \angle 3$ $\angle 7 + \angle 8$
    $\angle 1 + \angle 4$ $\angle 7 + \angle 6$

Exploration 3

3

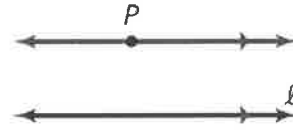## ⑤ Postulates

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.
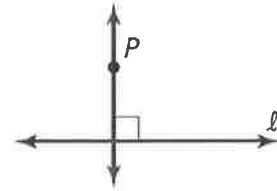
There is exactly one line through P parallel to ℓ.

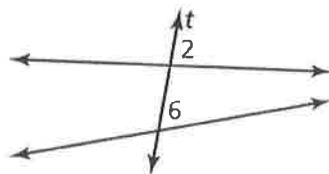### Postulate 3.2   Perpendicular Postulate

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.

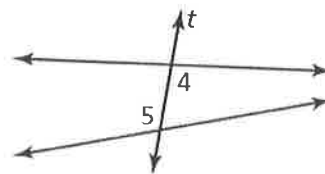There is exactly one line through P perpendicular to ℓ.

Postulates

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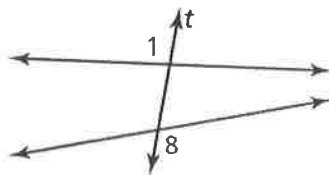
Two angles are **alternate exterior angles** when they lie outside the two lines and on opposite sides of the transversal t.
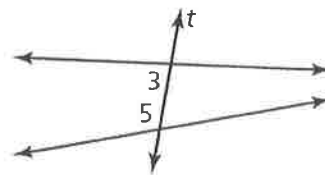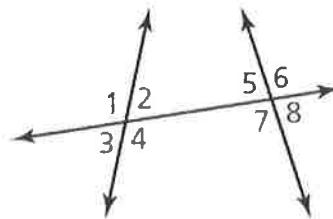
Two angles are **consecutive interior angles** when they lie between the two lines and on the same side of the transversal t.

Core Concept

4

Identify all pairs of angles of the given type.

a. corresponding

b. alternate interior

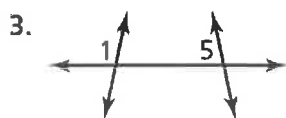**c.** alternate exterior

d. consecutive interior

a) $\angle 1 + \angle 5$
$\angle 2 + \angle 6$
$\angle 3 + \angle 7$
$\angle 4 + \angle 8$

b) $\angle 2 + \angle 7$
$\angle 4 + \angle 5$
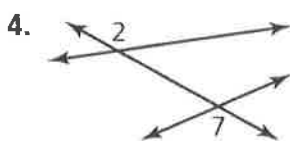
c) $\angle 1 + \angle 8$
$\angle 3 + \angle 6$

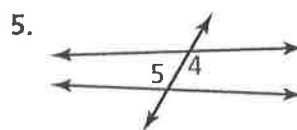d) $\angle 2 + \angle 5$
$\angle 4 + \angle 7$

Example 3

Classify the pair of numbered angles.

3.

Corresponding

4.

Alternate Exterior

5.

Alternate Interior

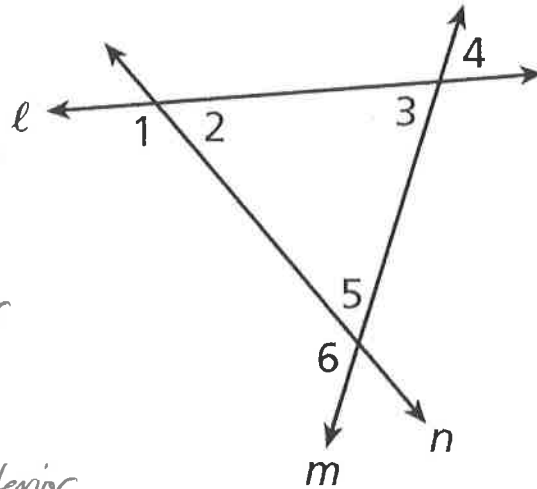## Identify the transversal and classify each angle pair.

A. ∠1 and ∠3

transversal ℓ, corresponding

B. ∠2 and ∠6

transversal n, alternate interior

C. ∠4 and ∠6

transversal m, alternate exterior

Oct 5-12:58 PM

Exit Ticket: Sketch a right triangular prism with the vertices labeled. Identify:

a pair of parallel lines

$\overline{UX} \parallel \overline{VY}$, $\overline{UX} \parallel \overline{WZ}$, $\overline{VY} \parallel \overline{WZ}$
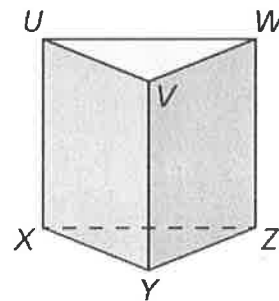
$\overline{UW} \parallel \overline{XZ}$

a pair of perpendicular lines

$\overline{UV} \perp \overline{VY}$

a pair of skew lines

$\overline{UW}$ is skew to $\overline{VY}$

Closure

6

Homework

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