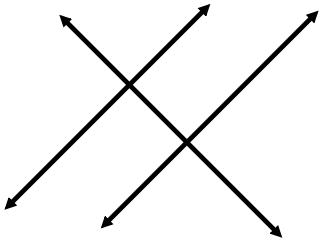
3.1: Pairs of Lines and Angles

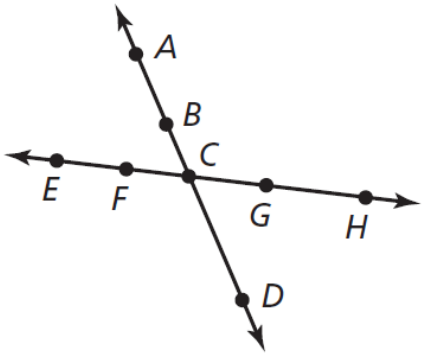
Essential Question

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



Warmup

Use the diagram.



1. What is another name for $\overleftrightarrow{BD}$?

2. What is another name for $\overline{EG}$?

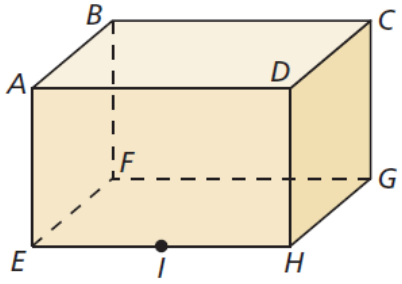
3. What is another name for $\overrightarrow{CH}$?

4. Name all segments with endpoint B.

5. Name one pair of opposite rays.

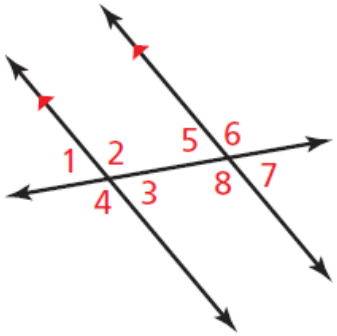
6. Name a point on $\overleftrightarrow{AC}$.

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



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 $\overleftrightarrow{GH}$		

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.

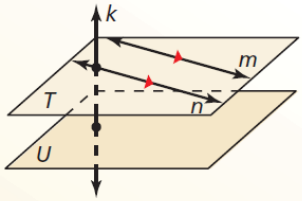
Consider this. Write the number of points of intersection of each pair of coplanar lines.

a. parallel lines b. intersecting lines c. coincident lines

Core Concept

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.

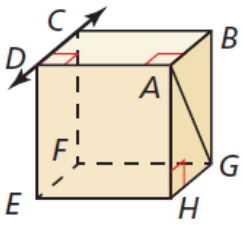
Planes T and U are parallel planes ($T \parallel U$).

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

Small directed arrows, as shown 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 $m \parallel n$.

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.

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

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

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

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

Try it:

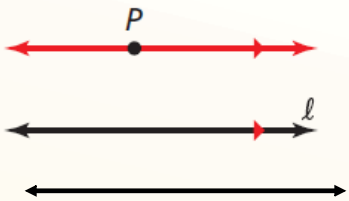
1. Look at the diagram in Example 1. Name the line(s) through point F that appear skew to $\overleftrightarrow{EH}$.

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.

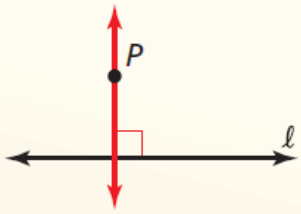
There is exactly one line through P parallel to ℓ.



Postulate 3.2 Perpendicular Postulate

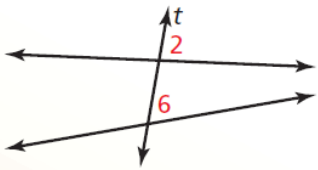
If there is a line and a point not on the line, then there is exactly one line through the point perpendicular to the given line.

There is exactly one line through P perpendicular to ℓ.

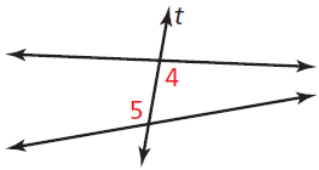


Core Concept

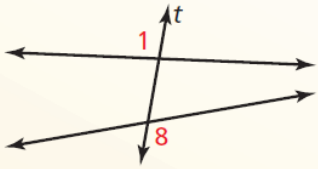
Angles Formed by Transversals



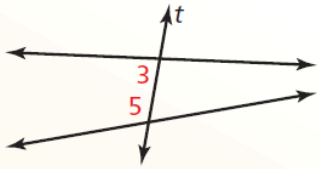
Two angles are **corresponding angles** when they have corresponding positions. For example, $\angle 2$ and $\angle 6$ are above the lines and to the right of the transversal t.



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

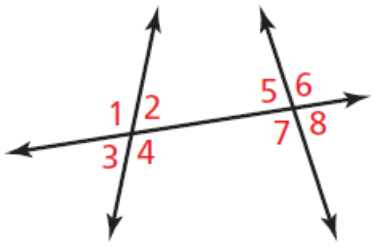


Two angles are **alternate exterior angles** when they lie outside the two lines and on opposite sides of the transversal t.



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

Identify all pairs of angles of the given type.



a. corresponding

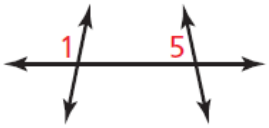
b. alternate interior

c. alternate exterior

d. consecutive interior

Classify the pair of numbered angles.

3.



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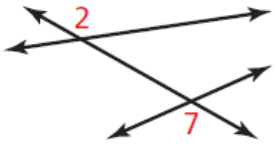

5.