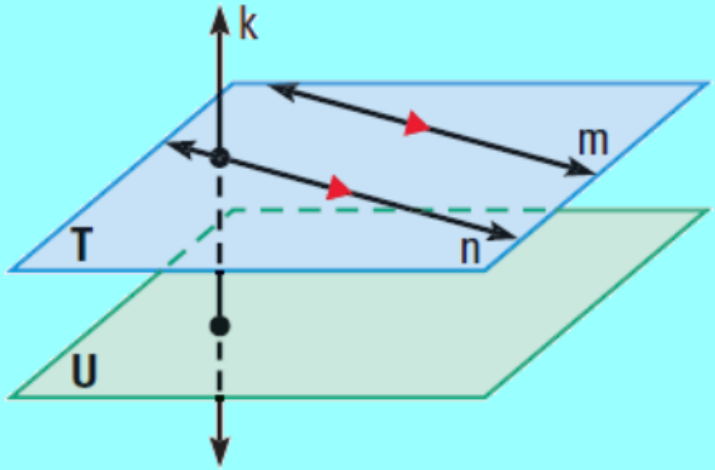
3.1 Identify Pairs of Lines and Angles

Goal • Identify angle pairs formed by three intersecting lines.

Parallel Lines - A pair of lines that do not intersect and are in the same plane

Skew Lines - A pair of lines that do not intersect and are not in the same plane

Parallel Planes - A pair of planes that do not 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 ($T \parallel U$).

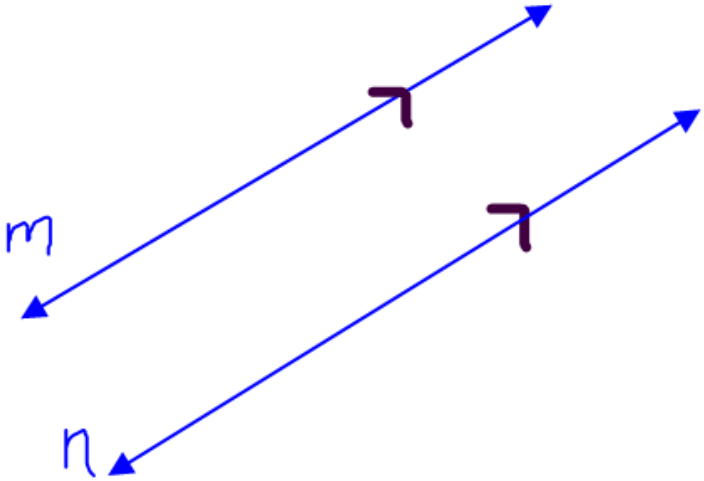
Lines k and n are intersecting lines, and there is a plane (not shown) containing them.

To show lines are parallel:

Put small triangles or arrows on the lines showing that they are parallel to each other.

Symbol for Parallel:

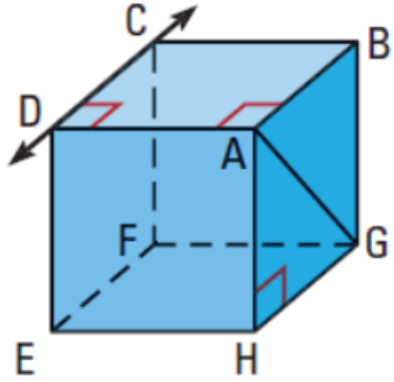
||



m || n

EXAMPLE 1 Identify relationships in space

Think of each segment in the figure as part of a line. Which line(s) or plane(s) in the figure appear to fit the description?



a. Line(s) parallel to $\overleftrightarrow{CD}$ and containing point A

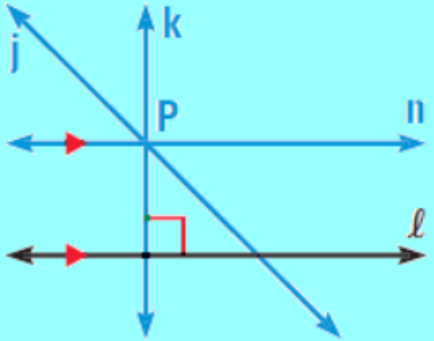
b. Line(s) skew to $\overleftrightarrow{CD}$ and containing point A

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

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

PARALLEL AND PERPENDICULAR LINES Two lines in the same plane are either parallel or intersect in a point.

Through a point not on a line, there are infinitely many lines. Exactly one of these lines is parallel to the given line, and exactly one of them is perpendicular to the given line.



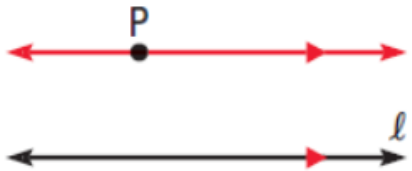
Animated Geometry at classzone.com

POSTULATES

For Your Notebook

POSTULATE 13 Parallel Postulate

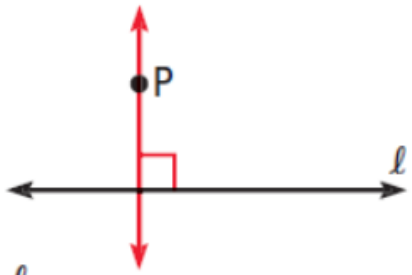
If there is a line and a point not on the line, then there is exactly one line through the point parallel to the given line.



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 Identify parallel and perpendicular lines

PHOTOGRAPHY The given line markings show how the roads are related to one another.

a. Name a pair of parallel lines.

b. Name a pair of perpendicular lines.

c. Is $\overleftrightarrow{FE} \parallel \overleftrightarrow{AC}$? Explain.

Niagara Falls, New York

Solution

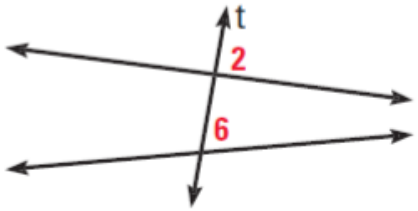
a. $\overleftrightarrow{MD} \parallel \overleftrightarrow{FE}$ **b.** $\overleftrightarrow{MD} \perp \overleftrightarrow{BF}$

c. $\overleftrightarrow{FE}$ is not parallel to $\overleftrightarrow{AC}$, because $\overleftrightarrow{MD}$ is parallel to $\overleftrightarrow{FE}$ and by the Parallel Postulate there is exactly one line parallel to $\overleftrightarrow{FE}$ through M.

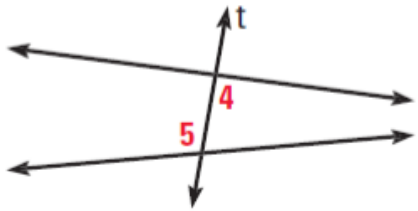
t

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

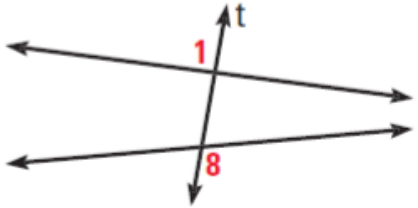
Angles Formed by Transversals



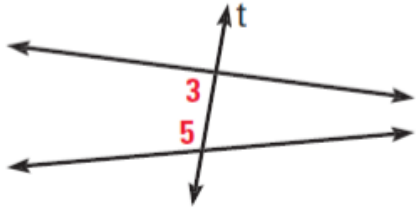
Two angles are **corresponding angles** if they have corresponding positions. For example, $\angle 2$ and $\angle 6$ are above the lines and to the right of the transversal *t*.



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



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



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

READ VOCABULARY
Another name for consecutive interior angles is **same-side interior angles**.

EXAMPLE 3 Identify angle relationships

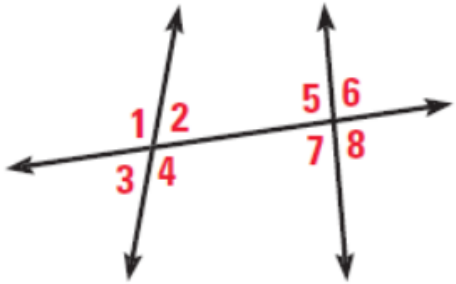
Identify all pairs of angles of the given type.

a. Corresponding

b. Alternate interior

c. Alternate exterior

d. Consecutive interior



Corresponding

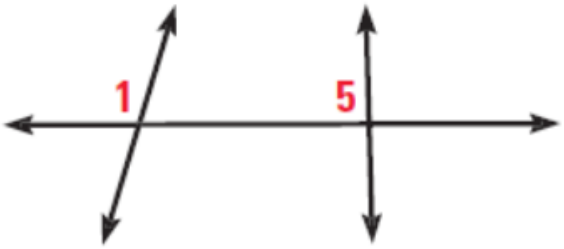
Alternate Interior

Alternate Exterior

Consecutive Interior

Classify the pair of numbered angles.

3.



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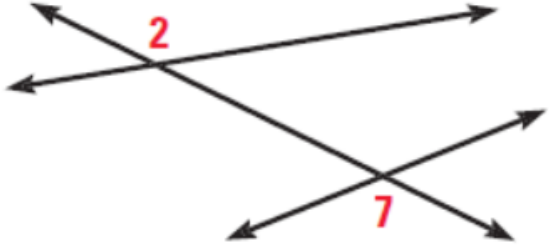
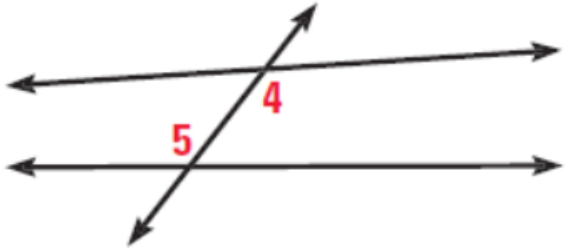


5.



Assignment:

p. 150 (1-32 all, 34, 35, 40-42, 45-49)