

Plane

A two-dimensional flat surface

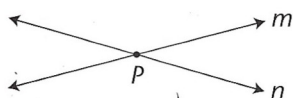
Transversal

A line that intersects two or more lines

A **plane** can be thought of as a two-dimensional flat surface. Pairs of lines in a plane can exist in two different ways.

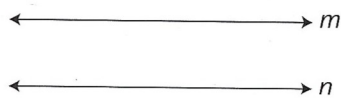
Lines in a Plane

Intersecting lines in a plane meet at exactly one point P .



The symbol for parallel is $||$; $m||n$ is read " m is parallel to n ."

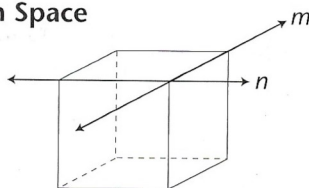
Parallel lines in a plane never meet or intersect.



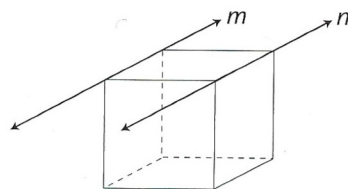
Space is three-dimensional. Pairs of lines in space can exist in three different ways.

Lines in Space

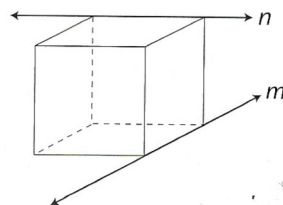
Intersecting lines form a plane and meet in that plane.



Parallel lines form a plane and do not meet.

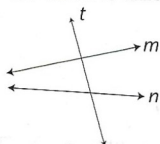


Skew lines are not parallel and do not intersect. Skew lines do not determine a plane.



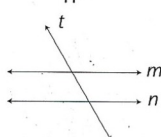
A **transversal** is a line that intersects two or more lines.

m and n intersect.



t is the transversal.

$m||n$



t is the transversal.

Exterior angles

Angles that are formed outside two lines cut by a transversal

Interior angles

Angles that are formed inside, or between, two lines cut by a transversal

Corresponding angles

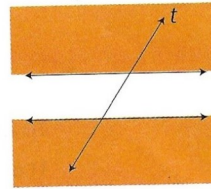
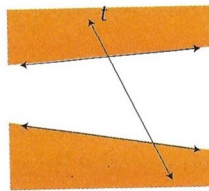
Interior and exterior angles on the same side of a transversal cutting through parallel lines

Theorem

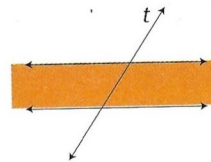
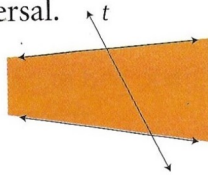
A statement that can be proven

Angles formed by transversals have special names.

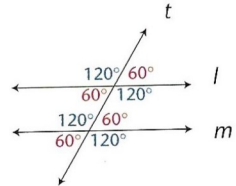
Exterior angles are those angles outside lines cut by a transversal.



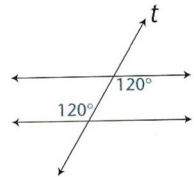
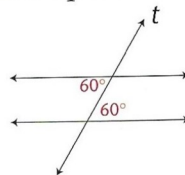
Interior angles are those angles inside, or between, lines cut by a transversal.



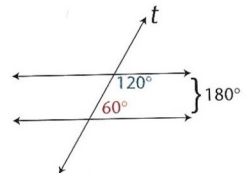
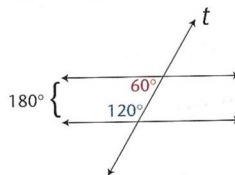
When parallel lines are cut by a transversal, certain angles will always be equal and others supplementary. Here is an example of $l \parallel m$, t is the transversal.



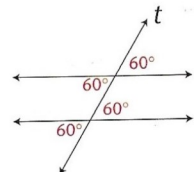
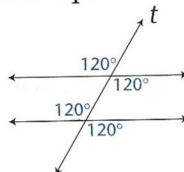
Alternate interior angles are equal:



Interior angles on the same side of the transversal are supplementary:

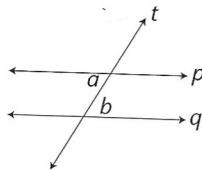


Corresponding angles are equal:



Each fact illustrated here is a **theorem** from geometry. This means these angles are always equal or supplementary as long as they are in the positions as shown in the diagrams.

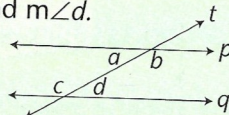
In this figure, $p \parallel q$ and t is a transversal.



If you would measure $\angle a$ and $\angle b$, you would find that $m\angle a = m\angle b$. $\angle a$ and $\angle b$ are alternate interior angles. Whenever a transversal cuts two parallel lines, the alternate interior angles that are formed are equal.

EXAMPLE 1

In the following figure, $p \parallel q$ and $m\angle a = 30^\circ$. Find $m\angle b$, $m\angle c$, and $m\angle d$.



Step 1

If $p \parallel q$ and t is a transversal, then $m\angle a = m\angle d$ and $m\angle b = m\angle c$. This statement is true because it is a theorem from geometry.

Step 2

Since $m\angle a = 30^\circ$, $m\angle d = 30^\circ$ because alternate interior angles have the same measure.

Step 3

Recognize that $\angle a$ and $\angle b$ are supplementary angles because they form a straight line. Find $m\angle b$.

$$m\angle a + m\angle b = 180^\circ$$

$$30^\circ + m\angle b = 180^\circ$$

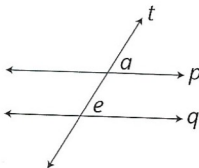
$$m\angle b = 180^\circ - 30^\circ$$

$$m\angle b = 150^\circ$$

Step 4

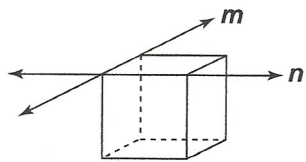
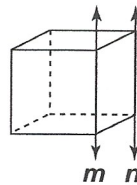
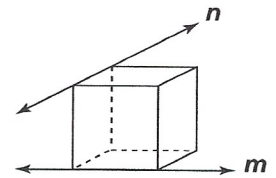
Since $m\angle b = 150^\circ$, $m\angle c = 150^\circ$ because alternate interior angles have the same measure.

In this figure, $p \parallel q$ and t is a transversal.

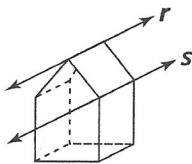


If you would measure $\angle a$ and $\angle e$, you would find that $m\angle a = m\angle e$. $\angle a$ and $\angle e$ are corresponding angles. Whenever a transversal cuts two parallel lines, the corresponding angles that are formed on the same side of the transversal are equal.

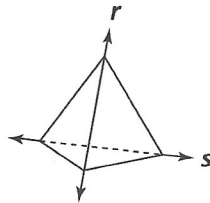
Pairs of Lines in a Plane and in Space

EXAMPLEIntersecting lines, m and n Parallel lines, m and n Skew lines, m and n 

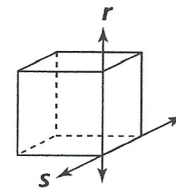
Directions Identify lines r and s in each figure. Write *intersecting*, *parallel*, or *skew*.



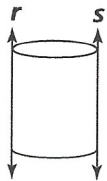
1. _____



2. _____



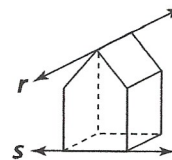
3. _____



4. _____



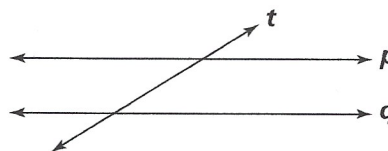
5. _____



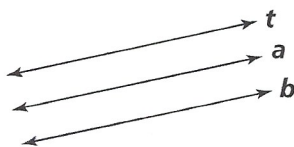
6. _____

EXAMPLE

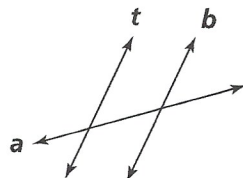
A transversal, t , intersects two or more lines.



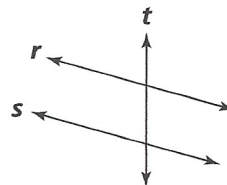
Directions If t is a transversal, write *yes*. Otherwise, write *no*.



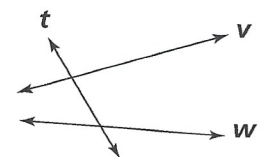
7. _____



8. _____



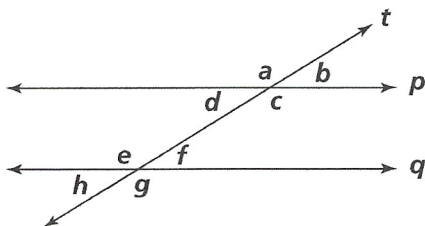
9. _____



10. _____

Pairs of Lines in a Plane and in Space

Use this figure for problems 1–7. Note that $p \parallel q$ and t is a transversal.



Directions Identify the following pairs of angles. Write *supplementary*, *alternate interior*, or *corresponding*.

1. $\angle d$ and $\angle f$ _____

3. $\angle e$ and $\angle c$ _____

2. $\angle e$ and $\angle g$ _____

4. $\angle a$ and $\angle b$ _____

Directions If $m\angle f = 48^\circ$, find m of the following angles.

5. $\angle d$ _____

6. $\angle e$ _____

7. $\angle h$ _____

Directions Circle the letter of the correct answer to each question.

Dana has her book open differently at three different moments. Diagrams 1, 2, and 3 represent these moments.

8. At 1, what kind of angle is formed by the open covers of Dana's book?

a. acute

b. obtuse

c. right

9. At 2, what kind of angle is formed by the book covers? (Assume that one cover is straight up and down.)

a. acute

b. obtuse

c. right

10. At 3, what kind of angle is formed by the book covers?

a. acute

b. obtuse

c. right

