

# Objective

Students will be able to recognize transversals and parallel lines and be able to identify pairs of angles formed by transversals.

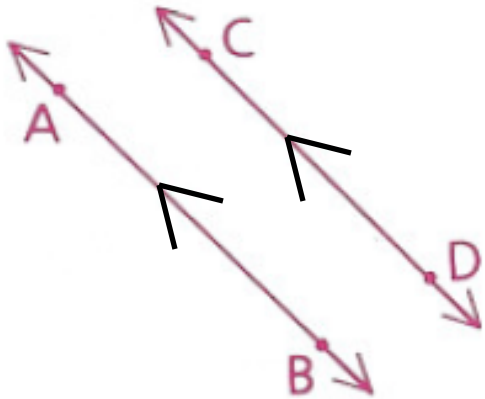
# Plane

A plane is a surface such that if any two points on the surface are connected by a line, all points of the line are also on the surface.

If two points, lines, segments, and so forth, lie in the same plane, we call them coplanar. Points, lines, segments, and so forth, that do not lie in the same plane are called noncoplanar.

# Parallel Lines

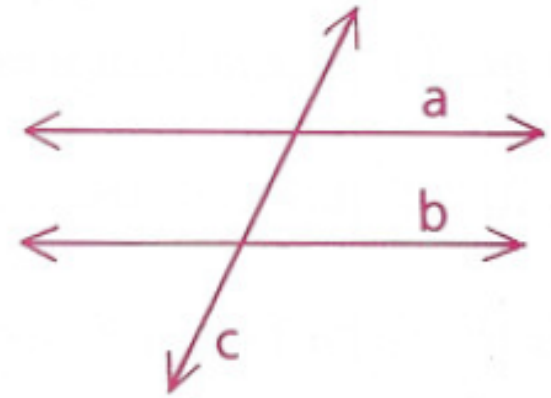
Parallel lines are two coplanar lines that do not intersect.



$$\overleftrightarrow{AB} \parallel \overleftrightarrow{CD}$$



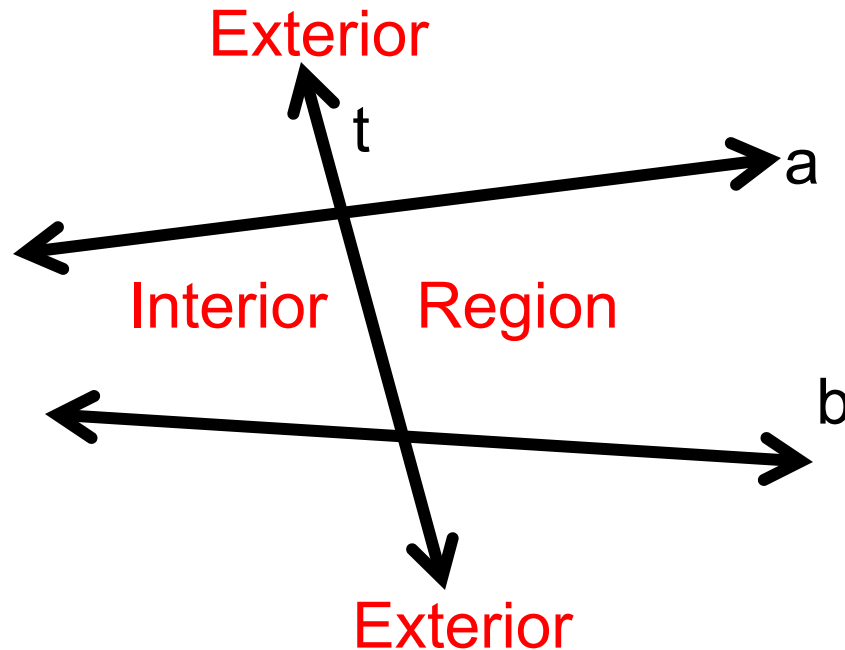
$$\overleftrightarrow{EF} \parallel \overleftrightarrow{GH}$$



$$a \parallel b$$

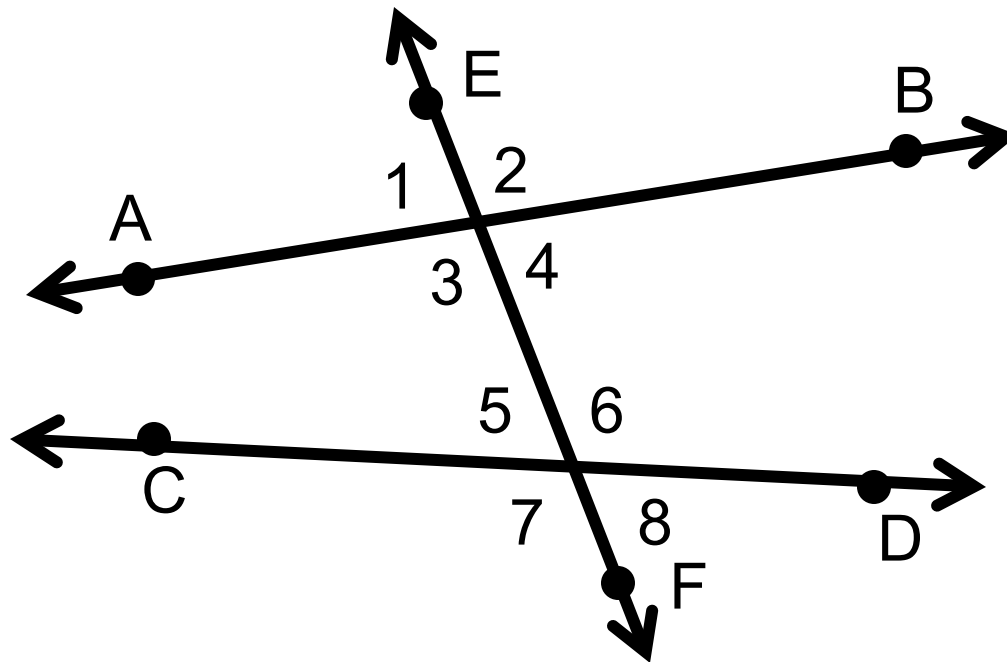
# Transversals

A transversal is a line that intersects two coplanar lines in two distinct points.



In the figure, line  $t$  is the transversal of lines  $a$  and  $b$ .

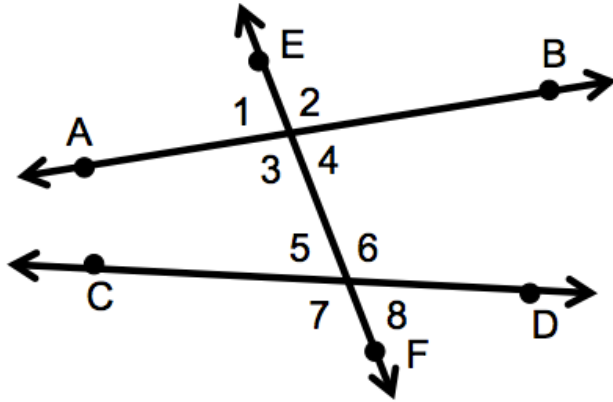
# Angle Pairs Formed By Transversals



In the figure,  $\overleftrightarrow{AB}$   
and  $\overleftrightarrow{CD}$  are cut  
by transversal  
 $\overleftrightarrow{EF}$ .

How many angles are  
formed?

What angle pair relationships do you already know?



From previous courses  
can you remember  
other angle pair  
relationships?

Pairs of angles formed by two lines and a transversal:

Alternate interior angles lie in the interior region of your lines and are on alternate sides of the transversal (ex:  $\angle 3$  and  $\angle 6$ )

Alternate exterior angles lie in the exterior region of your lines and are on alternate sides of the transversal (ex:  $\angle 1$  and  $\angle 8$ )

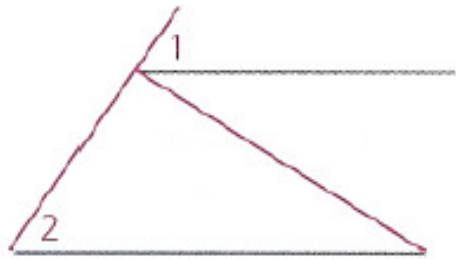
Corresponding angles lie in the same position of your lines and transversal; one in the interior, one in the exterior, same side of transversal (ex:  $\angle 4$  and  $\angle 8$ )

Same-side interior angles lie in the interior region of your lines and are on the same side of the transversal (ex:  $\angle 3$  and  $\angle 5$ )

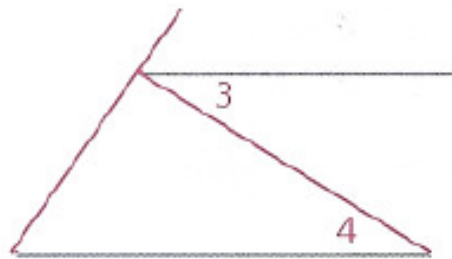
Same-side exterior angles lie in the exterior region of your lines and are on the same side of the transversal (ex:  $\angle 1$  and  $\angle 7$ )

# Name the pairs of angles formed by transversals in the figures below.

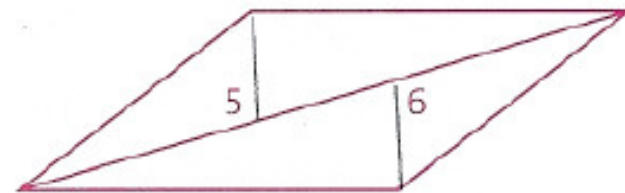
The segment corresponding to the transversal is shown in red and the segments corresponding to the lines it cuts are blue.



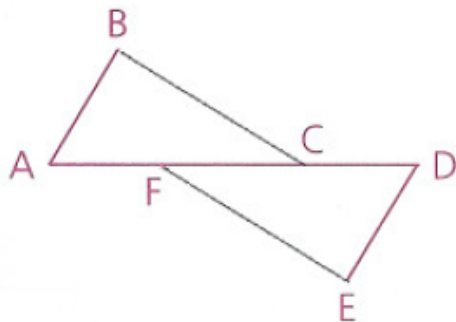
$\angle 1$  and  $\angle 2$  are corresponding  $\angle$ s.



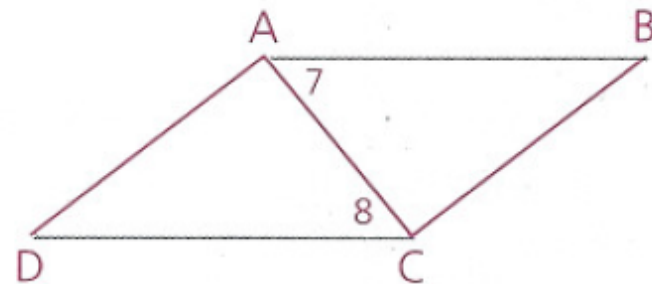
$\angle 3$  and  $\angle 4$  are alternate interior  $\angle$ s.



$\angle 5$  and  $\angle 6$  are alternate exterior  $\angle$ s.



$\angle BCA$  and  $\angle DFE$  are alternate interior  $\angle$ s.  
 $\angle BCD$  and  $\angle EFA$  are alternate exterior  $\angle$ s.



$\angle 7$  and  $\angle 8$  are alternate interior  $\angle$ s.

# Homework

p. 196: 1, 2, 3, 4

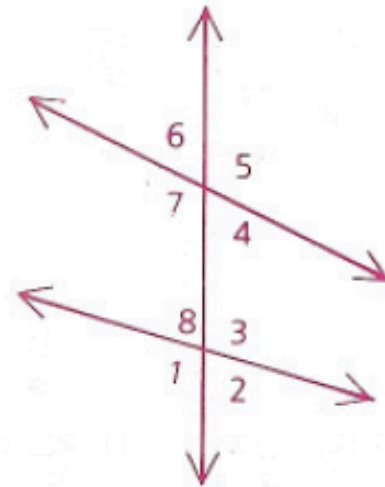
1 a Name all pairs of alternate interior angles.

b Name all pairs of alternate exterior angles.

c Name all pairs of corresponding angles.

d Name all pairs of interior angles on the same side of the transversal.

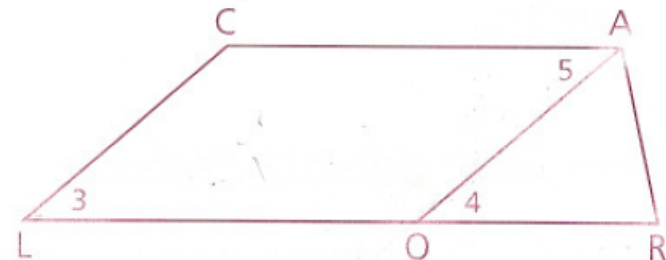
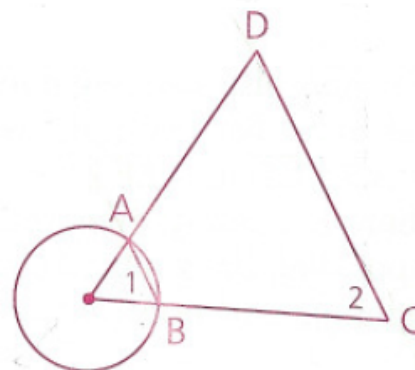
e Name all pairs of exterior angles on the same side of the transversal.



2 a What name is given to  $\angle 1$  and  $\angle 2$  for  $\overleftrightarrow{AB}$  and  $\overleftrightarrow{CD}$ ? What is the transversal?

b What type of angles are 3 and 4? Which lines and transversal form them?

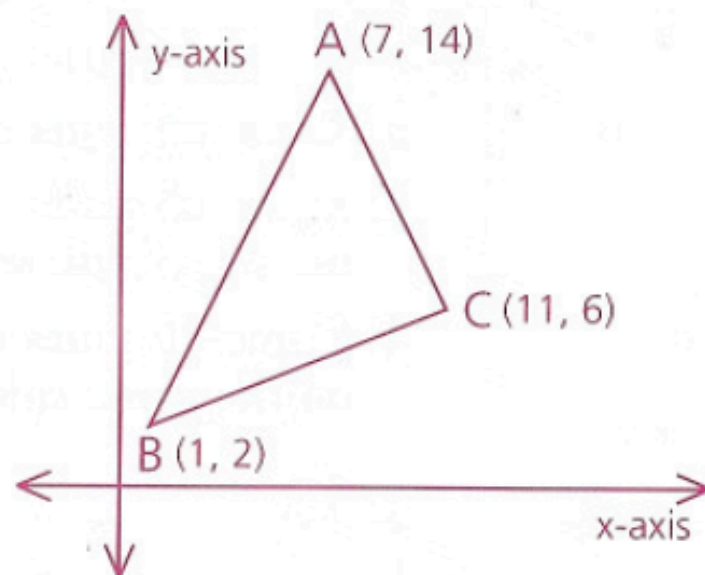
c What type of angles are 4 and 5? Which lines and transversal form them?





**3** Copy the diagram.

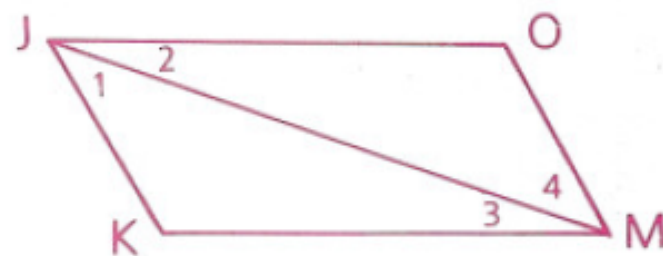
- a** Find the coordinates of M, the mid-point of  $\overline{AB}$ .
- b** Find the coordinates of N, the mid-point of  $\overline{AC}$ .
- c** Draw  $\overleftrightarrow{MN}$ . What appears to be true about  $\overleftrightarrow{MN}$  and  $\overleftrightarrow{BC}$ ?
- d** What appears to be true about  $\angle AMN$  and  $\angle ABC$ ?
- e** Name a pair of corresponding angles formed by  $\overleftrightarrow{MN}$  and  $\overleftrightarrow{BC}$  with transversal  $\overleftrightarrow{AC}$ .



**4 a** For which pair of lines are angles 1 and 4 a pair of alternate interior angles?

**b** For which pair of lines are angles 2 and 3 a pair of alternate interior angles?

**c** How many transversals of  $\overleftrightarrow{JO}$  and  $\overleftrightarrow{KM}$  are shown?



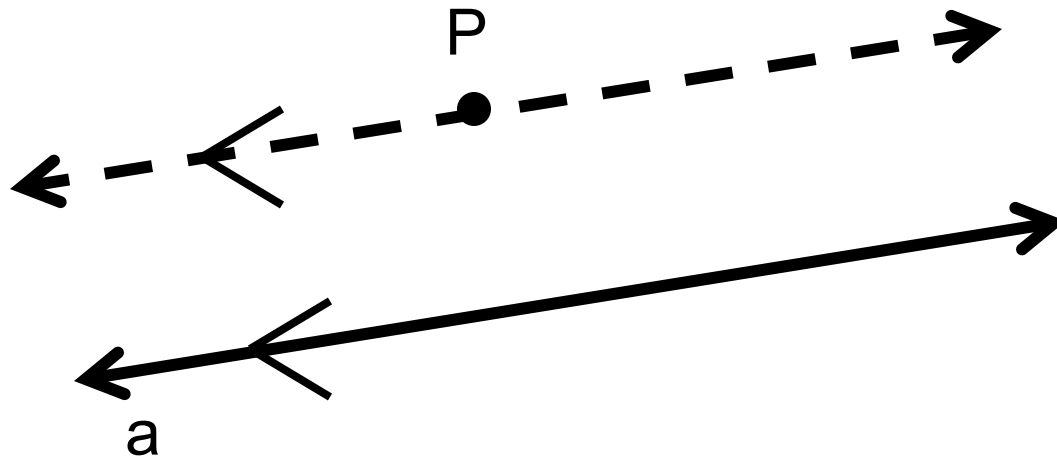
# Objective

Students will be able to apply the parallel postulate and identify the pairs of angles formed by a transversal cutting parallel lines.

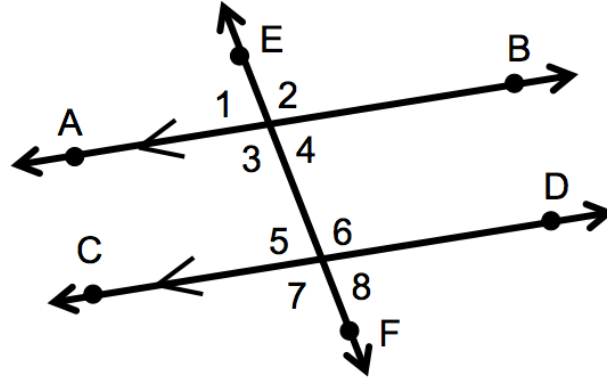
Right Angle, Equidistance, and Parallel Lines Quiz on Friday

# Parallel Postulate

Parallel Postulate: Through a point not on a line there is exactly one parallel to the given line.

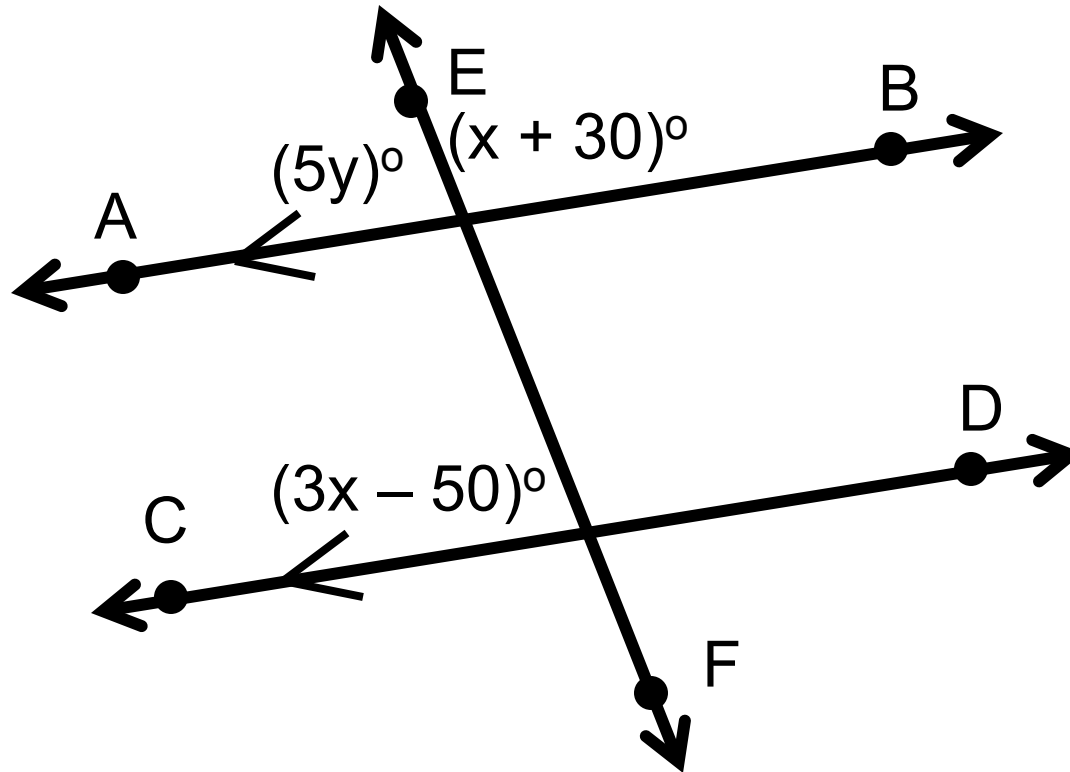


**Theorem 38:** If two parallel lines are cut by a transversal, then any pair of angles formed are either congruent or supplementary.



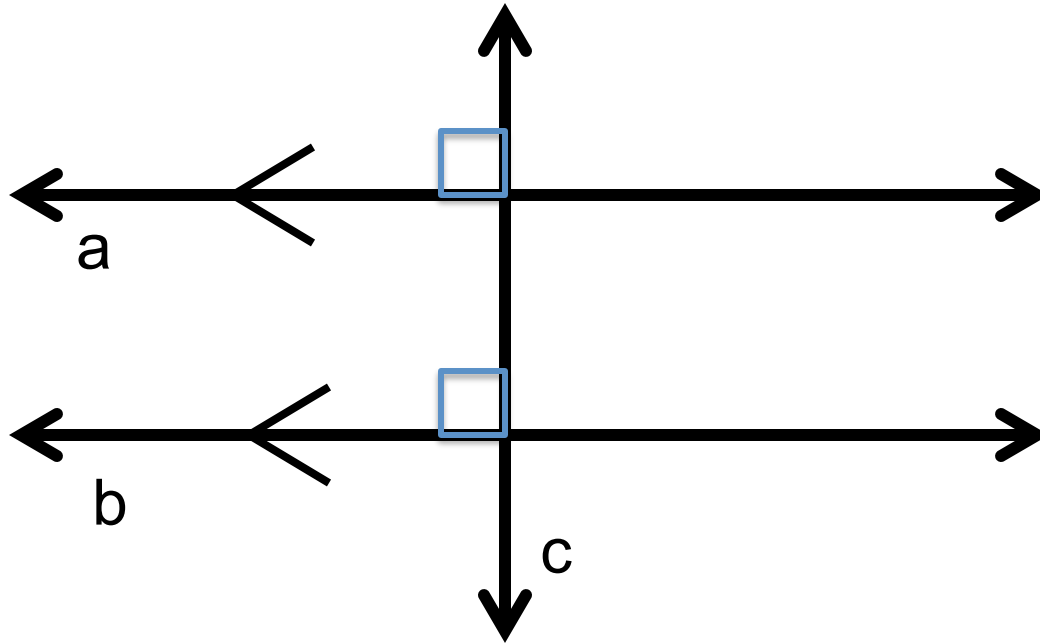
If two parallel lines are cut by a transversal, each pair of...

- alternate interior angles are congruent
- alternate exterior angles are congruent
- corresponding angles are congruent
- same-side interior angles are supplementary
- same-side exterior angles are supplementary



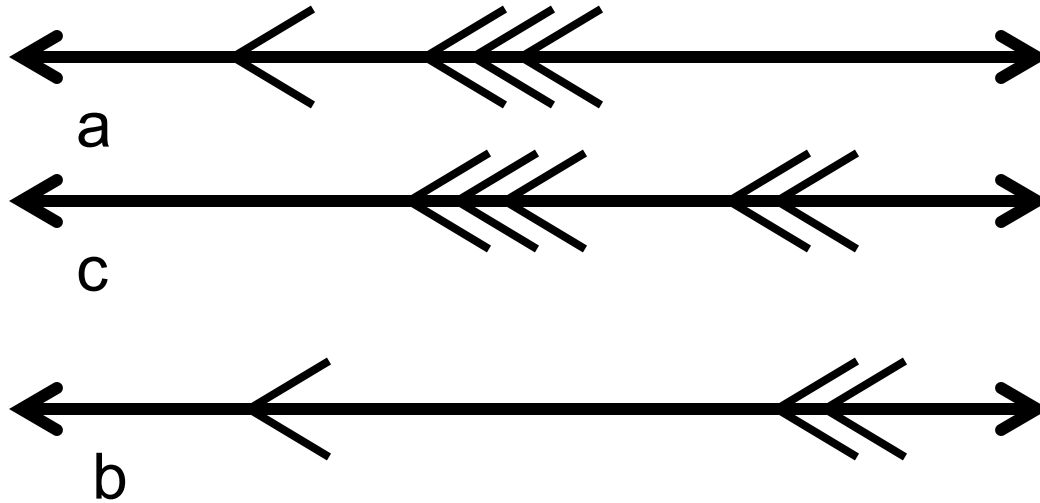
Given that  $\overleftrightarrow{AB}$  and  $\overleftrightarrow{CD}$  are parallel and cut by a transversal  $\overleftrightarrow{EF}$ , solve for  $x$  and  $y$ .

$$x = 50, y = 20$$



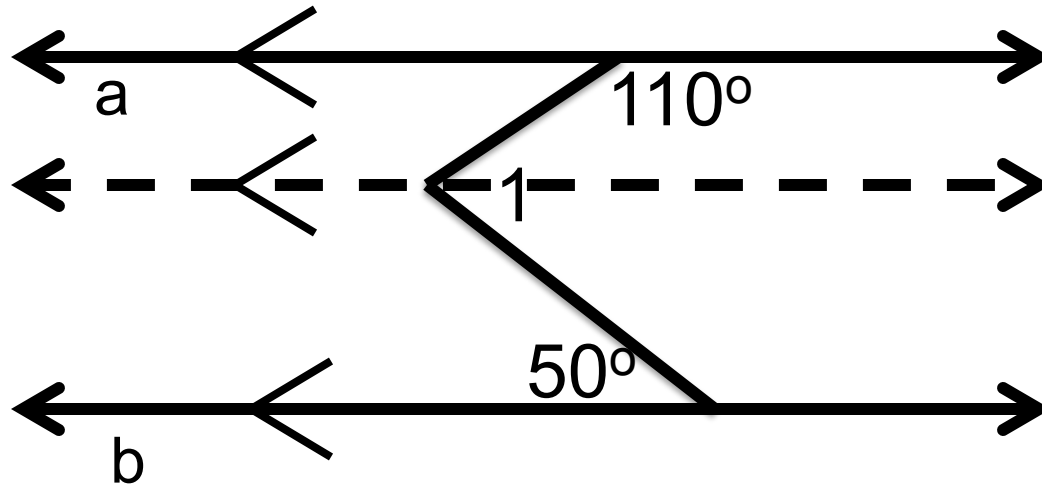
If line  $a$  and line  $b$  are parallel and line  $c$  is perpendicular to line  $a$ , then line  $c$  is also perpendicular to line  $b$

**Theorem 43:** In a plane, if a line is perpendicular to one of two parallel lines, it is perpendicular to the other.



If line *a* and line *b* are parallel and line *c* and line *b* are parallel, then line *c* is also parallel to line *a*

**Theorem 44:** If two lines are parallel to a third line, then they are parallel to each other (Transitive Property of Parallel Lines).



Given that line  $a$  and line  $b$  are parallel, find the measure of  $\angle 1$ .

$120^\circ$

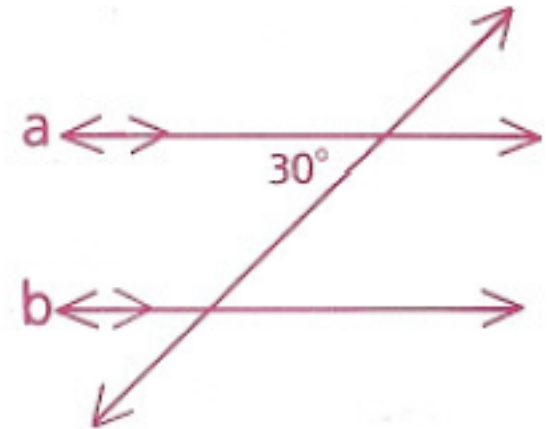


# Homework

p. 229: 3, 4, 7, 8, 22

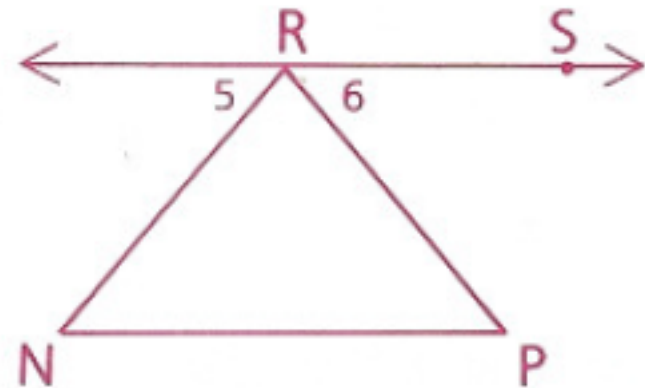
- 3** Given:  $a \parallel b$ ,  
 $30^\circ$  angle as shown

Copy the diagram and fill in the measures of the seven remaining angles.

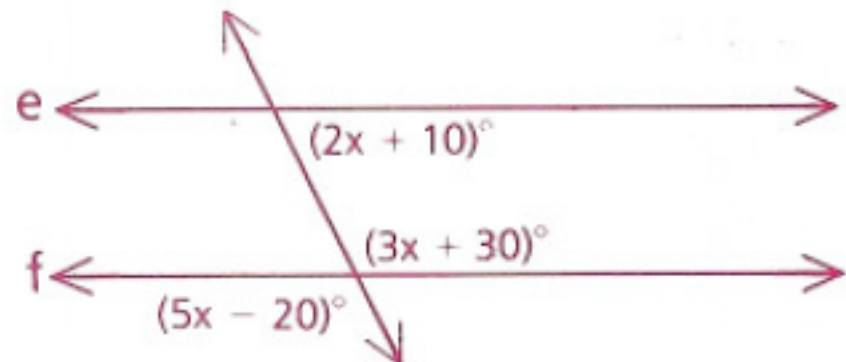


- 4** Given:  $\angle 5 \cong \angle 6$ ,  
 $\overline{RS} \parallel \overline{NP}$

Prove:  $\triangle NPR$  is isosceles.



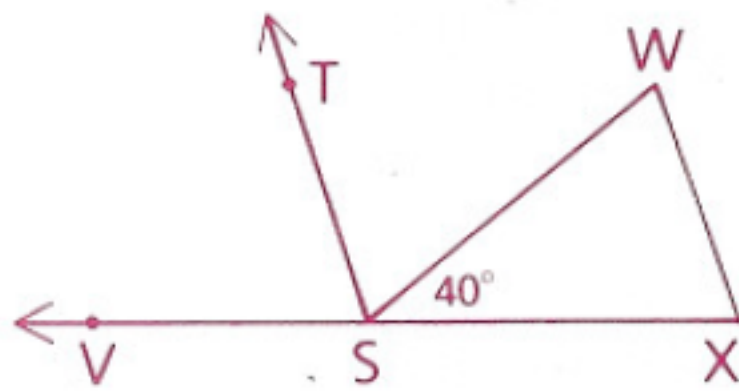
- 7** Are e and f parallel?



- 8 Given:  $\overrightarrow{ST} \parallel \overrightarrow{XW}$ ;  
 $\overrightarrow{ST}$  bisects  $\angle VSW$ .

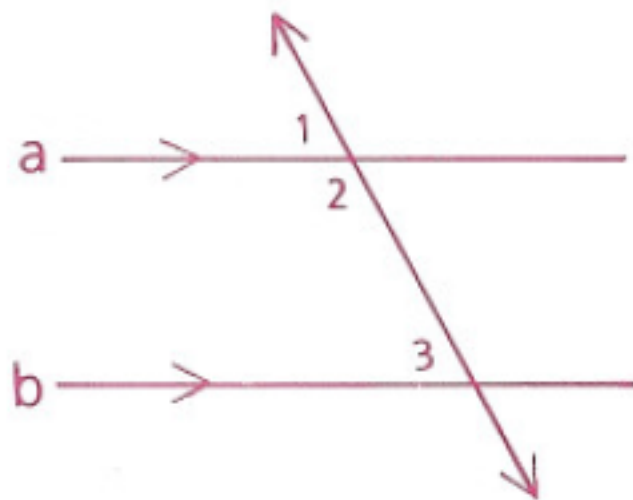
Find:  $m\angle X$  and  
 $m\angle W$

What do you notice about  $\triangle WSX$ ?



- 22 Given:  $a \parallel b$ ,  
 $\angle 1 = (x + 3y)^\circ$ ,  
 $\angle 2 = (2x + 30)^\circ$ ,  
 $\angle 3 = (5y + 20)^\circ$

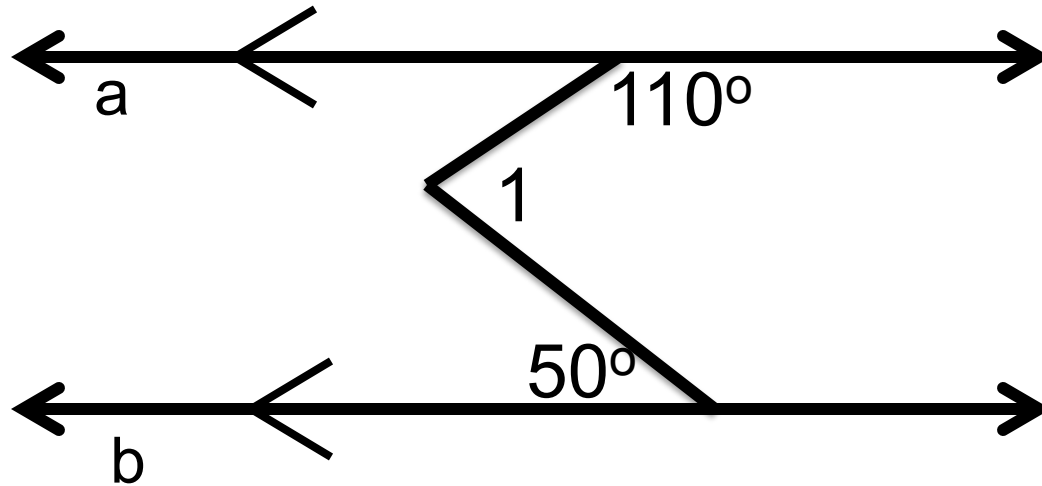
Find:  $m\angle 1$



# Objective

Students will be able to use various methods to prove lines parallel.

Right Angle, Equidistance, and Parallel Lines Quiz on Friday



Given that line  $a$  and line  $b$  are parallel, find the measure of  $\angle 1$ .

$120^\circ$

# Converse Theorems of Previous Day

If two lines are cut by a transversal such that...

Theorem 31: alternate interior angles are congruent

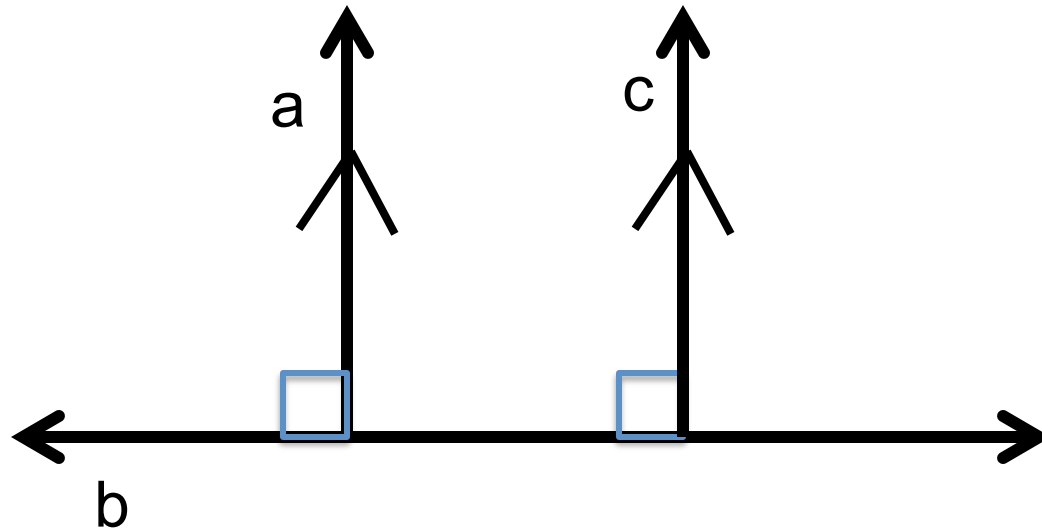
Theorem 32: alternate exterior angles are congruent

Theorem 33: corresponding angles are congruent

Theorem 34: same-side interior angles are supplementary

Theorem 35: same-side exterior angles are supplementary

...then the lines are parallel.



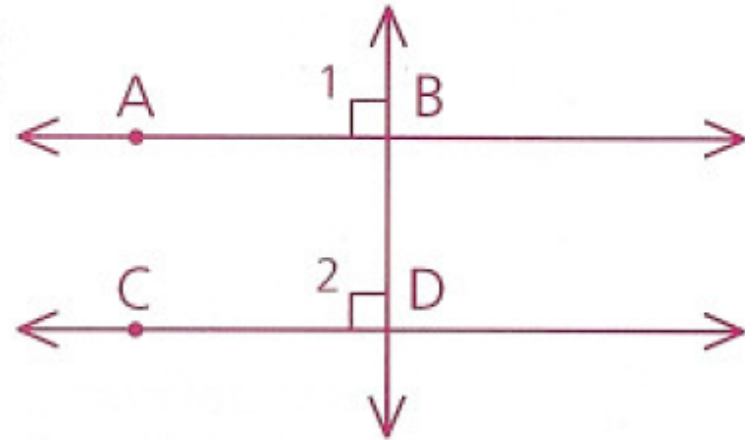
If line  $a$  is perpendicular to line  $b$  and line  $c$  is perpendicular to line  $b$ , then line  $c$  and line  $a$  are parallel.

**Theorem 36:** If two coplanar lines are perpendicular to a third line, then they are parallel.

# Prove Theorem 36

Given:  $\overleftrightarrow{AB} \perp \overleftrightarrow{BD}$  and  $\overleftrightarrow{CD} \perp \overleftrightarrow{BD}$

Prove:  $\overleftrightarrow{AB} \parallel \overleftrightarrow{CD}$

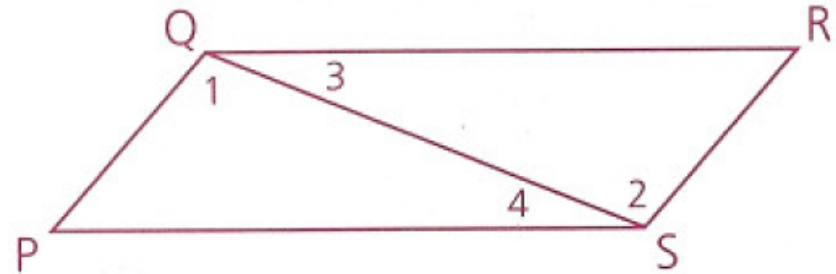


1 $\overleftrightarrow{BD} \perp \overleftrightarrow{AB}$	1 Given
2 $\angle 1$ is a right $\angle$ .	2 $\perp$ lines form right $\angle$ s.
3 $\overleftrightarrow{BD} \perp \overleftrightarrow{CD}$	3 Given
4 $\angle 2$ is a right $\angle$ .	4 Same as 2
5 $\angle 1 \cong \angle 2$	5 Right $\angle$ s are $\cong$ .
6 $\overleftrightarrow{AB} \parallel \overleftrightarrow{CD}$	6 Corr. $\angle$ s $\cong \Rightarrow \parallel$ lines

A parallelogram is a four-sided figure with both pairs of opposite sides parallel.

Given:  $\angle 1 \cong \angle 2$ ,  
 $\angle PQR \cong \angle RSP$

Prove: PQRS is a parallelogram.



- 1  $\angle 1 \cong \angle 2$
- 2  $\overline{PQ} \parallel \overline{RS}$
- 3  $\angle PQR \cong \angle RSP$
- 4  $\angle 3 \cong \angle 4$
- 5  $\overline{QR} \parallel \overline{PS}$
- 6 PQRS is a parallelogram.

- 1 Given
- 2 Alt. int.  $\angle s \cong \Rightarrow \parallel$  lines
- 3 Given
- 4 Subtraction Property
- 5 Same as 2
- 6 A four-sided figure with both pairs of opposite sides parallel is a parallelogram.

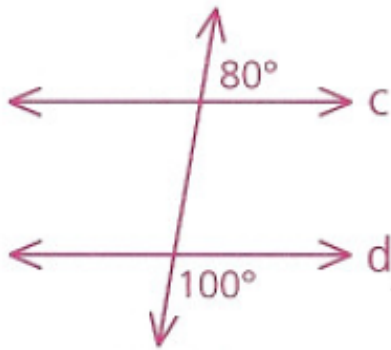


# Homework

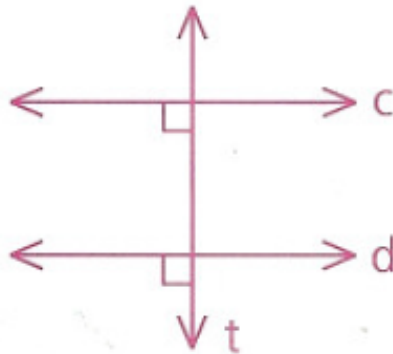
p. 219: 2, 16, 18, 20, 23

2 In each case, state the theorem that proves  $c \parallel d$ .

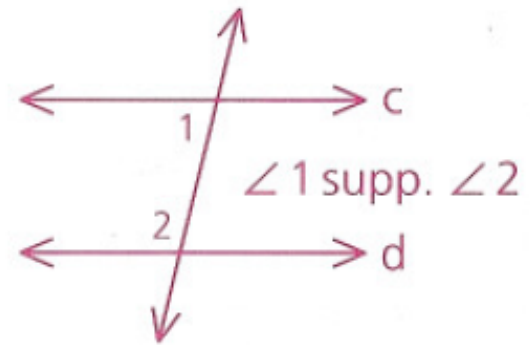
a



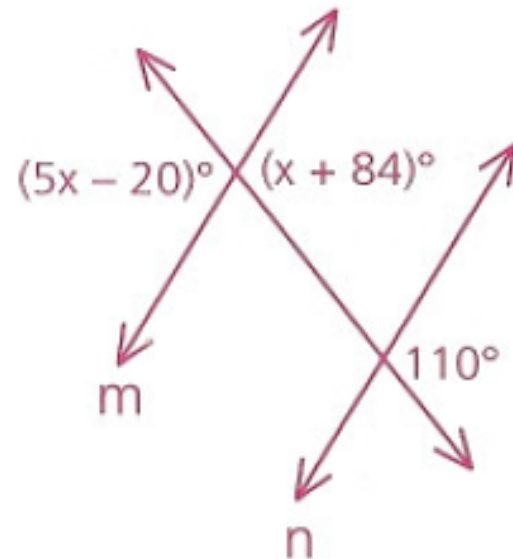
b



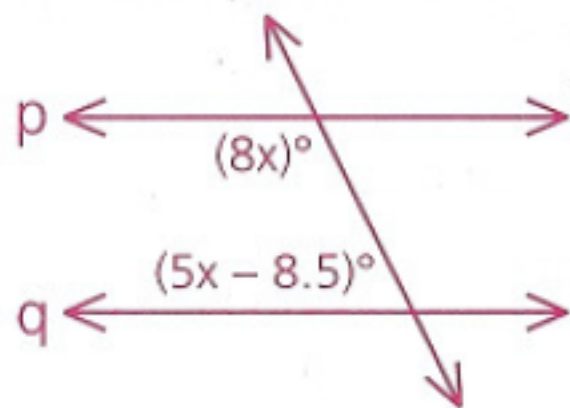
c



16 Solve for  $x$  and justify that  $m \parallel n$ .

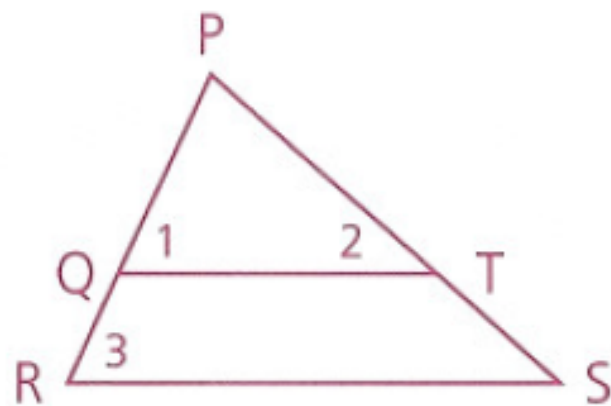


- 18** If  $x$  is 14.5, are  $p$  and  $q$  parallel?  
Explain.



- 20** Given:  $\angle 1$  comp.  $\angle 2$ ,  
 $\angle 3$  comp.  $\angle 2$

Prove:  $\overline{QT} \parallel \overline{RS}$



- 23** If  $\overleftrightarrow{PQ} \parallel \overleftrightarrow{RS}$ , can  $x$  be 25? Explain.

