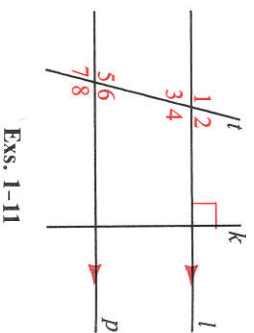# Classroom Exercises

1. What do the arrowheads in the diagram tell you?
2. a. How are lines k and l related?
   b. How are lines k and p related? Why?

**State the postulate or theorem that justifies each statement.**

3. $\angle 1 \cong \angle 5$
4. $\angle 3 \cong \angle 6$
5. $m\angle 4 + m\angle 6 = 180$
6. $m\angle 4 = m\angle 8$
7. $m\angle 4 = m\angle 5$
8. $\angle 6 \cong \angle 7$
9. $k \perp p$
10. $\angle 3$ is supplementary to $\angle 5$.
11. If $m\angle 1 = 130$, what are the measures of the other numbered angles?

Exs. 1-11

12. Alan tried to prove Postulate 10 as shown below. However, he did *not* have a valid proof. Explain why not.

If two parallel lines are cut by a transversal, then corresponding angles are congruent.

Given: $k \parallel l$; transversal t cuts k and l.
Prove: $\angle 1 \cong \angle 2$
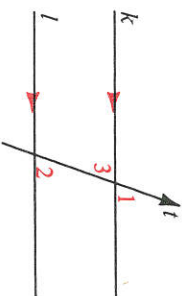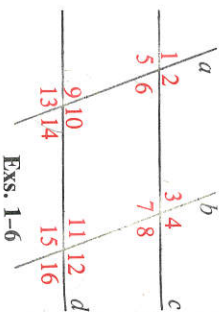
Proof:

Statements	Reasons
1. $k \parallel l$; t is a transversal.	1. Given
2. $\angle 3 \cong \angle 2$	2. If 2 parallel lines are cut by a transversal, then alt. int. ∠s are ≅.
3. $\angle 1 \cong \angle 3$	3. Vert. ∠s are ≅.
4. $\angle 1 \cong \angle 2$	4. Transitive Prop. of ≅

Written Exercises

A

1. If $a \parallel b$, name all angles that must be congruent to $\angle 1$.
2. If $c \parallel d$, name all angles that must be congruent to $\angle 1$.
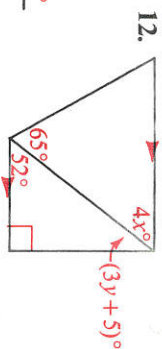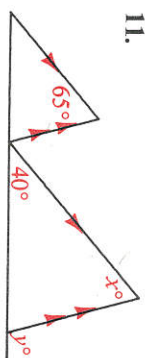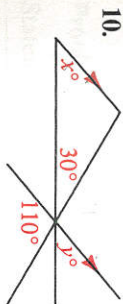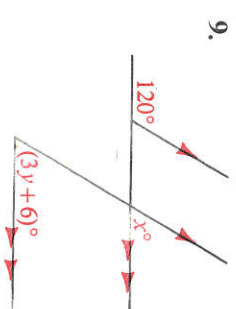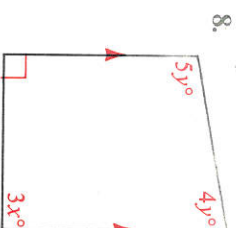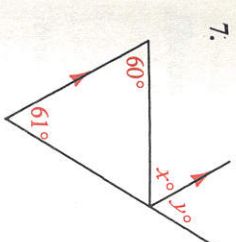
Assume that $a \parallel b$ and $c \parallel d$.

3. Name all angles congruent to $\angle 4$.
4. Name all angles supplementary to $\angle 4$.
5. If $m\angle 16 = 50$, then $m\angle 14 = \underline{\ ?\ }$ and $m\angle 2 = \underline{\ ?\ }$.
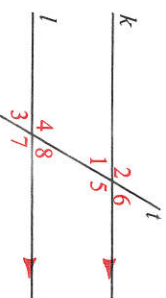6. If $m\angle 9 = x$, then $m\angle 12 = \underline{\ ?\ }$ and $m\angle 7 = \underline{\ ?\ }$.

Exs. 1-6

Find the values of x and y.

7.
8.
9.
10.
11.
12.

13. Write the reasons.

Given: $k \parallel l$
Prove: $\angle 6$ is supp. to $\angle 7$.

Proof:

Statements	Reasons
1. $k \parallel l$	1. ?
2. $m\angle 6 = m\angle 8$	2. ?
3. $m\angle 8 + m\angle 7 = 180$	3. ?
4. $m\angle 6 + m\angle 7 = 180$	4. ?
5. $\angle 6$ is supp. to $\angle 7$.	5. ?

B

14. Given: $\overrightarrow{PQ} \perp \overrightarrow{QR}$; $\overrightarrow{ST} \parallel \overrightarrow{QR}$; $\overrightarrow{QT}$ bisects $\angle PQR$.
    a. Find the measures of $\angle QST$, $\angle SQT$, and $\angle STQ$.
    b. If you are also given that $m\angle R = 60$, find the measure of $\angle QTR$.
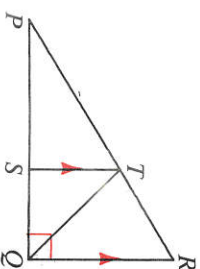
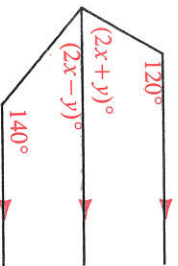15. Given: $\overline{AB} \parallel \overline{CD}$; $m\angle D = 116$; $\overrightarrow{AK}$ bisects $\angle DAB$.
    a. Find the measures of $\angle DAB$, $\angle KAB$, and $\angle DKA$.
    b. Is there enough given information for you to conclude that $\angle D$ and $\angle C$ are supplementary, or is more information needed?
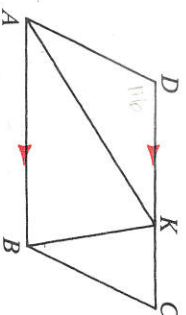
16. Find the values of x and y.

Use the diagram in Exercise 13. Write proofs in two-column form.

17. Given: $k \parallel l$
    Prove: $\angle 2 \cong \angle 7$

18. Given: $k \parallel l$
    Prove: $\angle 1$ is supplementary to $\angle 7$.

19. Copy what is shown for Theorem 2–3 on page 60. Then write a proof in two-column form.

20. Draw a four-sided figure $ABCD$ with $\overrightarrow{AB} \parallel \overrightarrow{DC}$ and $\overrightarrow{AD} \parallel \overrightarrow{BC}$.
  a. Prove that $\angle A \cong \angle C$.
  b. Is $\angle B \cong \angle D$?

C 21. Given: $\overrightarrow{AS} \parallel \overrightarrow{BT}$;
        $m\angle 4 = m\angle 5$
    Prove: $\overrightarrow{SA}$ bisects $\angle BSR$.

22. Given: $\overrightarrow{AS} \parallel \overrightarrow{BT}$;
        $m\angle 4 = m\angle 5$;
        $\overrightarrow{SB}$ bisects $\angle AST$.
    Find the measure of $\angle 1$.
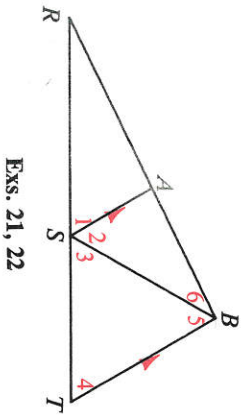
Exs. 21, 22

2-3 Proving Lines Parallel

In the preceding section, you saw situations in which two lines were given as parallel. You then concluded that certain angles were congruent or supplementary. In this section, the situation is reversed. From two angles being congruent or supplementary you will conclude that certain lines forming the angles are parallel. The key to doing this is Postulate 11 below. Postulate 10 is repeated so you can compare the wording of the postulates.

Postulate 10

If two parallel lines are cut by a transversal, then corresponding angles are congruent.

Postulate 11

If two lines are cut by a transversal and corresponding angles are congruent, then the lines are parallel.

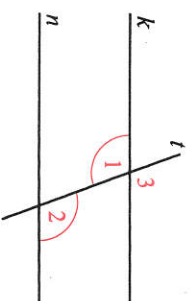The next three theorems can be deduced from Postulate 11.

Theorem 2–5

If two lines are cut by a transversal and alternate interior angles are congruent, then the lines are parallel.

Given: Transversal t cuts lines k and n;
    $\angle 1 \cong \angle 2$
Prove: $k \parallel n$

Proof:

| Statements	Reasons
1. Transversal t cuts k and n.	1. Given
2. $\angle 3 \cong \angle 1$.	2. Vert. ⦞ are $\cong$.
3. $\angle 1 \cong \angle 2$.	3. Given
4. $\angle 3 \cong \angle 2$.	4. Transitive Property
5. $k \parallel n$	5. If two lines are cut by a transversal and corr. ⦞ are $\cong$, the lines are $\parallel$.

Theorem 2–6

If two lines are cut by a transversal and same-side interior angles are supplementary, then the lines are parallel.

Given: Transversal t cuts lines k and n;
    $\angle 1$ is supplementary to $\angle 2$.
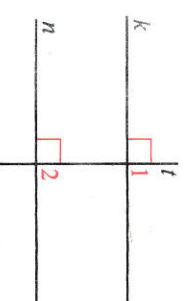Prove: $k \parallel n$

The proof is left as Exercise 19.
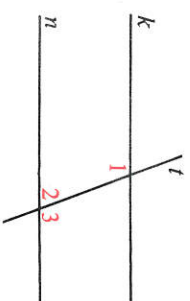
Theorem 2–7

In a plane, two lines perpendicular to the same line are parallel.

Given: $k \perp t$; $n \perp t$
Prove: $k \parallel n$

The proof is left as Exercise 20.