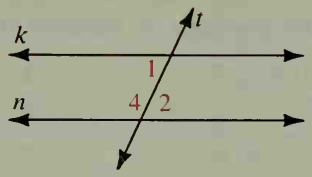
Theorem 3-3

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

Given: $k \parallel n$; transversal t cuts k and n.

Prove: $\angle 1$ is supplementary to $\angle 4$.

The proof is left as Exercise 22.



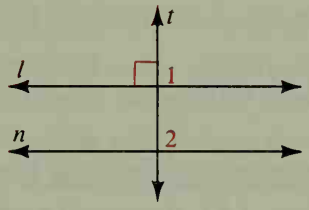
Theorem 3-4

If a transversal is perpendicular to one of two parallel lines, then it is perpendicular to the other one also.

Given: Transversal t cuts l and n;
$t \perp l$; $l \parallel n$

Prove: $t \perp n$

The proof is left as Exercise 13.



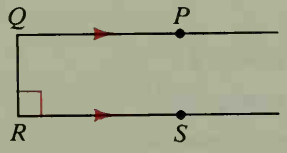
For the rest of this book, arrowheads will no longer be used in diagrams to suggest that a line extends in both directions without ending. Instead, pairs of arrowheads (and double arrowheads when necessary) will be used to indicate parallel lines, as shown in the following examples.

Example 1 Find the measure of $\angle PQR$.

Solution The diagram shows that

$$\overleftrightarrow{QR} \perp \overleftrightarrow{RS} \text{ and } \overleftrightarrow{QP} \parallel \overleftrightarrow{RS}.$$

Then by Theorem 3-4, $\overleftrightarrow{QR} \perp \overleftrightarrow{QP}$ and $m\angle PQR = 90$.



Example 2 Find the values of x, y, and z.

Solution

Since $a \parallel b$, $2x = 40$. (Why?)
Thus, $x = 20$.
Since $c \parallel d$, $y = 40$. (Why?)
Since $a \parallel b$, $y + z = 180$. (Why?)
$40 + z = 180$
$z = 140$