

## 3.5 Using Properties of Parallel Lines

### Goals:

- Use properties of parallel lines in real-life situations.

#### THEOREM 3.11

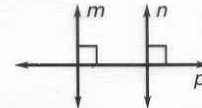
If two lines are parallel to the same line, then they are parallel to each other.



If  $p \parallel q$  and  $q \parallel r$ ,  
then  $p \parallel r$ .

#### THEOREM 3.12

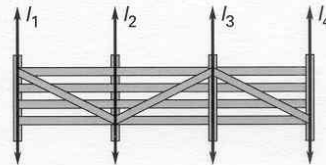
In a plane, if two lines are perpendicular to the same line, then they are parallel to each other.



If  $m \perp p$  and  
 $n \perp p$ , then  $m \parallel n$ .

#### Example 1 Explaining Why Fence Posts are Parallel

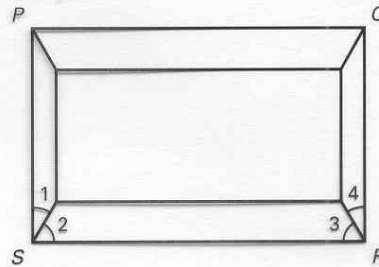
In the diagram at the right, each fence post is parallel to the fence post immediately to the right. Explain why the fence posts on each end are parallel.



We know that the first and second posts are parallel and that the second + third posts are parallel. Since the first and third are both parallel with the second then they are parallel to each other (Theorem 3.11 above). We also know that the 3rd and 4th posts are parallel and since the first + fourth (last) are parallel to the 3rd they are parallel to each other.

**Example 2 Building a Picture Frame**

You are building the picture frame in the diagram at the right. You cut pieces of wood such that the measures of  $\angle 1$  and  $\angle 4$  are  $30^\circ$  and the measures of  $\angle 2$  and  $\angle 3$  are  $60^\circ$ . Prove that the right and left sides of the frame are parallel.



**Solution**

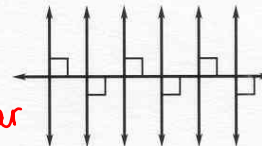
Given:  $m\angle 1 = 30^\circ$ ;  $m\angle 2 = 60^\circ$ ;  $m\angle 3 = 60^\circ$ ;  $m\angle 4 = 30^\circ$

Prove:  $\overline{PS} \parallel \overline{QR}$

Statements	Reasons
1. $m\angle 1 = 30^\circ$ , $m\angle 2 = 60^\circ$ $m\angle 3 = 60^\circ$ , $m\angle 4 = 30^\circ$	1. given
2. $m\angle PSR = m\angle 1 + m\angle 2$ $m\angle QRS = m\angle 3 + m\angle 4$	2. Angle Addition Postulate
3. $m\angle PSR = 90^\circ$ $m\angle QRS = 90^\circ$	3. Substitution property
4. $\angle PSR$ is a right angle $\angle QRS$ is a right angle	4. Def. of right angle
5. $\overline{PS} \perp \overline{SR}$ $\overline{QR} \perp \overline{RS}$	5. Def. of $\perp$ lines
6. $\overline{PS} \parallel \overline{QR}$	6. 2 lines $\perp$ to the same line are $\parallel$ to each other.

**Checkpoint** Complete the following exercise.

1. Are all the vertical lines parallel? Explain.



Yes - they are all perpendicular to the same line and therefore parallel to each other.