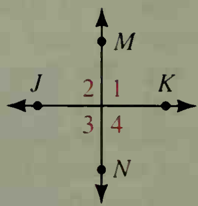
2-5 *Perpendicular Lines*

In the town shown, roads that run east-west are called streets, while those that run north-south are called avenues. Each of the streets is *perpendicular* to each of the avenues.

Perpendicular lines are two lines that intersect to form right angles (90° angles). Because lines that form one right angle always form four right angles (see Exercise 26, page 21), you can conclude that two lines are perpendicular, by definition, once you know that any one of the angles they form is a right angle. The definition of perpendicular lines can be used in the two ways shown below.



1. If $\overleftrightarrow{JK}$ is perpendicular to $\overleftrightarrow{MN}$ (written $\overleftrightarrow{JK} \perp \overleftrightarrow{MN}$), then each of the numbered angles is a right angle (a 90° angle).
2. If any one of the numbered angles is a right angle (a 90° angle), then $\overleftrightarrow{JK} \perp \overleftrightarrow{MN}$.

The word *perpendicular* is also used for intersecting rays and segments. For example, if $\overleftrightarrow{JK} \perp \overleftrightarrow{MN}$ in the diagram, then $\overline{JK} \perp \overline{MN}$ and the sides of $\angle 2$ are perpendicular.

The definition of perpendicular lines is closely related to the following theorems. Notice that Theorem 2-4 and Theorem 2-5 are *converses* of each other. For the proofs of the theorems, see the exercises.

Theorem 2-4

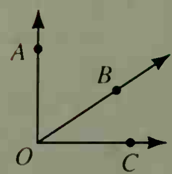
If two lines are perpendicular, then they form congruent adjacent angles.

Theorem 2-5

If two lines form congruent adjacent angles, then the lines are perpendicular.

Theorem 2-6

If the exterior sides of two adjacent acute angles are perpendicular, then the angles are complementary.



Given: $\overrightarrow{OA} \perp \overrightarrow{OC}$

Prove: $\angle AOB$ and $\angle BOC$ are comp. $\angle$s.