A **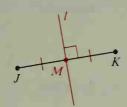perpendicular bisector** of a segment is a line (or ray or segment) that is perpendicular to the segment at its midpoint. In the figure at the right. line *l* is a perpendicular bisector of $\overline{JK}$.

In a given plane. there is exactly one line perpendicular to a segment at its midpoint. We speak of *the* perpendicular bisector of a segment in such a case.

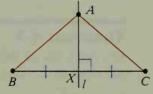Proofs of the following theorems are left as Exercises 14 and 15.

Theorem 4-5

If a point lies on the perpendicular bisector of a segment, then the point is equidistant from the endpoints of the segment.

Given: Line *l* is the perpendicular bisector of $\overline{BC}$; *A* is on *l*.

Prove: $AB = AC$

Theorem 4-6

If a point is equidistant from the endpoints of a segment, then the point lies on the perpendicular bisector of the segment.

Given: $AB = AC$

Prove: *A* is on the perpendicular bisector of $\overline{BC}$.

Plan for Proof: The perpendicular bisector of $\overline{BC}$ must contain the midpoint of $\overline{BC}$ and be perpendicular to $\overline{BC}$. Draw an auxiliary line containing *A* that has one of these properties and prove that it has the other property as well. For example. first draw a segment from *A* to the midpoint *X* of $\overline{BC}$. You can show that $\overline{AX} \perp \overline{BC}$ if you can show that $\angle 1 \cong \angle 2$. Since these angles are corresponding parts of two triangles. first show that $\triangle AXB \cong \triangle AXC$.

In the proof of Theorem 4-6 other auxiliary lines could have been chosen instead. For example, we can draw the altitude to $\overline{BC}$ from *A*. meeting $\overline{BC}$ at a point *Y* as shown in the diagram at the right. Here. since $\overline{AY} \perp \overline{BC}$ we need to prove that $\overline{YB} \cong \overline{YC}$. Either method can be used to prove Theorem 4-6.