

9. Prove that it is always possible to draw a perpendicular line from a point to a given line.

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Proof:

Statements:

Explain why statements on the left side are true.

1. Choose a segment on the line, call it  $AB$ . There exist two isometries that map the point  $A$  to the point  $A$ , and the point  $B$  to the point  $B$ .

2. One of those isometries is Identity map.

3. The other isometry (call it  $f()$ ) maps point  $C$  to  $f(C)=C'$ .

$C'$  and  $C$  are on different sides from the line  $\overleftrightarrow{AB}$ .

4. Lines  $\overleftrightarrow{AB}$  and  $\overleftrightarrow{CC'}$  intersect at some point. Call it  $M$ .

5.  $|AC|=|AC'|$

6.  $\angle BAC=\angle BAC'$

7. Line  $\overleftrightarrow{AM}$  is perpendicular to the line  $\overleftrightarrow{CC'}$ .

8. Line  $\overleftrightarrow{AB}$  coincides with the line  $\overleftrightarrow{AM}$ .

9. Line  $\overleftrightarrow{CC'}$  perpendicular to the line  $\overleftrightarrow{AB}$  and passes through the point  $C$ .