Proposition I.12
Speaker: Menglu
Scribe: Mark
Artist: Ruifan

Proposition I.12

To draw a perpendicular to a line segment from a point not on the line segment.

Let $AB$ be a given line segment, and $C$ a point not on $AB$.
Choose a point $D$ on the other side of $AB$.
Draw the circle $CD$. [post. 3]
Let the circle $CD$ cut $AB$ at the points $E$ and $G$.
Bisect the line segment $EG$ at $H$. [I.10]
Claim: $CH$ is perpendicular to $AB$.
Draw the line segments $CG$, $CH$, $CE$. [post. 1]
Then $CG = CE$ since both are radii of the same circle $CD$. [def. 15]
By construction, $HG = HE$, and $CH$ is common, so $\triangle CHG = \triangle CHE$. [I.4]
Therefore $\angle CHG = \angle CHE$, and these are right angles [def. 10]
So $CH$ is perpendicular to $AB$ as claimed. Q.E.F.