Proposition I.16

Statement:
For any triangle, if one of the sides is produced, the exterior angle is greater than both the interior angle and the opposite angle.

Proof:
We will first show that the exterior angle $\angle ACD$ is greater than $\angle BAC$.
Let $\triangle ABC$ be a triangle.
Extend $BC$ to $D$. [Post. 2]
Bisect $AC$ at $E$. [I.10]
Connect points $B$ and $E$. [Post. 1]
Extend $BE$ to $F$ such that $BE=EF$. [I.3]
Connect points $C$ and $F$. [Post. 1]
Extend $AC$ to $G$. [Post. 2]
By construction, we know $BE=EF$ and $AE=EC$.
We know $\angle AEB=\angle FEC$. [I.15]
Thus $\triangle ABE=\triangle CFE$. [I.4]
Then $AB=FC$, $\angle ABE=\angle FEC$, and $\angle BAC=\angle ECF$.
We know $\angle ACD > \angle ECF$. [C.N. 5]
Because $\angle BAC=\angle ECF$ and $\angle ACD > \angle ECF$, it is true that $\angle ACD > \angle BAC$.
We prove that the exterior angle $\angle ACD$ is greater than $\angle ABC$ in a similar way.
Begin with $\triangle ABC$ with $BC$ extended to $D$, as above.
Bisect $BC$ at $E$. [I.10]
Connect points $A$ and $E$. [Post. 1]
Extend $AE$ to $F$ such that $AE=EF$. [I.3]
Connect points $F$ and $C$. [Post. 1]
Extend $FC$ to $G$. [Post. 2]
By construction, we know $AE=EF$ and $BE=EC$.
We know $\angle AEB=\angle FEC$. [I.15]
Thus $\triangle AEB = \triangle FEC$. [I.4]

Then $AB = FC$, $\angle BAE = \angle CFE$, and $\angle ABC = \angle ECF$.

We know $\angle ECF = \angle GCD$. [I.15]

We know $\angle ACD > \angle GCD$. [C.N. 5]

Thus $\angle ACD > \angle ECF$.

Recall that $\angle ABC = \angle ECF$.

Thus $\angle ACD > \angle ABC$.

Then we have proved that $\angle ACD > \angle BAC$ and $\angle ACD > \angle ABC$. QED.