Proposition I.46

On a given straight line to describe a square.
Let \( AB \) be the given straight line

Construction:
Draw a perpendicular line \( AC \perp AB \) (I.11)
Cut off \( AC \) at point \( D \) such that \( AD = AB \) (I.3)
Draw a line from \( D \) parallel to \( AB \) (I.31)
Draw a line from \( B \) parallel to \( AD \) (I.31)
Let these two constructed lines intersect at point \( E \)

Proof:
\[ \because AD \parallel BE, AB \parallel DE \]
\[ \therefore AD = BE, AB = DE \text{ (I.34)} \]

But \( AB = AD \),
\[ \therefore AB = AD = BE = DE \text{ (c.n.1)} \]
\[ \therefore DE \parallel AB \]
\[ \therefore \angle BAD + \angle ADE = \perp \perp \text{ (I.29)} \]

But \( \angle BAD = \perp \),
so \( \angle ADE = \perp \).

Since \( ADEB \) is a parallelogram,
\[ \angle BAD = \angle DEB, \angle ADE = \angle EBA \text{ (I.34)} \]
So \( ADEB \) is a square (Def. 20)