

Lesson 15: Proposition 1.11 & 1.12

Proposition 1.11: Draw a straight line at right angles to a given straight line at a given point on it.

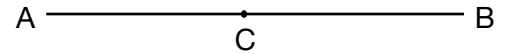
Given:

Construct:

Prove:

Construct

1. Let \overline{AB} be the given straight line, and point C be the given point on it.
2. Let point D be another point on \overline{AB} . Let point E also be on line \overline{AB} such that $\overline{CE} = \overline{CD}$ (**Prop 1.3**).
3. Construct an equilateral triangle FDE on \overline{DE} (**Prop 1.1**).
4. Join point C and F to make line \overline{CF} (**P1**).
5. \overline{CF} is perpendicular to \overline{AB} .



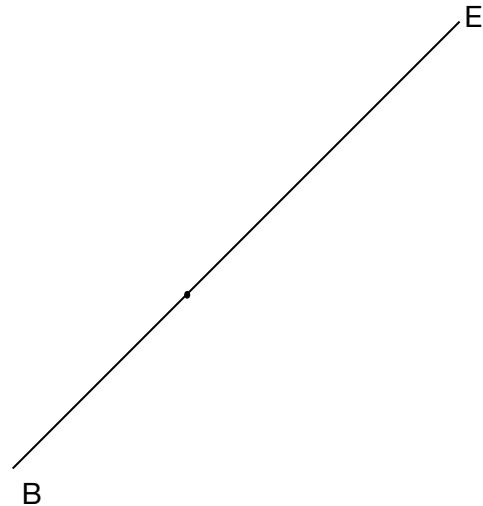
Proof

1. Since $\overline{CE} = \overline{CD}$, $\overline{CF} = \overline{CF}$, and $\overline{DF} = \overline{EF}$, then $\angle DCF = \angle ECF$ (**Prop 1.8**).
2. But $\angle DCF$ and $\angle ECF$ are also adjacent angles, therefore they are right angles (**Def 10**).

Q.E.F.

Practice

Construct a straight line at right angles to \overline{BE} at point Z.



Proposition 1.12: Draw a straight line perpendicular to a given infinite straight line from a given point not on it.

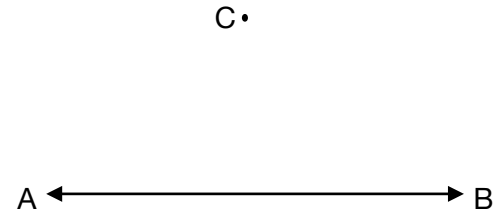
Given:

Construct:

Prove:

Construct

1. Let \overleftrightarrow{AB} be the given infinite straight line, and point C be the given point which is not on it.
2. Let point D be on the other side of \overleftrightarrow{AB} . Construct circle EDG with center C and radius CD , with points E and G on line \overleftrightarrow{AB} (**P3**).
3. Bisect \overline{EG} at point H (**Prop 1.10**).
4. Join point E, C, G, and H to make \overline{CG} , \overline{CH} , \overline{CE} (**P1**).
5. \overline{CH} is perpendicular to \overleftrightarrow{AB} .



Proof

1. Since $\overline{CE} = \overline{CG}$ (**Def 15**), $\overline{HC} = \overline{HC}$, and $\overline{HE} = \overline{GH}$, then $\angle CHA = \angle GHB$ (**Prop 1.8**).
2. Since $\angle CHE$ and $\angle GHC$ are also adjacent, then \overline{CH} is perpendicular to \overleftrightarrow{AB} (**Def 10**).

Q.E.F.

Practice

Construct a straight line perpendicular to \overleftrightarrow{JP} from point C.

