**Activity 5.2.2b Proof of the Perpendicular Bisector Theorem**

The Perpendicular Bisector Theorems says that the locus of points that are equidistant from the endpoints of a segment is the perpendicular bisector of the segment.

To prove this theorem we need to prove two things:

1. If a point lies on the perpendicular bisector of a line segment, then it is equidistant from the endpoints of the segment, and
2. If a point is equidistant from the endpoints of a segment, then it lies on the perpendicular bisector of the segment.

Prove part (1):

Given: $\overleftrightarrow{DC }$**is the perpendicular bisector of** $\overbar{AB}$ ***P* lies on** $\overleftrightarrow{DC}$

Prove: *PA* = *PB*

Fill in the blanks to complete the proof below

|  |  |
| --- | --- |
| **Statements** | **Reasons** |
| $\overleftrightarrow{DC }$**is the perpendicular bisector of** $\overbar{AB}$ **and *P* lies on** $\overleftrightarrow{DC}$ | Given |
| *AC* = *CB* | (a) Definition of **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** |
| $∠ACP $and $∠BCP$ are both right angles | (b) Definition of **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** |
| (c) **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** | All right angles are congruent |
| *PC* = *PC* | (d) **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** |
| (e) **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** | (f) **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** |
| (g) **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** | Corresponding parts of congruent triangles are congruent |



Prove part (2)

Given: *PA* = *PB*
 *C* is the midpoint of $\overbar{AB}$

Prove: $\overleftrightarrow{PC }⊥$ $\overbar{AB}$

|  |  |
| --- | --- |
| **Statements** | **Reasons** |
| ***PA* = *PB*** | Given |
| ***C* is the midpoint of** $\overbar{AB}$ | Given |
| *AC* = *CB* | (a) Definition of **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** |
| (b) **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** | Reflexive Property |
| (c) **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** | (d) **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** |
| $m∠ACP=$ $m∠BCP$ | (e) **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** |
| (f) $m∠\\_\\_\\_\\_\\_\\_\\_\\_\\_\\_\\_\\_+$ $m∠\\_\\_\\_\\_\\_\\_\\_\\_\\_\\_$ = 180° | (g) **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** |
| $m∠ACP+$ $m∠ACP$ = 180° | Substitution (substitute $m∠ACP for m∠BCP$) |
|  $2m∠ACP$ = 180° | (h) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| (i) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | Division property of equality |
| (j) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | Definition of perpendicular lines |