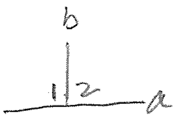
Geo H Name KEY date____________

Begin Proofs: Perpendicular Lines

Perpendicular lines: are two lines that intersect to form right angles.

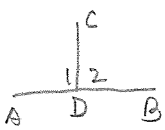
There are also perpendicular rays and segments.

What can I do if I know lines are perpendicular? Conclude: $\angle 1$ & $\angle 2$ are right $\angle$s.



Ex: $a \perp b \rightarrow \angle 1$ & $\angle 2$ are rt. $\angle$s.

Thm: If two lines are perpendicular, then they form congruent adjacent angles. (Proof back)



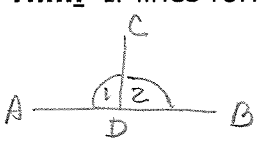
Given: $\overline{AB} \perp \overline{CD} \longrightarrow$ Conclude: $\angle 1 \cong \angle 2$

How to prove lines are perpendicular:

1. Lines that form one right angle also form four right angles. As a result, you can conclude that if you have a right angle, then you have perpendicular lines. Reason: definition of perpendicular lines.

2. **Thm:** If lines form **congruent adjacent** angles, then the lines are perpendicular.

Ex:



Prove: $\overline{AB} \perp \overline{CD}$

① $\angle 1 \cong \angle 2$ and adjacent $\rightarrow$ ② $\overline{AB} \perp \overline{CD}$

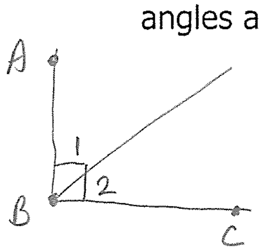
Given

How to prove angles are complementary:

1. Using the definition: If 2 $\angle$s total 90°, then they are complementary

$\overbrace{\text{two adjacent acute}}^{\text{3 Conditions}}$

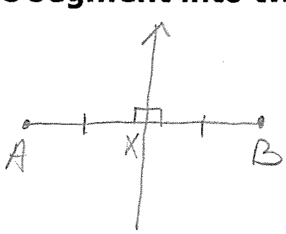
2. **Thm:** If the exterior sides of two adjacent acute angles are perpendicular, then the angles are complementary.



Given: $\overline{AB} \perp \overline{BC}$

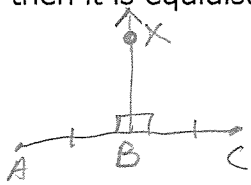
① $\overline{AB} \perp \overline{BC} \longrightarrow$ ② $\angle 1$ comp $\angle 2$.

(Def) Perpendicular bisector: is a line or segment that is perpendicular to another segment and divides the segment into two congruent parts.



$\overline{AX} \cong \overline{XB}$

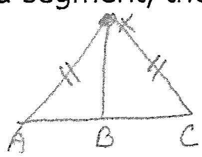
Perpendicular Bisector Theorem: If a point is on the perpendicular bisector of a segment, then it is equidistant from the endpoints of the segment.



Given: $\overleftrightarrow{XB}$ is $\perp$ bisector of $\overline{AC}$ $\rightarrow$ Conclude: $AX = XC$

Converse of the Perpendicular Bisector Theorem: If a point is equidistant from the endpoints of a segment, then it is on perpendicular bisector of the segment.

Ex:

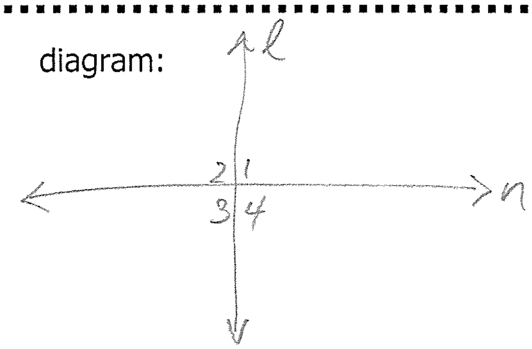


Given: $AX = CX$ $\rightarrow$ Conclude: $\overleftrightarrow{XB}$ is $\perp$ bisector of $\overline{AC}$

Given: $\ell \perp n$

Prove: $\angle 1$, $\angle 2$, $\angle 3$, & $\angle 4$ are $\cong$ $\angle$s.

diagram:



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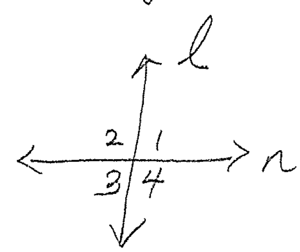
<u>Perp. lines</u> : 2 lines that form <u>Rt</u> angles.

If 2 lines $\perp$, they form congruent adjacent angles.
If 2 lines $\perp$, $\rightarrow$ form $\cong$ adjacent $\measuredangle$s.

Given: $\ell \perp n$
Prove: $\measuredangle 1$, $\measuredangle 2$, $\measuredangle 3$, & $\measuredangle 4$ are congruent $\measuredangle$s.



(1) $\ell \perp n$ $\rightarrow$ (2) $\measuredangle 1, \measuredangle 2, \measuredangle 3, \measuredangle 4$ are right $\measuredangle$s. $\rightarrow$ (3) $m\measuredangle 1 = 90$, $m\measuredangle 2 = 90$, $m\measuredangle 3 = 90$, $m\measuredangle 4 = 90$ $\rightarrow$

$\rightarrow$ (4) $m\measuredangle 1 = m\measuredangle 2 = m\measuredangle 3 = m\measuredangle 4$ $\rightarrow$ (5) $\measuredangle 1 \cong \measuredangle 2 \cong \measuredangle 3 \cong \measuredangle 4$

(def. of right $\measuredangle$: an $\measuredangle$ w/ measure of 90)

(1) Given
(2) Def. of $\perp$ lines: $\perp$ lines form Rt. $\measuredangle$s.
(3) Def of Rt $\measuredangle$: A rt. $\measuredangle$ measures 90°.
(4) Substitution Prop.
(5) Def of $\cong$ $\measuredangle$s. : $\cong$ $\measuredangle$s have = measures.