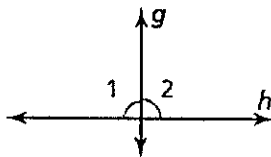


All about Perpendicular Lines

Lesson Objective

INBAT prove and apply thms about $\perp$ lines.Perpendicular Line Theorems (** to abbreviate "transversal," we will use transv. **)**Linear Pair Perpendicular Theorem:** If two lines intersect to form a linear pair of $\cong$ angles, then the lines are perpendicular. (Lin. Pair $\perp$ Thm)PROOF: Given: $\angle 1 \cong \angle 2$ Prove: $g \perp h$ 

Statements

Reasons

① $\angle 1 \cong \angle 2$

① given

② $m\angle 1 + m\angle 2 = 180$

② linear pair post.

③ $m\angle 1 = m\angle 2$

③ $\cong \rightarrow =$

④ $m\angle 1 + m\angle 1 = 180$

④ subst. prop. =

⑤ $2m\angle 1 = 180$

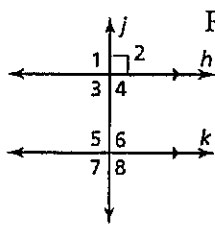
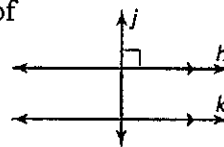
⑤ simplify

⑥ $m\angle 1 = 90$

⑥ div. prop. =

⑦ $\angle 1$ is a right $\angle$ ⑦ def. of a right $\angle$

⑧ $g \perp h$

⑧ def. of $\perp$ lines.**Perpendicular Transversal Theorem:** In a plane, if a transversal is $\perp$ to one of the two parallel lines, then it is $\perp$ to the other line. ($\perp$ Transv. Thm)PROOF: Given: $h \parallel k, j \perp h$ Prove: $j \perp k$ 

Statements

Reasons

① $h \parallel k, j \perp h$

① given

② $\angle 2$ is a right $\angle$ ② def. of $\perp$ lines

③ $\angle 2 \cong \angle 6$

③ $\parallel \rightarrow$ corresp. $\angle$ s $\cong$ ④ $\angle 6$ is a right $\angle$ ④ all right $\angle$ s are $\cong$

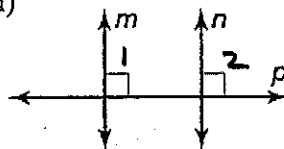
⑤ $j \perp k$

⑤ def. of $\perp$ lines

Lines Perpendicular to a Transversal Theorem: In a plane, if two lines are $\perp$ to the same line, then the two lines are $\parallel$ to each other. (Line $\perp$ to Transv. Thm)

PROOF: Given: $m \perp p, n \perp p$

Prove: $m \parallel n$

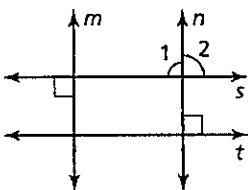


Statements	Reasons
① $m \perp p, n \perp p$	① given
② $\angle 1, \angle 2$ are right $\angle$ s	② def. of $\perp$ lines
③ $\angle 1 \cong \angle 2$	③ all right $\angle$ s are $\cong$
④ $m \parallel n$	④ corresp. $\angle$ s $\cong \rightarrow \parallel$

Examples:

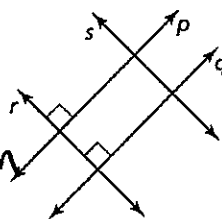
1. Determine which lines (if any) must be parallel and which (if any) must be perpendicular. Explain your reasoning.

a.



$m \parallel n$: line $\perp$ to a transv. thm
 $m \perp t$: $\perp$ transv. thm

b.



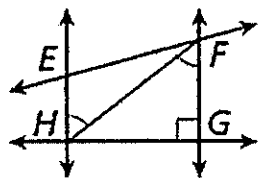
$r \perp p$
 $r \perp q$
 $p \parallel q$

$m \perp s$
 $n \perp t$
 $m \perp t$: lin. pair $\perp$ thm
 $s \parallel t$: line $\perp$ to transv. thm

2. Given: $\angle EHF \cong \angle HFG, \overline{FG} \perp \overline{GH}$

Prove: $\overline{EH} \perp \overline{GH}$

HINT: Use the $\perp$ Transv. Thm



Statements	Reasons
① $\angle EHF \cong \angle HFG$ $\overline{FG} \perp \overline{GH}$	① given
② $\overline{EH} \parallel \overline{FG}$	② alt. int. $\angle$ s $\cong \rightarrow \parallel$
③ $\overline{EH} \perp \overline{GH}$	③ $\perp$ transv. thm.