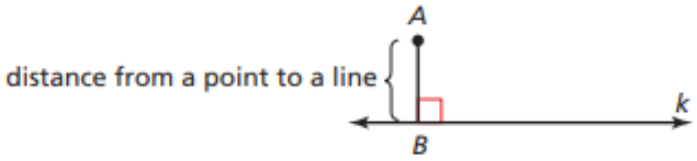
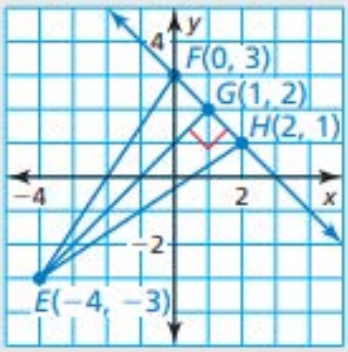
3.4 Proofs with Perpendicular Lines

The **distance from a point to a line** is the length of the perpendicular segment from the point to the line. The length of this segment is the shortest distance between the point and the line. For example, the distance between point A and line k is AB.



Example:

Find the distance from point E to $\overleftrightarrow{FH}$.



There are theorems related to perpendicular lines.

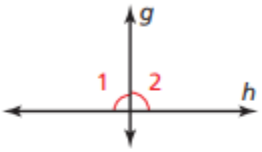
THEOREMS

3.10 Linear Pair Perpendicular Theorem

If two lines intersect to form a linear pair of congruent angles, then the lines are perpendicular.

If $\angle 1 \cong \angle 2$, then $g \perp h$.

Prove this Theorem Exercise 9, page 146

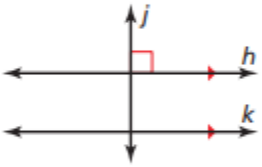


3.11 Perpendicular Transversal Theorem

In a plane, if a transversal is perpendicular to one of two parallel lines, then it is perpendicular to the other line.

If $h \parallel k$ and $j \perp h$, then $j \perp k$.

Prove this Theorem Exercise 3, page 144

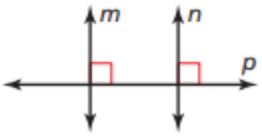


3.12 Lines Perpendicular to a Transversal Theorem

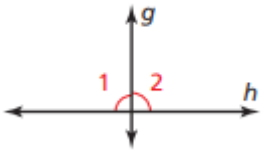
In a plane, if two lines are perpendicular to the same line, then they are parallel to each other.

If $m \perp p$ and $n \perp p$, then $m \parallel n$.

Prove this Theorem Exercise 10, page 146; Exercise 47, page 156



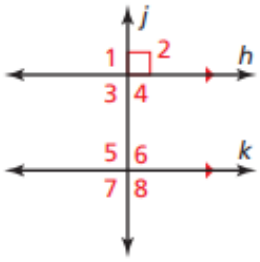
Let's prove Theorem 3.10

3.10 Linear Pair Perpendicular Theorem If two lines intersect to form a linear pair of congruent angles, then the lines are perpendicular. If $\angle 1 \cong \angle 2$, then $g \perp h$. Given: $\angle 1 \cong \angle 2$ Prove: $g \perp h$.	
Statements	Reasons
1. $\angle 1 \cong \angle 2$	1.
2. m∡1 = m∡2	2.
3. $\measuredangle 1$ *is forms a linear pair with* $\measuredangle 2$	3. Definition of linear pair
4. $\measuredangle 1$ *is supplementary to* $\measuredangle 2$	4.
5. $m\measuredangle 1 + m\measuredangle 2 = 180$	5. Definition of supplementary angles
6. $m\measuredangle 1 + m\measuredangle 1 = 180$	6.
7. $2(m\measuredangle 1) = 180$	7. Combining like terms (Simplifying)
8. $m\measuredangle 1 = 90$	8.
9. $g \perp h$.	9. Definition of perpendicular lines

Proof of Theorem 3.11:

Proving the Perpendicular Transversal Theorem

Use the diagram to prove the Perpendicular Transversal Theorem.



SOLUTION

Given $h \parallel k, j \perp h$

Prove $j \perp k$

STATEMENTS	REASONS
1. $h \parallel k, j \perp h$	**1.** Given
2. $m\angle 2 = 90°$	**2.** Definition of perpendicular lines
3. $\angle 2 \cong \angle 6$	**3.** Corresponding Angles Theorem
4. $m\angle 2 = m\angle 6$	**4.** Definition of congruent angles
5. $m\angle 6 = 90°$	**5.** Transitive Property of Equality
6. $j \perp k$	**6.** Definition of perpendicular lines

We will prove 3.12 in the homework exercises.