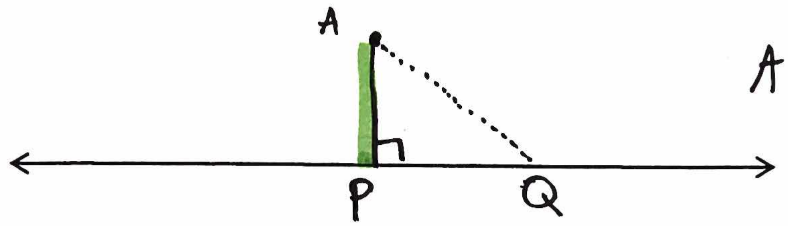
Name: Date: Period: 1

All About Perpendicular Lines

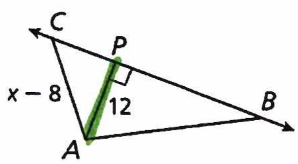
Lesson Objective IWBAT find dist. from a point to a line; prove and apply thms about ⊥ Lines.

Distance from a point to a line: this distance is the length of the __⊥__ segment from the point to the line.
→ This __⊥__ segment is also the __shortest__ distance between the point and the line.



$AP < AQ$

Example:

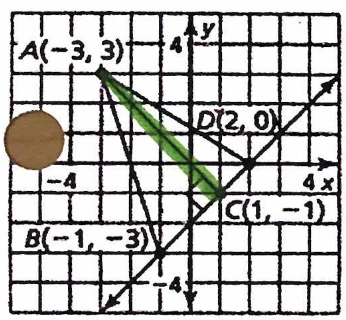


1. Name the shortest distance from point A to $\overline{BC}$: AP
2. Write and solve an inequality to solve for the values of x that are valid.

(a) $AP < AC$
$12 < x - 8$
$\boxed{20 < x}$

(b) * $AP = x-8$ and $AC = 12$
$AP < AC$
$0 < x - 8 < 12$
$\boxed{8 < x < 20}$

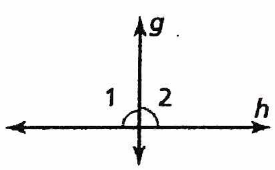
3. Find the distance from point A to $\overleftrightarrow{BD}$.



$= \sqrt{32} \approx 5.66$
$= \sqrt{16 \cdot 2}$
$\boxed{= 4\sqrt{2}}$

Perpendicular Line Theorems (*** to abbreviate "transversal," we will use __transv.__.***)

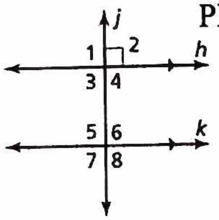
Linear Pair Perpendicular Theorem: If two lines intersect to form a linear pair of __≅__ angles, then the lines are perpendicular. (Lin. Pair ⊥ Thm)



PROOF: **Given:** $\angle 1 \cong \angle 2$
Prove: $g \perp h$

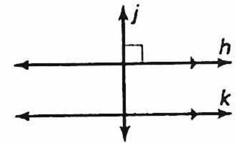
Statements	Reasons
① $\angle 1 \cong \angle 2$	① given
② $m\angle 1 + m\angle 2 = 180$	② lin. pair → supp.
③ $m\angle 1 = m\angle 2$	③ = ⟷ ≅
④ $m\angle 1 + m\angle 1 = 180$	④ subst. prop. = (step 3 into 2)
⑤ $m\angle 1 = 90$	⑤ div. prop. = (÷2)
⑥ $g \perp h$	⑥ rt. ∠ → ⊥

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)



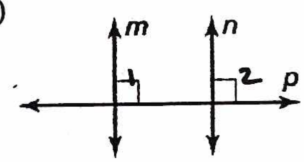
PROOF: **Given**: $h \parallel k, j \perp h$

Prove: $j \perp k$



Statements	Reasons
① $h \parallel k$, $j \perp h$	① given
② $\angle 2$ is a rt. $\angle$	② $\perp \rightarrow$ rt. $\angle$
③ $\angle 2 \cong \angle 6$	③ $\parallel \rightarrow$ corresp. $\angle$s $\cong$
④ $\angle 6$ is a rt. $\angle$	④ all rt. $\angle$s are $\cong$
⑤ $j \perp k$	⑤ rt. $\angle \rightarrow \perp$

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**: $m \perp p, n \perp p$

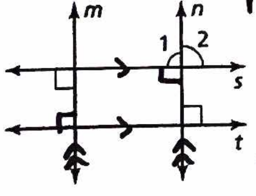
Prove: $m \parallel n$

Statements	Reasons
① $m \perp p$, $n \perp p$	① given
② $\angle 1$ is a rt. $\angle$ $\angle 2$ " " " "	② $\perp \rightarrow$ rt. $\angle$
③ $\angle 1 \cong \angle 2$	③ all rt. $\angle$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.



$n \perp s$: lin. pair $\perp$ thm

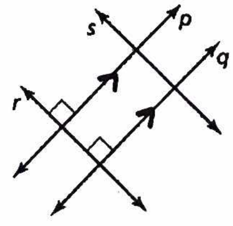
$s \parallel t$: both $\perp$ to n

$\left.\begin{matrix} m \perp s \\ n \perp t \end{matrix}\right\}$ rt. $\angle \rightarrow \perp$

$m \parallel n$: both $\perp$ to s

$m \perp t$: $\perp$ Transv. Thm

b.



$p \parallel q$: both $\perp$ to r

$\left.\begin{matrix} r \perp q \\ r \perp p \end{matrix}\right\}$ rt. $\angle \rightarrow \perp$