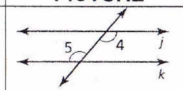
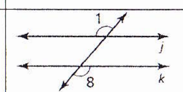
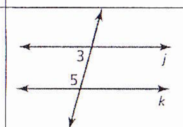
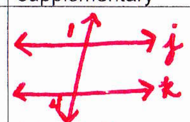
NOTES 3.3 & 3.4
PROVING LINES PARALLEL & PERPENDICULAR LINES

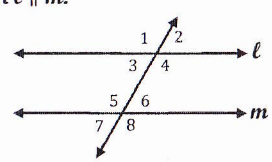
Objective: I can prove lines // using special ∢ pairs & perpendicular lines.

THEOREM	DESCRIPTION	PICTURE	CONCLUSION
Converse of the Alternate Interior Angles Theorem	If two lines are cut by a transversal so the alternate interior angles are congruent, then the lines are parallel.		j // k
Converse of the Alternate Exterior Angles Theorem	If two lines are cut by a transversal so the alternate exterior angles are congruent, then the lines are parallel.		j // k
Converse of the Same-Side Interior Angles Theorem	If two lines are cut by a transversal so the same-side interior angles are supplementary, then the lines are parallel.	 ∠3 and ∠5 are supplementary	j // k
Converse of the Same-Side Exterior Angles Theorem	If two lines are cut by a transversal so the same-side exterior angles are supplementary, then the lines are parallel.	 ∢1 & ∢4 are supplementary	j // k
Converse of the Corresponding Angles Theorem	If two lines are cut by a transversal so the corresponding angles are congruent, then the lines are parallel.		j // k

Use the theorems and the given information to show that $\ell \parallel m$.

EXAMPLE 1:

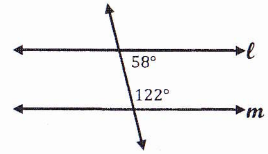
Given: $\angle 4 \cong \angle 5$



Alternate Interior ∢s ≅ → ℓ // m

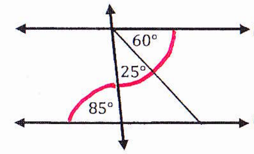
Is it possible to prove that lines ℓ and m are parallel? If so, state the postulate or theorem used.

EXAMPLE 2:



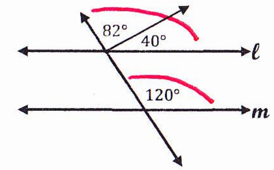
SS Int ∢s
58 + 122 = 180
– Supplementary
Yes!

EXAMPLE 3:



Alt Int ∢s
85 = 25 + 60
– ≅
Yes!

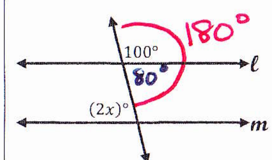
EXAMPLE 4:



Corresponding ∢s
82 + 40 = 120
122 ≠ 120
– Not ≅
No!

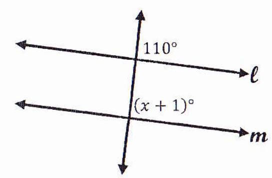
Find the value of x that makes $\ell \parallel m$.

EXAMPLE 5:



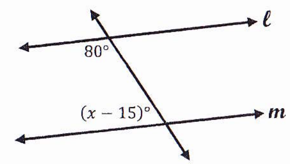
Alt Int ∢s
2x = 80
x = 40

EXAMPLE 6:

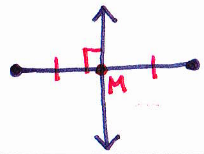


Corresponding ∢s
x + 1 = 110
x = 109

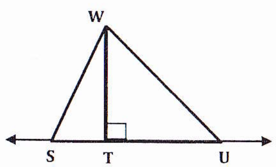
EXAMPLE 7:



SS Int ∢s
x – 15 + 80 = 180
x + 65 = 180
x = 115

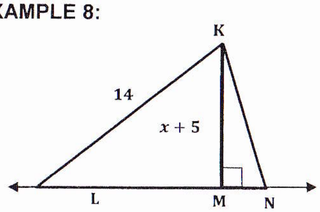
CONCEPT	DESCRIPTION	DIAGRAM
Perpendicular Bisector	A line perpendicular to a segment at the segment's midpoint.	

The distance from a point to a line is the length of the shortest segment from the point to the line. It is the length of the perpendicular segment that joins them.



***The shortest segment from W to $\overleftrightarrow{SU}$ is $\overline{WT}$.**

EXAMPLE 8:



Name the shortest segment from point K to $\overleftrightarrow{LN}$.

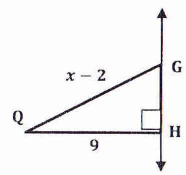
$\overline{KM}$

Write and solve an inequality for x.

$x+5<14$

$x<9$

EXAMPLE 9:



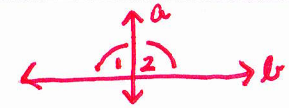
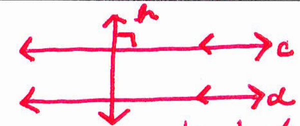
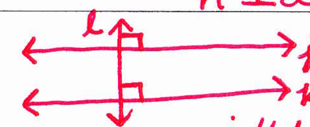
Name the shortest segment from point Q to $\overleftrightarrow{GH}$.

$\overline{QH}$

Write and solve an inequality for x.

$9<x-2$

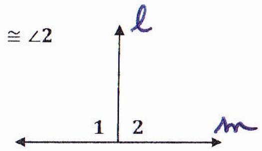
$11<x$

THEOREM	EXAMPLE
If two intersecting lines form a linear pair of congruent angles, then the lines are perpendicular.	 $a \perp b$
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.	 $h \perp d$
If two coplanar lines are perpendicular to the same line, then the two lines are parallel to each other.	 $j \parallel k$

What can you conclude from the given information? State the reason for your conclusion.

EXAMPLE 10:

$\angle 1 \cong \angle 2$



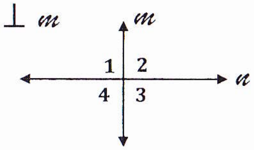
$m\angle 1 = 90°$

$m\angle 2 = 90°$

$l \perp m$

EXAMPLE 11:

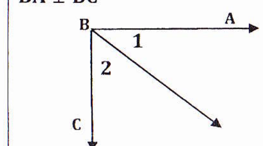
$n \perp m$



$\angle 1$, $\angle 2$, $\angle 3$, & $\angle 4$ are right $\angle$s.

EXAMPLE 12:

$\overrightarrow{BA} \perp \overrightarrow{BC}$



$\angle 1$ & $\angle 2$ are complementary. $\angle ABC$ is a right $\angle$.

Use the diagram to answer the following.

EXAMPLE 13: Is $r \parallel s$? No

EXAMPLE 14: Is $m \parallel n$? Yes
Both $\perp$ to line s

EXAMPLE 15: Is $s \parallel t$? Yes
Both $\perp$ to line n