§3.3 Prove Lines Are Parallel

Architects and contractors make extensive use of parallel lines in their plans and structures and require fail-safe ways of constructing them. Consequently, the geometry of parallel lines and the knowledge of how to prove that lines are parallel is a significant aspect of the work that these people do.

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Recap the postulate and 3 theorems about parallel lines and transversals that we learned in the previous lesson.

Corresponding Angles Postulate: If two lines cut by a transversal are parallel, then corresponding angles are congruent.

$\parallel \Rightarrow \angle s \cong$

Alternate Interior Angles Theorem: If two lines cut by a transversal are parallel, then alternate interior angles are congruent.

$\parallel \Rightarrow \angle s \cong$

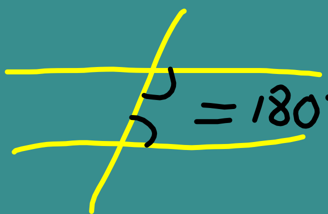
Alternate Exterior Angles Theorem: If two lines cut by a transversal are parallel, then alternate exterior angles are congruent.

$\parallel \Rightarrow \angle s \cong$

Same-Side Interior Angles Theorem: If two lines cut by a transversal are parallel, then same-side interior angles are supplementary.

Consecutive Int $\angle s$

$\parallel \Rightarrow \angle s$ are Supp $= 180°$



$= 180°$

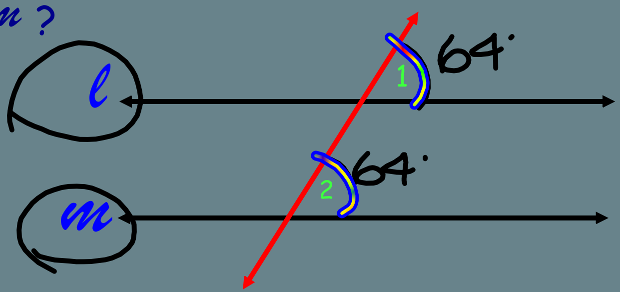
Write the converse of the Corresponding Angles Postulate.

Corresponding Angles Postulate: If two lines cut by a transversal are parallel, then corresponding angles are congruent.

Converse: If corresponding angles are congruent then two lines cut by a transversal are parallel.

Theorem: Converse of the Corresponding Angles Postulate
If two lines are cut by a transversal in such a way that corresponding angles are congruent, then the two lines are parallel. $\cong \rightarrow \parallel$

Suppose that $m\angle 1 = 64°$ and $m\angle 2 = 64°$ in the figure. What can you conclude about lines ℓ and m?



$\ell \parallel m$

Converse of Corresp. ∠s

Theorem: Converse of the Alternate Interior Angles Theorem

If two lines are cut by a transversal in such a way that Alternate Interior angles are congruent, then the two lines are parallel.

≅ → //

Theorem: Converse of the Alternate Exterior Angles Theorem

If two lines are cut by a transversal in such a way that Alternate Exterior angles are congruent, then the two lines are parallel.

≅ → //

Consecutive Int ∠s

Theorem: Converse of the Same Side Interior Angles Theorem

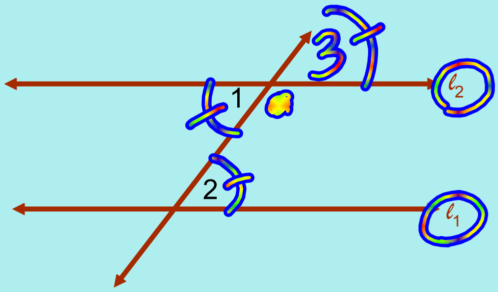
If two lines are cut by a transversal in such a way that Same Side Interior angles are supplementary, then the two lines are parallel.

∠s Supp → //

CONVERSE of ALTERNATE INTERIOR ANGLES THEOREM

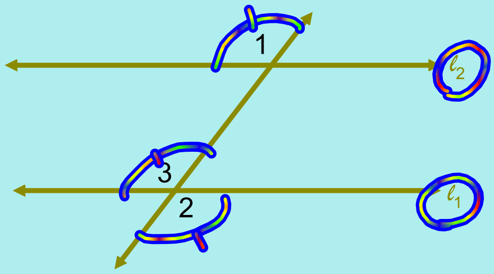
Given: <1 ≅ <2

Prove: $\ell 1 \parallel \ell 2$



Statement	Reason
$\angle 1 \cong \angle 2$	Given
$\angle 1 \cong \angle 3$	V.A.T.
$\angle 2 \cong \angle 3$	Transitive/Subst. Prop ≅
$\ell_1 \parallel \ell_2$	Converse Corresp. ∠s

CONVERSE of ALTERNATE EXTERIOR ANGLES THEOREM



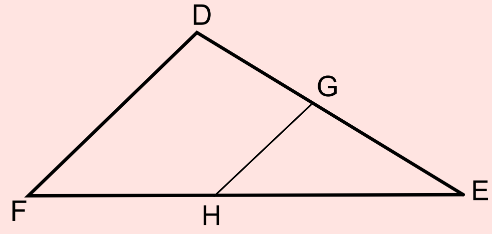
Given: <1 ≅ <2

Prove: $\ell 1 \parallel \ell 2$

Statement	Reason
$\angle 1 \cong \angle 2$	Given
$\angle 2 \cong \angle 3$	V.A.T.
$\angle 1 \cong \angle 3$	Transitive/Subst Prop ≅
$\ell_1 \parallel \ell_2$	Converse Corresp. ∠s

Given: <DFE = 55°
<GHF = 125°
<DFH and <GHE are corresponding angles

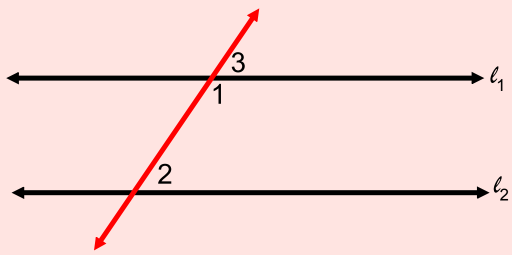
Prove: DF || GH



Statement	Reason

Given: <1 and <2 are Supplementary

Prove: ℓ_1 || ℓ_2



Statement	Reason