2.1 Parallel Lines

Monday, September 23, 2019 7:46 AM

# Warm Up

Given that x=37, find the other variable.

$x = y$ $\boxed{y=37}$

$x + t = 180$

$37 + t = 180$

$\boxed{t = 143}$

$180 - 2x = m$

$180 - 74 = m$

$\boxed{106 = m}$

$If\ r = 36, s = 34, and\ 2r + 3s - x = n, find\ n.$

$2(36) + 3(34) - 37 = n$

$72 + 102 - 37 = n$

$174 - 37 = n$

$\boxed{137 = n}$

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# Essential Question

What angle relationships are created when parallel lines are intersected by a transversal?

## Needed Vocab:

- **Parallel Lines**
- **Transversals**
- **Corresponding Angles**
- **Alternate Interior Angles**
- **Alternate Exterior Angles**
- **Same-Side Interior Angles**

## Goal: "I can...

**Determine the measures of the angles formed when parallel lines are intersected by a transversal."**

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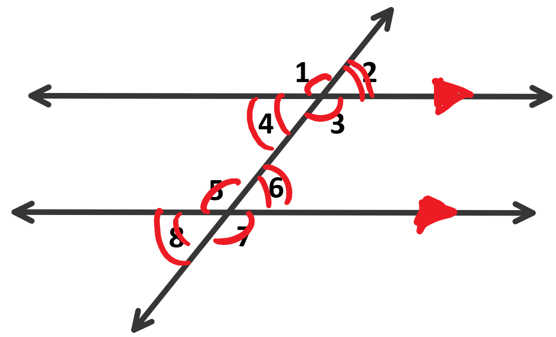
## Explore and Reason

**The diagram shows two parallel lines cut by a transversal.**

A. What relationships do we already know the angles have with the three immediately around them?

B. What relationships can we see that the angles will have to the angles of the other intersection?



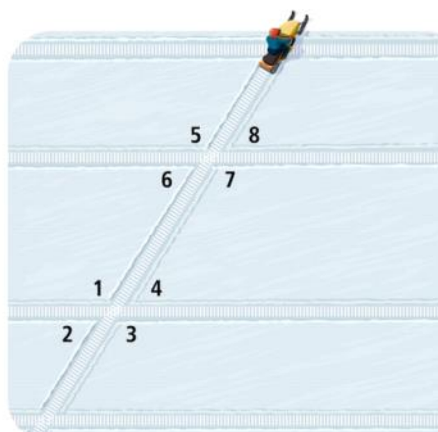

## Example 1

**Identify the pairs of angles of each angle type made by the snowmobile tracks.**

Alt. Ext:
5,3
2,8

Alt. Int:
6,4
1,7

SSI
1,6
4,7



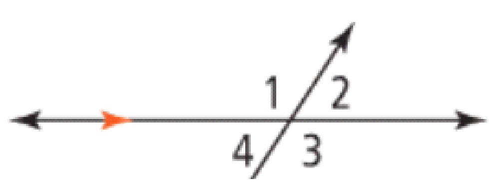

Vert. ∠'s:
5,7
6,8
1,3
2,4

Corresponding:
1,5
2,6
3,7
4,8

**1.** Which angle pairs include the named angle?

**a.** ∠4 vert.: 4,2
corr: 4,8
Alt.Int: 4,5

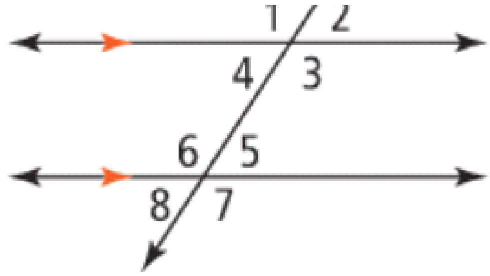
**b.** ∠5 vert: 5,8



Alt.Int: 4,5

**b.** $\angle 5$

vert: 5,8
corr: 5,2
Alt.Int: 5,4

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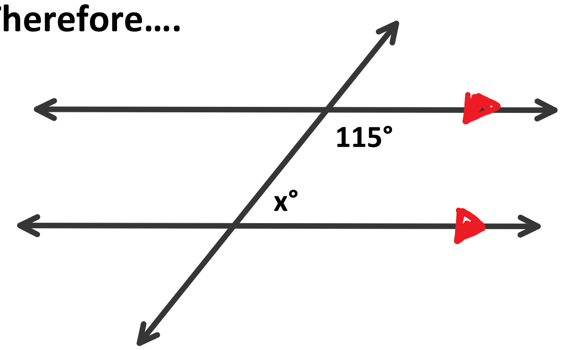
## Same-Side Interior Angles Postulate

If a transversal intersects two parallel lines, then same-side interior angles are supplementary.

**Therefore....**




$$x + 115 = 180$$
$$x = 180 - 115$$
$$x = 65$$

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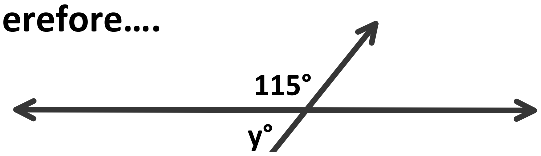
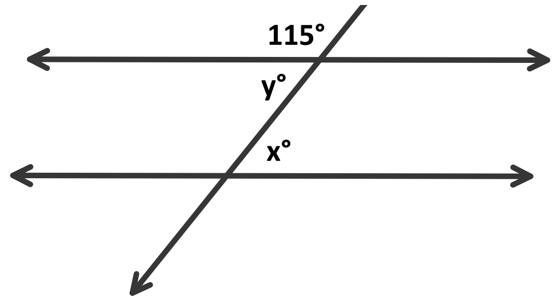
## Alternate Interior Angles Theorem

If a transversal intersects two parallel lines, then alternate interior angles are congruent.

**Therefore....**




$$y + 115 = 180$$
$$y = 180 - 115$$

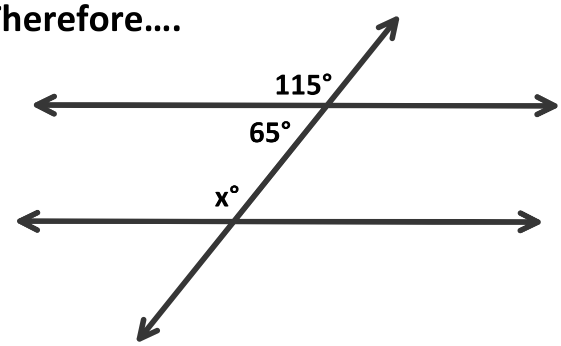



$y + 115 = 180$
$y = 180 - 115$
$y = 65$
$y = x$
$x = 65$

## Corresponding Angles Theorem

If a transversal intersects two parallel lines, then corresponding angles are congruent.

**Therefore….**



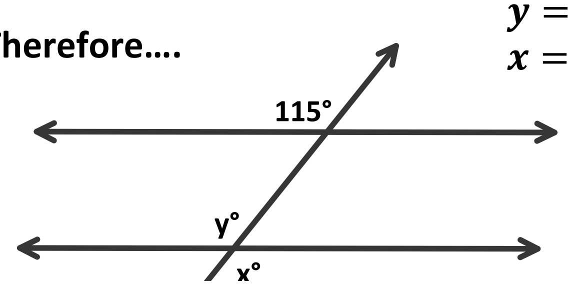

$x + 65 = 180$
$x = 180 - 65$
$x = 115$

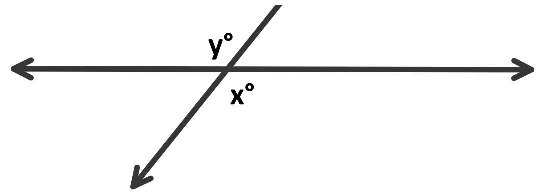
## Alternate Exterior Angles Theorem

If a transversal intersects two parallel lines, then alternate exterior angles are congruent.

$x = y$
$y = 115$ **Corresponding Angles**
$x = 115$ **Vertical Angles**

**Therefore….**

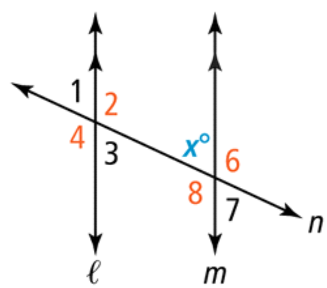





## Checking for Knowledge

How do each of the angles relate to **x**°?

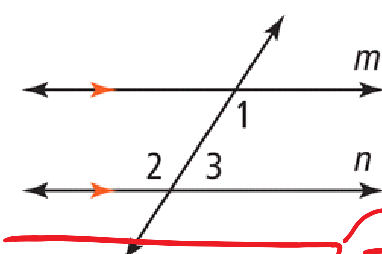
x and 8 are sup.
" " 6 " "
" " 2 " "
" " 1 are ≅.
" " 7 " "
" " 3 " "




$m\angle x + m\angle 2 = 180$
$m\angle 2 = m\angle 4$
$m\angle x + m\angle 4 = 180$

## Example 2

**Prove the Alternate Interior Angles Theorem**




**Given:** $m \parallel n$
**Prove:** $\angle 1 \cong \angle 2$

$\boxed{m \parallel n}$ → $\boxed{\angle 1 + \angle 3 \text{ are supplementary}}$ → $\boxed{m\angle 1 + m\angle 3 = 180°}$
Given — same-side interior — prop. of same side int.

$\boxed{m\angle 2 + m\angle 3 = 180°}$
Linear Pair

$\boxed{\begin{array}{l} m\angle 1 = 180° - m\angle 3 \\ m\angle 2 = 180° - m\angle 3 \end{array}}$
Subt. POE

$\boxed{m\angle 1 = m\angle 2}$
Trans. POE

$\boxed{\angle 1 \cong \angle 2}$
Def. of ≅

$\angle 1 \cong \angle 2$
Def. of $\cong$

$m\angle 1 = m\angle 2$
Trans. POE

$m\angle 1 = 180° - m\angle 3$
$m\angle 2 = 180° - m\angle 3$
Subt. POE

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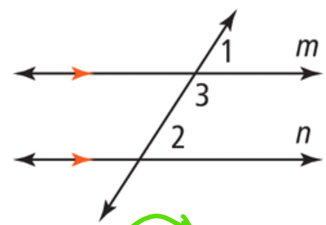
**3. Prove the Corresponding Angles Theorem.**




**Given:** $m \parallel n$

**Prove:** $\angle 1 \cong \angle 2$

$m \parallel n$, $\angle 1 + \angle 3$ are linear pair, $\angle 3$ and $\angle 2$ are SSI.
Given

$m\angle 1 + m\angle 3 = 180°$
$m\angle 2 + m\angle 3 = 180°$
Prop. of Linear pair + SSI

$m\angle 1 = 180° - m\angle 3$
$m\angle 2 = 180° - m\angle 3$
Subt. POE

$m\angle 1 = m\angle 2$
Trans. POE

$\angle 1 \cong \angle 2$
Def. of $\cong$

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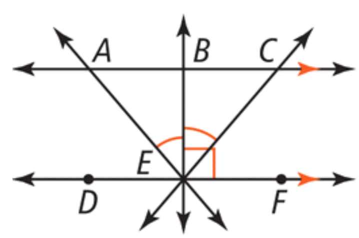
# Example 3

**Use the diagram to prove the angle relationship.**




**Given:** $\overline{AC} \parallel \overline{DF}$, $\overline{BE} \perp \overline{DF}$, and $\angle AEB \cong \angle CEB$

**Prove:** $\angle BAE \cong \angle BCE$

$\overline{AC} \parallel \overline{DF}$, $\overline{BE} \perp \overline{DF}$, $\angle AEB \cong \angle CEB$
Given

$m\angle BEF = 90°$
Def. of $\perp$

$m\angle CBE + m\angle BEF = 180°$
Prop. of SSI

$m\angle CBE + 90° = 180°$
Subs. POE

$m\angle CBE = 90°$
Subt. POE

$m\angle ABE = 90°$
Alt. Int. to $\angle BEF$

$m\angle CBE + m\angle BEC + m\angle BCE = 180°$
$m\angle ABE + m\angle BEA + m\angle BAE = 180°$
$\Delta$ sum th.

$90° + m\angle CEB + m\angle BCE = 180°$
$90° + m\angle CEB + m\angle BAE = 180°$
Subs. POE

$m\angle BCE = 90° - m\angle CEB$

$90° + m\angle CEB + m\angle BAE = 180°$
Subs. POE

$m\angle ABE + m\angle BEA + m\angle BAE = 180$
$\Delta$ sum th.

$\angle BEF$

$m\angle BCE = 90° - m\angle CEB$
$m\angle BAE = 90° - m\angle CEB$
Subt. POE

$m\angle BCE = m\angle BAE$
Trans. POE

$\angle BCE \cong \angle BAE$
Def. of $\cong$

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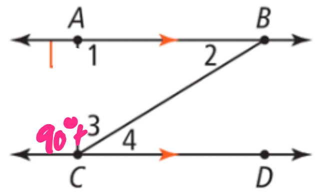
**4.** Given $\overline{AB} \parallel \overline{CD}$, prove that $m\angle 1 + m\angle 2 + m\angle 3 = 180$.




$\overline{AB} \parallel \overline{CD}$, $\overline{AC} \perp \overline{AB}$, $\overline{AC} \perp \overline{CD}$
$\angle 2 + \angle 3$ are SSI
Given

$m\angle 1 = 90°$
Def. of $\perp$

$m\angle 2 + m\angle 3 + 90° = 180°$
Prop. of SSI

$m\angle 2 + m\angle 3 + m\angle 1 = 180°$
Subs. POE

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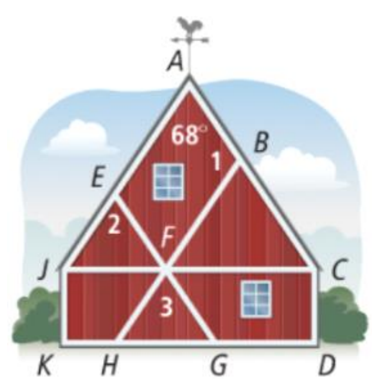
## Example 4

**The white trim shown for the wall of a barn should be constructed so that $\overline{AC} \parallel \overline{EG}$, $\overline{JA} \parallel \overline{HB}$, and $\overline{JC} \parallel \overline{KG}$. What should $m\angle 1$ and $m\angle 3$ be?**

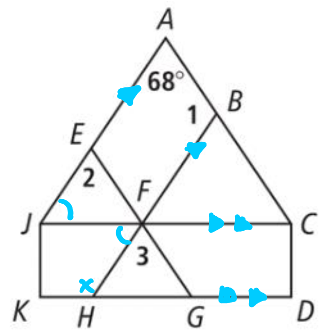



$1 + 68 = 180$
$m\angle 1 = 112°$
$m\angle 3 = 68°$

$1 + F = 180$
$F = 3$
$1 + 3 = 180$

**5.** If $m\angle EJF = 56$, find $m\angle FHK$.

$\boxed{124°}$




$56 + x = 180$

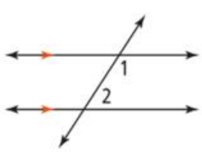
$x = 124$

## Parallel Lines and Angle Pairs

**There are four special angle relationships formed when parallel lines are intersected by a transversal.**

**POSTULATE 2-1** Same-Side Interior Angles Postulate

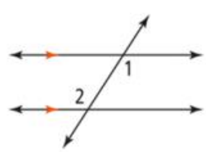
**If...**




**Then...** $m\angle 1 + m\angle 2 = 180°$

**THEOREM 2-1** Alternate Interior Angles Theorem

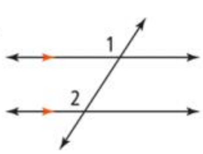
**If...**




**Then...** $\angle 1 \cong \angle 2$

**THEOREM 2-2** Corresponding Angles Theorem

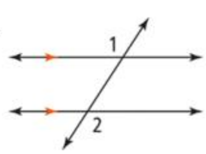
**If...**




**Then...** $\angle 1 \cong \angle 2$

**THEOREM 2-3** Alternate Exterior Angles Theorem

**If...**




**Then...** $\angle 1 \cong \angle 2$

# Homework

## Pg. 76
## 10-13, 15-17, 19-23 odd, 24, 28