Geometry H

3.3: Proving Lines Parallel

Name: Key

Date: ______ Period: ______

LEARNING TARGETS

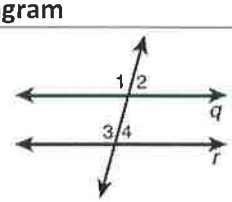
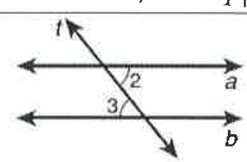
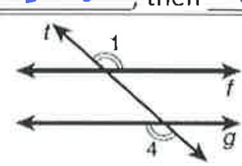
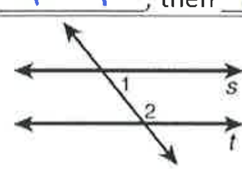
- I can prove lines are parallel.
  - I can use the corresponding angles converse
  - I can use the alternate interior angles converse.
  - I can use the alternate exterior angles converse.
  - I can use the consecutive interior angles converse.

You may have noticed that the postulates and theorems that we've studied so far have been written in the form "If *p*, then *q*." The **converse** of such a statement *switches the order of the parts of the statement* and has the form "If *q*, then *p*." The **converse** of a postulate or theorem may or may not be true, just as the **converse** of a mathematical statement may or may not be true.

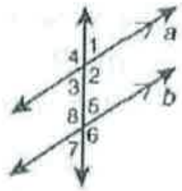
Mathematical Example:

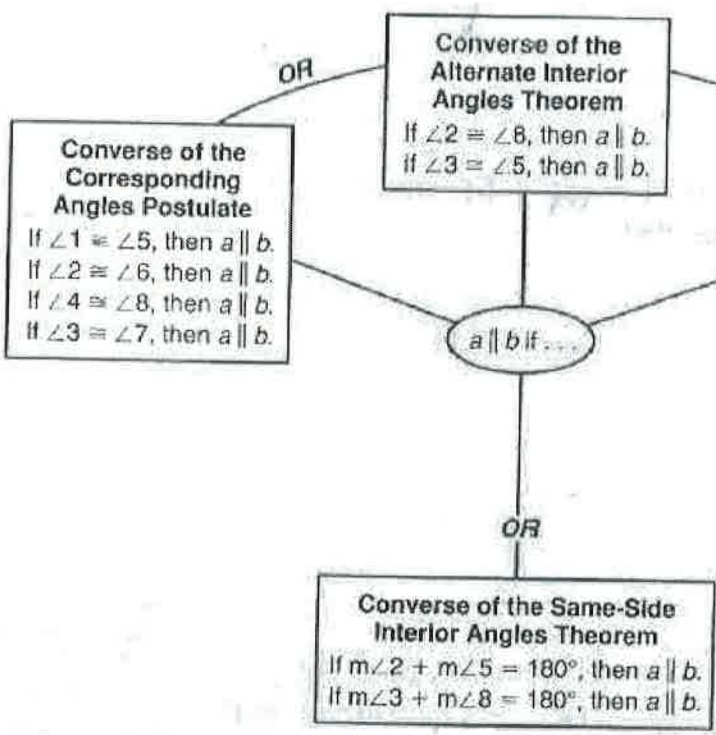
Statement	Write the *converse* of the Statement	*Is the converse always true?*
If $\overset{p}{x=2}$, *then* $\overset{q}{3x=6}$	If 3x = 6 then x = 2	Yes
If $\underset{p}{x=2 \text{ and } y=3}$, *then* $\underset{q}{x+y=5}$	If x+y = 5 then x=2 and y=3	No, x could be 4 and y could be 1

The **converse** of the Corresponding Angles Postulate is accepted as **true**, and this makes it possible to prove that the **converses** of the Alternate Interior Angle Theorem, Alternate Exterior Angle Theorem, and Consecutive Interior Angle Theorem are also true.

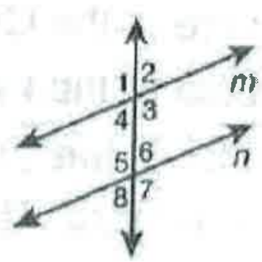
Converse	In words...	Diagram
Corresponding Angles Converse	If two lines are cut by a transversal so that corresponding angles are congruent, then the lines are parallel.	 If $\angle 1 \cong \angle 3$, then $q \parallel r$
Alternate Interior Angles Converse	If two lines are cut by a transversal so that alternate interior angles are congruent, then the lines are parallel.	 If ∠2 ≅ ∠3, then a∥b
Alternate Exterior Angles Converse	If two lines are cut by a transversal so that alternate exterior angles are congruent, then the lines are parallel.	 If ∠1 ≅ ∠4, then f∥g
Consecutive Interior Angles Converse	If two lines are cut by a transversal so that consecutive interior angles are supplementary, then the lines are parallel.	 If m∠1 + m∠2 = 180, then s∥t

Line ***a*** and line **b** can be proven parallel four different ways.





For questions 1 – 4, use the given information to explain why $m \parallel n$.



1. $\angle 1 \cong \angle 7$ alternate exterior angles converse
2. $m\angle 4 + m\angle 5 = 180°$ consecutive interior angles converse
3. $\angle 5 \cong \angle 3$ alternate interior angles converse
4. $\angle 8 \cong \angle 4$ corresponding angles converse

5. If $m\angle 1 = 47°$ and $m\angle 5 = 49°$, are the lines parallel? Explain.

no, in order for the lines to be parallel, ∠1 must be ≅ ∠5. Since 47 ≠ 49, the lines are not parallel

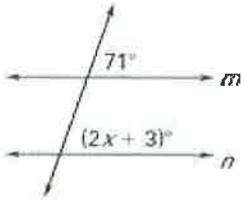
6. If $m\angle 3 = 119°$, what does the measure of $\angle 6$ need to be to prove $m \parallel n$?

$m\angle 6 + 119° = 180°$

$\boxed{m\angle 6 = 61°}$ by the consecutive interior angles converse

Example 1: Find value of x that makes line parallel.

a) Find the value of *x* that makes $m \parallel n$. Explain your reasoning.

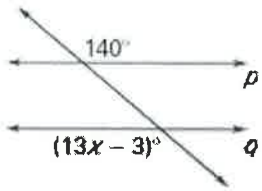


$71 = 2x+3$

$68 = 2x$

$\boxed{x=34}$ so m‖n by corresponding angles converse

b) Find the value of *x* that makes $p \parallel q$. Explain your reasoning.

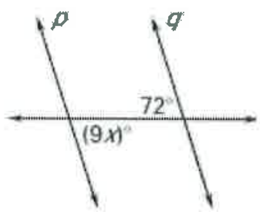


$140 = 13x-3$

$143 = 13x$

$\boxed{x=11}$ so p‖q by alternate exterior angles converse

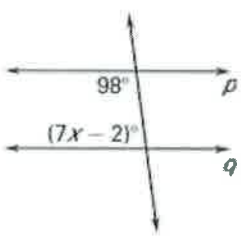
c) Find the value of *x* that makes $p \parallel q$. Explain your reasoning.



$72 = 9x$

$\boxed{x=8}$ so p‖q by alternate interior angles converse

d) Find the value of *x* that makes $p \parallel q$. Explain your reasoning.



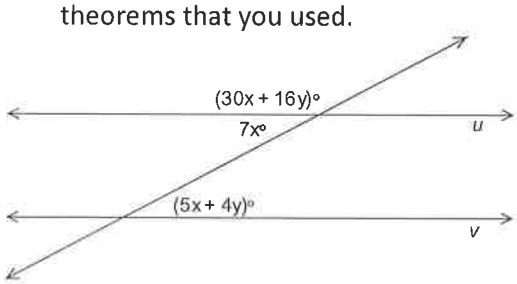
$98+7x-2=180$

$7x+96=180$

$7x=84$

$\boxed{x=12}$ so p‖q by consecutive interior angles converse

e) Find the values of *x* and *y* that makes $u \parallel v$. Justify why $u \parallel v$ by stating the appropriate postulates or theorems that you used.



$7x = 5x+4y$ (alt. int. angles converse)

$\frac{\cancel{2}x}{\cancel{2}} = \frac{4y}{2}$

$\rightarrow x=2y$

$30x+16y+7x=180$ (Linear Pair)

$\rightarrow 37x+16y=180$

System: $\begin{cases} x=2y \\ 37x+16y=180 \end{cases}$ substitute

$37(2y)+16y=180$

$74y+16y=180$

$90y=180$

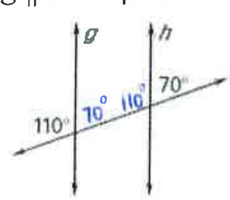
$\boxed{y=2}$

$x=2(2)$

$\boxed{x=4}$

Example 2: Solve a Real- World Problem

a) Noah needs to verify that the two posts (lines g and h) he's put into the ground are parallel. He measures the angles as shown in the diagram below. Is there enough information in the diagram to conclude that $g \parallel h$? Explain.



By using linear pairs, the angle next to 110° would be 70° and the angle next to 70° would be 110°. Then the two consecutive interior angles would sum to 180°, so g‖h by the consecutive interior angles converse.