

3.5 Proving Lines Parallel

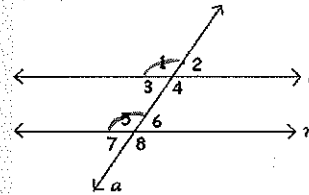
G.PL.3 Prove theorems about lines and angles.
 G.PL.4 Know that parallel lines have the same slope and perpendicular lines have opposite reciprocal slopes. Determine if a pair of lines are parallel, perpendicular, or neither by comparing the slopes in coordinate graphs and in equations. Find the equation of the line, passing through a given point, that is parallel or perpendicular to a given line.
 G.LP.4 Develop geometric proofs, including direct proofs, indirect proofs, proofs by contradiction and proofs involving coordinate geometry, using two-column, paragraphs, and flow charts formats.

Identify Parallel Lines

Postulate

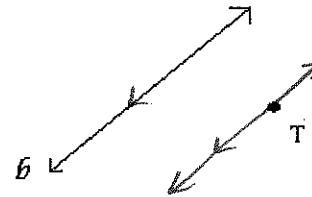
If two lines in a plane are cut by a transversal so that corresponding angles are congruent, then the lines are parallel.

Example: If $\angle 1 \cong \angle 5$, then $l \parallel r$.



Parallel Postulate

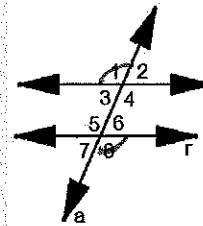
If given a line and a point not on the line, then there exists exactly one line through the point that is parallel to the given line.



Theorems for Proving Lines Parallel

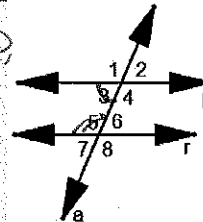
If two lines in a plane are cut by a transversal so that a pair of alternate exterior angles is congruent, then the two lines are parallel.

Example: If $\angle 1 \cong \angle 8$, then $l \parallel r$.



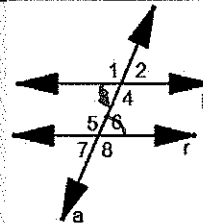
If two lines in a plane are cut by a transversal so that a pair of consecutive interior angles is supplementary, then the two lines are parallel.

Example: If $m\angle 3 + m\angle 5 = 180$, then $l \parallel r$.

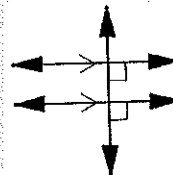


If two lines in a plane are cut by a transversal so that a pair of alternate interior angles is congruent, then the two lines are parallel.

Example: If $\angle 3 \cong \angle 6$, then $l \parallel r$.

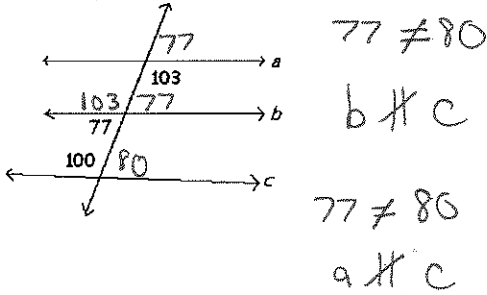


In a plane, if two lines are perpendicular to the same line, then they are parallel.



Ex 1:

Determine which lines, if any are parallel. Justify your answer.



$77 \neq 80$
 $b \nparallel c$
 $77 \neq 80$
 $a \nparallel c$

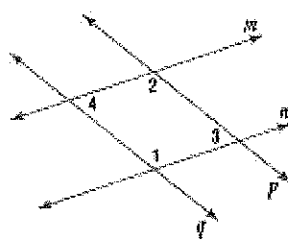
$103 = 103$
 $a \parallel b$

Prove Lines Parallel

Ex 3: Use the figure to the right.

Given: $m \parallel n$; $\angle 4 \cong \angle 3$

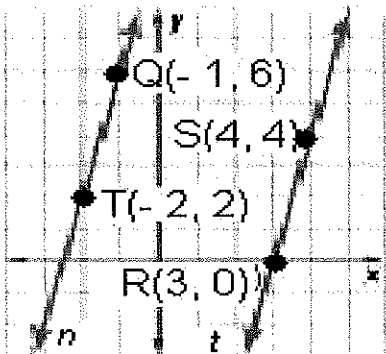
Prove: $q \parallel p$



Statements	Reasons
a. $m \parallel n$; $\angle 4 \cong \angle 3$	a. <u>Given</u>
b. $\angle 4$ and $\angle 1$ are supplementary	b. <u>Consecutive Interior \angle's</u>
c. $m\angle 4 + m\angle 1 = 180$	c. <u>Supplementary \angle Theorem</u>
d. $m\angle 4 = m\angle 3$	d. <u>Definition of Congruence</u>
e. $m\angle 3 + m\angle 1 = 180$	e. <u>Substitution</u>
f. $\angle 3$ and $\angle 1$ are supplementary	f. <u>Supplementary Angle Theorem</u>
g. $q \parallel p$	g. <u>Consecutive Interior \angle's</u>

Ex 4:

Determine whether $n \parallel t$. Justify your answer.



$$m_{\overline{QT}} = \frac{6-2}{-1-(-2)} = \frac{4}{1} = 4$$

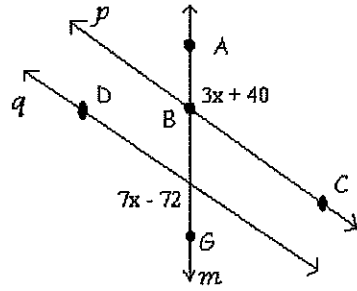
$$m_{\overline{SR}} = \frac{4-0}{4-3} = \frac{4}{1} = 4$$

$$m_{\overline{QT}} = m_{\overline{SR}}$$

parallel

Ex 2:

Find x and $m\angle ABC$ so that $q \parallel p$.



$$\begin{aligned} 3x + 40 &= 7x - 72 \\ -3x &\quad -3x \\ \hline 40 &= 4x - 72 \\ +72 &\quad +72 \\ \hline 112 &= 4x \\ \frac{112}{4} &= \frac{4x}{4} \\ x &= 28 \end{aligned}$$