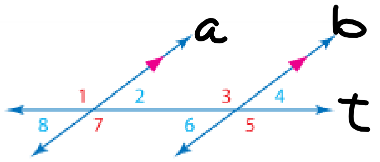
In this photo, line *t* is a transversal of lines *a* and *b*, and $\angle 1$ and ~~$\angle 2$~~ $\angle 3$ are corresponding angles. Since lines *a* and *b* are parallel, there is a special relationship between the corresponding angle pairs.

Corresponding Angle Postulate:

If two parallel lines are cut by a transversal, then each pair of corresponding angles is congruent.



$a \parallel b$

examples

$\angle 1 \cong \angle 3$ or $\angle 3 \cong \angle 1$ symmetric property

$\angle 2 \cong \angle 4$

$\angle 8 \cong \angle 6$

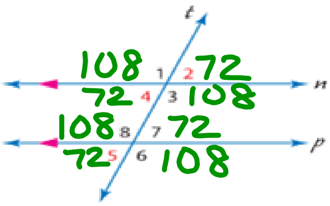
$\angle 7 \cong \angle 5$

In the figure, $m\angle 5 = 72$. Find the measure of each angle. Tell which postulate(s) or theorem(s) you used.

a. $\angle 4$ $= 72$

corresponding angles post.

$(\angle 5 \cong \angle 4)$



$$\begin{array}{r} 180 \\ -72 \\ \hline 108 \end{array}$$

b. $\angle 2$ $= 72$

Corresponding angles post. $(\angle 5 \cong \angle 4)$,

Vertical angles thm

$(\angle 4 \cong \angle 2)$

→ leap!

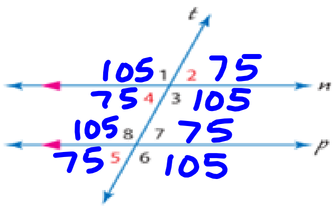
$\angle 5 \cong \angle 4$ and $\angle 4 \cong \angle 2$

$\angle 5 \cong \angle 2$

transitive property

leap frog

$$\begin{array}{r} 180 \\ -105 \\ \hline 75 \end{array}$$



n || p

In the above figure, suppose that $m\angle 8 = 105$. ~~$m\angle 5 = 72$.~~ Find the measure of each angle. Tell which postulate(s) or theorem(s) you used.

c. $\angle 1 = 105$

Corresponding angles post. ($\angle 8 \cong \angle 1$)

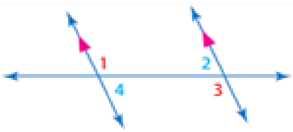
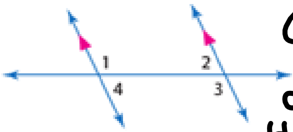
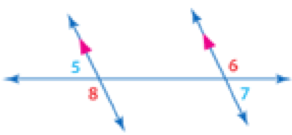
d. $\angle 2 = 75$

Corresponding angles post. ($\angle 8 \cong \angle 1$), linear pair thm. ($m\angle 1 + m\angle 2 = 180$)

e. $\angle 3 = 105$

Corresponding angles post. ($\angle 8 \cong \angle 1$), vertical angles thm. ($\angle 1 \cong \angle 3$)

PARALLEL LINES AND ANGLE PAIRS

Alternate Interior Angles Thm: if two parallel lines are cut by a transversal, then each pair of alternate interior angles are congruent.	$\angle 1 \cong \angle 3$ and $\angle 2 \cong \angle 4$	
Same-Side (or Consecutive) Interior Angles Theorem: if two parallel lines are cut by a transversal, then each pair of same-side (or consecutive) interior angles are supplementary.	$m\angle 1 + m\angle 2 = 180$ and $m\angle 3 + m\angle 4 = 180$	
Alternate Exterior Angles Thm: if two parallel lines are cut by a transversal, then each pair of alternate exterior angles are congruent.	$\angle 5 \cong \angle 7$ and $\angle 6 \cong \angle 8$	

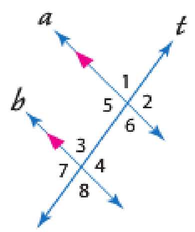
There is also a same-side (consecutive) exterior angles thm. It works the SAME WAY.

$m\angle 5 + m\angle 6 = 180$
and
$m\angle 7 + m\angle 8 = 180$

Postulates are accepted without proof. This means that we will always assume that the information given in a postulate is TRUE without question. Theorems, on the other hand, should be proven true before using them. We can use the Corresponding Angles Postulate to prove each of the above theorems. The following is an example of a proof of the Alternate Interior Angles Theorem. (Please note that there are more than one way to prove a theorem in most cases.)

Proof Alternate Interior Angles Theorem

Given: $a \parallel b$
t is a transversal of a and b. } assume true



Prove: $\angle 4 \cong \angle 5$, $\angle 3 \cong \angle 6$

Paragraph Proof: We are given that $a \parallel b$ with a transversal t. By the Corresponding Angles Postulate, corresponding angles are congruent. So, $\angle 2 \cong \angle 4$ and $\angle 6 \cong \angle 8$. Also, $\angle 5 \cong \angle 2$ and $\angle 8 \cong \angle 3$ because vertical angles are congruent. Therefore, $\angle 5 \cong \angle 4$ and $\angle 3 \cong \angle 6$ since congruence of angles is transitive. → transitive prop.

$\angle 5 \cong \angle 2$ and $\angle 2 \cong \angle 4 \rightarrow \angle 5 \cong \angle 4$
(vertical) (corresponding) (transitive prop.)

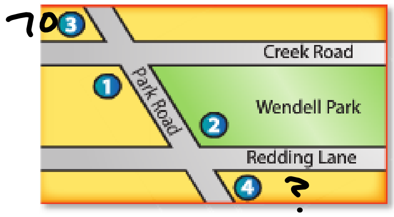
$\angle 6 \cong \angle 8$ and $\angle 8 \cong \angle 3 \rightarrow \angle 6 \cong \angle 3$
(corresponding) (vertical) (transitive prop.)

Redding Lane and Creek Road are parallel streets that intersect Park Road along the west side of Wendell Park. If $m\angle 1 = 118$, find $m\angle 2$.

we know: $\angle 1 \cong \angle 2$ by alt. int. $\angle$ thm.

$m\angle 1 = m\angle 2$

$118 = m\angle 2$



Refer to the above diagram to find each angle measure. Tell which postulate(s) or theorem(s) you used.

a. If $m\angle 1 = 100$, find $m\angle 4$.

$m\angle 2 + m\angle 4 = 180 \rightarrow$ linear pair thm

$\angle 1 \cong \angle 2 \rightarrow$ alt. int. $\angle$ thm

$m\angle 1 = m\angle 2$

$100 = m\angle 2$

$100 + m\angle 4 = 180$

$-100 \quad -100$

$m\angle 4 = 80$

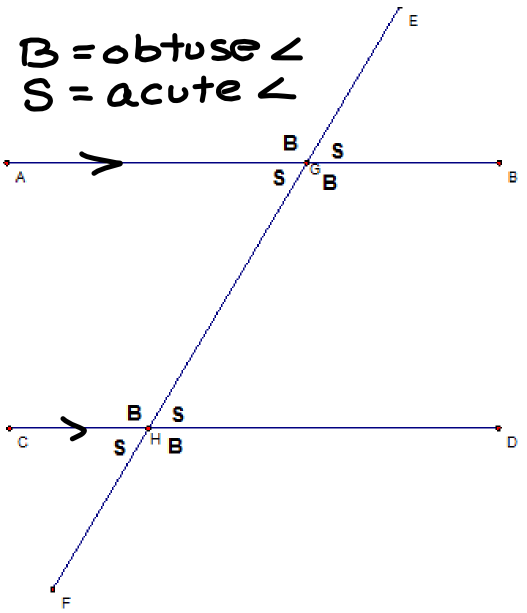
b. If $m\angle 3 = 70$, find $m\angle 4$.

$\angle 3 \cong \angle 4 \rightarrow$ by the alt. ext. $\angle$ thm

$m\angle 3 = m\angle 4$

$70 = m\angle 4$

B = obtuse ∠
S = acute ∠



$\overline{AB} \parallel \overline{CD}$ cut by $\overline{EF}$.

If two angles are both BIG (B), they are CONGRUENT.

If two angles are both SMALL (S), they are CONGRUENT.

If you have one BIG and one SMALL together (B+S), they are SUPPLEMENTARY.

Identify the following types of angles as CONGRUENT or SUPPLEMENTARY:

Linear Pair	supp. 180	Same-Side Interior	180
Vertical	cong. $\cong$	Corresponding	$\cong$
Alternate Interior	$\cong$	Alternate Exterior	$\cong$

Use the figure at the right to find the indicated variable. Explain your reasoning.

B S

a. If $m\angle 4 = 2x - 17$ and $m\angle 1 = 85$, find x.

$B + S = 180$

$m\angle 4 + m\angle 1 = 180$

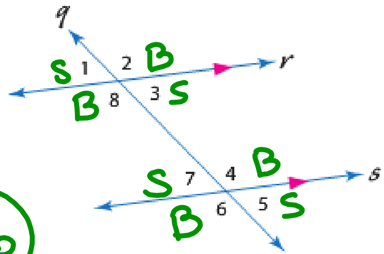
$2x - 17 + 85 = 180$

$2x + 68 = 180$

$-68 \quad -68$

$\frac{2x}{2} = \frac{112}{2}$

$x = 56$



b. Find y if $m\angle 3 = 4y + 30$ and $m\angle 7 = 7y + 6$.

S S

Both S → set =

$m\angle 3 = m\angle 7$

$4y + 30 = 7y + 6$

$-4y \quad -4y$

$30 = 3y + 6$

$-6 \quad -6$

$\frac{24}{3} = \frac{3y}{3}$

$y = 8$

Use the figure at the right to find the indicated variable.

c. If $m\angle 2 = 4x + 7$ and $m\angle 7 = 5x - 13$, find x.

j||k

both B → set =
alt. ext

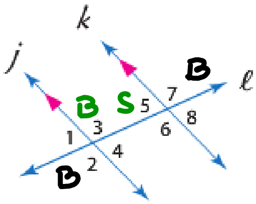
$m\angle 2 = m\angle 7$

$4x+7=5x-13$
$+13 \quad +13$

$4x+20=5x$
$-4x \quad -4x$

$20=x$

$x=20$



d. Find y if $m\angle 5 = 68$ and $m\angle 3 = 3y - 2$.

B+S=180 → same-side int.

$m\angle 3 + m\angle 5 = 180$

$3y-2+68=180$

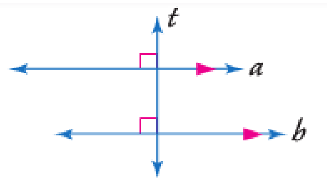
$3y+66=180$
$-66 \quad -66$

$\frac{3y}{3} = \frac{114}{3}$

$y=38$

Finally, a special relationship exists when the transversal of two parallel lines is a perpendicular line.

Perpendicular Transversal Theorem: In a plane, if a line is perpendicular to one of two parallel lines, then it is perpendicular to the other.



If $a \parallel b$ and $t \perp a$, then $t \perp b$.
This situation creates EIGHT right angles.