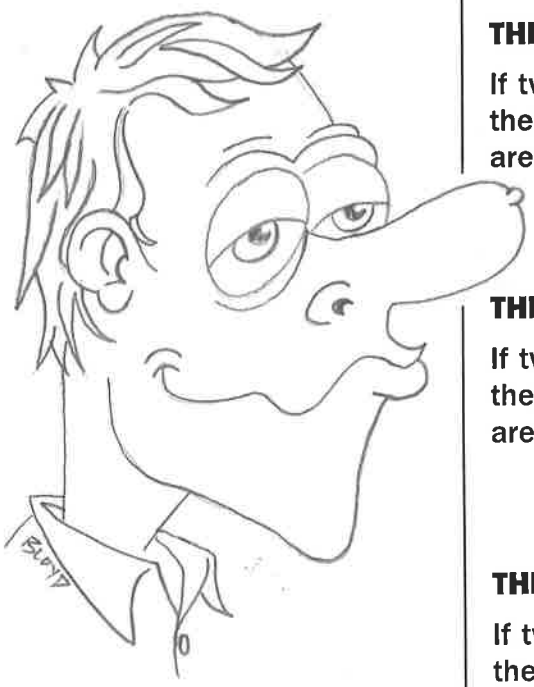
3-2 Parallel Lines and Transversals

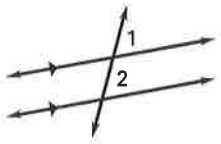
I will be able to...

(target) **Goals**
- Prove and use results about parallel lines and transversals.
- Use properties of parallel lines to solve problems.



POSTULATE 15: CORRESPONDING ANGLES POSTULATE

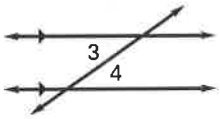
If two parallel lines are cut by a transversal, then the pairs of corresponding angles are congruent.



$\angle 1 \cong \angle 2$

THEOREM 3.4: ALTERNATE INTERIOR ANGLES

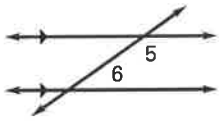
If two parallel lines are cut by a transversal, then the pairs of alternate interior angles are congruent.



$\angle 3 \cong \angle 4$

THEOREM 3.5: CONSECUTIVE INTERIOR ANGLES

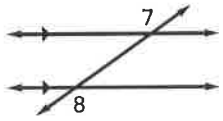
If two parallel lines are cut by a transversal, then the pairs of consecutive interior angles are supplementary.



$m\angle 5 + m\angle 6 = 180°$

THEOREM 3.6: ALTERNATE EXTERIOR ANGLES

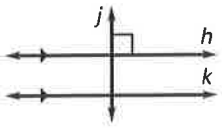
If two parallel lines are cut by a transversal, then the pairs of alternate exterior angles are congruent.



$\angle 7 \cong \angle 8$

THEOREM 3.7: PERPENDICULAR TRANSVERSAL

If a transversal is perpendicular to one of two parallel lines, then it is perpendicular to the other.

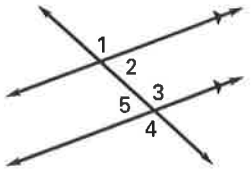


$j \perp k$

Example 1 ***Using Properties of Parallel Lines***

Given that $m\angle 1 = 118°$, find each measure. Tell which postulate or theorem you use.

a. $\angle 2$ **b.** $\angle 3$ **c.** $\angle 5$ **d.** $\angle 4$



Solution

a. $m\angle 2 = 180° - m\angle$ 1 $=$ 62 ° — Linear Pair Postulate

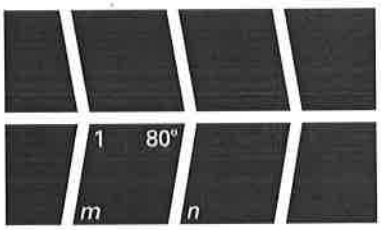
b. $m\angle 3 = m\angle$ 1 $=$ 118 ° — Corresponding Angles Postulate

c. $m\angle 5 = m\angle$ 2 $=$ 62 ° — Alternate Interior Angles Theorem

d. $m\angle 4 = m\angle$ 1 $=$ 118 ° — Alternate Exterior Angles Theorem

Example 2 ***Using Properties of Parallel Lines***

Parking Lot Design In the diagram of the parking lot, $m \parallel n$. What is $m\angle 1$?



Solution

$m\angle 1 + 80° =$ 180 ° — Consecutive Interior Angles Theorem

$m\angle 1 =$ 100 ° — Subtraction **Property of Equality**

✔ ***Checkpoint*** **Given that $m\angle 6 = 53°$, find the angle measure. Tell which postulate or theorem you use.**

1. $\angle 7$

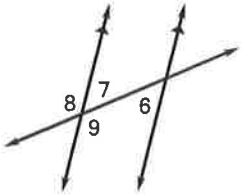
53°; Alternate Interior Angles Theorem

2. $\angle 8$ $m\angle 8 + m\angle 7 = 180°$

127°; Linear Pair Postulate

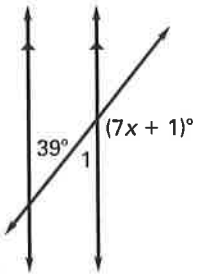
3. $\angle 9$ $m\angle 6 + m\angle 9 = 180°$

127°; Consecutive Interior Angles Theorem



Example 3 ***Using Properties of Parallel Lines***

Use properties of parallel lines to find the value of x.

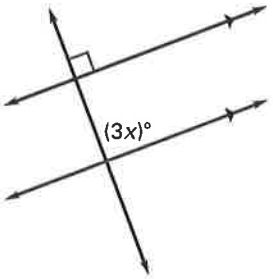


Solution

$m\angle 1 = 39°$	Alternate Interior Angles Theorem
$m\angle 1 + (7x + 1)° = 180°$	Linear Pair Postulate
$39° + (7x + 1)° = 180°$	**Substitute.**
$7x = 140$	**Subtract.**
$x = 20$	**Divide.**

✔ ***Checkpoint*** **Use properties of parallel lines to find the value of x.**

4.



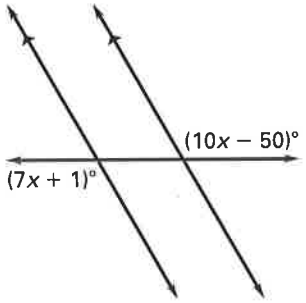
30

$3x = 90$
(perp. trans. thm.)

$\frac{3x}{3} = \frac{90}{3}$

$x = 30$

5.



17

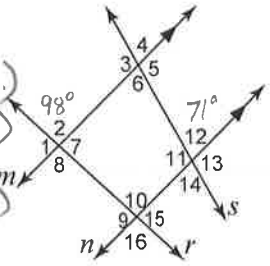
$7x+1 = 10x-50$
(alt. ext. ∠s thm.)
$-7x \quad -7x$
$1 = 3x - 50$
$+50 \quad +50$
$\frac{51}{3} = \frac{3x}{3}$
$17 = x$

NAME _____ DATE _____ PERIOD _____

3-2 Practice (*examples*)

Angles and Parallel Lines

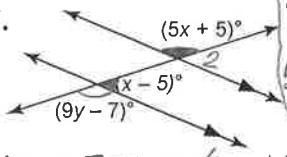
In the figure, $m\angle 2 = 98$ and $m\angle 12 = 71$. Find the measure of each angle. Tell which postulate(s) or theorem(s) you used.



1. $\angle 10 = m\angle 2 = 98°$ (corr. $\angle$s post.)
2. $\angle 8 = m\angle 2 = 98°$ (vert. $\angle$s thm.)
3. $\angle 9 + m\angle 10 = 180°$ (Suppl. Thm.)
   $\angle 9 + 98 = 180° \rightarrow m\angle 9 = 82°$
4. $\angle 5 + m\angle 12 = 180°$ (consec. int $\angle$s)
   $m\angle 5 + 71 = 180 \rightarrow m\angle 5 = 109°$
5. $\angle 11 + m\angle 12 = 180°$ (Suppl. Thm.)
   $m\angle 11 + 71 = 180°$
   $m\angle 11 = 109°$
6. $\angle 13 + m\angle 12 = 180°$ (Suppl. Thm.)
   $m\angle 13 + 71 = 180°$
   $m\angle 13 = 109°$

Find the value of the variable(s) in each figure. Explain your reasoning.

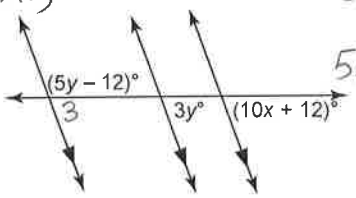
7.



$5x+5+m\angle 2 = 180$ (Suppl. Thm.)
$m\angle 2 = x-5$ (corr. $\angle$s post.)
$5x+5+x-5 = 180$ (subst.)
$6x = 180$
$\frac{6x}{6} = \frac{180}{6}$
$x = 30$

$9y-7+x-5 = 180$ (Suppl. Thm.)
$9y-7+30-5 = 180$
$9y+18 = 180$
$-18 \quad -18$
$\frac{9y}{9} = \frac{162}{9}$
$y = 18$

8.

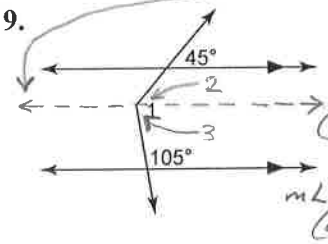


$5y-12+m\angle 3 = 180$ (suppl. Thm.)
$m\angle 3 = 3y$ (corr. $\angle$s Post.)
$5y-12+3y = 180$ (subst.)
$8y-12 = 180$
$+12 \quad +12$
$\frac{8y}{8} = \frac{192}{8}$
$y = 24$

$3y = 10x+12$ (corr. $\angle$s post.)
$3(24) = 10x+12$
$72 = 10x+12$
$-12 \quad -12$
$\frac{60}{10} = \frac{10x}{10}$
$6 = x$

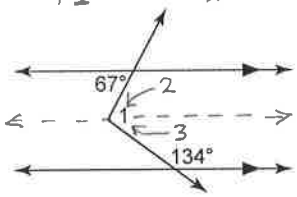
Find x. (*Hint*: Draw an auxiliary line.)

9.



$m\angle 2 = 45$ (corr. $\angle$s post)
$m\angle 3 + 105 = 180$ (consec. int. $\angle$s thm.)
$m\angle 3 = 75$
$m\angle 1 = m\angle 2 + m\angle 3$ (angle add. post.)
$m\angle 1 = 45 + 75 = 120°$

10.

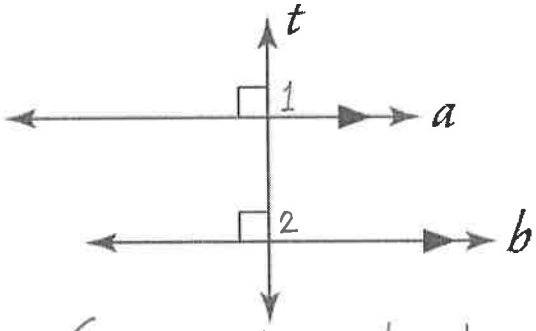


$m\angle 2 = 67$ (alt. int. $\angle$s thm.)
$m\angle 3 + 134 = 180$ (consec. int. $\angle$s thm.)
$m\angle 3 = 46°$
$m\angle 1 = m\angle 2 + m\angle 3$ ($\angle$Add. Post.)
$m\angle 1 = 67 + 46 = 113°$

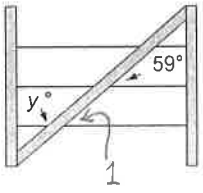
11. **PROOF** Write a paragraph proof of Theorem 3.4.

Given: $a \parallel b, a \perp t$
Prove: $b \perp t$

We are given that $a \perp t$, so by Def. of $\perp$, $\angle 1$ is a rt. $\angle$, and by Def. of rt. $\angle$, its measure is 90°. $\angle 1 \cong \angle 2$, because $a \parallel b$ and they are corr. $\angle$s, so $m\angle 1 = m\angle 2$ by Def. of $\cong$ $\angle$s. We can substitute and get $m\angle 2 = 90$. Therefore by Def., $\angle 2$ is a rt. $\angle$, and $b \perp t$ by Def. of perpendicular lines. Q.E.D. (quod erat demonstrandum "which is what had to be proven")



12. **FENCING** A diagonal brace strengthens the wire fence and prevents it from sagging. The brace makes a 59° angle with the wire as shown. Find the value of the variable.



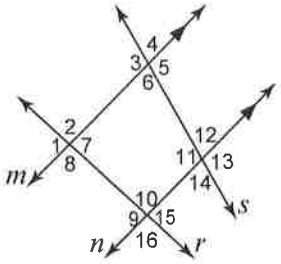
$m\angle 1 = 59°$ (corr. $\angle$s post.)
$m\angle 1 + y = 180°$ (suppl. thm.)
$59 + y = 180$
$y = 121°$

NAME _____ DATE _____ PERIOD _____

3-2 Practice

Angles and Parallel Lines

In the figure, $m\angle 2 = 92$ and $m\angle 12 = 74$. Find the measure of each angle. Tell which postulate(s) or theorem(s) you used.



1. $\angle 10$

2. $\angle 8$

3. $\angle 9$

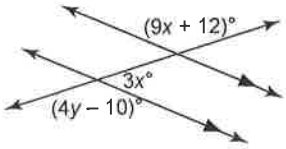
4. $\angle 5$

5. $\angle 11$

6. $\angle 13$

Find the value of the variable(s) in each figure. Explain your reasoning.

7.



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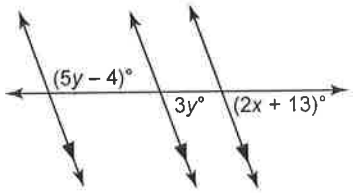
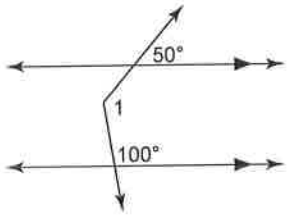
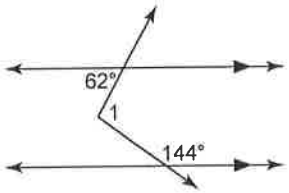


Find x. (*Hint*: Draw an auxiliary line.)

9.



10.

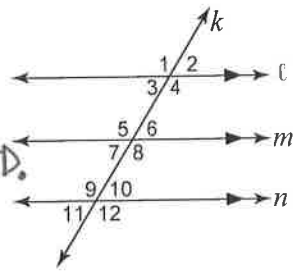


11. PROOF Write a paragraph proof of Theorem 3.3.

Given: $\ell \parallel m, m \parallel n$

Prove: $\angle 1 \cong \angle 12$

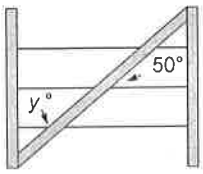
It is (1.) _____ that $\ell \parallel m$, so $\angle 1 \cong \angle 8$ by the (2.) _____. Since it is (3.) _____ that $m \parallel n$, $\angle 8 \cong \angle 12$ by the (4.) _____. Therefore, $\angle 1 \cong \angle 12$ by the (5.) _____ prop. of congruence. QED.



1. _____ 2. _____ 3. _____

4. _____ 5. _____

12. FENCING A diagonal brace strengthens the wire fence and prevents it from sagging. The brace makes a 50° angle with the wire as shown. Find the value of the variable.



(3-2 prac. answer bank)

Suppl. Thm. 106	Suppl. Thm. 37	vert. ∠s thm. 92
Alt. Ext. ∠s Thm.	suppl. Thm. & corr. ∠s Post. 23	Given
consec. int. ∠s thm. 106	98	130
Transitive	corr. ∠s post. 92	corr. ∠s Post. 28
Suppl. Thm. & Corr. ∠s Post. 14	Given	corr. ∠s post.
130	Suppl. Thm. 106	Suppl. Thm. 88