

Name: \_\_\_\_\_

Date: \_\_\_\_\_

## Congruence: Geometrical Theorems

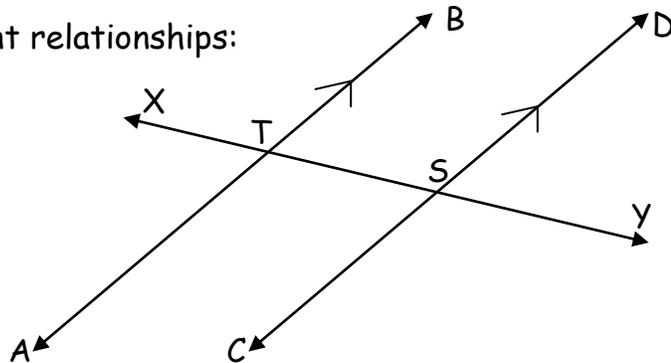
The **Corresponding Angles postulate** states that any corresponding angles created by parallel lines being intersected by a transversal are congruent.

From this, we can deduce other congruent relationships:

Alternate Interior Angles

Alternate Exterior Angles

Same-Side Interior Angles



**Example:** Determine the congruent relationships in the figure above.

**Step 1:** Start with what we know:

AB and CD are parallel lines.

XY is a transversal that cuts through AB and CD.

**Step 2:** Identify Linear Pairs

The linear pair theorem tells us that if two angles form a linear pair (combine to form a line), then they are supplementary (add up to  $180^\circ$ ).

The linear pairs are listed to the right.

Linear Pairs:

$\angle ATX$  and  $\angle BTX$

$\angle BTX$  and  $\angle BTS$

$\angle DST$  and  $\angle DSY$

$\angle DSY$  and  $\angle YSC$

$\angle YSC$  and  $\angle CST$

$\angle CST$  and  $\angle TSD$

$\angle ATS$  and  $\angle ATX$

The **Same-Side Interior  $\angle$  Theorem** states that two pairs of same-side interior angles are also supplementary.

Same-Side Interior Angles

$\angle ATS$  and  $\angle TSC$

$\angle BTS$  and  $\angle DST$

**Step 3:** Find Alternate Angles

The Alternate Angles theorem states that, when parallel lines are cut by a transversal, the pair of alternate interior angles are congruent (**Alternate Interior  $\angle$  Theorem**). Also, the pair of alternate exterior angles are congruent (**Alternate Exterior  $\angle$  Theorem**).

If  $m\angle ATX \cong m\angle BTS$   
and AB and CD are parallel

then  $\angle ATX \cong \angle BSY$

Corresponding Angles Postulate

Given

Alternate Angles Theorem

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**Practice.**

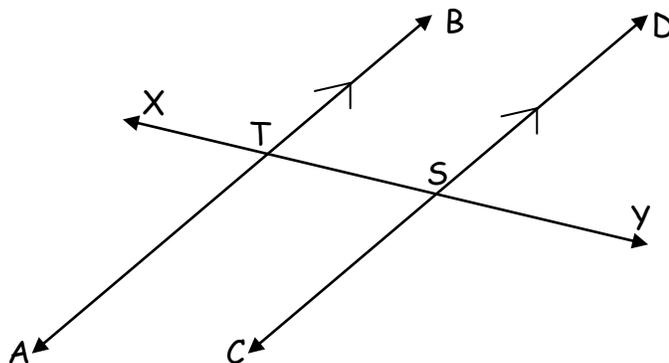
1-4. Give the angle of each measure. Justify your answers.

1.  $m\angle BTS$  if  $m\angle TSC = 75^\circ$

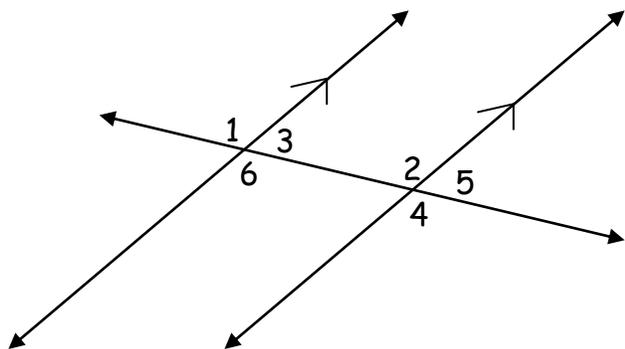
2.  $m\angle BTS$  if  $m\angle ATX = 36^\circ$

3.  $m\angle BTS$  if  $m\angle TSD = 139^\circ$

4.  $m\angle YSC$  if  $m\angle BTX = 100^\circ$



5-8. State the theorem/postulate(s) related to the measures of the angles in each pair. Then, find the angle measures.



5.  $m\angle 1 = (25x + 3)^\circ$ ;  $m\angle 6 = (30x - 17)^\circ$

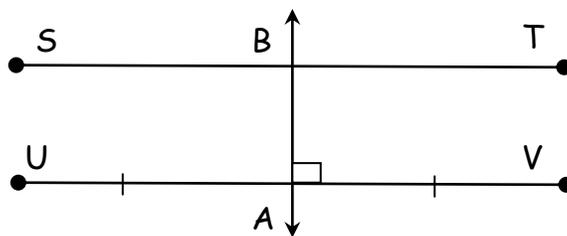
6.  $m\angle 3 = (7x + 15)^\circ$ ;  $m\angle 5 = (10x - 9)^\circ$

7.  $m\angle 2 = (2x + 1)^\circ$ ;  $m\angle 3 = (\frac{1}{2}x - 6)^\circ$

8.  $m\angle 4 = (37x - 15)^\circ$ ;  $m\angle 1 = (44x - 29)^\circ$

9-11. Extend. Line AB is a perpendicular bisector of segment ST.  $UA \cong AV$ . If ST and UV are parallel, prove that AB is a perpendicular bisector of UV.

- |                                  |                            |
|----------------------------------|----------------------------|
| 1. $AB \perp$ bisector ST        | 1. _____                   |
| ST is parallel to UV             |                            |
| 2. $SB \cong BT$                 | 2. Def of $\perp$ Bisector |
| 3. $\angle SBA$ is a right angle | 3. Def of $\perp$          |
| 4. $\angle VAB$ is a right angle | 4. _____                   |
| 5. $m\angle SBA = 90$            | 5. Def of Rt $\angle$      |
| 6. $m\angle TBA = m\angle SBA$   | 6. Rt $\angle$ Congruence  |
| 7. _____                         | 7. Alt. Int. $\angle$ Thm  |
| 8. $UA \cong AV$                 | 8. Given                   |
| 9. $AB \perp$ bisector UV        | 9. Def of $\perp$ Bisector |



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## Answer Key

### Congruence: Geometric Theorems

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1. Alternate Exterior Angle;  $m\angle BTS = 75^\circ$
2. Corresponding Angle;  $m\angle BTS = 36^\circ$
3. Same Side Interior Angle;  $m\angle BTS = 41^\circ$
4. Alternate Exterior Angle;  $x = 2$ ;  $m\angle 100^\circ$
5.  $x = 4$ ;  $m\angle 1 = m\angle 6 = 103^\circ$
6.  $x = 2$ ;  $m\angle 3 = m\angle 5 = 36^\circ$
7.  $x = 2$ ;  $m\angle 2 = 31$ ;  $m\angle 3 = 149^\circ$
8.  $x = 2$ ;  $m\angle 4 = m\angle 1 = 74^\circ$
9. Given
10. Alt Int. Angle
11.  $m\angle TBA = m\angle UAB$