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# Congruence: Geometrical Theorems

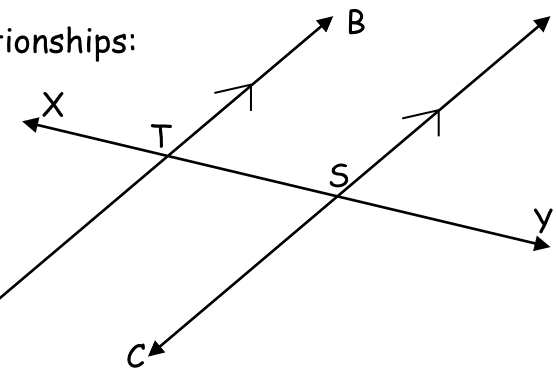
The **Corresponding Angles postulate** states that any corresponding angles created by parallel lines being intersected by a transversal are congruent.

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°).
The linear pairs are listed to the right.

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

Linear Pairs:
∠ATX and ∠BTX
∠BTX and ∠BTS
∠DST and ∠DSY
∠DSY and ∠YSC
∠YSC and ∠CST
∠CST and ∠TSD
∠ATS and ∠ATX

Same-Side Interior Angles
∠ATS and ∠TSC
∠BTS and ∠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 ∠ Theorem**). Also, the pair of alternate exterior angles are congruent (**Alternate Exterior ∠ Theorem**).

| | |
|---|---|
| If m∠ATX ≅ m∠BTS | Corresponding Angles Postulate |
| and AB and CD are parallel | Given |
| then ∠ATX ≅ ∠BSY | Alternate Angles Theorem |

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**Practice.**

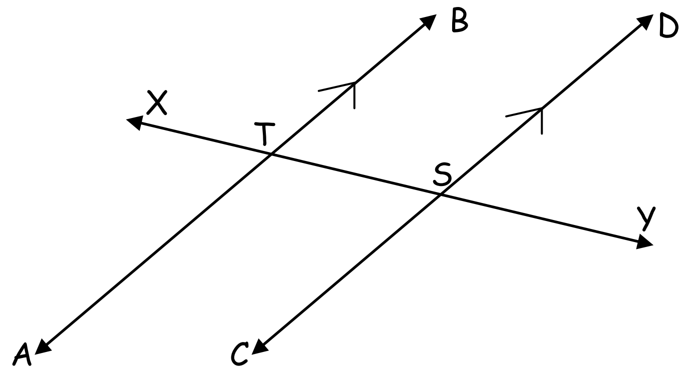
1-4. Give the angle of each measure. Justify your answers.

1. m$\angle$BTS if m$\angle$TSC = 88°

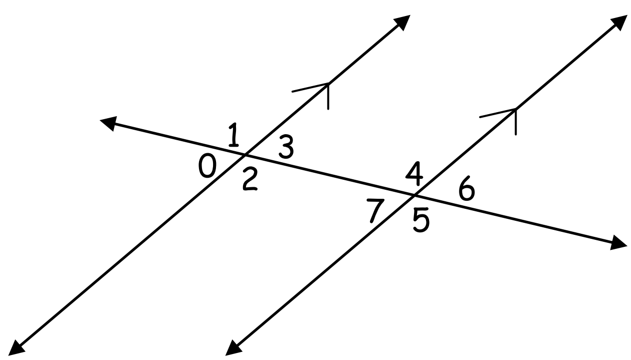
2. m$\angle$BTS if m$\angle$ATX = 64°

3. m$\angle$BTS if m$\angle$TSD = 120°

4. m$\angle$YSD if m$\angle$ATX = 88°




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$0 = (20x + 7)°; m$\angle$3 = (32x - 17)°

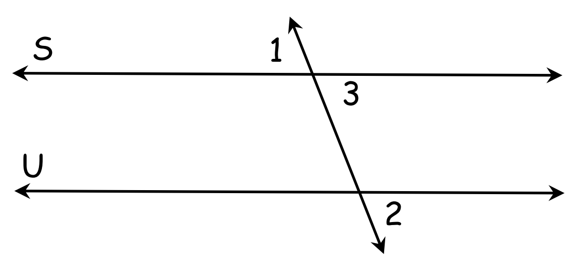
6. m$\angle$3 = (9x + 5)°; m$\angle$4 = (5x + 7)°

7. m$\angle$2 = (6x - 4)°; m$\angle$3 = (2x – 8)°

8. m$\angle$3 = (12x + 16)°; m$\angle$7 = (10x + 20)°

9-10. Extend. Line S is parallel to line U. Prove that $\angle 1 \cong \angle 2$.

| | |
|---|---|
| 1. ST is parallel to UV | 1. Given |
| 2. __________________ | 2. Vertical $\angle$ Theorem |
| 3. $\angle 3 \cong \angle 2$ | 3. ________________ |
| 4. $\angle 1 \cong \angle 2$ | 4. ________________ |



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**Answer Key**

## Congruence: Geometric Theorems

1. Alternate Interior Angles; m$\angle$BTS = 88°
2. Vertical Angles; m$\angle$BTS = 64°
3. Same Side Interior Angles; m$\angle$BTS = 60°
4. Alternate Exterior Angles; m$\angle$YSD = 88°
5. Alternate Exterior Angle ;x = 2; m$\angle$0 = m$\angle$3 = 47°
6. Same Side Interior; x = 12; m$\angle$4 = 113; m$\angle$3 = 67°
7. Supplementary Angle; x = 24; m$\angle$2 = 144; m$\angle$3 = 36°
8. Alternate Interior Angle; x = 2; m$\angle$3 = m$\angle$7 = 40°
9. $\angle 1 \cong \angle 3$
10. Corresponding $\angle$ Theorem
11. Trans Prop of $\cong$