

2-6

Proving Angles
Congruent

Content Standard

G.CO.9 Prove theorems about lines and angles. Theorems include: ... vertical angles are congruent ...

Objective To prove and apply theorems about angles

A theorem is a conjecture or a statement that you prove true.

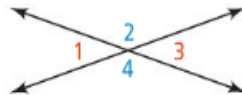
Essential Understanding You can use given information, definitions, properties, postulates, and previously proven theorems as reasons in a proof.

Take note

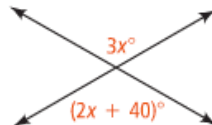
Theorem 2-1 Vertical Angles Theorem

Vertical angles are congruent.

$$\angle 1 \cong \angle 3 \text{ and } \angle 2 \cong \angle 4$$



Got It? 1. What is the value of x ?

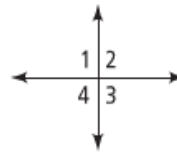




Problem 2 Proof Using the Vertical Angles Theorem

Given: $\angle 1 \cong \angle 4$

Prove: $\angle 2 \cong \angle 3$



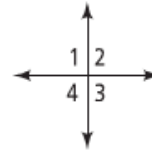
Statements	Reasons
1) $\angle 1 \cong \angle 4$	1) Given
2) $\angle 4 \cong \angle 2$	2) Vertical angles are \cong .
3) $\angle 1 \cong \angle 2$	3) Transitive Property of Congruence
4) $\angle 1 \cong \angle 3$	4) Vertical angles are \cong .
5) $\angle 2 \cong \angle 3$	5) Transitive Property of Congruence



Got It? 2. a. Use the Vertical Angles Theorem to prove the following.

Given: $\angle 1 \cong \angle 2$

Prove: $\angle 1 \cong \angle 2 \cong \angle 3 \cong \angle 4$

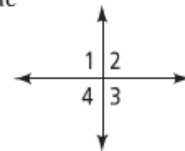


The **proof** in Problem 2 is two-column, but there are many ways to display a proof. A **paragraph proof** is written as sentences in a paragraph. Below is the proof from Problem 2 in paragraph form. Each statement in the Problem 2 proof is red in the paragraph proof.

Proof Given: $\angle 1 \cong \angle 4$

Prove: $\angle 2 \cong \angle 3$

Proof: $\angle 1 \cong \angle 4$ is given. $\angle 4 \cong \angle 2$ because vertical angles are congruent. By the Transitive Property of Congruence, $\angle 1 \cong \angle 2$. $\angle 1 \cong \angle 3$ because vertical angles are congruent. By the Transitive Property of Congruence, $\angle 2 \cong \angle 3$.



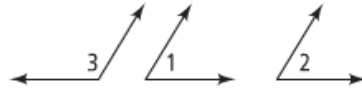
take note

Theorem 2-2 Congruent Supplements Theorem**Theorem**

If two angles are supplements of the same angle (or of congruent angles), then the two angles are congruent.

If ...

$\angle 1$ and $\angle 3$ are supplements and $\angle 2$ and $\angle 3$ are supplements

**Then ...**

$\angle 1 \cong \angle 2$

You will prove Theorem 2-2 in Problem 3.

take note

Theorem 2-3 Congruent Complements Theorem**Theorem**

If two angles are complements of the same angle (or of congruent angles), then the two angles are congruent.

If ...

$\angle 1$ and $\angle 2$ are complements and $\angle 3$ and $\angle 2$ are complements

**Then ...**

$\angle 1 \cong \angle 3$

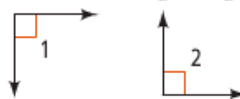
You will prove Theorem 2-3 in Exercise 13.

Theorem 2-4**Theorem**

All right angles are congruent.

If ...

$\angle 1$ and $\angle 2$ are right angles

**Then ...**

$\angle 1 \cong \angle 2$

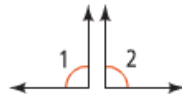
You will prove Theorem 2-4 in Exercise 18.

Theorem 2-5**Theorem**

If two angles are congruent and supplementary, then each is a right angle.

If ...

$\angle 1 \cong \angle 2$, and $\angle 1$ and $\angle 2$ are supplements

**Then ...**

$m\angle 1 = m\angle 2 = 90$

You will prove Theorem 2-5 in Exercise 23.